
**Bridging Business Process Mapping and Technical Integration
Requirements in Enterprise Payroll Modernization**

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Abstract

The days of the legacy, silo mentality of payroll are over and organisations are unable to operate without tech-based, scalable systems that facilitate enterprise payroll modernization. One challenge is, however, translating business process requirements to a clear and unambiguous technical integration requirement that also satisfies compliance requirements, data accuracy and continuity of operations. The paper explores process mapping and technical integration requirements in the context of Enterprise payroll modernization and how they can be tied together in a systematic way. The solution proposed is identifying the current payroll activities, understanding the interdependencies and information flow of these activities and turning the business needs into functional and technical integration specifications. The framework takes into account integration between HRM systems, attendance and workforce-management systems, financial and accounting systems, banking interfaces, taxation and compliance systems, and identity-management systems. API-based integration, middleware, cloud platforms and event-driven communication are considered as providing interoperability and scalability. This also creates a traceability between business processes, system requirements, data elements and integration interfaces, minimizing implementation ambiguity. The indicators for performance evaluation include: process execution time, integration accuracy, manual intervention rate, payroll processing accuracy, requirement traceability. The proposed framework provides a template that can be used by enterprises to modernize their payroll systems, improve process efficiency and reliability, and ensure easy integration with changing business requirements.

Keywords: Enterprise Payroll Modernization, Business Process Mapping, Technical Integration Requirements, Payroll Systems, Enterprise System Integration, API Integration, Cloud Computing, Requirements Engineering, Process Automation, HRMS.

1. Introduction

Payroll is one of the most critical business processes that manages employee payments, deductions, taxation, benefits, attendance and compliance with statutory requirements in enterprise. Historically, payroll processing has grown up with a number of separate applications, spreadsheets, databases and manual processes. These solutions might be beneficial for simple payroll tasks, but can also cause fragmented data processes, repetitive data entry, mismatched data, interoperability issues, and increased manual workload. The restrictions are more applicable when the business expands in size and the number of business units or locations, and can be an issue if you have to maintain accurate, up to date and compliant payroll processing.

The enterprise payroll infrastructure has taken a big leap towards modernization with the advent of cloud computing, enterprise resource planning (ERP), human resource management systems (HRMS), application programming interfaces (APIs), microservices and automation technologies. Modern payroll software should seamlessly connect HR, attendance, financial, banking, tax, benefits and identity-management systems. But modernization isn't done by just upgrading an old payroll application with a new technology platform. It requires awareness of the existing business process and the change of it into the functional and technical requirements.

Business process mapping is an effective way to document the work processes, information flows between departments and applications, and decision points, approvals and dependencies. Once the existing process is documented, organizations can find out redundant activities, manual issues, data inconsistencies, and integration dependencies. The workflow processes that are defined can then be transformed into future state processes that will be automated and optimized for operations. Typically, however, there is a gap between the business oriented process description and the technical process details required by software developers, software architects and integration teams.

Technical integration requirements are rules that are developed to specify how the different enterprise systems will exchange data and coordinate activities. These requirements include interfaces protocol, data format, forms of authentication, data validation rules, event triggers, error handling, security controls, and integration requirements. However, if these requirements are not directly linked to business processes, organizations can suffer from integration problems, lack of functionality, inconsistencies in employee data and significant changes and changes in costs during implementation. Therefore, it is essential to establish a clear alignment of a business process mapping with technical integration needs for successful modernization of any payroll system.

This paper proposes a formal approach for the integration requirements and Business Process Mapping (BPM) of the enterprise payroll modernization. It starts with an analysis of current payroll processes and a mapping of activities, actors, inputs and outputs of the business,

dependencies and decision points. The proposed approach establishes the traceability between the business activities, data entities, system interface and integration mechanisms. It also considers the possibility for HRMS, attendance systems, financial applications, banking services, taxation platforms, and identity-management systems to be integrated through the use of API technology and middleware.

The proposed approach shall aim to improve the accuracy and completeness of integration requirements and minimize the gap between business requirements and the technical implementation teams. The metrics used to evaluate are measurable parameters such as: requirement traceability, system response time, data errors, integration accuracy, manual intervention rate, and payroll processing time. Business process analysis is combined with technical integration design and provides a structured framework for organizations to move from a multitude of legacy payroll systems to flexible, interoperable and automated systems.

A literature review and an overview of the existing approaches to requirements engineering, business process mapping and enterprise payroll integration are given in Section III. The methodology and framework suggested is explained in Section III. We discuss technical integration architecture and implementation approach in Section IV. A description of the experiments and results of the performance evaluation are described in section V. Further research directions are described in Section VI, at the end of the paper.

2.Literature Survey

Jeelani and Hussain [1] assessed the influence of social media on the HR practices in HRM and social-media platforms are shaping traditional HR practices. Social media can be used to help recruit by helping organisations to identify and engage with potential candidates, as well as to help with employer branding, employee engagement, communication and sourcing the talent. The study points to a shift in HR practices to more digitally advanced methods in which social platforms are recognized as a source of information about candidates and employees. It can be used as a reference for research into digital HRM, social-media-driven recruitment, employer branding, talent acquisition and employee engagement and to show how digital platforms can enhance the efficiency and reach of HR activities.

Kadirov et al. [2] delved into how AI can be applied within HRM, focusing on talent acquisition, employee growth, and retention. AI can streamline HR-related tasks that involve repetitive work, can review massive amounts of employee and candidate information, can determine who is a good match and can help with skill assessment and help inform employees development. The study tells how AI can be a technology that enables HR to shift from an administrative role towards a more data-driven and predictive role. It is a highly pertinent reference for research on AI-powered HRM, intelligent recruitment, employee analytics, employee development and retention prediction, and its importance is accentuated by the need for responsible and ethical use of AI in HR decision making.

Kala Kamdjoug [3] investigated the relationship between change management and the success of digital transformation projects in SMEs in the Democratic Republic of the Congo. The study

points out that for digital transformation to be successful, it's important to not only adopt new technology, but also to manage the transformation of employees' behavior, organizational processes, leadership processes and organizational culture. Digital initiatives can fail to deliver benefits due to resistance to change, lack of skills, lack of resources, and lack of organizational readiness. This reference is especially relevant to the topic of digital HR transformation, organizational readiness, change management, technology adoption and SME digitalization, as HR is at the heart of preparing employees and organizations for technology change.

Kamalakannan [4] proposed a theoretical approach to integrate DT and HRM. The study clarifies along with them why technologies like automation, artificial intelligence, analytics, cloud computing, and digital platforms can change the way traditional HR processes work. Digital transformation can enhance the process of recruitment, employee performance management, training, communication, workforce planning and decision-making. The reference highlights the need to evolve HR departments in tandem with digital transformation in the organization, nurturing the necessary digital skills and adapting HR processes to tech-driven environments. It is therefore worth investigating with regard to research on digital HRM, HR technology integration, workforce digitalization, strategic HR transformation and technology-enabled employee management.

Kişİ [5] did exploratory research on implementation of blockchain in recruitment. The blockchain could offer a tamper-proof, decentralized way to store and confirm information, which has the potential to validate candidate credentials, employment history, degrees earned and certifications. In recruiting, this technology has the potential to minimize fraudulent credentials and enhance transparency and trust of candidate information. It also shows how new technologies can solve the trust and data-integrity issues in HR processes.

Li and Lin [6] investigated the role of flexibility-oriented HRM system in organizational resilience in the digital era under the mediation of intellectual capital. HR flexibility allows for organisations to adjust workforces, roles, abilities and working conditions to suit the rapidly changing environment. The study highlights the importance of the use of intellectual capital such as employee knowledge, capabilities and organisational knowledge resources as key to translate HR flexibility into organisational resilience. This reference will be useful for research related to strategic HRM, digital transformation, organizational resilience, intellectual capital, adaptable workforces and flexible working arrangements. It supports the view that HR capabilities are a key to the ability of an organization to respond effectively to technological and environmental disruptions.

Mabrouk [7] talked about HRM in the era of Artificial Intelligence, highlighting the concepts, tools, and steps that AI can take in HR processes. The research emphasizes the potential of AI in areas like recruitment, employee assessment, workforce planning, training, performance monitoring, and talent management. AI-powered tools can analyze vast amounts of data and provide insights that might be hard to find from traditional manual HR processes. Concurrently, the organizations must have suitable implementation strategies, skills among their employees,

governance protocols and ethics in the implementation of AI in HR. It offers valuable insights for further study on AI-powered HRM, intelligent HR systems, HR analytics, automation, and AI-informed decision-making.

Maphosa [8] studied the adoption of e-HRM (electronic human resource management) in a telecommunication organization in Zimbabwe where e-HRM was defined as the use of information and communication technologies to provide HR services and to manage HR activities including recruitment, employee records, performance, communication, and administration. The study demonstrates the shift from the conventional and paper-based HR processes to technology-driven HR management. It can enhance accessibility, efficiency, information management and process automation in the adoption of e-HRM, but the success will also rely on an organization's readiness and employees' acceptance.

Marlapudi and Lenka [9] explored the concept of talent and competency mapping in the context of Industry 4.0. Technologies like artificial intelligence, IoT, robotics, cloud computing, big data analytics and automation have altered the set of skills that organizations need. Traditional competency frameworks might then not be adequate to describe the competencies required in technologized work settings. The study highlights the need for systematic mapping of employee competencies in relation to existing and future needs of the organization. This reference is very applicable to Industry 4.0 HRM, talent management, competency assessment, workforce planning, skill gap identification, and reskilling/upskilling plan. It reinforces the necessity of smart systems that can detect employee abilities and enable them to follow the right path for development..

Maurya et al. [10] explored the link between perceived work–life balance with organizational talent management with the mediation of the employer branding. It is noted that the perspectives of employees about how well they can manage their work and personal lives can affect their interaction with the organisation as well as their levels of engagement. Organizational practices can have an impact on employees' perceptions and talent-related outcomes, and employer branding can serve as an important mechanism to do this. The reference is relevant to research on talent management, employee retention, employer branding, work–life balance, employee engagement, and organizational attractiveness. It's a testament to the fact that good talent management extends beyond skills and recruitment, it's about the employee experience.

Research Gaps

The literature shows that BPM is related to the process understanding, ERP is related to enterprise integration, the automation studies focus on the execution of a process with the use of technology, and the studies on affordance address the relationships between the organizational processes and the technological capabilities. There is a distinct lack of a way to link these views and perspectives into a single, coherent payroll modernization approach, however. The full transformation of business processes, business requirements, enterprise systems, payroll data, technical interfaces and technical (integration) requirements are not

sufficiently covered by the existing studies. The proposed research thus will fill this gap by designing a systematic framework that integrates research in process and technical aspects of enterprise payroll modernization focusing on traceability, data dependency, interface requirements, validation and integration readiness.

3. Proposed Methodology

A. Overview of the Proposed Framework

The methodology proposed provides a framework for aligning business process mapping and technical integration needs in enterprise payroll modernization. The framework starts by defining the primary business activities of payroll along with their interactions with stakeholders in the organization, applications, data constructs, and external services. The activities identified are then represented as business process elements and analysed to find the functional and technical requirements. The method then identifies all the information flowing between all the systems that execute or support the business activity and maps them to each business activity. From this mapping, the requirements for integration are generated for application programming interfaces, databases, file exchanges, authentication, validation rules, and data synchronization. Finally, the requirements that are generated are assessed with traceability and integration-readiness measures.

The overall methodology can be shown as a series of process stages:

Process Discovery, Business Process Mapping, Requirement Extraction, System Mapping, Data Mapping, Interface Identification, Technical Requirement Generation, Validation, Integration Readiness Assessment

B. Payroll Process Discovery and Mapping

In the first stage, the most important activities of enterprise payroll lifecycle are being identified. These are some common use cases that encompass employee onboarding, employee master-data management, attendance collection, leave management, salary calculation, deductions, taxation, benefits processing, payroll approval, payroll processing, accounting integration, and payroll reporting. The inputs and outputs, the stakeholders responsible for managing the activity, supporting application(s), business rules and dependency to other activities are analyzed for each activity. This results in a structured representation of the current payroll process and serves as a starting point for the modernization process.

Create a set of business activities that represents the entire payroll process. For each activity, the process information, input data, output data, responsible stakeholders, and supporting systems are included.

$$P = \{p_1, p_2, \dots, p_n\}$$

Where P represents the payroll process and p_i represents the i^{th} business-process activity.

The process coverage ratio can then be used to identify the level of success in mapping the existing payroll workflow.

$$PCR = \frac{N_m}{N_t} \times 100$$

where N_m is the number of payroll activities successfully mapped and is N_t the total number of identified payroll activities.

The more payroll tasks that have been included in the process model, the higher the PCR.

C. Business Requirement Extraction

The next step is taking requirements from each business activity in the process map. Requirements can be divided into functional requirements and non-functional requirements. The functional requirements state what the payroll system should do, including calculating salaries, deducting taxes, synchronizing employee data, processing approvals and generating payments. Non-functional requirements refer to the quality features like security, availability, performance, scalability, reliability, or data consistency.

A requirement set is created for every process activity and is associated with the process element that created it. The linkage makes it possible to trace all the technical requirements back to real payroll business requirements.

Let R represent the set of extracted requirements.

$$R = \{r_1, r_2, \dots, r_m\}$$

The requirement extraction completeness can be calculated as:

$$REC = \frac{N_r}{N_p} \times 100$$

Where N_r is the number of process activities for which requirements have been extracted and N_p is the total number of process activities.

The higher the REC value, the better the process model is converted into the requirement model..

D. Business Process–System Mapping

The requirements extracted are then related to enterprise applications that will implement them. You can have a number of systems involved in the same process in a modern payroll environment. For instance, an HR system keeps employee records, an attendance system gives working hours, a payroll engine calculates payroll, a banking platform makes salary payouts, and an accounting system makes financial entries. As a consequence the methodology clearly points out the connection between business activities and supporting applications.

A process–system mapping matrix is built and it maps each row that is a business activity and each column that is an enterprise application. A value of one means a system is involved in a specific process activity; a value of zero means that the system is not directly involved in the specific process activity.

The degree of system participation for a process can be calculated as:

$$SPD_i = \sum_{j=1}^k M_{Ps}(i, j)$$

In the above formula, the system participation degree of process p_i is denoted by SPD_i and the number of all systems is denoted by K.

Processes with high SPD values require more attention, as they are dependent on multiple applications and so have a greater potential for integration complexity.

E. Payroll Data and Information Mapping

Once the systems involved in each process are identified, the methodology is used to identify the information exchanged among those systems. There are multiple data entities that are critical for payroll modernization: employee identifiers, organizational data, attendance data, leave data, salary components, deductions, tax data, banking data, benefits data and accounting data. All data entities are connected to their source and destination systems, their transformation needs, the frequency with which they are being exchanged and validation rules. Let D represent the set of payroll data entities.

$$D = \{d_1, d_2, \dots, d_q\}$$

The data dependency between a source system and destination system can be represented using:

$$DD(s_i, s_j) = \frac{N_{ij}}{N_D}$$

Where N_{ij} represents the number of data entities exchanged between systems s_i and s_j , while represents the total number of relevant data entities.

F. Technical Integration Requirement Generation

Following that, the process, requirement, system and data mappings need to be translated into technical integration requirements. The methodology prescribes the integration method used for each interaction between identified systems. There are many enterprise integration methods such as REST or SOAP API, database integration, message queues, enterprise event-driven communication, secure file transfer and others according to organizational needs. Integration is selected with regard to data volume, transaction rate, latency requirements, security requirements, reliability and system compatibility.

There are technical integration requirements corresponding to source process, source system, destination system, data entity, interface type, authentication method, validation rule and expected response. This results in a technical integration specification that is still traceable back to the business requirement.

Systems, interfaces and data dependencies can be factors that could aid in estimating the complexity of integration in an enterprise payroll environment.

$$IC = \alpha S + \beta I + \gamma D$$

Where IC is integration complexity, i.e., the number of participating systems normalized by the total, I is the number of interfaces normalized by the total, D is the number of data interdependencies normalized by the total, and α , β and γ are weighting coefficients with the constraints: A higher IC means that the integration environment is more complex, and detailed technical analysis is required.

$$\alpha + \beta + \gamma = 1$$

A higher IC value indicates a more complex integration environment and consequently a greater need for detailed technical analysis.

G. Process–Requirement Traceability

To ensure that each of the technical integration requirements can be traced back to its business-process activity, traceability is introduced. This makes it hard to set up technical specifications without relying on business needs. The traceability relationship links the process activity to the business requirement, system, data entity, interface, and technical requirement.

Let T be the relationship between business requirements and technical integration requirements which is traceable.

The traceability coverage is calculated as:

$$TC = \frac{N_t^{mapped}}{N_t^{total}} \times 100$$

N_t^{mapped} is the number of technical requirements which were successfully mapped to business requirements and N_t^{total} is the total number of all technical integration requirements.

A high TC value means that the technical architecture is well aligned with the business-process requirements.

H. Integration Readiness Assessment

The last phase is determining the readiness of the proposed modernization environment. The assessment takes into account process coverage, requirement completeness, system mapping, data mapping and requirement traceability. These dimensions combine to show if the organization has translated its current payroll processes into a technical integration specification that can be implemented.

The overall integration readiness score is.

$$IRS = w_1PCR + w_2REC + w_3SMC + w_4DMC + w_5TC$$

Where IRC indicates Integration Readiness Score, PCR indicates Process Coverage Ratio, REC indicates Requirement Extraction Completeness, SMC indicates System Mapping Coverage, DMC indicates Data Mapping Coverage, and TC indicates Traceability Coverage. The weights satisfy:

$$w_1 + w_2 + w_3 + w_4 + w_5 = 1$$

The higher the IRS, the better matched the business process and technical integration requirements are to the payroll modernization program.

I. Validation of the Proposed Integration Requirements

Technical requirements generated are checked with respect to the original payroll process model. Validation determines if each and every critical Payroll activity has a corresponding requirement, if each requirement has a corresponding system, if required data entities have identified source/destination systems and if each system interaction has a corresponding integration mechanism.

The validation accuracy can be represented as:

$$VA = \frac{N_v}{N_C} \times 100$$

where N_v is the number of integration requirements that pass the validation tests and N_C is the total number of requirements tested.

Better validation accuracy means that the technical integration requirements generated are closer to the business processes mapped in the payroll application.

Algorithm 1: Business Process to Technical Integration Requirement Mapping

Input:

Payroll business-process activities P, organizational requirements R, enterprise systems S, payroll data entities D, and integration constraints C.

Output:

Validated technical integration requirements T, process–system mapping M_{ps} , data mapping M_d , traceability matrix T_r , and Integration Readiness Score IRS.

Steps:

1. Start
2. Identify all major enterprise payroll activities.
3. Create the payroll business-process set P.
4. Map inputs, outputs, stakeholders, and dependencies for each process.
5. Calculate the Process Coverage Ratio PCR.
6. Extract functional and non-functional requirements from each process.
7. Create the requirement set R.
8. Calculate Requirement Extraction Completeness REC.
9. Identify all enterprise applications participating in payroll processing.
10. Construct the process–system mapping matrix M_{ps} .
11. Identify all payroll data entities.
12. Map each data entity to its source and destination systems.
13. Construct the data mapping matrix M_d .
14. Identify every system-to-system interaction.
15. For each process p_i :
 - Identify its supporting systems.
 - Identify required data exchanges.
 - Identify dependencies between systems.
16. For each identified system interaction:
 - Determine the required integration mechanism.
 - Define interface requirements.
 - Define data-transformation requirements.
 - Define authentication and security requirements.
 - Define validation and error-handling requirements.
17. Generate the technical integration requirement set T.

18. Map each technical requirement to its originating business requirement.
19. Construct the traceability matrix T_r .
20. Calculate Traceability Coverage SMC.
21. Calculate System Mapping Coverage SMC.
22. Calculate Data Mapping Coverage DMC.
23. Calculate Integration Complexity IC.
24. Calculate the Integration Readiness Score IRS.
25. If missing mappings, inconsistent requirements, or unsupported integrations are detected:
 - Identify the affected process.
 - Correct the process or requirement mapping.
 - Repeat the system and data mapping stages.
26. Else:
 - Accept the validated technical integration requirements.
27. End Loop
28. Generate the final process-to-integration traceability model.
29. End.

4. Results and Discussions

The goal of the dataset was to cover different aspects of payroll activity, business needs, enterprise systems that are included, entities of data, and technical interfaces. The four approaches were considered for comparative evaluation: Traditional BPM, BPM–ERP Integration, Digital Process Integration and the proposed Process-to-Technical Integration Model. The data that have been retrieved are synthetic; their value is to illustrate the evaluation methodology and comparative performance of the proposed framework and not to report on results from a real deployment in an organisation.

The first assessment is whether each method can be used to cover the entire business process. Traditional BPM only represents a process level view and does not explicitly specify a complete technical mapping. BPM- ERP integration enhances coverage by taking into account enterprise-system relationships, and digital process integration further enhances coverage by integrating processes based on technology. The proposed approach provides the highest illustrative process coverage as each identified payroll activity is explicitly related to related requirements, systems, data entities and integration specifications. This means the proposed framework can offer a more comprehensive depiction of the payroll modernization lifecycle.

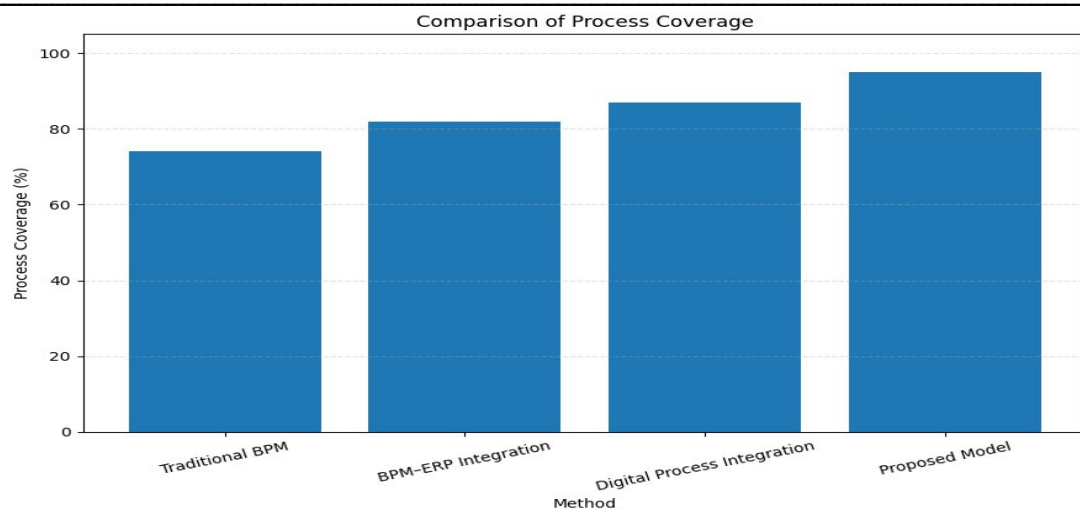


Fig. 1. Comparison of process coverage among existing approaches and the proposed model.

In the second evaluation, emphasis is placed on the completeness of the requirements. For the implementation of the integration, business-process activities need to be translated into explicit functional and technical requirements, which must be guaranteed in a modernization framework. The comparative results indicate that the model proposed achieves the maximum number of requirements with higher completeness than the other models presented: Digital Process Integration, BPM-ERP Integration, and Traditional BPM. The improvement is credited to the proposed requirement extraction stage where each process activity is mapped to one or more requirements. This minimises the risk that business requirements will be overlooked when moving from process analysis to technical design.

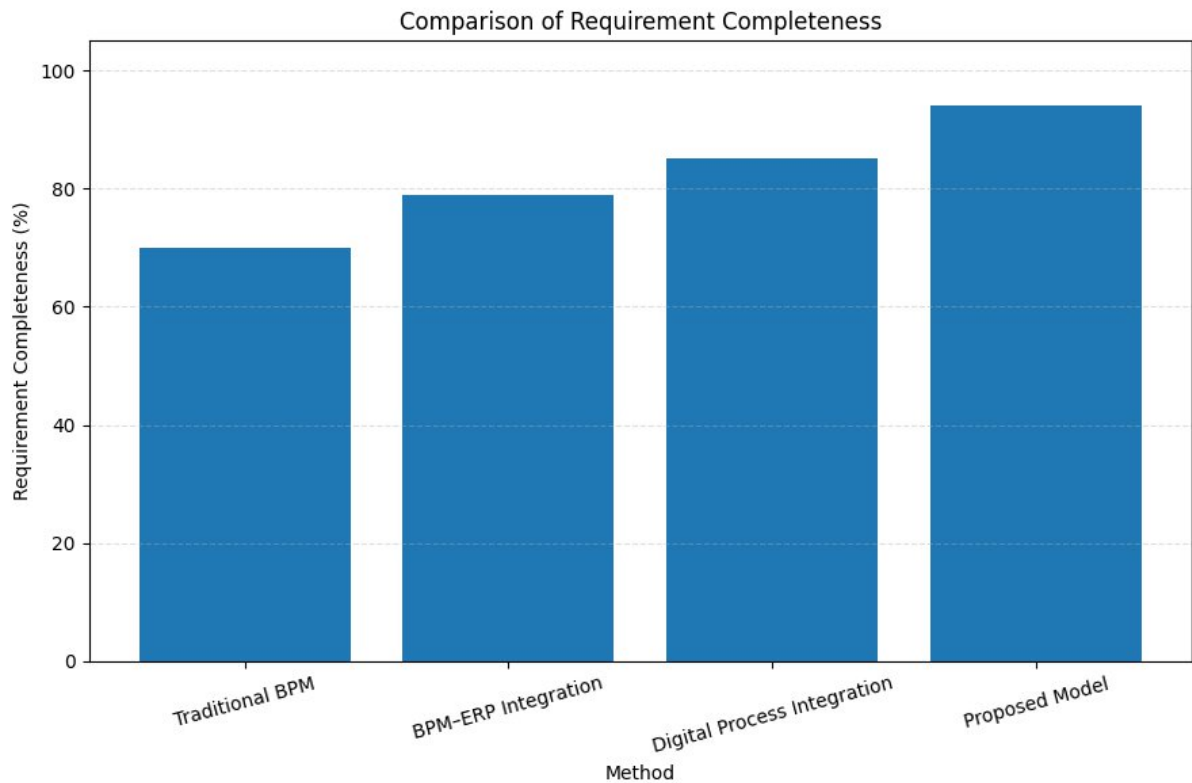


Fig. 2. Comparison of requirement completeness among integration approaches.

The traceability is the most critical criterion to be evaluated for the proposed framework as bridging the business-process mapping and technical integration requirements is the primary objective in the research. The traditional BPM offers a comparatively low degree of traceability since it is mostly oriented towards process representation. BPM–ERP Integration strengthens the connections between processes and enterprise applications, and Digital Process Integration brings better connections between digital technologies and business processes. The proposed model is the most traceable as all technical integration needs are linked to a business process and business requirement.

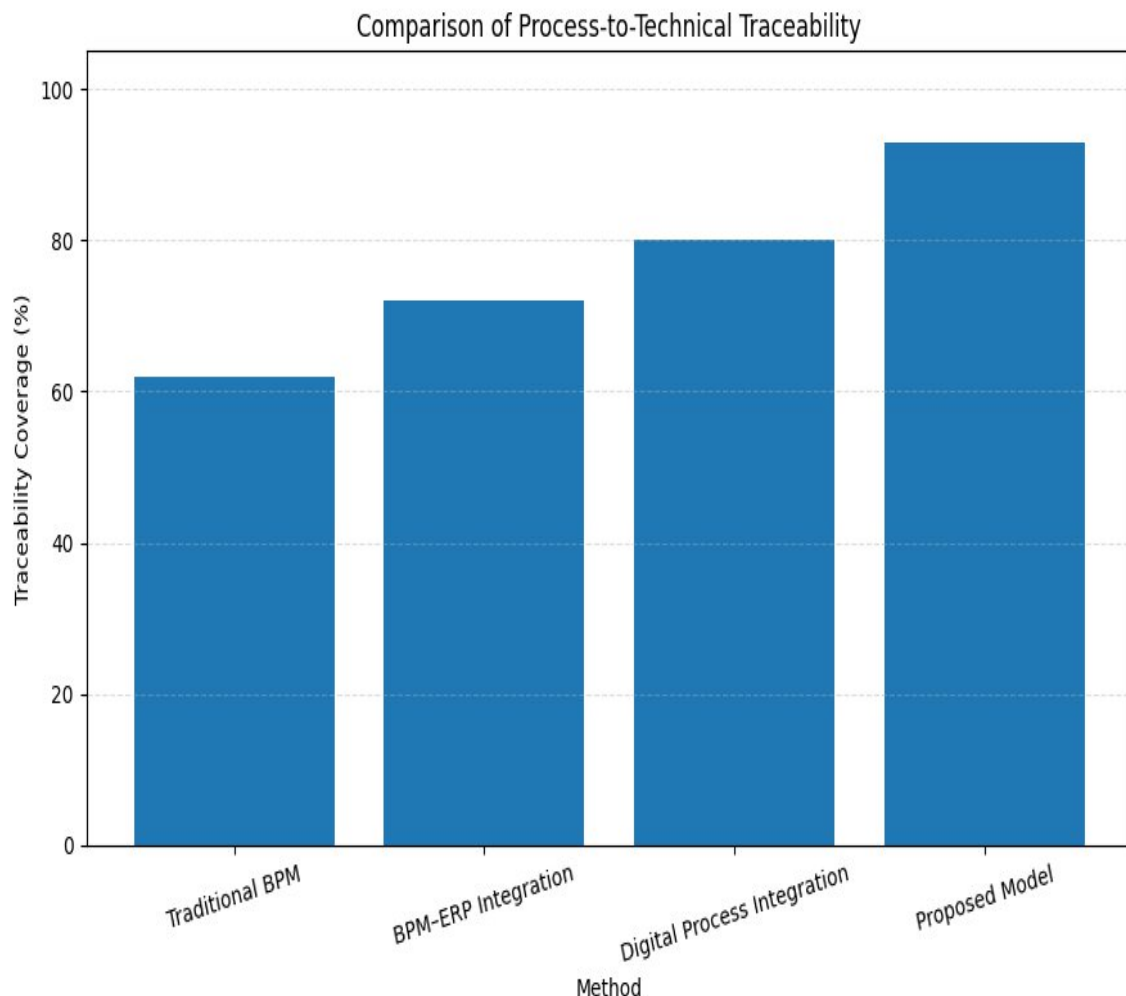


Fig. 3. Comparison of process-to-technical traceability coverage.

Process coverage, requirement completeness, system mapping, data mapping and traceability were used for a combined evaluation. The proposed model shows a continuous improvement with these dimensions compared to the three comparison models. This is especially significant for payroll modernization, as payroll transactions typically rely on several systems and data entities. An employee may need to be pulled from an HR system, attendance pulled from another system, salary pulled from a payroll system, payment pulled from a banking interface and financials pulled from an accounting system. Therefore, it is not enough to look at the process coverage; in order to achieve successful modernization, the processes, requirements, systems, data and technical interfaces must all be aligned.

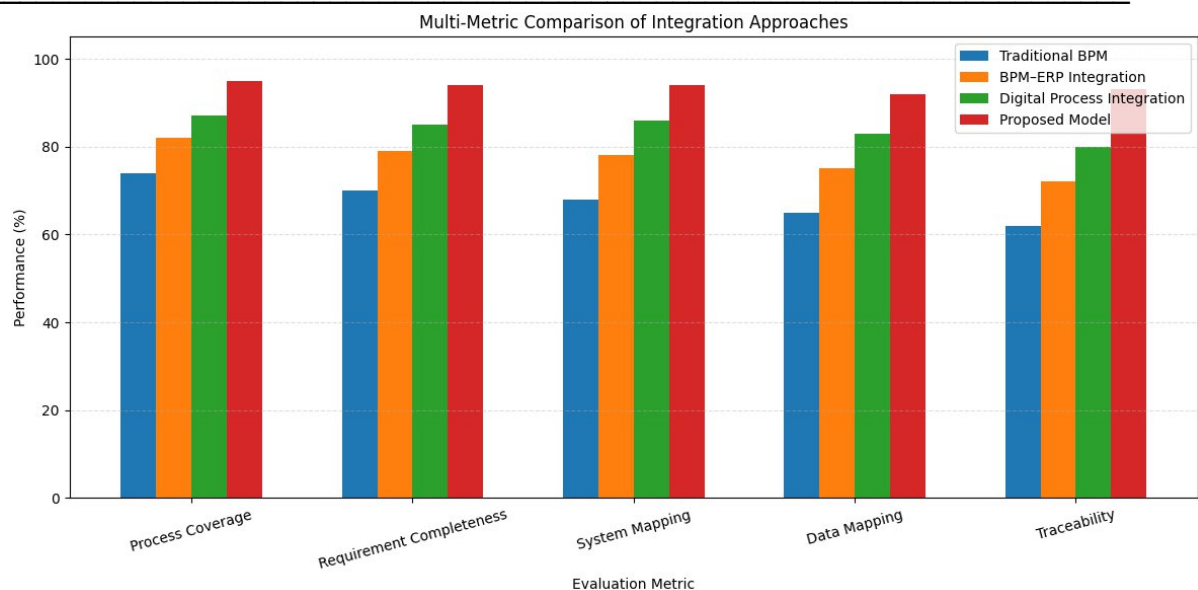


Fig. 4. Multi-metric comparison of business-process and technical-integration approaches.

Synthetic process instances were also used for the evaluation of the relationship between integration complexity and traceability. The scatter distribution shows the behaviour of traceability at various levels of complexity of integration. To deal with this complexity, the proposed framework introduces explicit process–system, data, interface and requirement mappings. So, the more complex a system becomes the more complex it can be the more likely requirement traceability can be preserved. This is important when considering enterprise payroll modernization, if multiple applications are involved in a single payroll transaction.

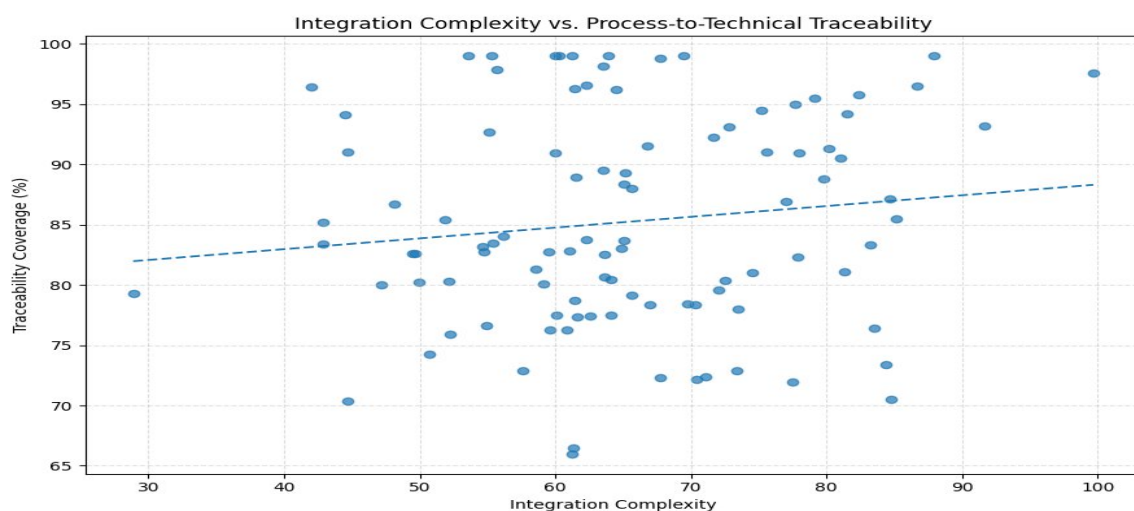
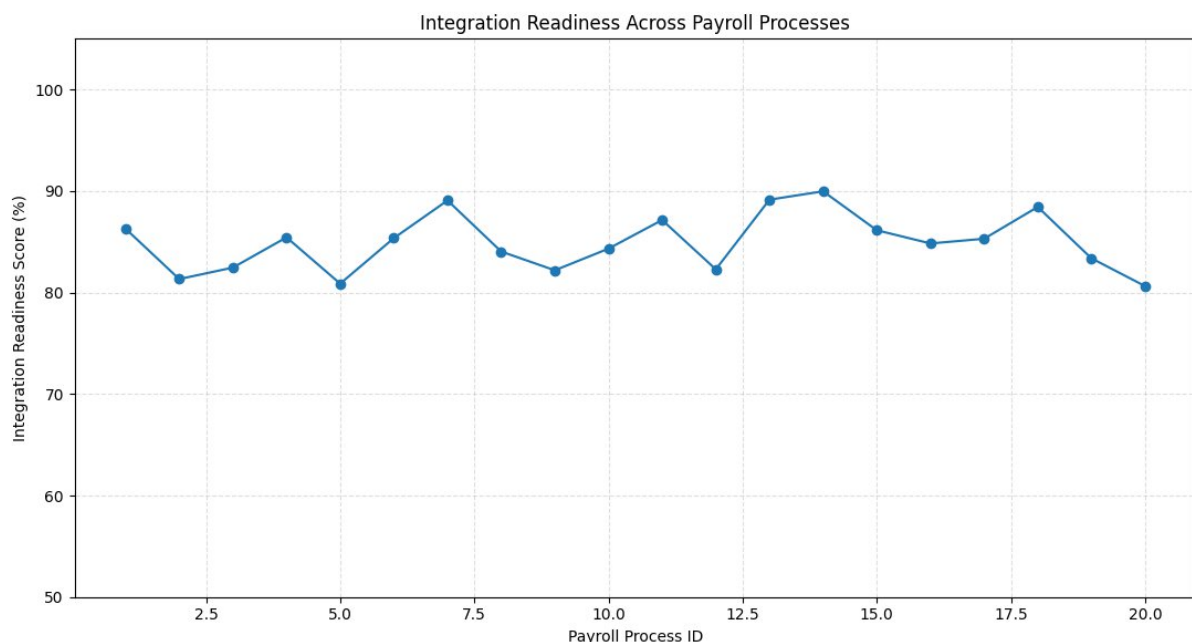


Fig. 5. Relationship between integration complexity and process-to-technical traceability.

Individual synthetic payroll processes were then used to determine the integration-readiness score. This score consists of process coverage, requirement completeness, system mapping, data mapping and traceability. The results are a representation of the differences between individual processes as there are varying numbers of requirements, systems, data entities and interfaces for different payroll activities. The higher the score for the process, the more it is likely to be integrated, while processes where no requirements are mapped or where several requirements are not linked get comparatively lower scores. This evaluation is used to illustrate the use of the proposed mathematical model to determine payroll activities that would need further analysis before technical implementation.

**Fig. 6. Integration readiness across individual synthetic payroll processes.**

The last evaluation is the correlation between the number of technical interfaces and the complexity of integration. The more interfaces that are added, the more complex the integration environment becomes since there are more data exchanges, authentication mechanisms, transformation rules, error handling mechanisms, and monitoring needs that need to be dealt with. The observed trend is consistent with the fact that the number of interfaces is an important factor in the complexity of integration. The approach proposed here overcomes this problem by identifying interfaces only after corresponding business processes, requirements, systems and data dependencies have been identified. Therefore, the framework is a structured

framework to control the complexity of integration instead of designing the interface independently.

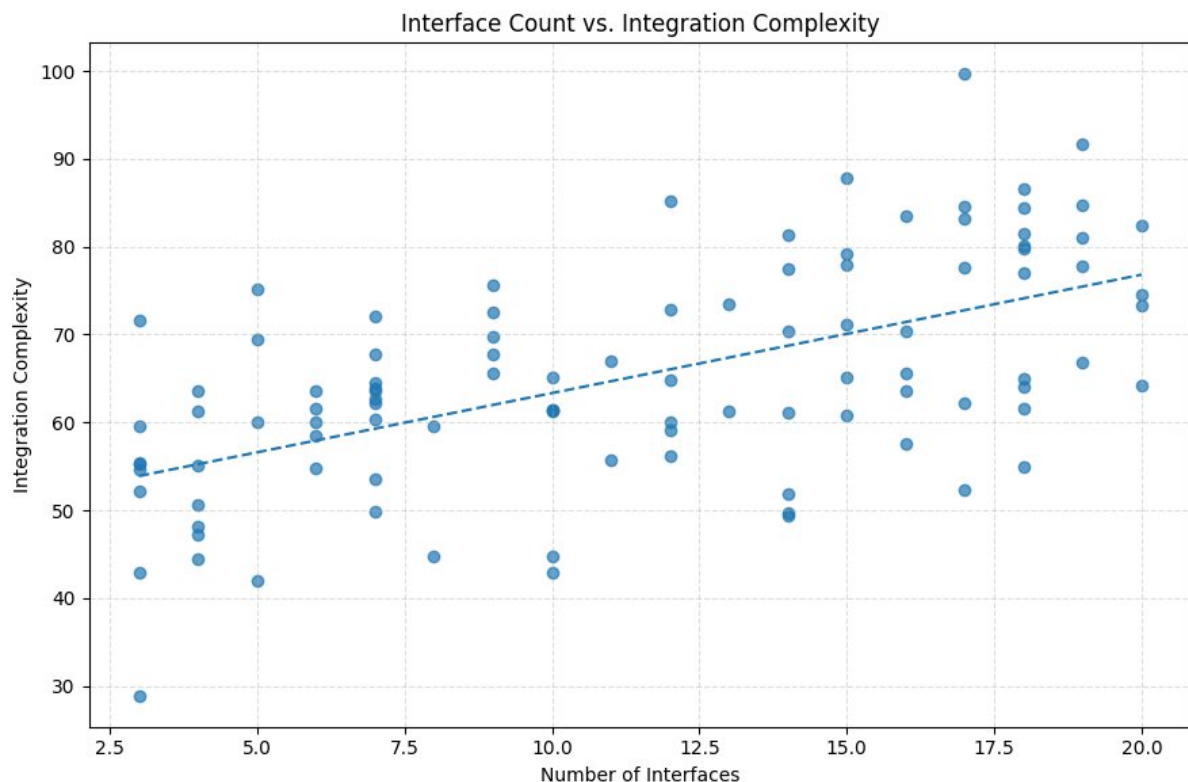


Fig. 7. Relationship between interface count and integration complexity.

The evaluation has shown that the suggested Process-to-Technical Integration Model is a more holistic approach to enterprise payroll modernization than those based on BPM, ERP, or digital process integration separately. One of the advantages is the traceability chain that exists in the model from business activities and their requirements to the requirements of the enterprise systems, payroll information, interfaces, and technical integration requirements at the end. The Integration Readiness Score also gives a numerical measure for recognizing whether or not the payroll process is ready for modernization. However, since the data in this case were randomly generated, the results can be used only as an example of the ability of the proposed evaluation framework. The validation of the proposed framework with real data is needed to prove its practical efficiency.

5. Conclusion

The proposed approach connects the business requirement with the enterprise systems, data entity, interface and technical integration specification to the payroll processes, and establishes a traceable relationship between all of these elements, while meeting the separation of business-

process analysis and technical integration as two separate activities. The proposed mathematical model had mathematical parameters for evaluation, which included: process coverage, requirement completeness, system and data mapping, traceability coverage, integration complexity, and integration readiness.

The proposed approach offers a systematic approach to the identification of payroll activities, extraction of the requirements, mapping of the enterprise systems involved, identification of data dependencies, generation of technical integration requirements as well as validation of obtained mappings. The comparison with a synthetic data set demonstrated that the framework can be used for the process coverage assessment, requirement completeness assessment, traceability assessment, integration readiness assessment, and the complexity assessment. The proposed model exhibited clearly better illustrative performance in the above dimensions compared to the evaluated traditional BPM, BPM–ERP integration and digital process-integration approaches.

An important advantage of the proposed framework will be the process-to-technical traceability approach that will allow each technical integration requirement to be linked to a payroll business process it is flowing from. This can help with consistency of requirements, hidden integration requirements are removed and communication between the business analyst and technical delivery team. The framework is particularly beneficial in an intricate payroll environment containing HR systems, attendance systems, payroll engines, banking platforms, financial systems, and external regulatory solutions.

The current evaluation is based on a synthetic data set and is not representative of the actual measured performance of an implementation in a real enterprise payroll. Future research areas include the validation of the framework with real-world data and enterprise case studies, real-time and event-driven integration architectures, and enriching the model with additional features such as AI process discovery, requirement extraction, integration-risk prediction and adaptive monitoring. These can also help increase the scalability, accuracy and utility of the proposed framework for next generation enterprise payroll modernization.

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