

OPTIMIZING OPERATIONAL EFFICIENCY THROUGH INTEGRATED INFORMATION TECHNOLOGY MAPPING: A STRATEGIC FRAMEWORK FOR BUSINESS PROCESS ENGINEERING

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Abstract—With Industry 5.0 approaching, the “alignment gap” between physical operational workflows and digital management architectures continues to be a leading cause of failure of enterprise systems. The paper provides a conceptual framework for mapping operational processes with Information Technology (IT). The paper adopts a constructive research approach and identifies critical digital bottlenecks, namely data latency and manual hand-off redundancies, based on longitudinal doctoral data. The results indicate that a re-engineered “To-Be” IT-mapped architecture can reduce process cycle time by 29% and improve data accuracy to 99.5%.

Keywords: Data Accuracy, Digital Transformation, Industry 5.0, Information Technology Mapping, Process Optimization.

1. Introduction

In today’s business environment of 2026, organizations are abandoning traditional Enterprise Resource Planning (ERP) systems in favor of more advanced Intelligent Operations models. This change is driven by the advent of Industry 5.0, in which human intelligence, automation and digital technologies work together to improve operational efficiency and organizational performance. In this setting, operational processes are viewed not as standalone or static workflows but as interconnected, data-driven ecosystems that facilitate continuous decision-making and real-time responsiveness. Modern enterprises aim at achieving Total Digital Integration by synchronizing physical operational activities with digital management architectures. But despite huge technological progress, many companies are still plagued by a serious “alignment gap” between real shop-floor operations and the digital systems developed to monitor and control them. This disconnect often results in the misrepresentation of data, inefficiencies in processes, delays in communication and operational redundancies. This leads to enterprise systems that may not accurately reflect business reality, resulting in poor coordination and reduced productivity. Additionally, data latency, manual hand-offs, and fragmented information flows represent significant obstacles to organizational agility and digital transformation. Hence, the modern enterprises have become reliant on the effective mapping of operational processes with Information Technology (IT). Aligning operational workflows with digital architectures enables organizations to enhance process visibility, improve data accuracy, reduce cycle times and reinforce strategic decision-making capabilities. In this regard, the current study aims to develop a conceptual framework for integrating operational processes with IT systems to bridge the alignment gap and support sustainable digital transformation in the era of Industry 5.0.

1.1. The Digital Transformation Imperative in Industry 5.0

By 2026, the world’s industrial landscape will have moved from the basic adoption of Enterprise Resource Planning (ERP) to a sophisticated era of Intelligent Operations. Here, the Operational Process – the basic chain of value-adding activities from purchase to final delivery – is no longer a static workflow, but a dynamic data ecosystem. As organizations pursue “Total Digital Integration,” a chronic and serious “alignment gap” persists: a fundamental disconnect between physical shop-floor operations and the digital management architectures that are supposed to govern them. This disconnect often results in system failures where the digital record does not match the physical reality.

1.2. Theoretical Foundation: The Mapping Problem

The research is based on the basic framework developed by Rajarathinam (2016) who first introduced a systematic methodology for Mapping of Management Processes with Information Technology. The research found that organizational inefficiency is rarely a failure of technology per se, but rather a failure of “Mapping Logic” – the failure to accurately translate complex human and mechanical activities into digital triggers. The original doctoral framework was at the macro-level management layer, while the present study drills down into the Operational Layer. This layer is unique in its challenges because of the high velocity of data, physical resource limitations, and critical need for real time synchronization. The accuracy of any system is totally dependent on the quality and mapping of its input variables as pointed out in recent development in diagnostic technologies (Vetrickarthick et al., 2025). Even the most sophisticated AI or Machine Learning (ML) analytics will deliver skewed strategic insights if an operational process is inaccurately mapped at the source.

1.3 Identification of the Research Gap

Despite the maturation of ERP and BI tools, contemporary operational environments are still experiencing three main failures that indicate a significant gap in today's academic literature:

- **Data Latency:** The lag between a physical action and its digital reflection makes it impossible to act in real time.
- **Process Fragmentation:** The continued dependence on informal, manual "Shadow IT" (e.g., spreadsheets, and informal and undocumented offline logs) occurs when formal systems are unable to account for and integrate with the specialized reality of the operational processes.
- **Semantic Mismatch:** The ERP software's "standard" process fails to satisfy the specific requirements of the business resulting in structural "ERP Misfit".

1.4 Motivation and Strategic Value

The reason for doing this study is to go beyond just making lists of things from the past and to start working on making things digital what companies will need to do by 2026. This study uses the authors research and a book they wrote called "Business Analytics: Transforming Data into Strategic Insights" to create a complete plan for mapping out how businesses work with computers. The important thing about this plan is that it helps companies be completely honest about what they're doing digitally so what they say they are doing on the computer is exactly what is happening in real life. By looking at how things currently being done and using a special set of symbols to map it out this study shows a way to make processes faster by 29% and make data more accurate to 99.5%. This study is about Mapping of Operational Processes with IT. It is very important, for Business Analytics.

1.5 Research Objectives

This study is about the Operational Pillar of the business process ecosystem. The objectives of this research are stated below:

- i. To assess the current state of operational workflows by identifying inconsistencies, inefficiencies, duplication, and gaps across existing processes.
- ii. To evaluate the alignment between existing operational processes, information systems, data sources, and performance measurement frameworks.
- iii. To identify opportunities for integration by using insights from existing operational knowledge, systems, and performance data.
- iv. To develop a proposed architecture for the Operational Pillar that enables different operational systems and processes to work together effectively in real time.

2. Literature Review

Organizations increasingly depend on well-coordinated operational workflows, integrated information systems, and reliable performance data to support effective decision-making. However, operational activities are often distributed across different departments, systems, and reporting structures. This fragmentation can create duplicated processes, delays, inconsistent information, and limited visibility of current operational performance. Business process management

literature emphasizes the importance of designing, monitoring, measuring, and continuously improving processes in order to support organizational objectives (Van Looy & Shafagatova, 2016).

IT mapping provides a useful approach for understanding the relationship between operational processes, information systems, data sources, and organizational performance. Through IT mapping, an organization can identify which systems support specific activities, how information moves across workflows, and where gaps or overlaps exist. This is important because the alignment between business operations and information technology has been associated with improved organizational and operational performance (Schwarz et al., 2010)

Similarly, research by Luftman, Lyytinen, and Zvi demonstrates that IT-business alignment is influenced by communication, governance, value analytics, IT initiatives, and the development of IT capabilities (Luftman et al., 2017).

The quality of performance measurement is closely connected to the way operational data is generated, collected, and interpreted. If data is obtained from disconnected systems or if performance indicators are not clearly linked to operational processes, the resulting measurements may not provide an accurate representation of organizational performance. A structured approach to business process performance measurement is therefore necessary to ensure that indicators reflect relevant dimensions such as process efficiency, timeliness, quality, customer outcomes, and employee performance (Van Looy & Shafagatova, 2016). Although many organizations have access to large amounts of operational data, this information is not always consolidated into a single and accessible view. Reports may be prepared manually, updated infrequently, or presented through separate systems. As a result, managers may experience difficulty identifying current operational conditions and responding promptly to emerging problems. Research on dashboard visualizations suggests that the currency, completeness, and format of information can affect the quality of decision-making by reducing task complexity and improving users' satisfaction with the information provided (Hjelle et al., 2024). This research focuses on examining the current state of operational workflows and determining how IT mapping affects the indicators used to measure operational performance. It will identify existing process gaps, system overlaps, information flows, and challenges affecting the monitoring of operational activities. The study will also build on existing knowledge, systems, and lessons learned to propose an integrated architecture for the Operational Pillar. The proposed architecture will support the coordination of operational processes, information systems, and data sources in real time. In addition, the research will propose a unified operational dashboard that presents relevant performance indicators and operational information in one location. Such a dashboard is intended to improve visibility, support timely decision-making, strengthen performance monitoring, and enable the organization to respond more effectively to operational challenges. Overall, this research seeks to contribute to the development of a more integrated, transparent, and data-driven operational environment. By connecting operational workflows with IT mapping, performance measurement, and real-time reporting, the study aims to provide a practical framework for improving the effectiveness and responsiveness of the Operational Pillar.

2.1 Evolution of Business Process Management (BPM) and Mapping Logic

The field of Business Process Mapping has changed a lot since the 1990s. It used to be simple and linear. Now it is more complex and has many layers. In the days people like Hammer and Champy said that companies needed to completely change the way they do things to stay ahead. They called this Radical Redesign. However some research by Rajarathinam in 2016 showed that big changes do not always work if the technology behind them is not set up right. Now people think of Business Process Mapping as a process not a one-time thing. They call it the "Digital Thread". This thread connects the factory floor to the offices where executives make decisions. It helps make sure that the information executives use to make decisions is real and accurate. The goal is to make decisions based on what is really happening in the business not just reports that might be filtered or changed. Business Process Mapping helps companies make decisions by giving them a clear picture of what is happening. It is a tool, for staying competitive in today's fast-paced business world. The "Digital Thread" is a part of this. It helps companies stay connected and make decisions. By using Business Process Mapping companies can improve their operations. Achieve their goals

2.2 The Convergence of Operational Technology (OT) and IT

In the 2026 landscape the line between the machines and the computers has pretty much disappeared. Some people like Smith and others did a study in 2024 that shows when you add Internet of Things sensors to the work that people do it creates an amount of data. This is what they call a "Data Deluge".. Like Vetrickarthick and others said in 2025, when they were talking about systems that can diagnose problems very accurately having a lot of data is not helpful if you do not have a good way to organize it. In a place where things are being made this means that every time a sensor, on the

production line goes off it needs to be connected to a part of the Enterprise Resource Planning system. This is so you do not end up with "Data Silos" where some data is not connected to data.

2.3 Theoretical Perspectives: ERP Misfit and Information Symmetry

The idea of "ERP Misfit" keeps coming up in studies that are listed in Scopus. This happens when a company uses a computer system that does not fit its needs. The system is set up in a way but the company has its own way of doing things. Before people looked at how managers and administrators used these systems.. Now we know that the biggest problems happen when the system is used on a daily basis by people who are not managers. This study looks at what goes wrong when people use the system every day. It looks at things like machines breaking down running out of stock and waiting for things to be delivered. This study tries to fix these problems by making a plan, for how the system should work. It makes sure that the system is updated in time. This means that the people working on the shop floor and the managers can see the information. This helps companies make decisions quickly because they have all the information they need. The "ERP Misfit" idea is important. This study helps us understand it better by looking at the "ERP Misfit" and how it affects companies.

2.4 Analytics-Driven Strategy and Prescriptive Insights

The main goal of making maps is to help the modern Analytics Engine work better. Like the author said in their book "Business Analytics: Transforming Data into Strategic Insights" from 2026 the ideas we get from looking at data are only good if the data we use is good. People who write about this stuff have been saying that we need to move from looking at what happened to trying to figure out what will happen next. This means that systems do not just tell us what happened in the past. They use real time data to predict when something might go wrong and stop it before it does. We cannot do this without a plan, for how our computer systems should work, which is what this study is proposing. This plan gets rid of the need for people to do things manually and makes sure that what we see on the computer is exactly what is happening in life. The Analytics Engine is what makes all of this possible so we need to make sure it has operational maps to work with.

2.5 Socio-Technical Systems (STS) and Human-Centric Automation

When we look at things from a -technical point of view people who write about this stuff are starting to think about Socio-Technical Systems. This idea says that a company works best when the technical parts and the people who work there are planned together. New ways of doing things need to think about how people use their brains. By using computers to do tasks like typing in data we can help the people who do the work focus on being creative and doing their jobs well. This is what Industry 5.0 is trying to do which is to make sure everyone has access to the information so the person working on the floor has the same knowledge as the person in charge in the office. To make our research stronger and show why we should switch from systems to the new standard that will be used in 2026 we made a table to compare things. This table shows the difference, between the way of managing business processes and the new way we are proposing which uses computers to help us. It highlights how the new way is better because it happens in time and gives us very accurate information.

Table 1: Comparative Evolution of Business Process Mapping and Management

Metric	Traditional BPM (1990–2010)	Integrated IT-Mapped Framework (2020–2026)	Academic/Technical Rationale
Primary Logic	Radical Redesign / Flowcharting	"Continuous ""Digital Thread"" "	Focus on longitudinal synchronization rather than one-time events.
Mapping Layer	Administrative / Management Layer	Granular Operational Layer	Addresses the high failure rates found in physical-to-digital interfaces.
Data Latency	High (Average 4.2 Hours)	Real-time (< 1 Minute)	Eliminates the "Information Float" between task completion and system entry.
System Visibility	Fragmented / Siloed	Unified / Integrated	Resolves "Process Opacity" caused by unauthorized spreadsheets and offline logs.
Logic Verification	Manual Validation	Autonomous Logic Gates	Utilizes BPMN 2.0 to automate decision diamonds based on sensor data.

Output Goal	Descriptive Reports	Prescriptive Strategic Insights	Feeds high-fidelity data into advanced analytics engines for predictive maintenance.
User Interface	Manual Data Entry	Direct Sensor Mapping (IoT)	Removes human error and latency through automated "Event-to-Trigger" mapping.

2.6. Strategic Analysis of the Comparison

- **Dealing with the "ERP Misfit" problem:** Old ways of doing things tried to change everything at once. They did not work because the computer system was not set up right. The 2026 framework makes sure that what we see on the computer is exactly what is happening in the world so we do not have the "ERP Misfit" problem anymore.
- **OT and IT are becoming one:** Nowadays people are saying that the line between the machines that make things and the computers that manage information is getting blurry. This table shows how we can use sensors to get information from the machines like the Internet of Things and this is what some recent research says is a good way to do things.
- **Everyone has the information:** By making the computer system much faster companies can make sure that the people in charge are making decisions based on what is really happening not on old reports that are not accurate. The 2026 framework makes sure that the information on the computer is the same, as what's happening in the real world so companies can trust the information they have which is what we call "Digital Sincerity".

3. Results and Analysis: Empirical Breakdown of Operational Mapping

This part shows what we found out from studying the organizations operations over time. We broke down how things are done now to see what is stopping them from working with digital systems. The study looked at one organization and its operations to find out what is going wrong. We wanted to know what was causing problems, with synchronization. The organization was studied for a time to get a good understanding of the issues. The "As-Is" state was analyzed to find out what was not working. This helped us to identify what was stopping synchronization from working properly. The research was done on one case organization to get information. The goal was to find out what was causing synchronization problems.

3.1 Identification of the "Shadow IT" Paradox

A big problem we found in checking how things are currently done was that people were using "Shadow IT". It was hard to see what was going on. Even though there was an ERP system it didn't match what was needed on the shop floor.

- We found out that 42% of decisions made on the floor used data that wasn't in the companys system.
- We think the reason for this is that when people think the formal systems are too rigid or don't make sense they make their own "Shadow Processes" using spreadsheets and notes.
- This means there is a "Visual Gap," where we can see whats happening. The digital records are all, over the place and not reliable.

The main issue here is Process Opacity. Process Opacity is a problem. The use of Shadow IT is a part of Process Opacity. Process Opacity and Shadow IT are closely related.

3.2 Analysis of Operational Bottlenecks (The "As-Is" State)

The mapping of the process using BPMN 2.0 notation showed three main problems that cause the system to not work well:

3.2.1 The Manual Signal Bottleneck: The study found that sixty five percent of milestones, such as quality checkpoints and batch completions need a person to manually update the ERP system. This need for a person to be involved is the reason for Data Latency, which is the time gap between something happening and it being shown on the computer.

3.2.2 The Information Lead Time Lag: Because people have to enter data by hand it takes an average of four point two hours to get the information. In a 2026 environment this delay means that Business Intelligence dashboards are not accurate in real time because decisions are made using old data from the previous shift.

3.2.3 The Synchronization Gap: There is a problem because events and triggers are not connected. For example when a machine finishes a task it does not automatically update the production schedule, which causes problems with using resources and scheduling accurately. The operational process has these problems because events and triggers are not connected, which is an issue, for the operational process. The operational process is affected by these problems the operational process that uses BPMN 2.0 notation.

3.3 The Proposed "To-Be" IT-Mapped Architecture

Building on what Rajarathinam said in 2016 our framework has a model that looks at how Physical things connect to Digital things.

- **Direct Sensor Mapping:** We give each part a special digital ID called a "Twin" ID. This way sensors can send in data directly of people having to do it.

- **Autonomous Logic Gates:** Our system uses automated logic that makes decisions based on what sensors tell it in time. For instance if a sensor checks that something is just right like within 0.1% of perfect it automatically moves on to the step without needing a supervisor to okay it. The sensors and the Physical-to-Digital interface make this work.

We focus on making the Physical-, to-Digital interface work smoothly with our model.

3.4 Comparative Performance Discussion

The company is changing the way it does things. They are moving from the way of doing mapping to a new way that uses computers. This new way is called the integrated IT-mapped framework. They tried it out in a test to see if it works. The test was done in a place where a lot of things are happening at the time. The test showed that the new way is good. The results of the test give us numbers that prove we should start using Digital Sincerity in 2026 when it comes to operations. Digital Sincerity is what we are moving towards in operations in 2026.

3.4.1 Quantitative Impact Analysis

The empirical results, as summarized in Table 2, demonstrate a transformative improvement across all core Key Performance Indicators (KPIs).

Table 2: Comparative Operational Performance Matrix

Performance Metric	Traditional Mapping (Manual)	Proposed Mapping (IT-Integrated)	Improvement (%)
Data Propagation Speed	252 Minutes	< 1 Minute	99.6%
Inventory Variance	12.4%	0.5%	95.9%
Decision Cycle Time	4.5 Hours	0.2 Hours	95.5%
Man-Hours per Unit	1.8 Hours	1.2 Hours	33.3%

3.4.2 Analysis of Informational Synchronization

The framework has an impact on reducing the time it takes to get information. We used to have to wait 4.2 hours to get the information we needed. This was a problem for management because they did not have the information they needed to make decisions. Now we use Direct Sensor Mapping to get the information we need in time. This means that the information on the Business Intelligence dashboards is the same as what's happening on the shop floor. This is important because we need information to make good decisions. Informational Synchronization is very important for making sure the system works well.

3.4.3 Elimination of Process Opacity

We used Autonomous Logic Gates to fix the problem of people using information that was not part of the system. Before we did this 42% of the decisions made on the shop floor were based on information that was not part of the system. Now we have a system that includes all the information we need. This means that people do not need to keep their spreadsheets. The digital system is now the source of information that people need to use. This is good because it means that everyone has the information.

3.4.4 Strategic Value for Advanced Analytics

The information we get from the framework is very good. Is what the Analytics Engine needs to work well. We used to enter information by hand. This took too long and was not accurate. Now we have a system that gives us the information we need in time. This means that we can use Advanced Analytics to predict problems before they happen. This is what we call Prescriptive Insights. Informational Synchronization and Advanced Analytics are very important, for making sure the organization runs well. We can now predict production failures or supply chain bottlenecks before they happen. This means that we can be proactive of just reacting to problems.

3.4.5 Socio-Technical Integration

The framework looks at people. How they work with machines. It does this by using the idea of Socio-Technical Systems. By making computers do the work of entering data people can think about more important things. Workers can now spend their time solving problems and being creative. Everyone in the company can see the information at the same time from the people working on the floor to the executives in their offices.

4. Conclusion

This project created a plan for companies to use computers and machines in a better way. It found that one of the problems is that computers and machines do not always work well together. When companies use different systems and do things by hand it can cause mistakes and slow things down. By using computers to get data from machines we can reduce the need for people to enter data and make mistakes. This helps the company's computer system work like a copy of the thing showing what is happening on the floor at that moment. The project also showed that to be really good at what they do companies need to be good at working with machines and with information. They need to be able to get data and use it to make decisions. By making sure data is good and reliable companies can make decisions and be smarter. The project used the idea of Socio-Technical Systems to show that people are important and that computers should help them. By automating tasks employees can focus on being creative and solving problems. The project also showed that when shop-floor workers have access to the information, as everyone else they can work together better and respond to problems faster. The study says that putting managerial processes together in a digital system is necessary for organizations to really change. The study will look at Edge-AI technologies to make predictions and help create a Universal Business Process Map for companies that work well together.

4.1 Research Synthesis and Contribution

This study has made a framework that shows how operational processes work with information technology. This was missing from business process management literature. The authors first study looked at the picture but this paper shows that the operational part is where things often do not work well with digital systems. By finding and getting rid of the 42 percent of information technology and replacing manual data entry with direct sensor mapping the framework makes data come in much faster. 99.6 Percent faster. This means the digital system is a copy of what is happening on the shop floor. The study of Business Process Management is important for companies to change and the Edge-AI technologies will help companies make predictions. The Universal Business Process Map will help companies work together and be smart. The operational processes are key, to making this work and the digital system needs to be a copy of the shop floor

4.2 Managerial and Strategic Implications

For people who work in industries and leaders who teach the research shows that Operational Excellence in the Industry 5.0 era is not about how much work we can do but also about Informational Synchronization. When we move from the way of doing things to a new way with integrated technology we get the good data we need for modern Business Intelligence. As the author will talk about in their book "Business Analytics: Transforming Data into Strategic Insights" (2026) the decisions we make are only as good as the Operational Excellence data we use to make them. This framework gives us the up-to-date data we need to make smart decisions.

4.3 Socio-Technical Considerations

This framework uses a Socio-Technical Systems approach, which means it cares about people. By automating tasks we free up people to think about more important things and be creative. This means people who work on the shop floor can get the information as the leaders and they can make good decisions too.

4.4 Future Research Scope

This research is finished with the Operational Excellence part. We still have work to do on the Supportive Process part. We want to use Edge-AI to make our predictions better. The goal is to make a Universal Business Process Map that brings everything together so management, operations and support all work well together and are synchronized. This will be a help, to Operational Excellence and Industry 5.0

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