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A Development of the Customer based On-premise ERP Implementation Process Framework

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Abstract

As the definition of the vendor-oriented implementation method, which was utilized in adopting an ERP system, has been centered around the project construction business, it was difficult for the EPR adopting organization to systematically prepare ERP projects and have enough deliberative opportunities to change-related policies. Furthermore, this method does not have a fully standardized construction process. Accordingly, by defining an organization that wants to adopt an ERP system as a customer, this paper develops the customer-based ERP construction process framework that assists both customers and developers who construct the system. For this purpose, this paper reviews the previous research and collects the construction processes of the commercial ERP SW vendor and ERP construction cases while proposing the three-layer process framework to construct ERP through the KJ method. The ERP process framework consists of 7 processes, 32 activities, 141 tasks while providing definitions for concepts of each component. Furthermore, the proposed processes and phases were set in order of the recommended execution, while the activities were suggested as an open-ended type so that the application and usability can be increased and polished by reflecting experts' opinions. The contribution of this study is to standardize the ERP project process by transforming the previous supplier-based ERP construction method into the customer-based one while providing important procedure and activity frameworks that apply to diverse ERP solutions per vendor. At the same time, this study provides an theoretical foundation to develop the construction process for the customer -based Cloud ERP. In practice, At the beginning of the ERP system construction project, it provides communication or process tailoring tools for the stakeholder.

Key words: ERP(Enterprise Resource Planning), On-Premise ERP, ERP Process, ERP Standardization, Process Framework

1. INTRODUCTION

ERP (Enterprise Resource Planning) is a system that companies use to manage their business activities in

an integrated

way. In other words, it is an adaptive and evolving commercial software package that offers an integrated way of corporate

management in real-time[1]. Firms have adopted the ERP (Enterprise Resource Planning) systems for integrated management of processes in corporate management activities including accounting, human resources, sales, logistics, and purchasing.

ERP typically provides integration of key business activities and adds value to business process operations performed by all business functions, such as manufacturing, purchasing, production planning, sales, and accounting [2,3].

The precursors of ERP system have their roots in inventory management and control systems in 1960s. The main focus of the system in the early days was to track inventory of raw materials and to provide inventory reports [4-6].

Subsequently, since their emergence on the packaged software market in the 1990s, ERP systems have shown remarkable growth in terms of their relative importance in the market [5,6]. The development of IT technology prompted the expansion in the adoption and construction of ERP systems led by vendors holding on-premise ERP solutions such as SAP, Oracle, Baan, as well as Samsung SDS and Younglimwon Soft Lab of Korea. Recently, with a majority of experts accepting Cloud ERP as a more future-oriented technology [2] the ERP market is undergoing rapid reform into a cloud-based one.

However, according to the 2021 ERP report [2] by Panorama Consulting, firms have indicated their preference toward the on-premise ERP due to drawbacks of cloud-based ERP such as the risk of data loss (26.7%) and security risk (26.7%), and difficulties in the process change and continuous process training.

In general, in terms of perceptions of enterprises on ERP adoption, they consider problems such as time-consuming system construction, high construction failure rate, uncertainty on performance in the operational phase after ERP construction, and problems of astronomical budget required for construction important [7]. In terms of the maintenance cost, it has been reported that the percentage of costs arising from customizing and additional development of modules showed a high correlation ($\chi2=81.758$, $p<0.000$) with the number of customer service requests (CSRs) [8], and therefore, finding the most efficient interface between the current process of an enterprise and the ERP solution standard module is also considered crucial. In addition, according to a report by the Panorama consulting group [2], when an organization decides on the ERP implementation method, consideration of organizational factors at the strategic level was important such as the time for employees to adapt to the new ERP system, the level of risk tolerance of the organization, and the cost of implementation. It can be seen that ERP adopting enterprises recognize the necessity of review at the organizational and strategic level, and perform a thorough preparation in terms of enterprise policy.

However, despite these findings, according to a study citing the SSA Global Korea survey, 42% of ERP adopting enterprises were dissatisfied with the on-premise ERP system, 47% were using a system developed in-house, and 53% responded that they have operated the system in dissatisfaction [9]. These results indicate that the ERP system may function as organizational system rather than a simple information system [10] and the reason for the dissatisfaction can be found in characteristics in technical, organizational, and informational dimensions inherent to the ERP system. According to a previous study [1], the ERP system has the following characteristics for the respective dimensions: the system has adaptability and evolutionary openness in the function and facility for the application and development in technical dimensions; the system affects the organization, structure and practice and characteristics of organizational integration, and

integration of general functions and has the characteristics of process-oriented transversality and the focus on best practices in organizational dimensions; the informational dimension of the system is related to the quality and utility of the information provided by the system and the system provides real-time information and simulation for real-world business processes.

Therefore, from the perspective of ERP adopting organizations, implementation methodologies that properly reflect and incorporate these characteristics of the ERP systems are required. Through the methodologies, enterprise-level resource management should be performed in a consistent and systematic process, from the adoption strategy to the transition to a new system after adoption, and the cutover from the legacy system. In addition, from the perspective of the vendor responsible for ERP construction, a method is required that allows the provision of the ERP construction process optimized for the project that reflects the solution development methodologies of the vendor, the business culture of the adopting enterprise and the characteristics of the adopted modules. In the future, if the cloud-based ERP construction is more dominantly implemented, the linkage between existing on-premise ERP and cloud ERP or the evolutionary type of ERP construction business is expected to increase further. As a result, there will be a rising demand for customer-based implementation methodologies.

However, the ERP implementation methodologies currently utilized vary depending on the ERP system vendor, and a majority of them are focused on the project performance aspect of the ERP system construction. These different, vendor-centered, ERP implementation methodologies and project execution-oriented methodologies cannot serve as a useful reference model for successful ERP adoption for enterprises who aim to adopt ERP systems with the characteristics of an enterprise-wide system. This may lead to inadequate preparation at the enterprise level prior to the adoption of the ERP system. Therefore, when ERP is introduced to an enterprise, in order to overcome the problems described above, enabling successful construction of ERP system and operation of the system to the enterprise-wide satisfaction, ERP construction process based on customers represented by ERP adopting enterprises is required, moving away from the vendor-oriented construction as it is now.

In this regard, this study defines ERP adopting enterprises as customer of ERP, and proposes a framework of ERP construction process that both the customers and vendors can make use of, which reflects the vendor-specific characteristics of ERP solution and allows its utilization in the process of ERP business implementation and construction. The process proposed in this study can be utilized as construction methodologies for enterprises in the process of ERP system construction and as ERP implementation methodologies for ERP adopting enterprises. In addition, it is considered that the proposed process will contribute to the development and research of customer-based on-premise ERP or Cloud SaaS ERP implementation methodologies by enabling process tailoring.

2. PRELIMINARY

Existing works related to ERP can be largely classified into ERP package selection method, CSF (Critical Success Factor) or weight estimation in relation to ERP adoption and implementation, ERP utilization and expansion cases, ERP management strategy and performance measurement, and research on ERP customizing [8]. In this section, we mainly review previous studies on implementation methodologies and processes in terms of ERP management strategy, which are related to the proposal on the customer-based ERP system construction methodologies, the main theme of this study.

J. K. Lee and M. Cho [11] reported that each of the leading consulting firms that specialize in ERP project or ERP package vendors has their own ERP implementation methodologies, and that typically, the implementation process consists of analysis, design, construction, and operation with different sub-processes

for each phase. S.H. Kim [12] and Nagpal, S. et al. [4] performed research related to Accelerated SAP ERP. The ERP construction process of SAP is classified into the following phases: 1.Project Preparation, 2.Business Blueprint, 3.Realization, 4.Final Preparation, and 5.Go Live & Support. However, S.H. Kim [12] further proposed activities for each phase such as 7 activities in Phase 1 including kickoff, 7 activities in Phase 2 including definition of organizational structure and business process documentation, 9 activities in Phase 3 including prototyping and approval on development environment configuration, 9 activities in Phase 4 including integration testing and end-user training, and 3 activities in Phase 5 including help desk operation, cutover from the legacy system to the new system, and completion report. On the other hand, Nagpal, S. et al. [4] proposed 7 activities in Phase 1, 3 activities in Phase 2, 2 activities in Phase 3, 4 activities of unit testing, integration testing, system testing, and acceptance testing in Phase 4, and 3 activities of installation, go-live and support in Phase 5.

Y.J. Choi [9] classified the ERP construction phase into 5 phases as follows: 1. Preparation, 2.Analysis, 3.Design, 4.Construction, and 5.Transition. In Phase 1, 8 activities were derived including project kick-off report and task force team (TFT) composition, in Phase 2, 4 activities were derived including current business analysis and CSF analysis, in Phase 3, 4 activities were derived including the establishment of standard information system and To-BE process design, in Phase 4, 9 activities including customized development and key user training, and in Phase 5, 5 activities were derived including system implementation and improvements on identified problems. Also, as cited in the study, the AIM implementation methodology for Oracle ERP is classified into a total of 6 phases: 1. Definition, 2. Operation Analysis, 3. Solution Design, 4. Build, 5. Transition, and 6. Production. Phase 1 is composed of 5 activities including quality assurance and deliverables documentation planning, Phase 2 is composed of 5 activities including business requirements identification and comparative review with the ERP standard model and analysis of the differences, Phase 3 is composed of 4 activities including the setting of applications for the process, Phase 4 is composed of 4 activities including development of additional programs and DB expansion, Phase 5 is composed of 5 activities including data conversion, and Phase 6 is composed of 4 activities including system go-live and monitoring.

Meanwhile, the OUM methodology of Oracle ERP [4] is a successor to the AIM methodology and is divided into the following 5 phases: 1. Inception, 2. Elaboration, 3. Construction, 4. Transition, and 5. Production. In phase 1, 4 activities are included such as project stakeholder synchronization, in Phase 2, 3 activities are included such as elaboration of the scope, in Phase 3, 3 activities are included such as system configuration, in Phase 4, 4 activities are included such as readying the system for acceptance by the client, and in Phase 5, 5 activities are included such as the operation of the new system. For Dynamics ERP of Microsoft, the Sure Step methodology [4] is divided into 6 phases as follows: 1.Diagnostic, 2.Analysis, 3.Design, 4.Development, 5.Deployment, and 6.Operation. Phase 1 is composed of 3 activities such as project planning, Phase 2 is composed of 2 activities such as customers' business analysis, Phase 3 is composed of 2 activities such as process development, Phase 4 is composed of 4 activities such as introducing new standards, Phase 5 is composed of 2 activities such as installation, and Phase 6 is composed of 2 activities such as using the system go-live.

In addition, the SYSPRO IDEAL methodology [13] of Syspro, a cloud ERP vendor, is divided into the following 5 phases: 1.Initiate, 2. Design, 3. Engineer, 4. Actualize, and 5. Leverage. Phase 1 includes 4 activities such as resource identification, Phase 2 includes 5 activities such as specifying business goals and requirements, Phase 3 includes 6 activities such as sample data creation, Phase 4 includes 5 activities such as data migration and end-user training, Phase 5 includes 5 activities such transfer for support

As can be seen from the review above, existing works and ERP implementation methodologies of major

vendors focus only on the construction phase, and there have been little in-depth research on the preliminary process and items in strategic aspects for ERP adoption.

3. RESEARCH PROCESS AND METHODS

3.1 Research Process

The structure of this study is organized into a total of 7 phases as shown in Figure 1. First, by conducting preliminary research on ERP implementation methodologies and processes, Process, Activity, and Task are collated according to the 3-layer classification of ISO/IEC12207 that defined the life cycle of software. At this time, by checking where the collected items were classified into among the three levels of Process, Activity, and Task, data are organized for the first round in the same level identified from the checking. In addition, the examples of work breakdown structure (WBS) and implementation schedule documented during ERP construction on the job are also collected. Second, the final Processes and Activities are defined by classifying the collected data by Process and by Activity. The Processes are defined based on the flow of the methodology presented in software engineering, and the Activities are classified as the sub-item for each Process.

Third, based on the collected data, it is defined that the Tasks are placed as sub-items of the Activity per Process defined in the previous studies. At this time, if the Tasks all aim for the same deliverables and are subdivided in detail and performed in sequence, these Tasks are grouped into one and escalated to a separate Activity and thus a new Activity is added and the name for the new Activity is assigned and the series of Tasks described above are placed as subitems of the newly defined Activity. Through this process, the Activities to be performed in a Process are expanded.

Fourth, the order is defined based on the defined Activities and Tasks.

Fifth, for the ERP Processes, Activities and Tasks derived through the 1st classification by the KJ Method, the respective concepts are defined in specific detail. When this phase of the research is completed, the customer-based ERP construction process is completed at the researcher level.

Sixth, by collecting expert opinions, the derived ERP construction process is validated and modified and the final version of the customer-based ERP construction process framework is determined. For the process of validation based on expert opinions, expert consultation is performed for the 1st round and an expert questionnaire is performed for the 2nd round.

Seventh, based on the derived ERP construction process model, applicability in process engineering and differentiating characteristics from existing implementation methodologies are analyzed.
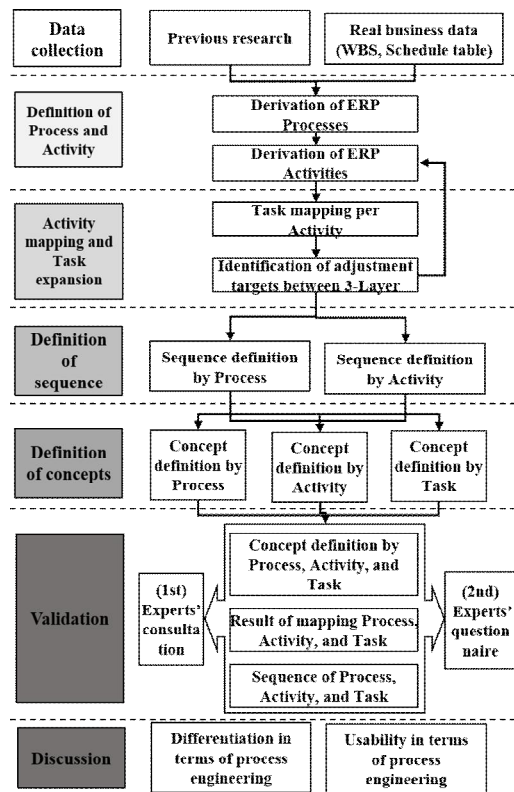
Figure 1. Research Process Overview

3.2 Research Method

The KJ method is named after Jiro Kawakita, and it is a method of classifying and grouping various items in consideration of their similarity or relevance [14]. In this study, the method is used for grouping and simplifying similar Processes, Activities, and Tasks expressed by different researchers. Using the KJ method, similar or identical Processes and Activities are simplified through a cleansing process and grouped into one, and a new name with representative significance for the group is assigned. In addition, the Tasks that have undergone the cleansing process are mapped to each specific Activity.

For example, in Table 1, the process named 'project definition' was those that were named as preparation, project preparation phase, detailed business planning phase, the final preparation phase, the project definition, system construction preparation, education/training and organizational development, Information strategy planning, project preparation phase, inception phase, diagnostic phase, planning, preparation, kick-off, and discovery and planning among activities from previous studies. These items share the common points that they are the processes in which the ERP business is planned and reviewed in terms of scope and cost of the business and the method of construction at ERP construction and for businesses whose feasibility has been determined, the preparation for implementation is conducted. Therefore, they were grouped into the same group and the 1st group name was determined as project definition.

Table 1. Result of 1st. KJ Method Application for derivation of processes and activities

process	derivation of processes and activities
Project definition	Preparation, Project preparation phase, Detailed business planning phase, Final preparation phase, Project definition, Project definition, System construction preparation, Education/training and organizational development, Information strategy planning, Project preparation phase, Inception phase, Diagnostic phase, Planning, Preparation, Kick-off, Discovery and planning

Analysis	Business analysis, Analysis phase, Business area analysis, Business blueprint, Elaboration phase, Analysis phase, Analysis, Analysis and design
Design	Solution design, Design phase, business system design, Technical design, Business blueprint, Elaboration phase, Design phase, Design, Analysis and design
Development	Implementation/construction, Construction, System implementation phase, System construction, Development phase, Construction phase, Construction, System implementation according to the business blueprint, Construction phase, Development phase, Construction, Production, Realization, Production
Testing	Testing
Execution	System go-live, Transition, Completion, Policy establishment and checking of the new process implementation, Implementation, Final preparation, Transition phase, Production phase, Deployment phase, Deployment and go-live
Operational support	System support phase, New system operation, Go-live and support phase, Production phase, Operational phase, Additional phase, Leverage, Stabilization, Post-production

For further classification of the 1st group derived as above to the controllable level, those with high similarity in terms of objectives or goals were grouped. As a result, the group named 'project definition' through the 1st KJ was further classified into 'Information strategy planning' and 'Preparation for project implementation' as shown in Table 2 through the 2nd KJ, and these were positioned as activity candidates.

Table 2. Result of 2nd. KJ of major classification of "Project Definition"

Name of category	*Sub-factors*
Information strategy planning	Diagnostic phase, Discovery and planning, Project planning/planning
Preparation for project implementation	Education/training and organizational development, Project preparation, Preparation / kick-off

In Table 1, the 2nd KJ was applied to analysis, design, development, testing, execution, and operational support, which correspond to the rest of the names for process classification in Table 1 in the same way. For the 'development' process with a high level of detail and low similarity, the 3rd KJ was applied to the activities for this process.

Meanwhile, we use the mapping method for activity mapping and activity expansion. In the previous step, Process 1 was assigned the name 'project definition', and activities were categorized into 'Information strategy planning' and 'Preparation for project implementation'. The results of activity mapping are outlined in Table 3. In Table 3, 'The project operational and organizational system configuration' activity is an example derived by expanding the task. Initially, this was classified as tasks of implementation planning but the task number was excessive and among these, tasks that can be clearly separated as human resources management in terms of project management knowledge area were identified and these were further classified through the KJ method. After all mappings were completed, the process names and activity names were cleansed based on the activities composed through the research team's review to ensure these names were clearly defined. The name of Process 1 was changed from 'project definition' to 'ERP construction strategy planning' so that this object could be clearly represented. As for the activity names, the 'Information strategy planning' was changed to 'Project strategy establishment' and the 'Preparation for project implementation' was divided into 'Project implementation planning' and 'Project operational and organizational system configuration'.

Table 3. Result of activity mapping and activity expansion of Process 1. information strategy planning

Process	*Activity*	*Tasks*
Information strategy planning	Project strategy establishment	Project strategy establishment, Construction strategy simplification
	Project implementation planning	Project planning, Project schedule establishment, setting goals and high-level scope, Setting goals and scope, Establishment of project scope, Determination of high-level requirements, Technical Requirement Planning
	Project operational and organizational system configuration	Project organization, Steering committee organization, Project TFT composition, Project stakeholder synchronization according to the set objectives

For example, <Table 4> shows the Process, Activity, and Task of Process 1 finally confirmed through this process. Here, 'Composition of project steering committee organization' is an activity that was not derived from the results of the data collection and investigation, and is a task added by reflecting the opinions of working-level staff and experts who have experience in DRP adoption.

Table 4. Result of deriving for Process 1 after first-refining

Process	*Activity*	*Tasks*
Information strategy planning	Project planning	Definition of project strategic objectives (goals), Setting the high-level scope
	Project implementation planning	Setting high-level objectives, Determination of high-level requirements, Technical Requirement Planning, Confirmation of project budget, scope and period and update of OPA, Definition of project stakeholders
	Project operational system and organizational system configuration	Composition of project steering organization, Composition of project steering committee organization

4. DEVELOPMENT OF CUSTOMER-BASED ON-PREMISE ERP CONSTRUCTION PROCESS FRAMEWORK

4.1 Data collection

All processes, activities, and tasks from ASAP methodology of SAP, AIM and OUM methodology of Oracle, Sure Step methodology of Microsoft, Ideal methodology of Syspro, which are vendor-specific methodologies for major EPR vendors and the research processes collected from previous research were collected. For real business cases, the methodology examples of UNI ERP of Bizentro and Speed-K methodology of Younglimwon Soft Lab were investigated and the processes, activities and tasks were collected from the schedule. Most of the existing ERP implementation methodologies were classified into two levels of Phase and Activity. For each methodology, Phases were typically divided into 5-6 phases, and Activities showed a variety of classifications depending on the level of details, and a total of 195 activities were collected.

In this study, for clear differentiation of main tasks performed for each process, the collected data were categorized into the 3-layer level of process, activity and task. As a result, the phase items from the raw collected data were categorized into processes or activities depending on the scope. In addition, for the collected tasks, they were assigned to tasks that correspond to the sub-activity level in this study, but for highly subdivided tasks, a new activity was created and the tasks were assigned as the subitems of the newly created activity. This is to consider effective scope and period for control during actual project implementation, and whether the tasks produced the same deliverables was determined as the major criteria.

4.2 Definition of Process and Activity

As a result of collating all phases of the research process collected from previous studies and from ASAP

methodology of SAP, AIM and OUM methodology of Oracle, Sure Step methodology of Microsoft, Ideal methodology of Syspro, which are vendor-specific methodologies for major EPR vendors, a total of 69 unique phases were collected. Although the phases were named the same or different for each researcher or vendor, the similarity was determined in terms of the objectives of the process and classified through the KJ method and the classification names for the phases were defined. In this study, the same name and definition of the process as defined in software engineering were applied to avoid confusion between terms. For this reason, the name of the major category was Processes, not phases. Accordingly, among those that were presented as phases in previous studies, the names of phases that were highly detailed were assigned to Activity level, the sub-item of Process.

4.3 Activity mapping and activity expansion

The main objective of this phase was determined to establish a project implementation strategy by defining the business scope and implementation entity by examining strategic feasibility and technical feasibility at the enterprise-level by an organization considering ERP adoption. The processes and activities derived through Section 4.2 and 191 tasks collected in the previous step were mapped. Identical or similar tasks were integrated into one task and a classification name, which can comprehensively represent these tasks, was assigned. In addition, the tasks judged to be out of the controllable level due to a large number of unit work tasks were reclassified into one group, and an activity name was newly assigned and these unit tasks were mapped as the sub-items of the new activity. For all of the processes and activities, the tasks were mapped in the same way as above, and if necessary, the activity was expanded and re-defined. Then, the research team conducted the first expert review of the derived results, and added important tasks judged by the experts or modified task names. As a result of completing the final cleansing task, a total of 7 Processes, 32 Activities, and 134 Tasks were defined.

4.4 Definition of process sequence

For the results of completing the mapping process, the recommended sequence was defined for the respective process and activity. On the other hand, the sequence for the tasks was not defined. Therefore, by using the model presented in this study, process tailoring can be performed by reflecting the methodology based on the vendor's solution, project characteristics, and requirements of the ERP adopting organization, and in the subsequent phase of schedule establishment, the schedule table can be documented and defined according to the situation.

4.5 Task concept definition

ISO/IEC 12207 groups the software life cycle process as primary processes, supporting processes, and organizational processes [15] and organizes them into layers of processes, activities, and tasks. Therefore, based on this structure, each component of the ERP construction process framework was classified into a 3-layer structure of Process, Activity and Task and each concept was defined. Thee process is the life cycle of the software, Activity is the classified group of tasks through which objectives of each process can be achieved, and Task is the actual detailed tasks and activities for each Activity and is the minimum unit of the work. Through the 3-layer structure, the terminologies defined for each ERP solution vendor can be standardized, confusion from terminologies can be avoided and the objectives and priorities can be clarified.

4.6 Validation
4.6.1. Validation through expert consultation

The results of this research were validated by reflecting the 1st round of expert consultation on the finally developed on-premise ERP construction process framework. As for the experts, three experts with much experience in ERP construction in business practice participated in the consultation. As a result, there were 35 cases in which the activities were added or the names of existing tasks were changed. After the process of cleansing through the validation, <Table 5> to <Table 11> outline the finally derived customer-based 3-layer ERP construction process framework. The framework is classified into 7 Processes in total with 32 Activities and 134 Tasks. Here, for Process and Activity, the presented sequence is the recommended sequence of performance for actual application in the business practice. However, Task indicates the important tasks that need to be conducted in ERP construction but the presented sequence does not represent the actual sequence of conducting the tasks. To be specific, the Process is composed of Construction strategy planning such as Table 5, Project kick-off like Table 6, Detailed analysis and prototyping such as Table 7, Detailed design such as Table 8, Development and testing such as Table 9, and Operation and improvements like Table 10 and these processes should be performed according to the presented sequence. In addition, the main work constituting the 'Construction strategy planning' Process includes three activities, which are Project strategy establishment, Project implementation planning, and Project operational and organizational system, and these activities should also be performed according to the presented sequence. However, the tasks which are defined under the 'Project implementation planning' Activity, which are Setting high-level objectives, Determination of high-level requirements, Technical requirement planning, Confirmation of project budget, scope and period and update of OPA, Definition of project stakeholders, are the specific tasks to be performed in the Activity, and the sequence of performing these tasks needs to be defined by discussion within the project. The Activities and Tasks defined for the other Processes are also defined in the same manner, and the same interpretation can be applied in terms of the sequence and concept. Among the Task items, '*' indicates that the result of expert consultation presented in the first validation process is incorporated. In addition, '**' represents an item that reflects the opinions presented in the expert questionnaire conducted for the second validation process. These indicate that the process of incorporating the expert opinions, for both the 1st and 2nd rounds, involved the addition of items, changes in the task overview and adjustment in sequence.

4.6.2. Validation through expert questionnaire

The second round of validation was performed with 12 special-level technicians with a number of experiences in ERP and extended ERP construction and IT experience of over 20 years and 4 high-level technicians with less than 20 years of experience. Twelve members of the experts have experience in the construction and development of two or more ERPs, and 56% of the experts have experience in ERP construction more than 10 times. In order to perform an examination on the characteristics specific for each size of ERP solution, the experts with SAP and Oracle's ERP construction experience, the experts with Bizentro's UNI ERP construction experience and the experts with Younglimwon Soft Lab's K-system ERP construction experience participated in the questionnaire. For reviewing the process from the customer-based perspectives, the expert with experience in business management in an ERP adopting organization also participated in the questionnaire. As a result of the expert questionnaire in the 2nd round of validation, 7 Tasks were added in addition to the 134 Tasks derived from the 1st validation, making the total number of Tasks at 141. The opinions presented in the expert questionnaire for each process and the contents of research that reflected the opinions are outlined as follows.

In the Construction strategy planning Process, the consensus of experts was that the process is an essential

component in the development of the ERP construction framework. Also, it was proposed that due to the nature of this process, it should be managed in the business phase or using the request for proposal (RFP) and by the project management officer or project manager. According to the opinions of experts, a Task was added to examine whether or not to link with other systems when adopting.

In the Project kick-off Process, the presented opinions were that the detailed implementation planning would be difficult to perform in an ERP adopting enterprise, and that the project quality should be handled as a separate Activity. According to the expert's opinions, 'Project acceptance testing and inspection planning' was added as a Task and the 'Critical success factor (CSF) analysis' Task was moved to the 'Detailed implementation planning' Activity.

In the Detailed analysis Process, the presented experts' opinions were that the activities and tasks were well derived on the whole but the As-Is analysis needs further detailed subdivision and for small and medium-sized ERPs, simplification is required. The opinions confirmed that there was no missing item in the scope of the analysis and the subdivision and simplification can be adjusted within the setting of the framework, so those were considered as not separate requirements for framework improvement. However, it was suggested that confusion may occur due to duplication of names, so the name of the screen design documentation (basic design) Task was changed to 'Basic screen design' Task.

In the Detailed design and prototyping Process, the experts' opinions suggested that the screen design documentation and UI/UX design are classified separately but they are not particularly separated in actual practice. Also, there was an opinion that the To-Be Workshop and To-be report meeting and acceptance are not particularly separated in practice. As for the 'System architecture and structure design', there was an opinion that this is more appropriate to be included in '3. Detailed analysis', the previous process, but since this is the actual design activity, it was left as a Task under To-Be Activity. In addition, an opinion was presented that confirmation on the list of additional developments is required and this was added as 'Confirmation on the list of additional developments' Task according to the expert opinion. In addition, the Task name of UI/UX design was changed to UI/UX standard design for a clear distinction between Screen design documentation and UI/UX design.

In the Development and testing Process, the experts' opinions suggested that unit functionality testing should be added in the development activity and acceptance testing and parallel testing should be set as tasks under an independent activity. Accordingly, the task name and task overview were revised for a detailed description on the inclusion of unit functionality testing conducted by the developer as a part of the 'Customizing and additional program development' Activity. In this way, the unit functionality testing was clearly differentiated from the unit testing task performed for each functionality module conducted by the testing group according to the official testing process under the Testing Activity. As for the acceptance testing and parallel testing, since these were the tasks for the phase before "Process 6. Transition and project completion", these were classified Tasks and included in the Testing Activity. In addition, according to an expert opinion that it is necessary to divide the task of defect actions for testing results, so the Task for 'Testing defect actions' has been added.

As an exceptional case, in the Transition and project completion Process, the experts' opinions suggested that when there were remaining matters for development, conditional inspection should be performed in the final inspection phase. However, this is a matter of judgment on the result conducted within the scope rather than omission in the scope of Activity or Task, and therefore, this opinion was rejected to be reflected into the framework. Furthermore, as for the "Legacy parallel operation and evaluation completion" and "Validation through periodic business closing and balance closing", they were judged to be necessary to be included in the scope of the task and these were added as Tasks, respectively.

In the last process, the Operation and improvement Process, the operation status monitoring Task was added according to the experts' opinion that response activities to issues that arise post-operation are required. In addition, the experts highly valued that this process derivation research had a well-established research direction and the analysis was considerably detailed compared to the existing works or methodologies, and provided the foundation for presenting new ERP implementation methodologies. On the other hand, there was an opinion on the simplification of the framework but this was judged as a matter of utilization rather than a matter of framework development.

5. RESULT AND DISCUSSION

5.1 Result

The finally defined ERP process framework is composed of 7 Processes, 32 Activities, and 141 Tasks. The results of detailed final development are outlined in Table 5, Table 6, Table 7, Table 8, Table 9, Table 10, and Table 11.

Table 5. Definition of Activity and Task for the Process 1. Construction Strategy Planning Process

Process	Activity	Task	Task overview
1. Construction strategy planning		By reflecting the results of the information strategy planning (ISP) in the organization, the goal, scope, and strategic plan for achieving objectives for ERP adoption are established.	
	Project strategy establishment	Definition of project strategic objectives (goals)	The project mission, vision, and strategic objectives (goals) for ERP adoption are defined.
		Setting the high-level scope	The scope and priority of ERP adoption are set
		Review of linking with other systems**	When adopting ERP, whether to link with other systems is reviewed.
	Project implementation planning	An implementation plan for ERP adoption is established.	
		Setting high-level objectives*	The high-level objectives for each task are set to fit the goal of each scope.
		Determination of high-level requirements	In order to successfully accomplish the objectives of each ERP application work, the requirements that meet the objectives of the system and construction project are determined.
		Technical Requirement Planning	Decisions are made on the plan and level of application of the technology for strategic application, and the essential technologies to be applied.
		Confirmation of project budget, scope and period and update of OPA*	The budget, scope, and period, which are required resources for project implementation, are determined, and for OPA (Organizational Process Assets) included within the scope, the regulations, processes, and forms are standardized and developed to an operational level at the organizational level.
		Definition of project stakeholders	The stakeholders of the project implementation are clearly defined and the specific requirements and characteristics of each stakeholder are analyzed.
	Project operational system and organizational system configuration	Composition of project steering organization	The type and system for the project implementation organization are configured reflecting the opinions of the interested departments and the person in charge is defined. If necessary, a task force team (TFT) is formed
		Composition of project steering committee organization*	The committee is formed based on the organizational OPA, centering on decision makers from various interested departments, including project sponsors.

* : Items reflecting the 1st round expert consultation, ** : Items reflecting the 2nd round expert questionnaire

Table 6. Definition of Activity and Task for the Process 2. Project Kick-off Process

Process	Activity	Task	Task overview
2. Project kick-off		The resources to prepare for project kick-off are allocated and a project implementation plan is established.	
	Project	Identification and elaboration on	The scope of project implementation is identified centering on the task statement and

detailed implementation planning	the project implementation scope (module)	detailed definitions are made.
	Analysis of critical success factor (CSF)	The success factors for successful implementation of the project are analyzed and the key requirements for cooperation to be requested to the client are derived.
	Setting the project objectives and levels	The project goal of the client is checked and reconfirmed and the appropriate objectives and levels are defined.
	Project scheduling	The detailed schedule for the project is defined.
	Detailed planning on the project implementation process and tasks	The detailed plans for the project implementation processes and tasks are defined.
	Establishment of plans for project quality mgt. and assurance	The project quality mgt. plan is established and the measures for quality control and assurance are defined.
	Planning for the scope, objectives and methods of testing	The scope and objectives of the testing for the system under construction are checked and confirmed and a plan for establishing the objectives is established.
	Project organization composition and allocation of human resources	The organization and manpower for project implementation are confirmed and allocated.
	Planning on education and training	The education and training plans for the organization and manpower for project implementation are defined.
	Planning on project acceptance testing/inspection **	The project acceptance testing and inspection plan are established.
	Planning on change/risk mgt.	The plan, implementation process and form of deliverables for change mgt. of the project are confirmed and deployed.
Project kick-off report	The commencement of the project is announced by the project kick-off report.	
	Project workshop	Workshops are held for successful project implementation
	Confirmation on the project implementation planning	The project scope, objectives, schedule, process, quality mgt., testing, human resources, change and risk, and project support plan are confirmed.
	Project kick-off report	Kick-off reporting is performed based on the project implementation plan, and major requests for cooperation from the client are presented.
Project environment	The appropriate work environment and development environment are built for project implementation.	
	Project work environment building	The physical and spatial work environment such as project implementation location and space arrangement are initialized.
	Project development environment building	The development system installation, ERP S/W installation, confirmation and deployment of the form of the deliverables and report are performed.
Performance mgt.	Based on the kick-off process, the change, quality, risk and issues are managed and controlled.	
	Change mgt.	Based on the kick-off, deliverables, environmental changes in business implementation and change history are tracked and managed.
	Quality mgt.	Based on the kick-off, internal quality mgt. of software such as standard and quality level of deliverables is performed.
	Mgt. of risks and issues	Based on the kick-off, control activities are performed by identifying risks and assessing the level of risk.

Table 7. Definition of Activity and Task for the Process 3. Detailed analysis Process

Process	Activity	Task	Task overview
3. Detailed analysis		The collected requirements are reexamined, the detailed analysis is performed on the specifics of the requirements and the documentation is prepared in detail. At this time, by presenting the basic screen design centered on the solution, the requirements are derived actively and documented accordingly.	
	Definition of detailed analysis of requirements	Collection of requirements	All requirements of the client are collected (RFP, workshop and kick-off report meeting minutes, a list of requirements)
		Definition of detailed business objectives	The business objectives for detailed implementation by the ERP service are defined in specific details
		Requirements analysis and definition	The requirements in the area of applications DB, system, security that are fitting to the project characteristics and also the requirements on architecture and performance are analyzed in detail and defined accordingly.

	Elaboration of the scope and requirements	The business objectives and requirements analysis are mapped to define project requirements scope and individual requirements in detail.
	Definition of priorities	The priorities of the finalized requirements are finally confirmed.
	Basic screen design	If it is deemed necessary, the screen design at a basic level is performed and analyzed for accurate and detailed analysis of the requirements.
AS-IS analysis	The current business process of the client is analyzed in detail and documented.	
	Organization structure analysis	The organizational structure is analyzed to identify requirements, major needs and stakeholders for each organization.
	Application OS analysis	The current application architecture and application types and flows are analyzed in detail.
	Business process analysis	By mapping the client's business and the process of the current system in operation, detailed analysis is performed and main requirements for improvements are identified.
	Legacy system analysis*	The existing information system and application operating environment used in the client business are analyzed.
	Review of business and work analysis result*	The analyzed organization structure, business, and the corresponding business process are reviewed in detail with the client.
	Current DBMS analysis*	The current DBMS environment, backup and recovery, and capacity before and after the business service analysis are analyzed to calculate the appropriate capacity
	Master Data analysis	The scope and target of master data at the enterprise level are analyzed.
	Analysis of OS configuration currently in operation	The operation server resource configuration status, OS configuration information, and preparations related to migration are analyzed in detail.
	Understanding of analysis data, modeling documentation	By sharing the content and result of analysis at the project level, the results of modeling and analysis are documented based on the accurate and consistent understanding
Basic training on the system	Basic training on the system is conducted for project stakeholders and the implementation workforce	
	Training	Training for project organization mgt. and operation, and basic development education
	Initial business process training	In order to share the understanding of ERP solutions, training is performed on the initial business process
Process mapping and analysis of the difference	The difference between requirements and ERP solutions is analyzed, the GAP handling methods are defined and documented, and the review with the client is performed to derive a consensus	
	Mapping with ERP standard model and analysis	Based on the results of detailed analysis on the requirements, the difference from the client business process is derived for each ERP standard model
	GAP analysis	Response measures are established based on the results of GAP analysis.
	New task and process definition*	A new business is derived from the result of the different analysis and the new business process is clearly defined.
	Definition for GAP analysis result actions	Based on the documentation comparing AS-IS vs. TO-BE, comprehensive judgments are made on the GAP analysis result and the methods of implementation and construction are defined in detail.
	Elaboration of the requirements & identification of development method	The scope is divided into ERP standard model domain and extended development domain, and the required scope such as system, application, DB architecture and security and the corresponding requirements are elaborated.
Performance mgt.	The change, quality, risk, and issues are managed and controlled based on the detailed analysis process.	
	Change mgt.*	Based on the detailed analysis process, changes in the deliverables and business environment and change history are tracked and managed.
	Quality mgt.*	Based on the detailed analysis process, internal quality mgt. of software such as standards of the deliverables and quality levels is performed.
	Mgt. of risks and issues*	The risk is identified and the level of risk is assessed to perform control activities.
	Inspection acceptance by the client*	After completing the deliverables of the detailed analysis phase, the acceptance of the result of the detailed analysis is requested to the client and explicit approval is obtained.

Table 8. Definition of Activity and Task for the Process 4. Detailed design and prototyping Process

Process	Activity	Task	Task overview
4. Detailed	The detailed design is performed on the organization (permission), business process, master data, extension development, and interface		

design and prototyping	for To-BE process.		
	TO-BE design	Program and environment design	Each sub-program for the detailed design content is designed. (Compliance with configuration and development standards)
		Design of system architecture and structure	Detailed architecture for To-Be design for system and DB, NW and application is designed. (e.g. system, DB, NW, applications)
		Detailed setting on the application for the process	The detailed configurations necessary for the detailed design of the additionally derived application according to the TO-BE process are confirmed
		Organization structure definition and design	By defining new organization structure, R&R and prerequisites, the ownership (permission) for access and access range to data and applications is designed
		Business Process definition and design	Considering the dynamics process, the changed business process of the client is compared with the current business process, and a new business process is defined
		Confirmation on the list of additional development**	The additional development and improvement in the development are defined and confirmed in the new system
		Detailed design on the additional development task	The detailed design is performed for additional development in the new system. The risks of new development are identified and a design that can respond to the identified risks is presented.
		Design of interface scope and applied technique	The methods and types of system and the user interface are defined for the operation and utilization of the new system.
		Detailed design for the test plan	The detailed design is performed for integration, system, acceptance testing.
		Detailed program and test environment design for performance test	A detailed program and testing environment are designed for performance testing for detailed design content.
		Master data and business process documentation	The master data and business processes are documented in detail.
		Elaboration on the To-Be system and modeling	For the To-Be system, the implementation method for each requirement is specified in detail, and if necessary, modeling is performed using formal methods.
	Prototyping	Prototype development is performed.	
		System configuration	The prototyping environment is configured based on the TO-Be architecture.
		Business prototyping documentation and simulation development*	The subject and characteristics of prototyping are determined based on business, a prototype is designed accordingly, and it is developed to enable simulation.
		Sample data generation	The sample data for prototyping are generated.
		Development/testing/completion of standard functional components	The standard functional components for prototyping are developed and completed through the developed prototyping testing.
		Data preparation and input	The input data for prototyping and result data are provided in advance for input and checking.
		Prototyping checking and acceptance by client	Through the prototyping result report meeting with a client, the accuracy of the experimental results and feasibility of the requirements are finally checked and confirmed.
	Screen design	Based on services provided by ERP solution, the screen and UI methods are designed for application processes that are changed and expanded.	
		Screen design (Detailed design document) documentation	The screen design is performed by applying the screen standard framework for changing and expanding tasks.
		UI/UX standard design*	The design is documented by reflecting the user interface standard of the ERP solution and user experience, including the interface between systems.
	Data and information system design	The system for enterprise-wide data and information is designed.	
		Establishment of reference information system	The enterprise-wide data reference information system and the scope are confirmed.
		Master Data design and preparation	The enterprise-wide master data are designed and the related data are prepared.
	TO-Be design report meeting	Based on the results of GAP analysis between ERP requirements and current business analysis, the ERP service construction strategy is confirmed.	
		To-BE Workshop*	The entire project-level process validation is performed for To-BE integration

			simulation.
		CSF derivation and consensus	Based on the finally confirmed content of To-Be definition, CSF according to corporate culture transition are derived and major activity plans for CSFs are confirmed
		Establishment of new system transition strategy	Based on the detailed analysis results, a high-level system transition strategy is established.
		To-Be report meeting and acceptance by the client	A report meeting on the results of To-BE analysis is held with the client sponsor and the acceptance is confirmed.
	Performance mgt.	The change, quality, risk, and issues are managed and controlled based on the detailed analysis process.	
		Change mgt.	Based on the detailed analysis process, changes in the deliverables and business environment and change history are tracked and managed.
		Quality mgt.	Based on the detailed analysis process, internal quality mgt. of software such as standards of the deliverables and quality levels is performed.
		Mgt. of risks and issues	Based on the detailed analysis process, the risk is identified and the level of risk is assessed to perform control activities.
		Interim report	The current project status and issues, as well as the predicted situation and derived risks or issues related to the future schedule are reported with a focus on the construction progress after kick-off.
		Inspection acceptance by the client*	After completing the deliverables of the detailed analysis phase, the acceptance of the result of the detailed analysis is requested to the client and explicit approval is obtained.

Table 9. Definition of Activity and Task for the Process 5. Development and testing Process

Process	Activity	Task	Task overview
5. Development and testing		Development is conducted for the business processes that are different from the ERP solution and the part of applications that need changes in the details of the requirements.	
	Customizing development	Modification of existing functionality	The components that need to be modified from the existing functionality are modified
		Implementation of additional business process, and unit functionality testing	The additional business processes and functionalities that are different from existing functionality are implemented and modified, and the developers perform testing of the unit functionality.
	Additional functionality development	The business processes that need to be separately developed in addition due to the nature of the business process and linked to the ERP solution are developed.	
		Additional program development	Based on the detailed design contents, all programs for the additional business processes are developed, and the developer tests the unit functionality.
		DB expansion for new functionalities	A dedicated DB for additionally developed new functionality is implemented for expansion
	Data conversion and migration testing	Enterprise-wide data are constructed and preparation is made for data migration.	
		Establishment of data migration plan and scenario*	A list of major migration items and task schedule, communication and reporting system, and checklist for migration success are defined.
		Composition of data implementation organization and setup of DB server	The data implementation organization is confirmed and the DB server setup for operation is completed.
		Reference information registration	The reference information data are generated including data conversion.
		Basic data registration	The basic raw data are registered.
		Data conversion and migration pilot test	Testing is performed on the conversion and migration methods and the required time for data migration targets to satisfy the requirements.
	Testing	Testing is performed according to the order defined in the kick-off phase in the project, such as unit, integration, system, acceptance, and parallel testing.	

	Unit testing		The unit testing is conducted for each functional module through the testing organization.
	Integration testing		The testing scenario is documented and integration testing is conducted. (eg. Simulation)
	System testing		The system testing is conducted according to the objective, such as testing scenario documentation and testing script creation. (load/performance/interface/recovery)
	Acceptance testing		In order to check the completeness of development and perform the final check on the transition possibility, the user conducts testing by building the OS environment.
	Parallel testing		The performance and integrity of the processing result are validated by testing the information system currently in operation and the ERP system to be newly constructed in parallel
	Testing defect actions**		Measures for improvements are implemented for defects and matters for corrective actions as a result of testing, and re-validation is performed through testing to check whether the results of measures taken satisfy the quality requirements.
User training	An end-user training plan is established for system use and the training is conducted accordingly.		
	Key user training		With the preparation of user environment, creation of an initial version of the manual, and development of training materials, training is provided for key users for each module.
	Advanced training for users		By preparing the user/system mgt./technical manuals, the manuals are distributed for top mgt./middle managers/users in the business practice, and the user training is conducted including the ERP process.
	Operator training		With the preparation of user environment, creation of an initial version of the manual, and development of training materials, training is provided for major infrastructure service operators.
Performance mgt.	The change, quality, risk, and issues are managed and controlled based on the development and testing process.		
	Change mgt.*		Based on the development and testing process, changes in the deliverables and business environment and change history are tracked and managed.
	Quality mgt.*		Based on the development and testing process, internal quality mgt. of software such as standards of the deliverables and quality levels is performed.
	Mgt. of risks and issues*		Based on the development and testing process, the risk is identified and the level of risk is assessed to perform control activities.
	Inspection acceptance by the client*		After completing the deliverables of the development and testing (e.g. unit, integration, system) phase, the acceptance of the result of the development and testing is requested to the client and explicit approval is obtained.

Table 10. Definition of Activity and Task for the Process 6. Transition and project completion Process

Process	Activity	Task	Task overview
6. Transition and project completion	Transition test	Transition preparation and transition, New system operation, Acceptance handover, Inspection, and completion report	
		System and SW license installation and setup testing*	After installing the system and software using the operating server, the license acquisition process and operating environment setup process are tested. The content of the testing, results, and method of checking proper installation are documented, and the documentation is used as a checklist for actual transition.
		Final data conversion testing*	The data conversion testing is performed by installing scripts or software tools to be used at actual transition. Data conversion items, conversion methods, and methods of checking proper conversion are documented and the documentation is used as a checklist for actual transition.
		Final data migration testing*	The data migration testing is performed by installing scripts or software tools to be used at actual transition. Data migration items, migration methods, and methods of checking proper migration are documented and the documentation is used as a checklist for actual transition.
		Final application release deployment testing*	The first release is prepared as a beta and the checklist and validation method to check whether normal deployment has been performed are documented and the documentation is used as a checklist for actual transition.
		Transition rehearsal*	Final transition rehearsal for Service Open is performed by dividing into the system, DB, network and applications, and the preparation status for each divided area is checked and inspected. By reflecting the inspection result, the task sequence is optimized so that the transition task can be completed within the given time, and the identified problems are corrected or improved to confirm the transition plan and process.

	Establishment of Go-live support plan*	A support plan is established for problems of Go-Live such as QA, operation and installation, R&R, technical issues, and help desk following the ERP Service Open for users and also for the overall operation plan.
	Trial Go-live*	If necessary, trial operation is performed on the new system to derive problems and make improvements for stable Open before the new ERP service.
Transition preparation and transition		The transition is performed through preliminary preparation for transition to the new system and activities for normal Go-live and normal operation are performed.
	Legacy system backup	The legacy service is disabled for the Service Open with the new system. If necessary, in preparation for failure in the service Open, backup is performed for each area considering the recovery time.
	Go-live of new service operation server and SW installation, Operation configuration	Final checking is performed on the new server for Go-live, operation configuration and license acquisition and using the checklist, the normal go-live for all servers and software are checked such as server, system software, network, storage and security.
	Data conversion and migration	Data conversion and migration are performed and normal migration status is checked through a checklist. Data performance and optimization status are also checked for abnormalities.
	Application transition	After deploying the first release as a beta version, the normal deployment and activation status are checked through a checklist.
	Checking of system Go-live configuration and normal operation of Go-live*	Final check is performed on Go-live configuration and normal Go-live status of all systems for service provision.
	Checking normal operation of Go-live in terms of application and data service*	Checking is performed for any abnormalities in performance and processing results by viewing the main screens for each area.
	System baseline backup for service open*	When the Service Open of the new system is confirmed, backup of the operating service baseline is performed.
New system operation		ERP service is provided through the newly constructed system.
	Start of new ERP service	The access information is activated to allow access to the ERP service.
	Start of parallel service*	The same data as the existing legacy system are received and processed and the results are compared with the new ERP service.
	Help Desk operation	Problem solving, monitoring, performance measurement and bug fixing are performed in the user service.
	System monitoring	Application service and data optimization of the OS, problem solving and monitoring, performance measurement and system tuning are performed.
	Evaluation on the parallel operation of the legacy system and completion**	The results of parallel operation with the existing legacy system are evaluated and the parallel operation is terminated.
	Periodic business and balance closing validation**	For a new system, monthly balance closing and monthly business closing validation can be performed.
	Technical support	The overall technical problems are resolved such as access, compatibility and installation problems that occur in new ERP service after the Service Open.
Acceptance handover		Acceptance handover system and maintenance support system are constructed.
	Acceptance planning	The scope, deliverables, process, timing, construction inspection and requirements are defined for project acceptance.
	Acceptance handover	According to the acceptance plan, acceptance handover for each task is performed for the relevant person in charge and if necessary, training for the operator is provided.
	Consensus on stabilization support plan and support environment setup	The scope and method of stabilization support and support environment defined upon discussion and the relevant technical support environment is setup.
Inspection and completion report		The final inspection process is performed for project construction and project completion reporting is performed.
	Completion report	The project completion and post-operation support plan are reported.
	Final inspection and project completion	The inspection is performed and checked for deliverable to be inspected including all SW related to ERP service and major targets of acceptance, and the process of summarizing the balancing and settlement of the cost and the assets used for development is performed.

Table 11. Definition of Activity and Task for the Process 7. Operation and Improvement Process

Process	Activity	Task	Task overview
7. Operation and improvement	System stabilization support	The vendor that performed the ERP construction provides technical support for the system operation of the ERP adopting enterprise according to the stabilization support plan.	
		Support for application service stabilization	In accordance with the scope and method of the stabilization plan, measures for application defects, performance tuning, and bug fixes are performed.
		deploy of additional release	Fixing bug in the solution and performing an upgrade
	Operation and maintenance	The organization that took over the newly constructed system operates the system and performs further improvements to respond to new client needs.	
		Service maintenance*	new system maintenance by ERP service maintenance provider
		Help Desk operation	For the seamless use of the service by users, operational tasks are performed such as support on the method of use and receipt and registration of user requirements.
	Evaluation of system operational performance	The operational performance of the system is evaluated according to the criteria defined at the organizational level and the system life cycle is reviewed	
		Operation monitoring**	Regular monitoring of operation status is conducted.
		Service level evaluation for the new construction service*	The operational organization selects SLA metrics to evaluate service levels of the ERP services and derive further improvement requirements
		Usability evaluation for planned operation of the system*	The usability of the new construction system and legacy system are evaluated to establish whether to continue maintenance/operation and to establish a system disposal plan.

5.2 Discussion

5.2.1 Analysis on the differentiation in terms of process engineering

The significance of the derived customer-based on-premise ERP process framework was examined in terms of differentiation in the process engineering dimension.

First, in the aspect of software engineering, terminologies were standardized through the process framework. From the perspective of software engineering, the software process model provides an overall framework as a general approach and guideline for what types of tasks should be executed and in what order for the construction of a software system. However, the ERP methodologies provided by the ERP solution vendors do not provide the definition for the processes but employ the solution-centered methodology for the method of performing the ERP construction. As a result, even experts with extensive experience in ERP implementation often mistake the phase as a process. These results were also revealed in the expert survey of this research, and there was an expert who suggested that the concepts of phase and process were misrepresented. The reason for this error in concepts can be found that ERP was not handled in terms of software construction previously, and therefore, the significance of the proposed on-premise ERP construction process framework lies in that classification was performed based on the Process and the items were organized in terms of Activity and Task, and through the 3-layer approach, the errors in the concept of terminologies were resolved through clear definition using the theoretical framework of software engineering.

Second, the derived process framework is a new process developed by combining software implementation and project management included in the subcategory of software engineering into one process. In general, when defining a software process, it is recognized that the process meets the conditions of a desirable process if it supports predictability, testing and maintenance, is capable of easy management of changes, and is easy to resolve defects.

Therefore, this process framework can be regarded as a construction process optimized for ERP that satisfies these characteristics. The proposed framework presents a direction for how the ERP construction

methodologies, which have not been able to provide any value to the ERP adopting organization, should theoretically evolve and be improved from the perspectives of software engineering due to the implementation methodologies from the commercial ERP vendors and researchers only presented phases and activities with a heavy focus on implementation

5.2.2 Analysis on the usability in terms of process engineering

First, in the proposed framework, the unique fundamental characteristics of the ERP system as an organizational system have been reflected. That is, the main phases and activities that should be performed as a preparatory process prior to the project kick-off are presented in detail for the ERP adopting organization to implement the ERP construction project. This can reduce the problems arising in the process of the project after the kick-off of the ERP construction, such as lack of understanding at the organizational level, opposition from members of the organization, non-standardized business process of the ERP adopting enterprise and the delay in decision making, the consequent delay in the project development schedule and increase in the risks. This ultimately increases the possibility of success in ERP construction with the satisfaction of the adopting organization, and the enhancement in the organizational culture and work efficiency can also be expected. In addition, for detailed tasks, these should be reflected with importance when changing the vendor-specific ERP implementation methodologies to the user-oriented framework.

Second, after the go-live of the new ERP system, the monitoring and control activity over the system life cycle was presented in the process through the evaluation of system operation performance. From the perspective of the gradually increasing informatization budget control, it is possible to strategically decide the timing of cutover from the legacy system as well as enhancing the level of satisfaction for the new ERP system through evaluation of the information system usability at the organizational level. This clarifies the scope of major tasks during the maintenance and operational period that the ERP adopting organization and the operators should be responsible for, thus providing the effect of supporting the systematic informatization budget planning and reliable information service asset management and control system at the organizational level.

Third, using the standardized process of customer-based on-premise ERP construction, the ERP adoption in the form of cloud ERP or hybrid ERP can be planned. In general, most enterprises have already adopted or are in operation of on-premise ERP, and considering effective ways of implementing cloud-based ERP construction using the on-premise ERP. This can also be confirmed in statistics [2] showing the recent increase in business demand for Cloud ERP. In fact, 85% of ERP adoption in 2018 was SaaS or cloud-based ERP [16], and 53.1% in 2021 also opted for cloud ERP [2]. In addition, most of the on-premise ERP vendors are participating in this business by developing cloud ERP solutions, and the existing on-premise ERP construction process is applied as it is during the process. Therefore, this study can provide a starting point for the development of customer-based standardized cloud ERP implementation methodologies.

Fourth, the derived on-premise ERP process framework can be used not only as a medium for seamless communication with customers at the initial stage of project kick-off, but also as a tool for process tailoring. Until now, when the ERP implementation project started, customers were forced to spend a considerable amount of time and effort to learn the vendor's unique ERP methodology and terminologies, which tend to be a one-sided presentation from the vendor. Also, it was not possible to determine whether the phase the vendors proposed was suitable for the characteristics of the ERP adopting organization. The resulting inadequacy in kick-off and lack of detailed analysis was pointed out as an important cause of the delay in construction and failure of the ERP process. However, the proposed process framework provides a solution to these problems.

6. CONCLUSION

The on-premise ERP solution defines unique ERP implementation methodology from the kick-off to completion, and requests the adopting organization to make the organizational decisions necessary for ERP implementation during the ERP construction project, and the decisions are applied to the ERP service. However, these processes are vendor-oriented implementation methodologies, and when adopting ERP, these existing processes cannot serve as a specific reference for strategic and systematic preparation for the adopting organization. The vendor-driven approach also hinders decision making of the ERP organization that reflects the culture of the organization and characteristics of the project. This is the reason for the need for an ERP construction process that can be shared and referenced by both ERP adopting enterprises and vendors, rather than vendor-oriented implementation methodologies.

Therefore, in this study, a customer-based ERP construction process framework was developed that can be utilized in the implementation of ERP projects and construction of ERP systems from the perspective of both customers who are adopting ERP and the vendors who perform the ERP construction. To this end, we collected the results of existing research, the implementation process defined in the methodology of commercial ERP SW vendors, the actual business cases of ERP construction of a real-world ERP adopting organization and the implementing organization. To this end, the collected data were classified using the KJ method repeatedly, and a three-layer process framework was completed by simplifying the collected data. The developed ERP process framework consists of 7 Processes, 32 Activities, and 141 Tasks. In addition, the concept of each item was defined in detail, and the recommended sequence of execution was presented for Processes and Activities, and the Tasks were presented in an open format so that a precedence relationship could be established by reflecting the project characteristics and context. The finally derived deliverables underwent a cleansing process by reflecting the experts' opinions.

The meaningful significance of this research lies in that the proposed method standardizes the process of the on-premise ERP project by reflecting both the perspectives of the ERP adopting enterprises and the vendor and presents the framework. In terms of business practice, the proposed framework enables the organization-level preparation for the ERP construction process through the processes and specific activities for ERP adoption. The proposed method will also be useful in the reliable and cost-efficient operation of the ERP system. Furthermore, in the process of ERP project construction, each ERP vendor can use the developed on-premise ERP process framework as a tool for communication with the client and for process tailoring, which will enable the reflection of project characteristics as well as the unique characteristics and culture of the ERP adopting organization, thereby making a positive contribution to the successful ERP construction. Above all, considering the current trend of the increase in cloud-based ERP construction, there will be a further increase in the need for cloud ERP construction process development, which is a SaaS-type service rental method centered on ERP adopting enterprises. Therefore, the proposed customer-based standardized on-premise ERP construction process framework will provide the basis for the development of the cloud ERP construction process framework. Meanwhile, this study was conducted as a preliminary study for the development of the Cloud-ERP construction process framework. Three-quarters of all organizations opting to use a cloud ERP system also adopted the software as a service (SaaS) model [17]. Therefore, the next study will be the development of the Cloud-ERP building process framework that can provide the foundation for the successful implementation of the recently rapidly increasing Cloud SaaS ERP.

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