



# Multi-Project Information Management Platform Based on PDIE System

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**Abstract.** In order to solve the information management problem of enterprise project R&D, the work breakdown structure (WBS) method is used to decompose the product development process in three levels. PDIE platform construction is carried out based on the three-level process, so as to achieve management synergy, technical synergy and knowledge inheritance. Establish a standardized project R&D process and form a process template to realize internal work collaboration and data collaboration within the unit. Integrating elements related to tasks in each phase of the project in the form of work packages, providing engineers with work wizards and quality specifications, and realizing technical synergy in each phase of product development. The management synergy of project management elements such as schedule, quality, cost and risk are realized in the whole process of product development. Knowledge management system is established, and the effective accumulation and reuse of core knowledge of the enterprise is realized through the construction of knowledge engineering system. Through the practical application of several projects in scientific research, the effectiveness of the platform has been verified and the purpose of digital management of enterprise network projects has been realized.

**Keywords:** Information management · Knowledge base · Multi-project · Process control · WBS

## 1 Introduction

With the advent of the digital era and the penetration of information work into various fields, the information management of research projects is undoubtedly becoming increasingly prominent [1]. Enterprises need to take into account the need to carry out prospective applied basic science and technology research, core fundamental common technology development, product design development and engineering transformation

IPD Special Fund Project: Xi'an Research Institute Science and Technology Innovation Fund IPD Special Fund Project (China Coal Science and Industry Group Xi'an Research Institute Co., Ltd: 100000000328).

while completing order product design [2]. As a result, enterprise products are often developed in parallel with multiple projects. The key factor for the success of enterprise digital transformation [3–5] lies in the digital transformation of research multi-project management.

The main issues facing current product development project management are as follows.

- The project process is not managed online with information technology. As a result, progress, quality information and data of the product development process are not easily stored, collaborated and shared. Members within the project form information silos, and project teams are not informed of each other, so management and decision-making cannot follow up and coordinate resources to solve project problems in a timely manner.
- Lack of knowledge information sharing and heritage platform. It cannot well complete knowledge acquisition, knowledge management, intelligent search and knowledge application in the project process. There is a need to accumulate norms, typical case analysis, quality requirements, templates, equipment and instruments, tools and other knowledge in the project proceeding.
- Product requirements management is not in place. The input of requirements at each node in the project is not rigorous and the demands management is not in place. Leading to frequent requirement changes during the development process and frequent project rework.
- Restructured R&D process is not completely sorted out, and refined multi-project control capability is weak. The control of multi-project schedule, quality, cost and risk management is difficult, and the ability of resource prioritization and dynamic balance needs to be improved. Such as contract, plan and funding have not been integrated management; R&D plan management and quality management are not closely linked; there are difficulties in implementing responsibilities in the process of cross-department and cross-unit business execution.
- There is no effective system for multi-project management. There is a heavy reliance on the project manager's personal experience in developing project plans, process reviews and decisions. The project process does not have clearly defined decision review points, lacks consistent measurement criteria, and relies on a few experts to make technical decisions.

At present, domestic and foreign scholars have conducted various researches on research project management. Alegre, LaPietra and Chiva [6] pointed out that product development and management should focus more on performance management, knowledge and creativity management, interdepartmental coordination management, communication management during product development, and shortening the time and cost of product launch into the market [7]. Relatively speaking, there is a gap between Chinese scholars' research on product R&D management in enterprises and foreign countries. F. Ma et al. [8] concluded that the main reason for the problems of new product development in China is the absence of a systematic R&D management platform. X.Y. Nie et al. [9] proposed a three-dimensional management model for civil-military integration projects based on the method of matrixed project management. Most of the domestic enterprises still adopt the goal-based project management approach. With the in-depth

development of information technology as well as digitalization, Huawei and other outstanding enterprises have introduced IPD project management based on their product strategy, product development characteristics for iterative upgrading and success.

## 2 Development Process Based WBS Decomposition

### 2.1 Project Development Process Based on IPD Theory

To sum up, it is a solution to the problem of the information management in project development based on the project management experience of advanced companies based on the full research of enterprise product development.

As shown in Fig. 1, the overall IPD [10] product development process is divided into six phases, four decision review points and six technical review points. The four decision review points are: concept review, plan review, availability review, and end-of-life review. The six technical review points are: product requirements and concept review, requirements decomposition and specification review, overall solution review, module/system review, prototype review, and small batch review. The six phases of the development process are: concept phase, planning phase, development phase, verification phase, release phase and life cycle phase.

- During the concept phase, the project decision team makes the decision to terminate the project by evaluating the financial, market and technical feasibility.
- In the planning phase, the product development team integrates organizational, resource, time, and cost factors to form a detailed business plan.
- During the development phase, execute the product design, development plan, manufacturing plan and marketing plan contained in the approved product package.
- In the verification phase, complete testing, validate products, and release final specifications and related documentation to verify manufacturing and market readiness.
- In the release phase, release products and manufacture sufficient quantities to meet customer requirements in terms of performance, functionality, reliability, and cost objectives.
- During the life cycle management phase, the product is managed during the period from stable production to the end of life of the product. This includes cessation of production, cessation of marketing and termination of service time.

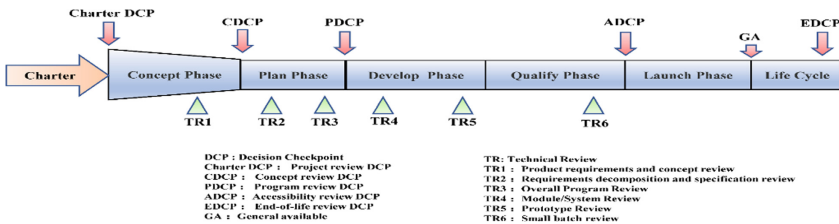


Fig. 1. IPD-based product/project development process

**Table 1.** Integrated Product Development Process

Level 1	Level 2	Level 3
Concept stage	Top Level Planning	Product Route
		Technical route
Planning stage	Project validation	Requirement's validation
		Technical Validation
Development Phase	Solution Design	Test Design
		Process design
		System design
	Detailed Design	Professional Design
		Detailed design review
Validation phase	Group component validation	Component assembly and debugging
		Component assembly
	Prototype verification	Prototype prototyping
		Prototype validation
Product finalization	Industrial testing	Test Preparation
		Industrial test conclusions
	Product finalization	System inspection
		Product handover
Life cycle	Technical support	Technical support
		Customer training

## 2.2 Project Work Breakdown Structure

In order to implement PDIE online project management, it is important to perform a WBS decomposition of the actual product development process. The Work Breakdown Structure (WBS) specifies the project milestones, deliverables, inter work dependencies, responsible persons for each work and workload estimation. Therefore, developing a reasonable WBS becomes the key to product development project management [11] (Table 1).

## 2.3 PDIE System Work Packages

The work package [12] is the smallest unit of the product WBS decomposition and contains six elements: basic elements, input, output, control, enablement, and activity. The project manager passes the work package to the responsible person through the order of task issuance according to the actual work content. The responsible person receives the corresponding task in the personal account workspace and completes the task sequentially according to the requirements and contents in the work package in accordance with the steps of the activity elements. The project manager controls the

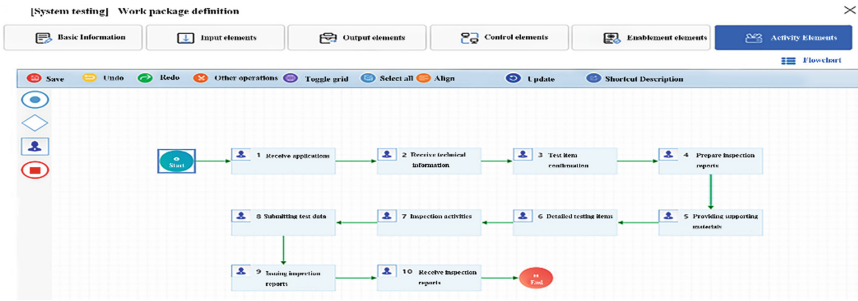


Fig. 2. PDIE platform work package activity elements

project quality, progress and time through the statistics of work package completion. At the same time, the input process of work package is also the process of transforming personal knowledge into company knowledge assets.

As shown in Fig. 2, the main contents of the elements contained in the work package in PDIE system are as follows.

- Basic elements: including work start time, task name, information of the person in charge and the department that dispatched the work package, etc.
- Input elements: the input items of the work package defined consistently according to the WBS product development process combing, the source of the start of the work. It may be the output element of the previous work package, or it may be other defined input elements.
- Output elements: The final result document of the work package that needs to be submitted according to the requirements of the process grooming. The final deliverable may be a standardized document provided in accordance with the company’s system, or it may be a physical object, design drawing, source program, etc.
- Control elements: The standards, specifications, and company guidelines that must be followed by the person in charge when completing the work package.
- Enabling elements: Resources needed to support the completion of the work, such as typical case guidance, internal design guidance documents, knowledge base documents or other data information formed by the accumulated experience of designers.
- Activity elements: When completing the work package in accordance with the company’s internal product development process, certain steps must be followed and the research output delivered at the corresponding step.

### 3 Multi-Project Information Process and Knowledge Management

#### 3.1 Multi-Project Process Information Control

In order to realize multi-project process information control in PDIE system, the main settings are as follows.

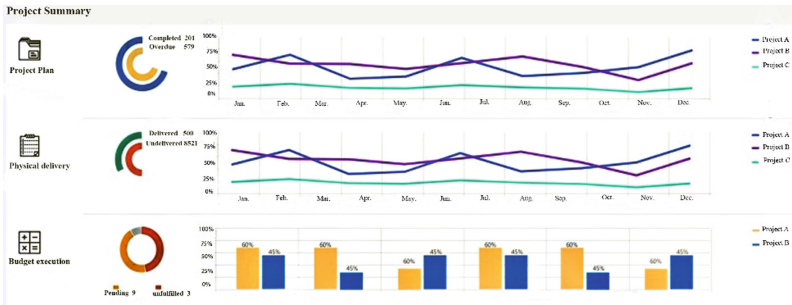


Fig. 3. PDIE platform multi-project process control

- According to the different roles of project members, project managers and project management departments, different permissions are set respectively. Project members can manage the progress of multiple projects in which they are personally involved, complete the tasks assigned to them, and understand the work progress of related work packages. The project manager can summarize the progress of all project team members in each project phase, assign project tasks, coordinate project issues in a timely manner, and manage project time using Gantt charts. The project management department can comprehensively count the project completion rate over a period of time, and visually understand the workload of each business department, milestone deliverables, delivery time, nodes with problematic items stuck and the reasons for them in the form of statistical histograms. As shown in Fig. 3, it is PDIE platform multi-project process control.
- Project communication information control. Project communication includes project travel report management, meeting minutes management, telephone records and fax records management. The four-communication management in the project process has a very important role in performance assessment and project management.
- Multi-project information storage. Project profile of multiple projects, project objectives and project task decomposition are recorded. Also, project contracts can be managed.

### 3.2 Multi-Project Knowledge Base Management System

Multi-project knowledge base [13, 14] management system construction, containing the following three aspects.

- Multi-project template control. According to the actual research situation, we classified the products, created the corresponding product templates for each product category and completed the formulation of work package elements. In the actual development, new projects only need to import the corresponding type of templates and make slight changes according to the individual needs of the project.
- Project process knowledge control. The scientific research results of the project are completed according to the standard templates already imported in the system. Problems, key core technologies and scientific research results in the process of product

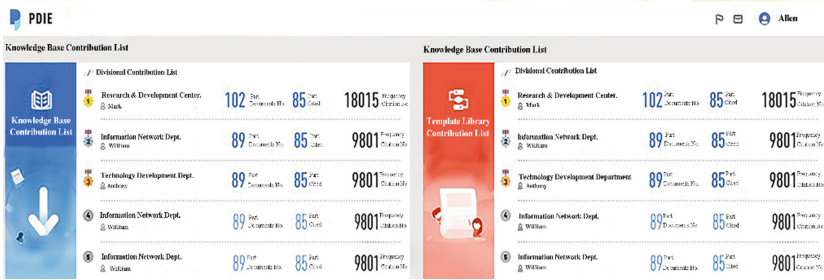


Fig. 4. PDIE platform multi-project process control

development are stored in the PDIE system. The contribution of organizational knowledge of each department and individual can be promoted by means of rankings as shown in Fig. 4.

- Inheritance and storage of organizational assets such as project processes and systems. Enterprise regulations and product development processes are solidified in the system. The review in the project development process is conducted online according to the process, which clarifies the review elements, review scoring items and optimizes the review process. PDIE platform multi-project process control.

### 4 Conclusion

This paper focuses on the problem of enterprise multi-project information management, and uses the method based on WBS decomposition of product development process, and builds PDIE information management platform based on IPD idea. After a number of projects actually run in PDIE platform, it improves the ability of enterprise multi-project management and the construction level of knowledge base in the project development process, and provides a reference for the project management of digital enterprises.

**Acknowledgment.** The work in this paper was financially supported by the project: Xi'an Research Institute Science and Technology Innovation Fund IPD Special Fund Project (China Coal Science and Industry Group Xi'an Research Institute Co., Ltd: 100000000328).

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