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From the Classical SCOR Model to the SCOR Digital Standard (SCOR DS): Aligning Quality Management and Digitalization for After-Sales Service Resilience

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***Abstract*— In an increasingly vulnerable supply chain context, After-Sales Service (ASS) performance suffers from organizational fragmentation across returns, diagnostics, and spare parts management. While the quality-digitalization nexus is recognized as an agility lever, operational frameworks integrating modern digitally native standards remain lacking. To address this gap, this study relies on a four-year longitudinal intervention research within a major industrial logistics platform. It adapts the SCOR Digital Standard (SCOR DS) model to align an ISO 9001:2015 Quality Management System with an ERP/BPMN digital architecture, specifically analyzing the transition from traditional SCOR to SCOR DS to optimize Return processes. Empirical results demonstrate that SCOR DS acts as a catalyst for data-driven integration, shifting ASS from a siloed, reactive model to a predictive ecosystem while significantly reducing Return Cycle Time**

***Keywords*— After-Sales Service (ASS), SCOR Digital Standard (DS) Model, Digital Transformation, Quality Management, Operational Resilience.**

I. Introduction

In the face of recent global shocks, after-sales service (ASS) and reverse logistics have become strategic factors for profitability, customer satisfaction, and the circular economy. However, after-sales service performance remains hampered by significant organizational fragmentation, with different departments operating in silos. [1] While the integration of quality management and digital transformation is a recognized driver of agility, the literature lacks up-to-date operational frameworks to overcome this fragmentation. [2]
To address this gap, this article draws on the SCOR Digital Standard (SCOR DS) published by the ASCM in 2022. This new framework moves away from a linear approach toward a circular one, incorporates resilience and sustainability, and introduces the "Orchestration" process. Although adopted by practitioners, the SCOR DS remains understudied in research, particularly regarding its integration with quality management systems (ISO 9001) and digital architectures (BPMN/ERP) applied to after-sales service.

II. Literature Review

A. After-Sales Service and Reverse Logistics: Structural Fragmentation

Reverse logistics is an essential component of the circular economy. However, Mallick et al. [3] show that its implementation lacks a comprehensive approach, with collection, diagnosis, and recovery too often managed as isolated subprocesses.

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This fragmentation is directly observable in after-sales service. Using the SRLSQ framework, Dabees et al. [4] emphasize that perceived service quality depends on the seamless integration of these stages rather than on their individual performance. Similarly, Chen et al. [5] highlight the complexity of this ecosystem, where diagnostics, replacement parts, and customer relations are governed by distinct logic. This results in processing delays (Return Cycle Time, MTTR) that require a comprehensive architectural overhaul of after-sales service rather than mere optimization by subsystem.

B. Quality Management System and Digital Transformation: Toward Quality 4.0

Although the ISO 9001:2015 standard forms the foundation of quality management systems (QMS), it was not designed to accommodate the continuous and distributed nature of data flows from ERP systems and connected sensors.

To bridge this gap, the concept of Quality 4.0 combines quality management and digital transformation. Ranjith Kumar et al. [6] identify three key drivers: data centralization, decentralized decision-making, and the development of quality teams' skills. Nevertheless, Quality 4.0 remains theoretical and lacks longitudinal empirical studies on specific functions such as after-sales service. While process modelling (BPMN) coupled with ERP systems is a key enabler for realizing this integration (Abouzid et al. [10]), its application to aligning a certified QMS with an end-to-end digital architecture remains largely unexplored.

C. From the Traditional SCOR Model to the SCOR Digital Standard

Historically structured around six linear processes (Plan, Source, Make, Deliver, Return, Control), the SCOR (Supply Chain Operations Reference) model has long served as the standard framework for modelling supply chains. However, the publication of the SCOR Digital Standard (SCOR DS) by the ASCM in 2022 marks a fundamental shift [1]. By replacing the traditional sequence with a double-loop representation, this new standard repositions the Returns process at the heart of the system, natively integrates attributes of resilience and sustainability, and introduces "Orchestration" as the seventh key process linking strategy to execution [2]. For after-sales service, this evolution promises recursive management that is continuously synchronized with the logistics ecosystem. Nevertheless, the available documentation remains primarily institutional: academic literature has not yet validated an empirical operational framework for analysing this transition in an industrial setting, which constitutes a significant scientific gap.

D. Operational Resilience and Dynamic Capabilities: Theoretical Framework

Operational resilience finds a natural theoretical foundation in the theory of dynamic capabilities. In the context of digital transformation, Dubey et al. [7] demonstrate that dynamic digital capabilities enhance the resilience of supply chains, an effect that is, however, moderated by the institutional context, while Alvarenga et al. [8] emphasize that technologies improve organizational robustness by consolidating the memory derived from past disruptions, a finding also shared by Ali et al. [9] in the agri-food sector. This research converges on a central idea: resilience does not stem solely from the accumulation of technologies, but from their ability to fuel a continuous cycle of sensing, seizing opportunities, and reconfiguring resources. To date, no integrative framework explicitly articulates the transition to the SCOR DS, the alignment of a certified QMS (ISO 9001:2015) with a BPMN/ERP architecture, and the creation of measurable resilience within the after-sales service; it is precisely this threefold challenge (Quality, Digitalization, Resilience) that this research addresses.

III. METHODOLOGY

A. Overview of the Case Study

The study was conducted at a Tunisian logistics platform specializing in the marketing and distribution of products, which also operates an after-sales service (ASS). The ASS handles the receipt of products returned by customers, their diagnosis, any necessary repairs, the management of replacement parts, and their return to customers. The initial analysis of the process revealed a lack of integration among the various activities. Information regarding customer returns, diagnostics, repairs, and parts used was recorded on different media. This organizational structure limited the traceability of cases and made it difficult to track processing times.

B. Conduct of the Intervention Research

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The research was conducted using a longitudinal approach in four phases.

Phase 1: Assessment and Analysis of the After-Sales Service Process.

An analysis of the current situation was conducted based on direct observations, semi-structured interviews with after-sales service personnel, and an analysis of available documents and data. This phase identified the main organizational and informational gaps affecting the process. The initial process was analysed using a traditional SCOR framework, particularly with regard to the role of the Return process within the supply chain. The objective was to identify the activities, stakeholders, physical and informational flows, and key performance indicators.

Phase 2: Alignment with Quality Management.

The after-sales service process was then structured according to the principles of ISO 9001:2015, including the process approach, control of documented information, risk-based thinking, monitoring and measurement, and continuous improvement. This phase made it possible to standardize activities, clarify responsibilities, and define the control points necessary for process control.

Phase 3: Process Reconfiguration and Digitization.

The identified processes were modelled using BPMN to represent the interactions between the various stakeholders and highlight critical interfaces. The model was then integrated with the ERP architecture to centralize information related to after-sales service cases. A unique identifier was assigned to each service call and represented by a barcode. This barcode allows information regarding the product, the customer, the diagnosis, the work performed, the parts used, and the closure of the service call to be linked to the same case.

Phase 4: Transition to a SCOR DS framework and data-driven management.

The final phase involves realigning the after-sales service process with the SCOR Digital Standard framework, particularly with regard to the Return process and the Orchestrate function. Data generated by the ERP system is used to build performance metrics and decision-making dashboards in Power BI. This step enables a shift from a primarily reactive management approach to a data-driven one.

C. Analytical Framework

The analytical framework is based on four interrelated dimensions:

- Quality management: standardization, process control, risk management, and continuous improvement.
- Digitalization: BPMN, ERP, digital traceability, and data utilization.
- SCOR DS: integration of the Return process and orchestration logic.
- After-Sales Service Resilience: the ability to detect disruptions, respond quickly, and reconfigure resources and processes.

The longitudinal analysis thus allows for a comparison between the initial situation and the situation achieved after the various interventions.

IV. Results and Discussion

A. An Initial Situation Characterized by Fragmentation of After-Sales Service

The initial assessment highlights fragmentation of the after-sales service process at several levels.

From an organizational standpoint, the activities of receiving, diagnostics, repairs, and spare parts management are carried out by different parties with limited coordination.

From an information perspective, data is spread across multiple systems. The lack of a unique case identifier makes it difficult to reconstruct the complete history of a service call.

From a management perspective, metrics are primarily generated after the fact, which limits the manager's ability to quickly detect delays and anomalies.

This situation leads, in particular, to longer turnaround times for returns, incomplete traceability, and limited visibility into the actual status of cases.

The assessment thus confirms that the after-sales service issue lies not only in the efficiency of each individual activity but also in the lack of integration between these activities.

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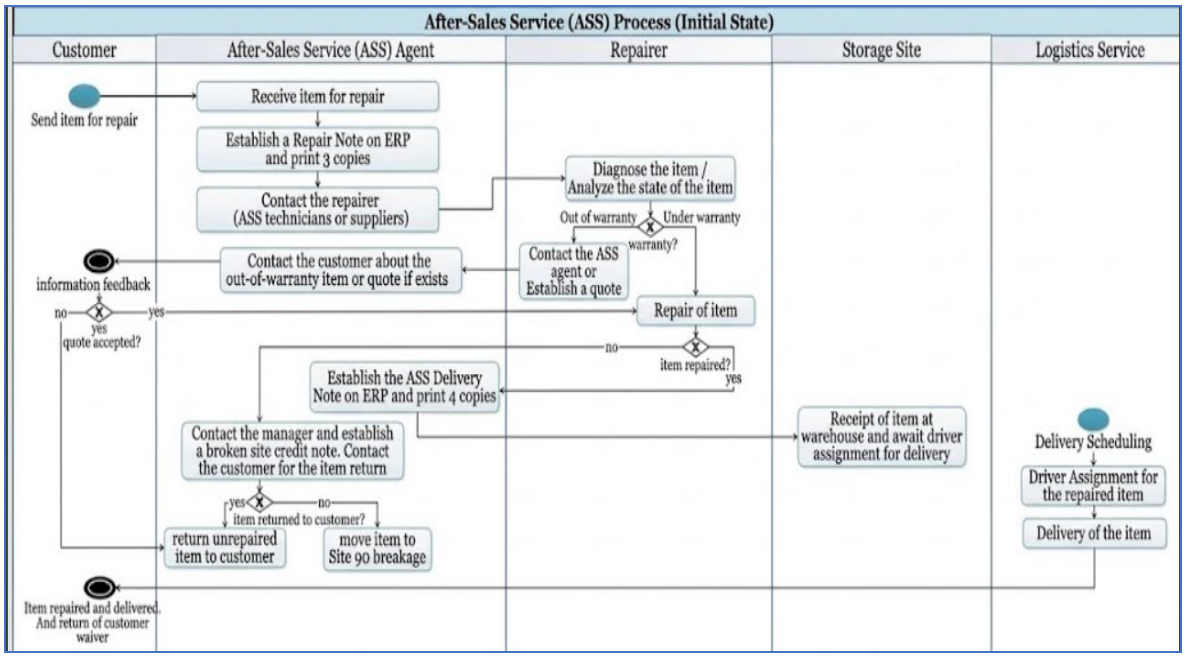


Fig.1. BPMN of the After-Sales Service Process (Initial State)

B. From Traditional SCOR to a SCOR DS Approach

In the initial configuration, the Return process is primarily viewed as a return activity located downstream in the supply chain.

The transformation underway is gradually leading to a view of returns as a process integrated into the entire logistics system.

The approach is evolving as follows:

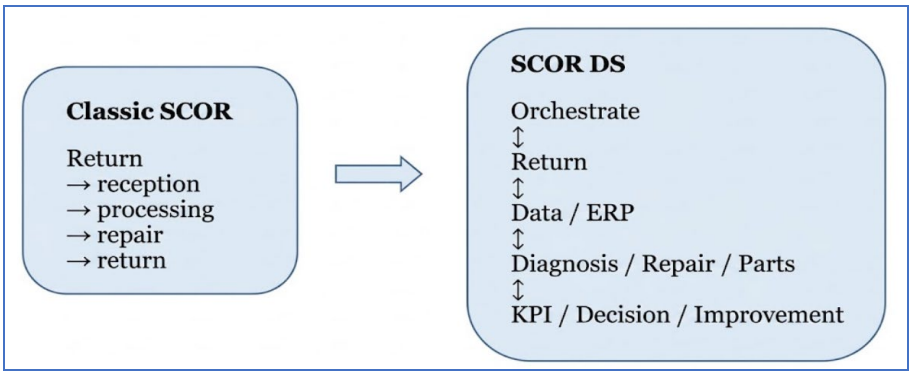


Fig. 2. From Traditional SCOR to a SCOR DS Approach

The Return process thus becomes an integrated loop connecting physical flows, information, stakeholders, and decisions.

This evolution is consistent with the SCOR DS framework presented in the literature review, which places the Return process at the center of a loop-based model and introduces Orchestration to link strategy, business rules, technologies, human resources, and execution.

C. Digitization and Traceability of the After-Sales Service File

The implementation of a digital after-sales service file is one of the main outcomes of the project.

Each service call is assigned a unique identifier. The barcode allows all information related to the file to be retrieved.

The process can be represented as follows:

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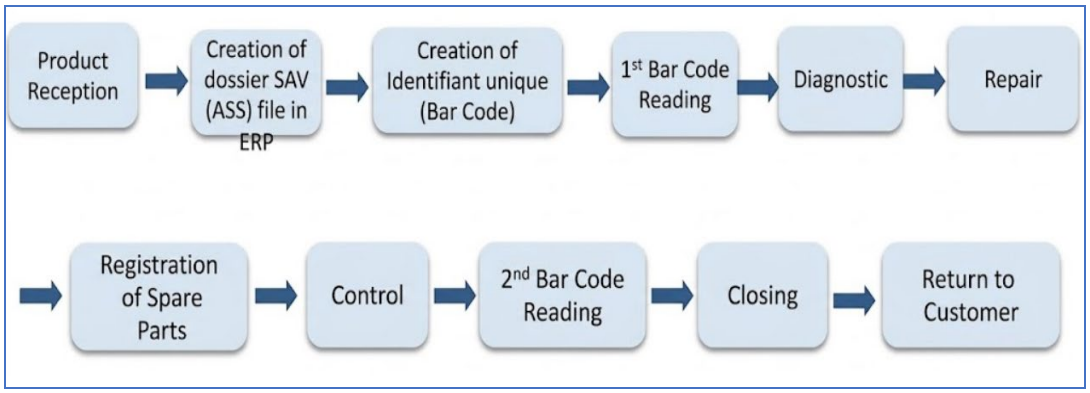


Fig. 3. Digitization and Traceability of the After-Sales Service File

This structure ensures information continuity across the various stages of the process.
The after-sales service case thus becomes a tool for traceability and process management, rather than a mere administrative document.

D. Improving After-Sales Service Process Management

Integrating data into the ERP system enables the generation of metrics such as:

- Average case processing time;
- Average diagnosis time;
- Percentage of cases processed on time;
- Service call traceability rate;
- Number of overdue cases;
- Frequency of return reasons;
- Spare parts usage;
- Failure recurrence rate.

Analyzing this data in Power BI provides the after-sales service manager with a consolidated view of the process.
The progress can be presented as follows:

TABLE I
INDICATOR TRENDS

Indicator	Initial Status	Post-Intervention Status
Full file traceability	75%	95%
Average processing time	12 days	7 days
Average diagnosis time	3 days	1.5 days
Overdue files	30%	12%
Files closed within the target deadline	60%	88%

These values are provided as examples and should be replaced with the actual data observed in the field.

E. Trends In Operational Resilience

The process transformation also improves the after-sales service department's ability to cope with disruptions. Before digitization, detecting a delay or an anomaly often required a manual search for information. After data integration, overdue cases and anomalies can be identified more quickly.
Digitization thus contributes to three essential capabilities:

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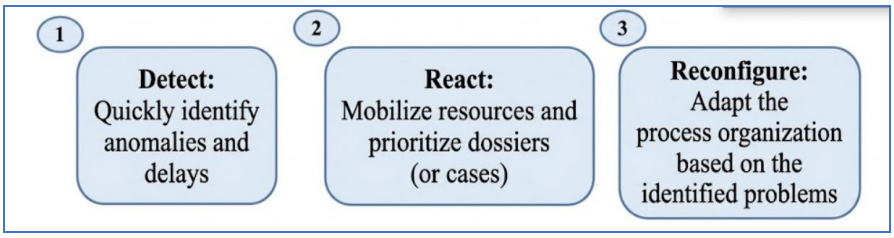


Fig. 4. Three Key Transformation Capabilities

This logic aligns with the dynamic capabilities approach discussed in the literature review, according to which resilience is based on the capabilities to detect, seize opportunities, and reconfigure.
The results show that the transition from the traditional SCOR model to the SCOR Digital Standard should not be interpreted as a mere change in the reference framework. In the case studied, it represents an evolution in how the after-sales service process is designed, integrated, and managed.

The first key finding concerns the role of quality management. ISO 9001 provides the framework for formalizing processes, defining responsibilities, managing risks, and organizing continuous improvement. However, this formalization alone does not guarantee a high capacity to respond to disruptions.

The second lesson concerns digitalization. BPMN-ERP integration makes it possible to transform process control requirements into operational mechanisms for traceability and management. Data then becomes a basis for decision-making and not merely information recorded after the activity has been completed.

The third finding concerns SCOR DS. The shift from a primarily linear view of the process to an integrated approach centered on “Return” and “Orchestrate” allows for a better representation of the interactions between processes, data, resources, and decisions. This evolution is particularly relevant for after-sales service, where return flows require coordination across multiple functions.

Finally, the results suggest that operational resilience is the result of the interplay between quality, digitalization, and organizational reconfiguration, rather than an automatic effect of technology.

The observed mechanism can thus be formulated as follows:



Fig.5. The Integration of Quality, Digitalization, and Organizational Reconfiguration

This framework helps clarify the contribution of the research. While existing studies address quality, digitalization, and resilience separately, the case study proposes considering them as complementary components of the same organizational transformation process. The literature review specifically identified the absence of an integrative framework linking SCOR DS, ISO 9001, BPMN/ERP, and measurable resilience in the after-sales service sector.

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Thus, SCOR DS can be considered a framework for orchestrating after-sales service transformation, enabling a fragmented organization to evolve into a more integrated, digitized system capable of adapting to disruptions.

From a managerial perspective, this research provides a step-by-step approach: diagnosing fragmentation, standardizing the process through quality management, modeling it, digitizing it, leveraging data, and finally managing its performance and adaptability.

From a scientific perspective, the value of this case lies in highlighting the mechanism linking quality, digitization, reconfiguration, and resilience from a longitudinal perspective.

V. CONCLUSIONS

This literature review highlights a twofold convergence: first, between the imperatives of quality and digitalization, now united under the banner of Quality 4.0; and second, between digitalization and operational resilience, viewed through the lens of dynamic capabilities. At the same time, it reveals a persistent theoretical and empirical gap: the transition from the traditional SCOR model to the SCOR Digital Standard, although presented by its designers as a catalyst for data-driven integration, has not yet been studied as the operational vehicle for this dual convergence in the specific field of after-sales service.
From a theoretical perspective, the aim of this research is to demonstrate that SCOR DS is not merely another process framework, but rather the concrete implementation of the quality-digitalization linkage as a dynamic capability in its own right. From a managerial perspective, it aims to provide practitioners with an up-to-date framework for steering the transition toward a digitalized, circular, and resilient after-sales service.

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