01-060 – Reducing variability in project management through the combination of dynamic dual-layer processes – Reducción de la variabilidad en la gestión de proyectos a través de la combinación de procesos dinámicos de doble capa

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Real estate projects are characterized by the collaboration of multiple stakeholders, including owners, investors, designers, production teams, and commercial partners. These projects involve complex, long-term processes that require efficient management to ensure competitiveness. Traditionally, project management has focused primarily on activities, which limits the ability to manage task dependencies, deliverable validation, and milestone tracking. To address these limitations, we propose a dual-layer process management approach. The upper layer focuses on optimizing activity coordination, while the lower layer is dedicated to document management. This model integrates a standardized data structure that automatically generates project schedules, which are distributed through process management software. This software automates task assignments, improving visibility and control across the project. This comprehensive and transparent approach allows stakeholders to reliably track project progress, ensuring that quality, cost, and timeline objectives are met, ultimately safeguarding the projected profitability.

Keywords: *Project management; Process management; Document management*

Los proyectos inmobiliarios, caracterizados por la colaboración de múltiples actores como propietarios, inversores, diseñadores, equipos de producción, y comerciales, entre otros, así como por procesos complejos y prolongados que requieren de una gestión eficiente para garantizar su competitividad. Tradicionalmente, esta gestión se ha centrado en las actividades, pero esta visión resulta limitada para abordar la complejidad de la gestión de dependencias entre tareas, la validación de entregables y el seguimiento de hitos clave. Para superar estas limitaciones, se propone un enfoque de gestión de procesos de doble capa, una superior que se enfoca en optimizar la coordinación de actividades, y otra inferior que se centra en la gestión documental. Este modelo combina la utilización de una estructura de datos estandarizada que genera automáticamente la planificación que se distribuye a través del motor del software de gestión de procesos que, automatiza la asignación de responsabilidades y mejora la visibilidad y el control del proyecto. Un enfoque integral y transparente que permite, a los diferentes interesados, en el desarrollo del proyecto, realizar un seguimiento fiable del progreso del proyecto para que se cumplan los objetivos de calidad, coste y plazo, garantizando la rentabilidad prevista.

Palabras claves: *Gestión de proyectos; Gestión de procesos; Gestión documental*

1. Introduction

Real estate projects are characterized by the collaboration of multiple stakeholders, including owners, investors, designers, production teams, and commercial partners. These projects involve complex, long-term processes that demand high levels of coordination and control to ensure competitiveness and quality (Love et al., 2016). The volatility and multidimensional nature of these environments create increasing pressure on project leaders to manage uncertainty, time, and resources effectively. In this context, it becomes essential to adopt management strategies that respond not only to the complexity of the tasks involved but also to the interactions between people, processes, and goals (Winch, 2010).

The prevailing management culture in construction and real estate development is rooted in traditional project management. It is built around the idea that projects are unique, time-bound efforts designed to achieve specific objectives (PMI, 2017). Planning and control tools such as Gantt charts, CPM (Critical Path Method), and milestone tracking have become standard practice, reflecting an emphasis on linearity, predictability, and the logical breakdown of activities. These tools allow for precise scheduling and progress tracking, ensuring that each phase of the project advances in accordance with predefined plans.

Despite its structured nature, project management practices often fall short when applied to the fluid realities of construction environments (Williams, 2005). Task interdependencies, last-minute design changes, external approvals, and human factors introduce unexpected variability that linear planning tools struggle to address. While project management software like Microsoft Project or Primavera helps in organizing macro-level tasks and resources, it frequently overlooks the detailed, repetitive, and dynamic processes embedded in day-to-day operations — especially in documentation, coordination, and approval flows (Azhar, 2011).

In contrast, process management emerges from the realm of business administration and operations, focusing on the standardization, optimization, and automation of workflows (Dumas et al., 2018). It treats activities as repeatable processes rather than unique events. Using tools like BPM (Business Process Management) software, organizations can design visual workflows, assign roles, automate decisions, and track every step in a structured way. This approach brings transparency, consistency, and control — particularly in areas like document handling, responsibility chains, and compliance routines (van der Aalst, 2013).

While process management is still relatively new in construction contexts, it offers powerful advantages, especially for companies managing multiple simultaneous projects (Porwal & Hewage, 2013). By embedding standard procedures for tasks such as document validation, quality assurance, or contractor approvals, companies can minimize errors, ensure continuity across teams, and support digital transformation. Tools like Camunda, Bizagi, or Kissflow provide intuitive platforms to define, execute, and monitor processes, helping teams focus on how work is done, rather than just what needs to be done (Recker, 2014).

The main difference between project and process management lies in their orientation: while project management emphasizes goal-oriented control over unique timelines, process management prioritizes the repeatability and optimization of workflows (Kerzner, 2013). Project tools are typically task-based and flexible but lack integration with document flows and approval logic. Process tools, on the other hand, structure routine actions and roles but are less suited to managing long-term deliverables and strategic scheduling. Understanding how these two logics differ — and how they complement one another — is essential to creating a management system capable of responding to the full spectrum of complexity in real estate development.

Table 1: Comparasión between Project Management and Process Management.

Feature	Project Management	Process Management
Scope	Temporary, unique goals	Ongoing, repeatable tasks
Orientation	Task- and milestone-based	Workflow-based
Flexibility	High (custom projects)	Lower (standardized paths)
Document Flow	Often secondary	Central to function
Best for...	Construction, product dev	Administration, approvals

By comparing both approaches, it becomes clear that neither project nor process management alone is sufficient to handle the full range of demands in real estate projects. Project management ensures strategic planning and milestone tracking, while process management supports the operational reliability and consistency of daily activities. A dual-layer model — integrating both approaches — allows for a more holistic, adaptable, and intelligent management system (Ogunlana, 2010). This synergy empowers organizations to maintain control over schedules and budgets while also streamlining internal processes, enhancing collaboration, and supporting long-term organizational learning.

2. Challenges and Proposed Solution for Real Estate Project Control

Managing real estate projects effectively requires more than just scheduling tasks or tracking deadlines. It demands a deep integration between planning, documentation, and execution — all in a dynamic, collaborative environment (Winch, 2010; Love et al., 2016). The complexity of these projects lies not only in their duration and scale but in the number of agents involved, the diversity of typologies, and the continuous flow of documents and approvals. The key challenges that must be addressed to keep these projects under control are presented below, followed by a proposal for a dual-layer management model that brings both structure and flexibility to real estate development (Ogunlana, 2010; Porwal & Hewage, 2013).

Each real estate project follows a typology (residential, commercial, industrial, etc.), and each typology has its own logic, sequence of phases, and documentation needs. To streamline planning, we need customizable templates that reflect each typology's structure (Kerzner, 2013). These templates should allow automatic generation of a project plan based on selected parameters — reducing time, increasing consistency, and standardizing initial planning procedures.

Documents are not stand-alone — they are deeply linked to project activities. For a plan to be actionable, each task must reference its necessary documents, and each document must indicate the tasks it supports. Associating documents directly to activities ensures that no stage progresses without the proper technical or legal backing (Recker, 2014; Azhar, 2011).

Progress tracking should not stay siloed within management. Every agent — designers, contractors, supervisors — should receive filtered information about work progress based on their own tasks and responsibilities. This requires a system that compares actual progress to

the project plan in real time and distributes that feedback appropriately to all involved agents (Williams, 2005; PMI, 2017).

Each profile (design, engineering, execution, administration) often works in its own digital environment. To enable seamless collaboration, these separate platforms must integrate into a central control system. This integration must support decentralized work while providing unified visibility to project managers (Dumas et al., 2018; van der Aalst, 2013).

Project managers need more than static plans — they need flexibility. This includes defining custom document validation flows (e.g., approvals, reviews, rejections) and modifying the sequence or scope of tasks as conditions change. A real solution must allow managers to replan or redirect activities and documents dynamically, without breaking the structure of the overall plan (Kerzner, 2013; PMI, 2017).

To address these challenges, a dual-layer management model is proposed, implemented through a process management platform. The first layer manages the sequence of activities (the project plan), while the second layer controls the flow of documents associated with those activities. This platform generates macroprocesses tailored to each agent profile, integrating all tasks and documents into a single, unified control environment. However, each profile can continue managing its part of the project autonomously — ensuring both coordination and flexibility. This model bridges planning with execution and documentation with accountability, allowing real estate projects to be fully monitored, guided, and adapted through a single source of truth.

Figure 1: Dual-Layer Model for Real Estate Project Management.
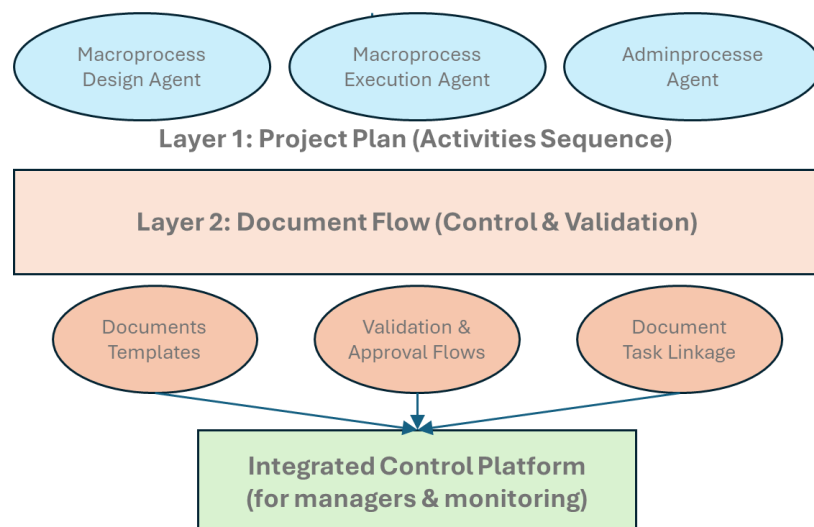
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This approach is illustrated in Figure 1, where the upper layer represents macroprocesses aligned with agent responsibilities (design, execution, administration), while the lower layer shows document templates, validation flows, and document-task linkages. These two levels are connected and synchronized through a centralized control platform that empowers managers to track progress and replan dynamically as needed. This diagram illustrates the integration of project planning (activity sequences) with document control flows. Each agent interacts with a customized macroprocess, and all layers are connected through a central control platform that allows real-time monitoring, workflow validation, and adaptive planning.

3. Implementation of the Dual-Layer Model in Real Estate Projects

Implementing a dual-layer process management model in real estate projects begins with a major challenge: adapting a general-purpose cloud-based process platform to the specific operational logic of real estate development. To address this, a "hawk's-eye view" was adopted — observing the organization from a high-level perspective before detailing the internal dynamics of each area. This top-down approach made it possible to initially structure the company's activities into three broad process categories: strategic, operational, and support processes. As shown in Figure 2, this classification represents the visual outcome of the initial "hawk's-eye view." At this perspective, the organization is structured into three primary process types: strategic, operational, and support. This classification forms a comprehensive process map, offering a panoramic view of how the company functions. The strategic processes are responsible for high-level decision-making and long-term planning. The support processes provide essential services and resources across departments to ensure functionality and alignment. Most notably, the operational processes serve as the entry point for project execution, where different types of real estate projects are identified. These typologies — which include developments with design phases, predefined execution projects, and informal or non-standardized works — form the backbone of the following figure, which details how these projects are decomposed and structured through the methodology.

Figure 2: Process Map – Hawk's-Eye View of Organizational Structure.

After building a high-level map of the organization, the next level is detailed by modelling the internal structure of one specific project typology: the "real estate project with design phase." In this more detailed level, the standard project phases are defined— and can see the

professional profiles, or knowledge areas are need to execute each project tipology — and illustrated they become involved in each phase. Figure 3 presents this phase-based project map, showing the integration of four key generics departments in Real Estate projects, The overlapping of roles across phases highlights the collaborative dynamics within the company, as well as the need for coordination tools that allow each department to contribute effectively without losing control of its own responsibilities.

Figure 3: Project Map of Real estate project with design phase.
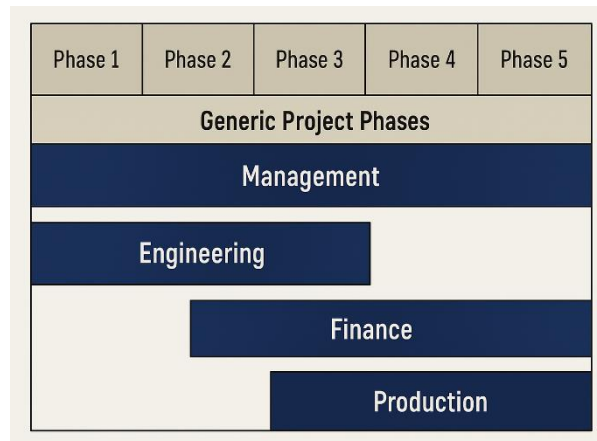
To design the operational processes that will support this project structure, a methodological bridge has been introduced between our theoretical framework and digital implementation. To deepen the modeling of each phase and make the project processes more adaptable and dynamic, has been integrated into the Business Process Model and Notation (BPMN) framework. By doing so, the linear foundations have been translated into comprehensive process flows that can reflect operational realities with greater flexibility. However, unlike conventional BPMN implementations, our approach retains the linearization principle as a structuring logic — not only to simplify the initial mapping but also to guide continuous improvement, reduce redundancies, and reinforce the alignment between planned and actual performance across projects. In this way, linearization acts not merely as a modelling technique but as a methodological core that supports the gradual integration of digitalization, Lean principles, and collaborative practices.

Building upon the concept of process linearization, as introduced and developed in earlier research (Fonseca et al., 2024), each phase of the project can be initially structured as a linear sequence of activities and responsibilities. This methodological linearization serves as a foundation for establishing a common framework across diverse stakeholders and systems. Once the linear model is defined, it becomes possible to layer additional complexity, such as process interdependencies, systemic relationships, and iterative loops, without losing the traceability and clarity offered by the original design.

Each knowledge area represented in the project phase map (Figure 3) is implemented in the process platform as a separate macroprocess, allowing for the configuration of distinct workflows that reflect the specific responsibilities, timelines, and document requirements of each domain. These macroprocesses are interconnected within a centralized SQL database table, which establishes the project as a unified reference unit and enables the synchronization of task statuses, deliverables, and validations across knowledge areas. Within each macroprocess, the dual-layer process management model is applied: the upper layer is responsible for coordinating the sequence of activities associated with that knowledge area,

while the lower layer governs the document flows — including approvals, revisions, and formal validations. This configuration ensures that each knowledge area operates within its specialized domain while maintaining full integration with the overarching project logic, thereby enabling transparency, consistency, and adaptability throughout the project lifecycle.

To ensure operational reliability and respect data governance principles, the document flow layer within each macroprocess is integrated with the company's internal document management system, implemented through SharePoint. This approach allows all project-related documents to remain within the enterprise domain, avoiding external cloud storage dependencies and aligning with corporate security policies. In parallel, the upper layer — dedicated to activity coordination — uses structured SQL database tables to generate and distribute personalized views for each knowledge area leader. These views present filtered task sequences, status updates, and relevant deadlines, enabling each leader to manage their macroprocess plan effectively while maintaining alignment with the overall project structure. This architecture reinforces the independence and specialization of each knowledge area while ensuring centralized visibility and real-time synchronization.
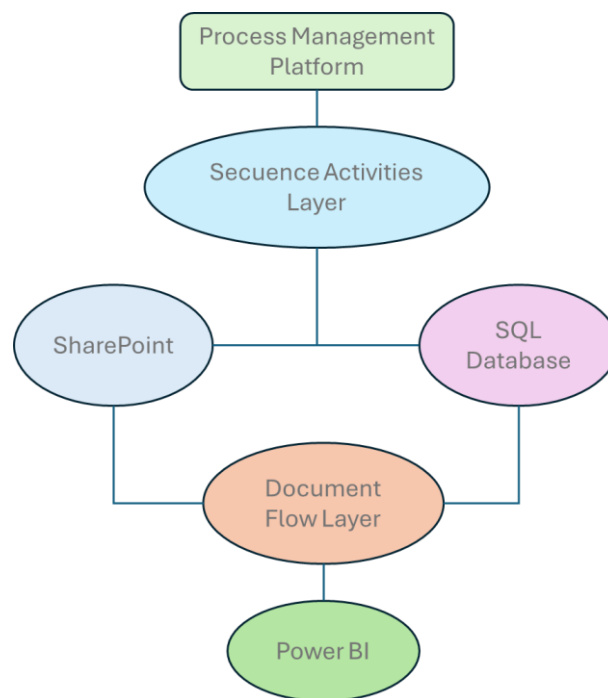
Figure 4: Methodology Ecosystem.

Figure 4 illustrates the complete ecosystem that supports the dual-layer methodology, where each knowledge area operates within a dedicated macroprocess in the process management platform. The document flow layer is integrated with the enterprise SharePoint system to manage templates, revisions, and validations internally, while task and activity data are stored in a SQL database. This data is then analysed and visualized through Power BI dashboards, allowing managers to monitor the relationship between planned activities and actual execution in real time.

The architecture presented establishes a robust yet adaptable foundation for managing real estate projects with multiple knowledge areas, complex documentation needs, and strict

coordination demands. By integrating standardized workflows with the company's existing digital infrastructure, the methodology fosters both autonomy and alignment across participants. The next section presents how this structure was implemented and validated through a pilot project conducted at COANFI, where the methodology demonstrated its capacity to enhance transparency, control, and strategic decision-making in practice.

4. Methodology Applied in COANFI

While the previous figure outlined the methodology's generic structure at a high level, Figure 5 illustrates how this same framework was specifically adapted and applied at COANFI. The three layers of processes — strategic, operational, and support — remain conceptually intact, but have been contextualized based on the company's internal structure and project typologies. In particular, the operational layer reflects the three main types of real estate initiatives managed by COANFI: projects with a design phase, execution-only projects, and informal or ad hoc initiatives. This real-world adaptation demonstrates the flexibility of the proposed methodology and serves as the foundation for the pilot implementation described in the following sections.

Figure 5: Process Map of COANFI.

Following the high-level process classification adapted for COANFI, the next step in the implementation involved detailing how a specific type of operational process — the "real estate project with design phase" — is structured across departments and phases. Figure 6 presents this project typology as a phase-based map, aligning the standard project phases (from feasibility study to after-sales) with the departments involved in each stage. This visualization offers a tangible representation of how strategic alignment and interdisciplinary coordination are required throughout the entire project lifecycle. By detailing one representative project type, COANFI was able to test and validate the broader methodology in a concrete and practical context.

Figure 6: Project Map of Real estate project with design phase.

To operationalize and monitor the methodology in practice, COANFI implemented an integrated reporting system using Power BI. Figure 7 presents an extract from the interactive dashboard used to manage projects through process logic. The report consolidates data from multiple macroprocesses — structured according to the project map — and displays real-time progress, task statuses, document completions, and role-based responsibilities. By aligning activities with documents and timelines, the platform enables dynamic visualization of project execution against the original plan. This layer of transparency and traceability has not only improved communication and accountability across departments, but also empowered managers to make data-driven decisions with greater confidence. This implementation marks the final stage of the methodology, validating its potential to integrate planning, documentation, and monitoring into a single ecosystem — as further discussed in the following section on conclusions.

Figure 7: PowerBI Report.
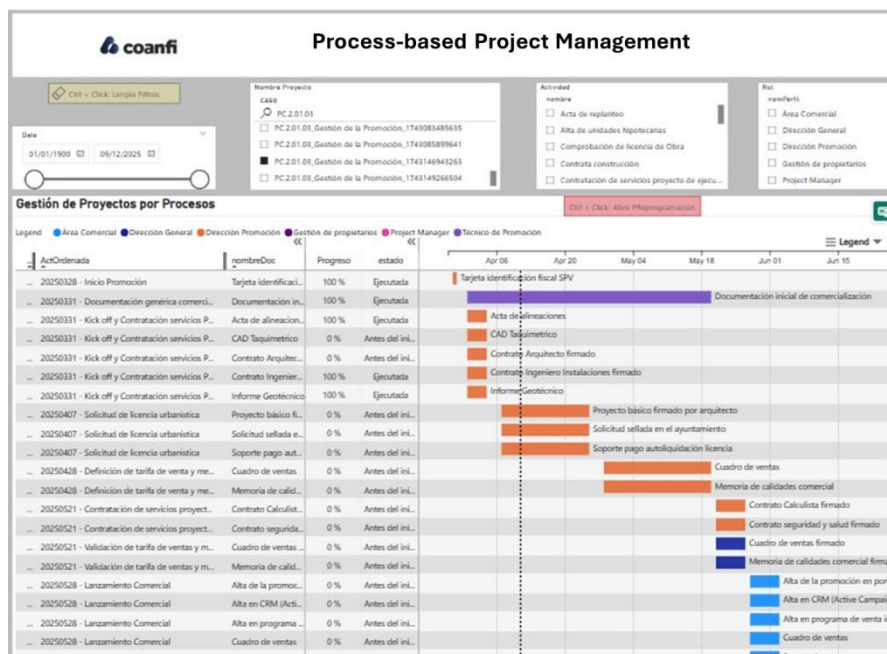
5. Conclusions

The methodology presented in this paper was developed specifically for COANFI, aiming to address the complexity and fragmentation typical of real estate project management. By structuring organizational activities into strategic, operational, and support layers — and

introducing a dual-layer process model to distinguish between activity coordination and document flow — the approach offers a flexible yet coherent foundation for digital transformation.

Although still in its implementation phase, the first applications of the methodology have shown promising results. In particular, the digitalization of project workflows and the automation of approval processes have led to significant improvements in coordination and transparency across departments. These early outcomes suggest strong potential for broader adoption and scaling within the company.

For documentation management, a custom metadata structure was designed to store and organize documents within SharePoint. This configuration enables document recovery at speeds far surpassing those of traditional folder-based systems. The combination of structured metadata and integrated dashboards allows stakeholders to access, validate, and monitor project data with unprecedented agility.

The experience at COANFI demonstrates that a tailored methodology, when aligned with enterprise systems and operational logic, can transform not only how projects are executed — but how knowledge, responsibility, and progress are shared across the entire organization.

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Use of Generative Artificial Intelligence

In this paper have not used any generative AI or AI-assisted technologies in the writing of this manuscript, nor for the creation of images, graphics, tables, or their corresponding captions. However, AI tools were utilized for translation support improvement, and to show an enhanced, clarity and readability language, or some reference management.

Communication aligned with the Sustainable Development Goals

This research aligns with the following SDGs:

SDG 9: Industry, Innovation and Infrastructure

> The paper promotes sustainable industrialization and fosters innovation in project management practices.

SDG 11: Sustainable Cities and Communities

> By addressing variability in project management, the paper contributes to making cities and human settlements inclusive, safe, resilient, and sustainable.