Impact of ERP Integration on Management Control Practices in a Moroccan Construction Company: An Action Research Approach

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This article examines the impact of ERP on management control practices within SBST, focusing on five key aspects: project cost and margin assessment, automation and improved reporting, development of tailored dashboards, and optimization of budget monitoring and financial risk control. Before the ERP implementation, these practices were characterized by fragmented management, manual data collection, and a lack of real-time visibility into project performance. The methodology adopted is based on an action research approach, in which the author, as an actor-researcher, actively participated in implementing the ERP and evaluating its effects. The results of this study show that integrating an ERP improved cost traceability, reduced reporting times, increased reliability of budget forecasts, improved the quality of analyses and more responsive decision-making, thus strengthening the role of management control in the strategic management of projects. Finally, this research opens up perspectives on the long-term impact of digitalizing management processes, particularly regarding resource optimization and financial risk management.

Keywords: ERP, management control, digitalization, reporting, construction, action research

INTRODUCTION

In an economic context marked by increased competition, growing pressure on costs and a heightened demand for responsiveness, digital transformation is now a major strategic lever for companies, particularly in project-intensive sectors such as Construction and Public Works. According to Martinsuo and al. (2019), this sector, characterized by organizational complexity, the multiplicity of stakeholders and the heterogeneity of construction sites, requires efficient tools to ensure the coordination and effective management of human, material and financial resources.

Among the most structuring technologies in this modernization dynamic, integrated management systems, or ERP (Enterprise Resource Planning), occupy a central place. These IT solutions allow for cross-functional integration of business processes, centralization of data, and automation of administrative and operational tasks. According to Gallad and al. (2020), the introduction of an ERP thus represents a profound change in the company's information architecture, affecting not only technical and financial flows, but also management control and management practices.

In this perspective, this article aims to analyze the impact of integrating an ERP on management control practices within the company SBST, which operates in the construction sector. Before the implementation of the ERP, this company suffered from fragmented financial management, based on heterogeneous tools

(Microsoft Excel, isolated business software), resulting in poor data traceability, a high risk of errors and a lack of responsiveness in the budgetary monitoring of projects.

To address this issue, an action research approach was adopted, combining concrete intervention in the field (as an actor-researcher) with the production of scientific knowledge on the organizational and managerial effects of ERP. The study, conducted over two years, is based on a longitudinal approach comparing management practices before and after the integration of the system, through process observation, documentary analysis and interviews with stakeholders.

The objective of this article is threefold: the first is to understand how ERP transforms management control practices in a complex project environment. The second is to identify the levers for improvement made possible by automation and process integration. The third is to discuss the conditions for success and the challenges associated with such a transformation in a specific context such as that of the construction industry.

The results obtained reveal major developments in several dimensions of management control, including data reliability, fluidity of information exchange, prospective analysis capacity and real-time budget monitoring. These findings highlight the operational contribution of ERP and the strategic repositioning of management control as a steering and decision-making tool in a rapidly changing sector.

LITERATURE REVIEW

Enterprise Resource Planning (ERP) systems are integrated IT solutions that allow companies to centralize and automate the management of their business processes. Since their emergence in the 1990s, these systems have continued evolving to adapt to different industries' specific needs. Vuorinen and Martinsuo (2019) shows that ERP plays a key role in the digital transformation of organizations by promoting data integration, process standardization, and improved decision-making.

In the construction sector, characterized by high project complexity, tight deadlines, and tight budgets, the adoption of ERPs has attracted growing interest. Teittinen et al. (2013) highlight that integrating an ERP improves coordination between project stakeholders, reduces data entry errors, and optimizes resource management. However, Khalfaoui and Zenasni (2014) show that implementing these systems remains a major challenge due to the need to adapt the tools to the sector's specificities.

ERP and the Evolution of Management Control Practices

Management control is an essential tool for ensuring a company's strategic and operational management. It relies on tools and methods for planning, monitoring, and analyzing economic, financial, and organizational performance. As such, the quality, reliability, and speed of access to information are critical dimensions of the control process. The introduction of ERP (Enterprise Resource Planning) systems has significantly changed this information environment, acting as a catalyst for transforming management practices (Badda, 2025).

According to Liew (2019), ERP integration profoundly transforms the way information is collected, processed, and shared within organizations. As integrated systems covering several key functions (accounting, finance, project management, purchasing, etc.), ERPs allow for centralization and unification of data, thus reducing redundancies. This centralization promotes better traceability, greater information consistency, and increased value chain transparency.

Kouki and al. (2020) emphasize that ERPs act as a structuring tool for management control, by standardizing processes and enabling faster and more reliable collection of financial and operational data. This allows management controllers to abandon repetitive tasks with low added value (manual entry, reprocessing, consolidation), to devote more time to analysis, consulting and strategic management activities. El Guennouni and Chafik (2019) demonstrated that adopting an ERP system significantly improves cost management, reduces reporting production times, and better data traceability. These systems offer an enhanced capacity to monitor real-time performance indicators, detect budgetary deviations, and feed decision-making dashboards.

More recently, several studies highlight the evolution of the role of the management controller following the digitalization induced by ERP. According to Bennani and al. (2021), these systems encourage an increase in the skills of controllers towards business partner functions, placing them more at the heart of strategic decision-making than in a purely technical or administrative role. Alhatabat (2020) highlighted the impact of ERPs on reducing the risk of errors and accelerating the production of financial statements. Automating accounting processes not only helps reduce the administrative burden on financial functions, but also ensures greater compliance with accounting and tax standards. This is particularly crucial in contexts with high regulatory requirements or in subsidiaries of international groups (Badda and Rahmouni, 2023).

The Specificities of Management Control in the Construction Sector

The construction and public works sector have structural and operational characteristics that make management control particularly demanding. The nature of projects, which are often long, heterogeneous, capital-intensive, and exposed to multiple hazards, considerably complicates budget planning, cost monitoring, deadline management, and resource allocation (Bouziane and Ourrad, 2023). Unlike industrial sectors where production is generally repetitive and standardized, construction projects are mostly carried out on a tailor-made basis and in a specific context, which requires great flexibility in financial management. Management control must therefore integrate complex temporal, geographical and contractual dimensions, while ensuring consistency between operational monitoring on the ground and information feedback to central structures. Erraoui and Slimani (2021) thus highlighted the central role of project control in construction, structured around specific practices such as budget reporting by site, monitoring of margins at completion, and multi-level variance analysis.

In this context, ERPs play a structuring role by allowing us to overcome the limitations of traditional tools, often based on spreadsheets or non-integrated business software. Malki and al. (2023) note that ERP contributes to more reliable management of project costs and margins, thanks to the automation of data collection processes, the unification of repositories and the possibility of producing cross-analyses in real-time. Furthermore, construction companies operating across multiple sites or internationally need to consolidate inter-subsidiary data. Tarmidi (2022) emphasizes the benefits of ERPs at this level, by promoting harmonization of accounting and management practices between different entities. This capability was highlighted in our study, where ERP served as a lever to standardize budget control and reporting processes between construction sites and headquarters.

Papiorek and Hiebl, (2024)) show that ERPs not only allow information to be centralized, but also enrich management practices with analytical functionalities (predictive variance analysis, cost forecasts at completion, scenario simulation). These advances pave the way for more proactive management control, adapted to the performance, responsiveness and strategic management requirements specific to the construction sector.

The Impact of ERP on Management Control Practices in the Construction Industry

Integrating ERP systems in the construction industry is profoundly changing traditional management control practices (Badda and al., 2021). Through centralized management, automated data flows, and increased interoperability between accounting, operational, and budgetary functions, ERP enables more precise and strategic project management. This transformation is taking place at several key levels of the control process.

Improving Reporting and Performance Monitoring

Before ERP integration, reporting was often manual, relying on Excel files and decentralized databases, which led to errors and significant delays. ERP significantly improves this function by automating information reporting and standardizing financial and operational reports. In the construction industry, where companies must rigorously monitor construction sites and margins, reliable, real-time reporting is a major competitive advantage. ERPs have facilitated the automation of financial and operational reporting, reduced information transmission times and enabling better monitoring of construction site performance.

Thanks to ERPs, management controllers have access to continuously updated key indicators, facilitating decision-making (Fähndrich and Pedell, 2025).

Optimizing the Evaluation of Costs and Profitability of Projects

Cost management in the construction industry is a complex process that involves many variables: material costs, labor, lead times, unforeseen events, etc. Traditionally, this information was dispersed among several departments, making it difficult to accurately assess project profitability. ERP centralizes all this data and allows for more detailed cost analysis across different project phases. It improves visibility into project costs and margins by providing real-time indicators, enabling more proactive resource management and increased responsiveness to budget variances. ERP also facilitates comparison between forecast budgets and actual results, thus improving budget control and variance management (Roffia and Dabić, 2024).

Improving the Project Dashboard and Strategic Management

The dashboard is an essential management control tool for synthesizing key information and managing project performance. ERP integration has significantly improved this tool by providing real-time data and facilitating its visualization in the form of interactive dashboards. In construction companies, dashboards allow them to track project progress, analyze margins, anticipate financial risks, and adapt strategies accordingly. Thanks to better transaction traceability, ERPs have enabled process standardization and improved data reliability. They thus provide greater visibility across the entire project portfolio, promoting proactive management and more responsive decision-making (Fähndrich, 2023).

Limitations and Challenges of ERP Adoption

Despite their very important role in the digital transformation of organizations, Enterprise Resource Planning systems are not without their challenges during their adoption. Although they represent a structuring tool for streamlining and integrating management processes, their implementation often involves technical, organizational, and human constraints that sometimes limit the expected effects. Several studies highlight that the success of an ERP project does not depend solely on the technological performance of the solution, but above all on the ability of organizations to manage the transitions it induces: (Granlund and al., 2013; Ruivo and al., 2014)

- Investment costs and resources mobilized: One of the major barriers to ERP adoption concerns its total implementation cost. The project requires not only the acquisition of a software package, but also significant investments in infrastructure, consulting, configuration, training and change support. These costs, often underestimated upstream of the project, can impact the profitability of the ERP, particularly in SMEs or companies in the construction sector, where margins are traditionally lower and project cycles long.
- Resistance to organizational change: Another challenge widely documented in the literature is the resistance to change induced by the introduction of an ERP. It profoundly modifies work routines, accountability logics, and the way in which information circulates within organizations. These changes can give rise to reluctance, even opposition, especially when users perceive the tool as a constraint or a threat to their autonomy.
- The complexity of integration with existing processes: The rigidity of ERP systems can be a barrier to their adoption, particularly when it comes to adapting them to very specific or evolving business processes. They are based on standardization logics that can come into conflict with the need for operational flexibility, particularly in sectors such as construction where each project is unique, often non-repetitive and subject to significant uncertainties (deadlines, bad weather, cost variations, etc.).
- Data quality and user training: The performance of an ERP system depends largely on the quality and consistency of the data entered into the system. It is not a miracle solution: it can only produce reliable results if the input data itself is reliable, complete and well-structured.

However, in many organizations, the initial databases are fragmented, redundant or obsolete, making feeding the system both tedious and risky.

In summary, ERP is now an essential tool for construction companies looking to improve their financial management and optimize project monitoring. Its impact on management control practices is considerable, particularly with regard to reporting automation, cost evaluation, and dashboard consolidation. The literature shows that ERP is a powerful tool for modernizing management control practices, particularly in construction-intensive sectors. However, implementing an ERP requires adaptation to the specificities of the sector and rigorous change management to maximize its benefits. Its impact also largely depends on the quality of its implementation within organizations.

The integration of ERP systems into organizations has been the subject of extensive management research, particularly in the areas of management control and organizational performance. This literature review aims to contextualize the main issues associated with the adoption of ERP systems, with an emphasis on their impact on management control practices, particularly in the construction sector. Thus, this study is part of this research dynamic by analyzing in depth the concrete impact of the integration of ERP on management control practices in a construction company, by adopting an action research approach.

RESEARCH METHODOLOGY

Choice of Methodology

The study presented in this article is part of an action research approach, a qualitative methodology that combines solving practical problems and producing robust scientific knowledge (Cornish et al., 2023). This methodological choice was imposed due to the dual objective pursued by the research: on the one hand, to support a company in the construction sector in the integration of an ERP and, on the other hand, to rigorously evaluate the impact of this transformation on management control practices. Action research is particularly suited to the complex organizational context where change is simultaneously desired, supported, and studied. It differs from traditional approaches in its iterative, collaborative, and interventionist nature (De Oliveira et al., 2024).

In this context, the researcher is not a simple external observer, but an actor-researcher engaged in the transformation process, simultaneously assuming the functions of design, change facilitation, and scientific evaluation. In our study, this approach allowed the researcher to be closely integrated into the reality on the ground, actively participating in the operational implementation of the ERP, coordination between teams and the ongoing analysis of the effects on management control practices. The method made it possible to co-construct solutions with internal stakeholders (finance department, works departments, management control, etc.), while ensuring analytical traceability of the changes observed at each stage of the project (Mukhopadhyay, 2022).

Action research also promotes collective organizational learning, since corrective actions are designed and implemented collaboratively, in response to dysfunctions or emerging needs. This methodological approach makes it possible to produce contextualized knowledge, anchored in a real environment, while contributing to the concrete improvement of management tools, processes and practices. In the specific case of this study, it made it possible to document in depth the changes made in the steering mechanisms, the structuring of financial data, budget monitoring, margin evaluation, and the quality of reporting within the company. Thus, action research constitutes a relevant, coherent and rigorous methodology for analyzing the impact of integrating an ERP on management control practices in the construction sector, while generating concrete operational benefits for the company concerned (Davison et al., 2021).

Framework of the Study

This research was conducted within SBST, a company operating in the construction and public works sector. A sector whose environment is marked by high capital intensity, project complexity and tight margins, which makes the control of management information an essential strategic lever. The study focused on analyzing the impact of integrating an enterprise resource planning software package on management control practices within this company. More specifically, the research focused on five key

dimensions of the management control function, identified as essential for the performance and sustainability of projects in the construction industry:

- Establishment of a reliable and simple documentary system: in order to structure the traceability of decisions, financial commitments and technical choices throughout the project life cycle.
- Evaluation of project costs and margins: with a view to forecasting and securing profitability.
- Assurance of budgetary monitoring of projects: to manage expenditure in line with forecast budgets.
- Implementation of appropriate reporting: guaranteeing rapid and relevant circulation of financial information to management.
- Development of a project dashboard: as a summary and decision-making tool in terms of operational performance.

The choice of these five practices stems from a preliminary analysis of the specific challenges of management control in the construction industry and an initial diagnosis carried out prior to the research with SBST's stakeholders. These practices reflect the major levers through which ERP is likely to influence, directly or indirectly, decision-making processes and steering mechanisms.

The research took place over 24 months, between the initial scoping phase of the ERP project and the post-deployment stabilization phase. This duration made it possible to cover the entire action research cycle, divided into four main phases:

- Diagnostic phase: evaluation of existing management control practices, identification of dysfunctions, process mapping.
- Design phase: participation in defining needs, modeling processes, and configuring key modules.
- Implementation phase: gradual system deployment, user training, adaptation of practices.
- Evaluation phase: observation of developments in the field, comparative analysis of practices before and after, and formalization of lessons learned.

The researcher-intervener position allowed for complete immersion in the organization, fostering a detailed understanding of the interactions between technological tools and human, structural and cultural dynamics. This research framework thus made it possible not only to observe the transformations induced by the ERP, but also to act directly on their design and support, in a logic of collective intelligence and continuous improvement.

Progress of the Action Research

Phase 1: Initial Diagnosis and Identification of Needs

The first phase of the action research focused on conducting an in-depth diagnosis of management control practices within the SBST company before integrating the ERP. This exploratory stage had a dual objective: on the one hand, to understand the actual functioning of existing management systems, beyond formal procedures, and on the other hand, to identify functional and organizational needs to guide the design of the ERP solution.

Data Collection Methodology

The diagnostic phase was based on a qualitative approach combining several complementary data collection techniques:

- Semi-structured interviews: Eight interviews were conducted with key stakeholders in management control, namely the financial manager, the management controller, two employees from the administrative department, and four site managers, chosen for their involvement in the budgetary management of construction sites. These interviews made it possible to collect rich data on actual uses, perceptions of existing tools, difficulties encountered, as well as expectations regarding the future system.
- Document analysis: A systematic review of internal documents was conducted, including quarterly financial reports, budget tracking sheets on spreadsheets, minutes of site meetings,

and internal management procedures. This analysis made it possible to assess the structuring of the available information and its compliance with good management practices.

- Non-participant observation: Observation sessions were conducted within the management control department and in the works departments, in order to understand the actual progress of the budgeting, budget review, and reporting processes. These observations highlighted the informal practices often used to compensate for the shortcomings of the formal system.

Diagnostic Results

Cross-analysis of this data revealed several structural limitations in the management system in place before the integration of the ERP:

- Low process automation: Most budgetary and analytical operations were carried out manually via Excel spreadsheets, without interconnection with the accounting system. This fragmentation led to significant time losses, a high workload, and an increased risk of human error.
- Lack of data reliability and traceability: The absence of an integrated system limited the reliability of the data produced, particularly in terms of construction cost, margin monitoring, and commitment history. Documents were often stored locally, without a systematic backup or validation procedure.
- Difficulty in real-time monitoring: The sequential nature of the data collection and processing processes did not provide an up-to-date view of the financial situation of projects. Budgetary deviations were only detected after the fact, often too late to allow for effective corrective actions.
- Heterogeneity of practices between departments: Each works department used different formats and calculation methods, making consolidation at the central level difficult. This compartmentalization harmed the consistency of management.

Identification of Needs

At the end of this phase, several priority functional needs were identified to guide the design of the future ERP:

- Automated integration between accounting, budgeting, and operational monitoring;
- Establishment of a single repository for management data;
- Systematic traceability of decisions and commitments;
- Real-time monitoring of key indicators (costs, margins, progress);
- Harmonization of reporting practices and formats.

This initial diagnosis thus made it possible to lay the foundations for an ERP project geared towards the performance of management control practices, by placing end users at the heart of the thinking from the first stages of the action research.

Phase 2: Design and Configuration of the ERP

The second phase of the action research was dedicated to the design and configuration of the ERP, based on the initial diagnosis results. The main challenge of this stage was to translate the needs expressed by users into precise functional specifications, while ensuring that the solution developed was adapted to the culture, processes and constraints of the SBST company, operating in the specific construction sector.

Definition of Functional Needs

To develop functional specifications, collaborative work was carried out with the various stakeholders (management control, financial management, project managers, design office, construction management). This document formalized the requirements around several key areas:

- Budget management by project: integration of a single site reference, structuring of budgets according to the phases of the project (forecast budget, actual budget, budget revisions).

- Real-time cost tracking: automation of reporting of expenses incurred, breakdown by analytical item and by task.
- Margin assessment: automatic calculation of net site margin, comparison between initial, revised and actual budget.
- Reporting and dashboards: generation of personalized reports and performance indicators in line with management expectations.
- Document traceability: automatic archiving of budget versions, validations, and decisions related to projects.

This co-construction made it possible to ensure strong ownership of the ERP project by future users and to limit resistance to change.

Choice of Software Package and Configuration

After benchmarking several market solutions, the choice fell on a specialized ERP for construction companies, capable of managing complex, multi-stakeholder projects. The selected software package enabled complete integration between accounting, purchasing management, budget tracking, management control, and reporting. As an actor-researcher, we participated with an active role in the configuration phase, working with the technical team and external consultants to:

- Adapt the modules to SBST's specific business processes;
- Create analytical account plans aligned with site monitoring practices;
- Develop personalized dashboards, particularly for calculating net margin and monitoring budget variances;
- Ensure interoperability with existing systems (particularly accounting software).

At the end of this phase, the configuration made it possible to build an information system focused on project management logic, and not on simple accounting automation. SBST thus had a fully operational ERP, configured to meet the specific challenges of managing construction projects. The tool not only made it possible to centralize financial information, but also to produce reliable and up-to-date decision-making indicators. This success is explained by the direct involvement of end users in the design process and by the reflexive approach specific to action research, which allowed for continuous adjustments at each stage.

Phase 3: Implementation and Support for Change

Following the configuration phase, the research entered a crucial phase: the operational implementation of the new ERP, accompanied by a structured change management system. This phase aimed to observe the system's behavior in a real-world context, support users in getting to grips with the tool, and adjust processes based on feedback from the field. It lasted ten months and was a key moment in the organizational anchoring of the innovation.

Pilot Phase on Selected Sites

Implementation began with an experiment on a sample of pilot projects, chosen for their representativeness in terms of size, technical complexity, and budgetary implications. This strategic choice aimed to ensure detailed observation of the interactions between new digital practices and pre-existing management routines. Each pilot project was supported by a pair consisting of an administrative employee and a user project manager, whose mission was to:

- Monitor budget execution in real time via the ERP module;
- Test new reporting features (margins, deviations);
- Document malfunctions, adjustment needs and observed gains.

Monitoring Performance Indicators

Throughout the pilot phase, a performance indicator monitoring system was implemented to measure the concrete effects of the ERP on management control practices. Among the indicators monitored:

- Deadline for production of budget reports;
- Reliability rate of the data entered (difference between forecasts and actual results);

- Responsiveness in detecting margin drifts;
- Number of corrective returns requested on financial statements.

These indicators enabled a continuous assessment of the appropriation of the system, but also of its impact on the quality of budgetary management.

Collection and Analysis of User Feedback

A systematic feedback system has been established, through:

- Weekly meetings bringing together operational teams, management controllers and ERP consultants;
- Satisfaction questionnaires at the end of each budget cycle;
- An ideas box allowing users to submit suggestions or reports at any time.

This feedback was analyzed iteratively, in keeping with the participatory logic of action research. It led to several concrete adjustments:

- Improved ergonomics of certain interfaces;
- Added custom filters in dashboards;
- Clarification of budget closure procedures.

Training and Support for Change

The technical implementation of the system was accompanied by a change management strategy, aimed at ensuring user buy-in and skills development. Over the weeks, functional optimizations were integrated into the tool to adapt the system to the specific business requirements of SBST. This strategy included:

- Targeted training sessions for different user profiles (project managers, management controllers, assistants, accountants);
- The implementation of user manuals and operational procedure guides;
- The designation of reference users in each pole, responsible for relaying good practices;
- Field support after deployment to correct any usage errors and refine settings;
- The creation of an internal support center, providing local support in resolving technical incidents and assistance with usage;
- Weekly follow-up meetings between project teams, key users and ERP consultants, allowing for continuous improvement of the system as it is taken over.

This support process has encouraged a gradual acculturation to digital management tools and a transformation of users' representations with regard to management control, now perceived not as a simple monitoring tool, but as a strategic steering lever.

This implementation phase enabled the validation of the relevance of the ERP as a structuring tool for the management control function, and to lay the foundations for modernized budgetary governance. The initial findings revealed:

- A significant reduction in the production time of monthly reports (halved on average);
- An improvement in the quality of data used for decision-making;
- Greater proactivity of project managers in anticipating budgetary deviations.

Phase 4: ERP Impact Assessment

The fourth phase of this action research consisted of a systematic and rigorous evaluation of the effects produced by the integration of ERP on management control practices within the SBST company. This evaluation aimed to measure the tangible results of the digital transformation and understand its organizational and behavioral implications by combining quantitative and qualitative data.

Comparison of Key Performance Indicators

The impact analysis was first based on the comparison of key indicators before and after the integration of the ERP system. These indicators were selected for their ability to reflect the critical dimensions of budget management and performance monitoring:

- Average budget processing time (from preparation to validation): reduced by 40%, from an average of 12 days to 7 days.
- Rate of errors in budget forecasts (unjustified differences between forecasts and actual results): reduced by 35%.
- Time taken to report financial information to management: reduced by 50%, with almost immediate access to consolidated data.
- Compliance rate with configuration standards (monitoring of compliance with defined processes): constantly improving, reaching 92% after 12 months.

These results reflect a significant improvement in the efficiency, reliability and responsiveness of management control.

Post-Implementation Qualitative Interviews

To complete this numerical assessment, a series of 10 semi-structured interviews were conducted with the main users of the ERP: management controllers, project managers, department heads, and members of the financial department. These interviews allowed us to gather detailed perceptions on the system's appropriation, the obstacles encountered, and the benefits experienced. The results reveal a positive change in representations and behaviors:

- A general recognition of the added value of the system in terms of transparency and traceability of data;
- An increase in decision-making autonomy among project managers, who are now able to analyze margins, deviations and indicators themselves;
- Reduced organizational stress related to budget closures, thanks to automation and data reliability.

However, some respondents highlighted the need for ongoing support and enhanced training, particularly for those less familiar with digital tools.

Analysis of Forecast/Actual Deviations

Another aspect of the evaluation involved a comparative analysis of the gaps between budget forecasts and actual results. This analysis was carried out on a panel of four comparable projects, taking into account two consecutive budgetary years: one before ERP, the other after ERP. The results show an average reduction of around 30% in unanticipated variances, reflecting better cost control and an increased ability to anticipate deviations. This trend was particularly noticeable in complex projects, where real-time monitoring features enabled earlier readjustments.

Synthesis of Effects

The overall assessment confirms that the ERP has acted as a structuring lever for the management control function on a technical level (automation, data integration) and managerial level (improved collaboration, increased team skills). It also highlights the conditions for the success of such a transformation:

- Active involvement of users from the early stages;
- The existence of strong, cross-functional project management;
- The ability to articulate technology, organization and business practices in a collective learning approach.

This evaluation phase thus constitutes the culmination of the action research cycle.

Limits, Challenges and Constraints of Action Research

Although this study generated significant results in improving management control practices through integrating an ERP in a construction company, several methodological, organizational and human limitations were encountered throughout the action research process. These constraints must be recognized in order to qualify the results obtained and identify the conditions necessary for the success of similar projects.

Resistance to Change and Dynamics of Appropriation

One of the main challenges encountered concerned organizational change management, which is inherent in any digital transformation project. Despite the support efforts implemented, persistent resistance from some users was observed, particularly among employees unfamiliar with digital tools or attached to old ways of working. This resistance resulted in:

- Reluctance to adopt new computerized procedures;
- Partial use of certain ERP functionalities;
- Cognitive overload linked to the learning curve of the new tool.

This phenomenon, well documented in the literature on the adoption of information systems (Lapointe & Rivard, 2005; Venkatesh et al., 2012), required the implementation of ongoing training, demonstration sessions, and technical support mechanisms to facilitate the gradual appropriation of the system.

Constraints Related to the Temporality of Research

The duration of the action research cycle, although relatively long (24 months), did not allow for the measurement of certain medium- and long-term effects. In particular, certain transition periods between the old system and the new ERP were marked by interruptions in data collection (interruptions in data entry, duplicate information, changes in the reference frameworks used), limiting the rigorous comparability of certain before/after metrics. Furthermore, the post-implementation performance assessment focused on the first few months following deployment, which may bias the analysis by underestimating delayed effects (learning effects, maturation of practices, stabilization of processes).

Potential Bias of the Actor-Researcher Posture

The direct involvement of the researcher in the conduct of the ERP project is a strength, but also a potential limitation. While this dual role of actor-researcher allowed for complete immersion in organizational dynamics and privileged access to data, it raises questions relating to:

- The neutrality of the analytical perspective, likely to be influenced by operational commitment;
- The selection of study objects and evaluation indicators, sometimes guided by field constraints or the strategic priorities of the company.

In order to limit these biases, triangulation mechanisms have been put in place (cross-interviews, collective validation of analyses, comparison with factual data), but the subjectivity inherent in this position cannot be totally eliminated.

Generalization of Results

The contextual and unique nature of the case study conducted necessarily limits the external scope of the results of this research. The structural, cultural and economic specificities of the SBST company and those of the construction sector mean that the lessons learned cannot be automatically transposed to other contexts without adaptation. However, they offer avenues for reflection and useful methodological recommendations for organizations facing similar issues.

RESULTS AND DISCUSSION

The Establishment of a Reliable and Simple Documentary System

Situation before ERP Integration

Before the integration of an enterprise resource planning (ERP) software package, information management within SBST relied on traditional practices that made data flow complex and time-consuming. Information relating to construction sites was often dispersed between different departments, and its transmission was mainly done through informal exchanges, leading to risks of errors and loss of information. The lack of a structured documentation system made coordination between teams difficult, particularly between management control and site managers. This situation created several problems:

- A lack of standardization of documents and processes, complicating the consolidation of financial and operational data.

- Difficulty in ensuring regular and reliable updating of procedures due to fragmented document management.
- Poor communication between the various stakeholders, which could slow down decision-making and hamper the efficiency of operations.
- Limited accessibility to essential information, increasing the risks of inconsistencies and errors in site management.

With this in mind, management has decided to modernize its documentary approach and improve site management by implementing a structured procedures manual and specific digital tools to optimize performance monitoring and analysis.

Impact After ERP Integration

The integration of an ERP into SBST has brought about a significant transformation in document management and internal communication. Thanks to the implementation of an integrated system, several improvements have been observed:

- Standardization and formalization of processes: the procedures manual implemented as part of the ERP project has become a common reference for all stakeholders involved in site management. It clearly and detailed describes the missions of site managers and the project monitoring procedures. This has helped to harmonize practices, ensure better traceability of actions, and strengthen compliance with internal and external standards.
- Centralized accessibility and real-time updates: the ERP has made it possible to centralize all documents and data in a single database accessible to all relevant departments. Updates to procedures and documents are now carried out in real time, thus reducing the risk of errors linked to the use of outdated versions. In addition, the digitization of documents and their integration into the ERP ensures simplified accessibility, facilitating consultation by teams in the field.
- Streamlining communication and interdepartmental collaboration: the ERP has fostered better communication between the management control department and the construction site teams. The unification of data and the implementation of an information system allow for standardization of expenditure entry, reliable reconciliation with accounting and facilitate budget monitoring and construction site forecasting.
- Optimizing time management and decision-making: thanks to process automation and document structuring in the ERP, the time spent searching for and consolidating information has been significantly reduced. Site managers now have interactive dashboards that facilitate the monitoring of performance indicators and enable faster and more relevant decision-making.
- Improved transparency and trust: the existence of a reliable and structured documentation system has strengthened the trust of stakeholders, particularly customers and auditors. The transparency of processes and the company's ability to justify its decisions with precise and well-documented data have reinforced its image of professionalism and rigor.

The integration of ERP into SBST has profoundly transformed document management, moving from an informal and dispersed system to a structured, centralized and secure framework. This evolution has enabled better circulation of information, improved site monitoring and optimization of the work of management controllers. Thanks to this tool, SBST has been able to establish a more rigorous and efficient management culture, thus facilitating the achievement of its strategic and operational objectives.

Evaluation of Project Costs and Margins

Situation Before ERP Integration

Before ERP integration, project cost and margin assessment was a manual and fragmented process. Each project began with an initial budget estimate prepared by the Pricing Studies department. This budget served as a reference, but monitoring it during the project was complex due to the lack of a centralized management tool. Site managers had to manually adjust their estimates based on site developments, consolidating information from several disparate sources (paper documents and Excel files). This lack of

integration led to discrepancies between forecasts and actual costs, limiting visibility into project profitability and complicating timely corrective decision-making.

Impact After ERP Integration

The implementation of ERP has profoundly transformed this practice. Now, all costs, forecasts, and margins are centralized in a single system, accessible to all stakeholders. The ERP integrates budget tracking from the moment the contract is awarded, allowing for complete traceability of expenses and budget adjustments. The main improvements brought about by the ERP are as follows:

- Real-time cost tracking: Expenses related to materials, labor and subcontractors are recorded directly in the system, allowing for continuous updating of costs incurred.
- Development and validation of the adjusted budget: This budget, established by the site manager in collaboration with management control, is now structured and standardized in the ERP. It allows for precise identification of discrepancies between the initial estimate and the detailed execution budget.
- Better anticipation of budget variances: ERP facilitates comparison between the initial budget, the adjusted budget, and actual costs. It automatically generates alerts in the event of budget overruns, allowing for greater responsiveness in construction site management.
- Automation of project financial reporting: Site managers and management controllers can quickly extract reports detailing project profitability, highlighting differences between planned and actual costs.
- Improved collaboration between departments: Centralized access to budget data strengthens communication between the Price Studies department, site managers and the management controller, thus reducing errors and optimizing the financial management of projects.

ERP has made project cost and margin assessment more accurate, faster, and more reliable. This transformation has improved project management, optimized resource allocation, and maximized project profitability.

The Assurance of Budgetary Monitoring of Projects

Situation Before ERP Integration

Ensuring project budget monitoring for companies operating in the construction sector relies on initial estimates and rigorous budget monitoring. Before the integration of ERP, this process, within SBST, relied primarily on heterogeneous tools, informal exchanges between different departments, and fragmented document management. Each project was subject to an initial study carried out by the "Price Studies" department, which established a basic forecast budget. This budget was then transmitted to the site managers, responsible for implementing the project, who had to refine these forecasts based on the realities on the ground. Project budget monitoring within SBST relied on fragmented processes and manual data exchanges between construction sites, the accounting department, and management control. This management relied on Microsoft EXCEL for entering expenditure commitments and reconciling them with accounting, and on software for extracting accounting data. However, this system had limitations, particularly in terms of data reliability, the time taken to update information and the additional efforts required to consolidate and analyze the differences between the forecast budget and the actual budget. However, several limitations hampered the effectiveness of this approach:

- Lack of harmonization: The absence of a centralized system forced stakeholders to manage dispersed Excel files, generating inconsistencies in the data.
- Poor traceability of changes: The transmission of budgets and adjustments was often done via paper documents or informal exchanges, complicating the justification of deviations between forecasts and actual results.
- Difficulty tracking margins in real time: Updating costs and margins required frequent manual interventions, slowing down decision-making.
- Lack of a single benchmark: Each site manager interpreted the budgets according to their own methodology, which led to heterogeneity in the financial evaluation of projects.

Impact After ERP Integration

The integration of the ERP has enabled a significant overhaul of budget monitoring by automating the entire process, ensuring real-time traceability of financial flows, and structuring the key stages of budget monitoring. Site administrators now directly enter expenses incurred into the ERP, centralizing the information and ensuring instant reconciliation with recorded invoices. This automation reduces the risk of errors and facilitates the rapid identification of discrepancies between the initial budget and actual expenses.

In addition, the ERP has structured budget monitoring by establishing rigorous controls and in-depth monthly analyses. The construction manager benefits from an integrated dashboard that allows him to understand the progress of the work and assess expenditure and revenue entitlements in real time. This dynamic monitoring promotes better anticipation of contingencies and more responsive decision-making to adjust costs and maintain project profitability. Furthermore, the digitalization of budget monitoring has strengthened collaboration between stakeholders. Thanks to the ERP, management control can now directly access construction site data, analyze monitoring files, and produce consolidated reports. During monthly accounts meetings, discussions are now supported by reliable and up-to-date data, thus facilitating the analysis of financial performance and the implementation of corrective actions. Thus, the integration of this IT tool has enabled:

- Standardization and centralization of data;
- Increased data integration, consistency and reliability;
- Better traceability and justification of budgetary deviations;
- An automatic comparison of the differences between the forecast budget and the adjusted budget, thus providing immediate visibility on any overruns;
- Visibility of the justifications for the technical and financial choices made at each stage of the project;
- Enhanced and more proactive support for site managers;
- Immediate access to up-to-date data facilitating the organization of budget framework meetings;
- Real-time monitoring of costs and margins;
- An instant update of costs incurred and margins achieved;
- An adjustment of budget forecasts based on actual expenditure, thus reducing the risk of financial drift;
- Improved decision-making and responsiveness;
- Generation of detailed financial reports, facilitating the identification of risks and optimization opportunities.

Integrating ERP into ensuring project budget monitoring has enabled SBST to improve the reliability of its budget forecasts and optimize its financial management. By centralizing and automating the budget process, the ERP has promoted faster and more informed decision-making, thus strengthening the company's competitiveness in the construction sector by controlling its costs. Now, site managers and management controllers have a powerful tool to ensure accurate and responsive monitoring of the economic performance of projects.

Implementation of Appropriate Reporting

Situation Before ERP Integration

Before ERP integration, reporting within SBST was a tedious and time-consuming process. Data collection was fragmented across different departments, with each entity using its own methods and tools to track project progress and financial performance. Management control had to manually extract information from different software programs and databases, consolidate it into Excel files, and check its consistency before presenting it to management. This approach led to a high risk of errors, significant processing times, and a lack of real-time visibility into the company's financial and operational situation.

Impact After ERP Integration

With the integration of ERP, reporting has undergone a major transformation. All accounting, budgetary, and analytical information is now centralized within a single system, ensuring automated and reliable data reporting. Thanks to this IT tool, management control can generate standardized financial statements and reports tailored to the needs of various stakeholders in just a few clicks. ERP has helped optimize several aspects of reporting:

- Monthly reporting: This ensures detailed and regular monitoring of financial and operational performance. Key indicators are updated automatically, allowing managers to make decisions more quickly.
- Quarterly reporting: the ERP automatically generates consolidated financial statements using standardized formats, thus reducing the risk of errors and speeding up the transmission of information to management.
- Budget reporting: ERP facilitates budget planning and monitoring by automating the collection of forecasts and actual results. It also allows for comparison of variances between forecasts and actual results, thus providing better visibility into project performance.
- Customer risk monitoring: Customer risk assessment is facilitated by ERP integration, which automates customer solvency analysis by taking into account invoices, collections and provisions for doubtful debts. This automation improves risk management and the prevention of non-payment.
- Management file: ERP allows the management file to be prepared, ensuring the reliability of financial data and its compliance with accounting. Since the information is extracted directly from the system, the risk of discrepancies between different data sources is considerably reduced.
- The income statement and the consolidated balance sheet: Management control can now produce these documents with greater precision, thanks to automated information collection and processing. Real-time updates of these indicators provide a more precise view of the company's profitability.

ERP has made reporting faster, more reliable, and more relevant. The standardization of processes and automation of tasks have reduced the workload of management control, allowing it to focus more on analyzing and anticipating trends. As a result, management now has more accurate and responsive information to guide the company's strategy and improve its competitiveness.

Developing a Project Dashboard

Situation Before ERP Integration

Before integrating an ERP, developing a project dashboard within SBST was a tedious and fragmented task. Data came from multiple, dispersed sources, including Excel files, manual records, and paper tracking documents. This situation presented several major drawbacks:

- Lack of data reliability: The absence of a centralized system encouraged data entry errors and inconsistencies between different reports.
- Delays in data consolidation: Analysis of key indicators was not instantaneous, making it difficult to react to budget or performance deviations.
- Laborious construction site monitoring: Project managers had to manually process large volumes of information to monitor construction site progress.
- Difficulties in analysis and projection: The forecasts were unreliable because they were based on estimates made from heterogeneous and often obsolete data.

Impact After ERP Integration

The integration of the ERP enabled optimized and centralized management and radically transformed the development of the project dashboard. The centralized reporting system, particularly via this IT tool, enabled a significant improvement in monitoring and analysis processes:

- Data reliability and integrity: ERP ensures a single source of truth, reducing errors and inconsistencies. Data is automatically extracted and updated in real time.
- Instant access to essential information: Dashboards are available in real time, providing a comprehensive view of the business situation. Monitoring forecasts and achievements is more efficient, thus facilitating budget control.
- Optimized site monitoring: ERP allows for simplified site monitoring by consolidating key indicators (progress status, budget consumed, net margin, remaining work). Project managers can analyze site profitability more quickly and identify potential risks.
- Ease of use and automated reporting: The system is intuitive and allows users to generate customized reports. Budget forecasts are automatically updated with each budget revision, providing better long-term visibility.
- Improved decision-making: Projections for the following year (order intake, order book, turnover) are more accurate, improving the company's overall planning. Dashboards therefore allow for better anticipation of trends, facilitating strategic adjustments.

Integrating ERP into SBST's project dashboard management has enabled the company to move from a slow, unreliable, and traditional management system to a high-performance, fast, and accurate system. By centralizing information and automating analyses, ERP optimizes decision-making and strengthens the company's ability to manage its projects efficiently and proactively. This change perfectly illustrates how digitalization can transform management control practices and improve organizational performance.

CONCLUSION

This research, conducted using an action research approach, highlighted the importance of methodical support in the implementation of an ERP in order to ensure its appropriation by users and maximize its benefits. Our results show that the digitalization of management control processes in the construction industry constitutes a performance lever in terms of operational efficiency and the reliability of financial forecasts. The study conducted within the SBST company highlighted the profound effects of integrating an ERP on management control practices in the construction sector. By adopting an action research approach, we were able not only to observe but also to support the organization's digital transformation, by playing an active role in the implementation of the system and the evaluation of its impacts.

The results of this research show that ERP has helped to address several of the shortcomings observed in the previous system: data fragmentation, unreliable information, delays in budget monitoring, and the lack of a consolidated view of project performance. Through the centralization and automation of processes, management control has become more responsive, precise, and focused on analysis and decision support, thus strengthening its strategic role in project management. In particular, significant progress has been made in five key areas: the implementation of a reliable documentation system, cost and margin assessment, budget monitoring, the development of relevant reports, and the construction of appropriate dashboards. These transformations have helped improve operational performance and the reliability of financial forecasts, while reducing low-value-added manual tasks.

However, the success of this transformation relies on several critical factors: change management, user involvement from the early stages of the project, and the ability to continuously adapt the system to the specificities of the projects and changes in the organizational environment. Resistance to change, the learning curve, and the complexity of certain settings were significant challenges that had to be overcome. This study highlights that ERP integration is not purely technical but a genuine organizational project that requires strategic thinking, strong cross-functional coordination, and sustained support.

In terms of future prospects, it would be relevant to broaden the analysis to other dimensions of strategic management, such as risk management, resource optimization, or measuring the environmental performance of projects. Furthermore, the emergence of new generations of ERP integrating advanced technologies such as artificial intelligence, predictive analytics, or cloud computing opens the way to future research on the automation of management control and the transformation of decision-making practices in construction companies.

In general, this study enriches the literature on the digitalization of management control in a project context by showing how an empirical and participatory approach can help better understand and better support the changes underway in organizations with high operational intensity.

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