The Information Relevance Task Model of SAP System and Information Presentation

Wu Xiaoli[1,2], Zhang Lan[1], Huang Xiaoli[3,4]

[1]School of Design Arts and Media, Nanjing University of Science and Technology, Nanjing, 210094
[2]Research School of Industrial Internet, Nanjing University of Science and Technology, Nanjing, 210094
[3]Human factors and Information System Interaction Laboratory, School of Mechanical and Electrical Engineering, Hohai University, Changzhou 213022
[4]Administrative examination and approval bureau, People's Government of Daqiao Town, Jiangdu District, Yangzhou, 225000

SUMMARY

SAP system, as a typical production management system, has great advantages in operation monitoring and production management, which has the characteristics of rapidly processing massive data and integrating information modules. However, in terms of human-computer interaction, the presentation of massive data is prone to an increase of cognitive load of users. The disorderly connection of information makes the user's misunderstanding of interface information, and it is also easy to add unnecessary operation steps. The SAP system information data of an enterprise was selected as the sample to optimize the information organization and presentation. It analyzed the production management task process for different types of users, and built an information association architecture for them based on the task domain model. The results show that the information association structure of purchasing engineer, planning engineer, quality engineer and manufacturing engineer established according to the task domain model can intuitively show the hierarchical relationship, importance and task flow of production data information under the real-time monitoring of SAP system, which is conducive to improving the work efficiency of users.

KEYWORDS

SAP system; task domain model; information relevance; information visualization

Introduction

With the development of modern enterprises and the expansion of competition, there is higher demands in production management and information integration for enterprises. As the leader of current enterprise management information systems, the structured design of information modules in the application and Product in data processing (SAP) system meets the requirements for interconnection between various subsystems, such as finance, procurement, inventory, production, sales, etc. Its functions can optimize management processes and promote the improvement of management level and capability (Sinzig, 2000; Veneziano, et al., 2014). However, the large amount of data and the complex structure of the information module in the SAP system leads to cognitive disorientation or information confusion for users during the operation process, which would reduce work efficiency (Genaidy, et al., 2010). Therefore, it is necessary to further improve the information structure and effective presentation of the SAP system.

CARD et al. (1999) indicated that the transformation process of information visualization can be divided into three stages: raw data to data table, data table to visual structure, and visual structure to view. Researchers have maximized the application effectiveness of SAP system from the perspectives of system technology and human performance. Troiano et al. (2008) used genetic algorithms to optimize the layout of interface menus and verified the feasibility of the proposed approach. Raeisi et al. (2016) used chain value analysis to calculate the indicator weights of inter panel links, and designed human-machine interfaces. Habuchi et al. (2006) found that user preferences and visual design factors can both affect the human-computer interaction efficiency based on dividing the information interface into different functional areas. Storrle et al. (2014) pointed out that it is necessary to consider the User operation characteristics when designing interface layouts.

This paper took the information data in the production management of an enterprise's intelligent production line as a sample and optimized SAP system information structure from the perspective of information correlation. A preliminary SAP system task model was constructed by analyzing the user needs and management requirements of the enterprise. And using methods such as questionnaire surveys and interviews to construct a system information correlation structure for multiple operators, which was helpful to enhance the visual design of human-computer interfaces.

Task model and Its Characteristics

Task model is an analysis model of information structure based on abstract hierarchy theory, which helps designers to deconstruct task-oriented information and effectively solve the problem of correlation between task and information from a theoretical perspective (Xue, 2015). The abstract hierarchy theory defines a complex task environment as a multi-level organization that explains the interaction behavior between humans and interface information from top to bottom. This method has better adaptability because it is not limited to a specific situation or event. The task model based on abstract hierarchy theory subdivides total tasks into sub tasks with specific goals, and conducts information analysis from top to bottom to determine information is related to the current level, which is also helpful to solve the problem of information presentation, as shown in Figure 1.

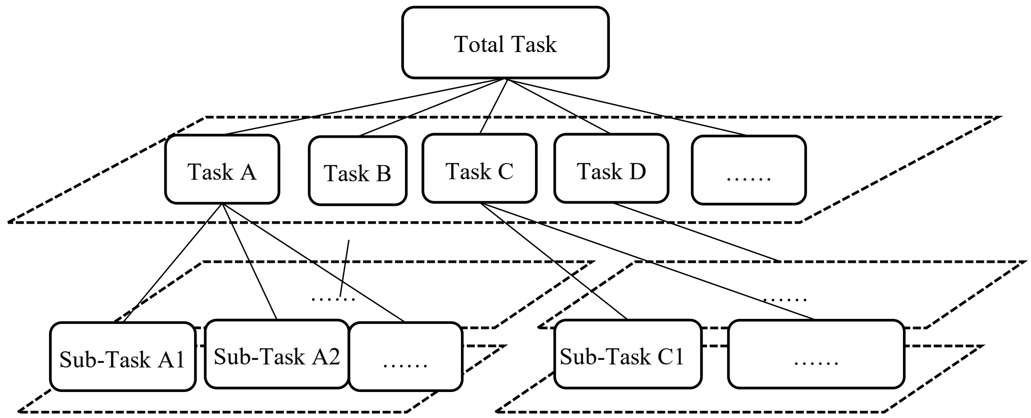

Figure 1: Task model

1 SAP System Task model Construction

1.1 *Operation Process of SAP System*

There were six functional modules in the SAP system, including On-time Delivery and on-finished Trade (OTD&OFT), Inventory, Inventory-Demand Driven Material Requirement Planning (Inventory-DDMRP), Letters of Credit and Trade- production Delivery Time (LT-PDT), Letters of Credit and Trade-Goods Receiving (LT-GR), Letters of Credit and Trade-production lead time (LT-PLT). The operators located the functional modules of system related to the task after they received task instructions, then they were required to check data and make production modifications. Finally, the users exited SAP system after completed the task instructions.

1.2 *User Analysis of SAP System*

The users of SAP system were all professional experts that were capable to manage enterprise production. They were able to check real-time data charts to obtain information such as production inventory, production line efficiency, and finished product quality inspection in SAP system, thereby improving the efficiency of enterprise production management. According to the enterprise's production needs, four types of users work together to complete tasks: planning engineer, purchasing engineer, quality control engineer, and manufacturing engineer. The specific task requirements obtained through user interviews are as follows:
1) Planning engineer
The planning engineer checked the six modules of the SAP system to complete six tasks. Task A: the task objective is to evaluate the completion status of product order, which was based on data of Module OTD&OFT, such as delivery day, and the planned time, rate of compliance etc. Task B: The data in Module Inventory provided the total amount of finished products in different dimensions, which facilitated the superior department to understand the company's finished product inventory situation. Task C: Analyzing the inventory problems in the past three months by comparing the order amount, order quantity, and 12 months data of order products in the Module Inventory-DDMRP. Task D: Engineers completed order delivery tasks based on the data of Module LT-PDT including delivery status of order goods, supplier status etc. Task E: The engineer completed the received-order task from the data in Module LT-GR, with the goal of monitoring and analyzing the order reception situation and preventing material shortages. Task F: The task objective was to organize and summarize the entire production cycle of the enterprise based on the data from Module LT-PLT, in order to analyze at which stage there is a significant difference between actual production and planned production and make timely adjustments.
2)Purchasing engineer
The purchasing engineer also checked the six modules of the SAP system to complete six tasks. Task A: The task goal of Task 1 for the purchasing engineer were same as those of the planning engineer, and they were based on the data from Module OTD&OFT to complete order information evaluation. Task B: The task objective was to ensure the correct amount of material procurement, while regularly reporting the implementation of procurement to superiors. Task C: The task goal of Task 1 for the purchasing engineer were same as those of the planning engineer, and they were based on the data from Module Inventory-DDMR to complete inventory information queries for the past three months. Task D: Engineers reviewed the order volume of top 15 suppliers and sought opportunities for order delivery improvement based on the data from Module LT-PDT. Task E: In order to drive the progress of order reception, engineers focused on the order reception of top 15 suppliers provided by Module LT-GR. Task F: The purchasing engineer need to purchase raw materials according to the order quantity as soon as possible after the customer placed an order, and

then delivered the raw materials purchased to other engineers for record and storage. The information they needed all from the Module LT-PLT.

3) Quality control engineer

Task E: Quality control engineers were required to complete the order receiving task and analyzed the failed production data provided by Module LT-GR with the goal of improving the pass rate of production.

4) Manufacturing engineer

Task F: Manufacturing engineers were supposed to complete the production cycle task based on the data of Module LT-PLT. They coordinated the production progress of raw materials, semi-finished products and finished products, arranged the production process reasonably, and prevented low production efficiency from affecting order delivery time and production efficiency.

1.3 *Multi-user Task Model of SAP System*

Based on operation process and user analysis of SAP system combined the task model theory, different task sets were divided for planning engineer, purchasing engineer, quality control engineer, and manufacturing engineer. A preliminary multi-user task model of SAP system was constructed as shown in Figure 2. The planning engineer and purchasing engineer were both required to checked the six modules of the SAP system to complete six tasks. Quality control engineer and manufacturing engineer only have one task to view Module LT-GR and Module LT-PLT, respectively.

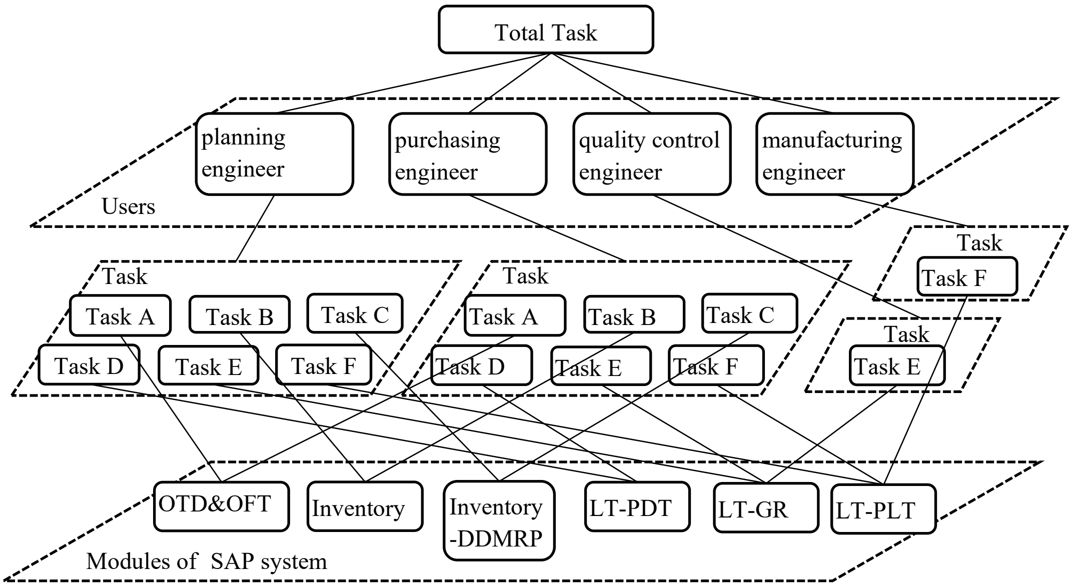

Figure 2: Multi-user Task Model of SAP System

However, due to the various information contained in each module of the SAP system, there existed a mapping relationship between single module and multiple information. In order to further highlight the inter information relationships of functional areas and the impact of the information importance on users, it is necessary to construct the comprehensive task model of SAP system with mapping relationships between tasks.

2 Information Correlation Structure of SAP System – Using Planning Engineer as An Example

This section takes user planning engineer as the research object and constructs information correlation through the application of user interviews and questionnaire surveys. All information of SAP system is shown in Table 1.

Table 1 information of the SAP system

Modules	Information
OTD&OFT	1) Actual Ave. OTDr; 2) Actual Ave. OTDc; 3) Actual Ave. OFT; 4) Actual Ave. Fill Time; 5) Actual Ave. OTDr (By Month); 6) OTDr Failure Analysis (By Product Family); 7) Actual OFT Distribution; 8) OTD Failure Improvement; 9) OTD Oppo. Improvement; 10) OTD Risk Improvement
Inventory	1) Total yield; 2) Finished Goods (FG) yield; 3) Raw Materials (RM) yield; 4) Work in Process (WIP) yield; 5) FG Amount (By Month); 6) FG Amount (By Strategy group); 7) FG Amount (By Product Family); 8) RM Amount (By Month); 9) RM Amount (By ABC/XYZ); 10) RM Amount (By Buyer); 11) FG Oppo. Improvement; 12) RM Oppo. Improvement
Inventory-DDMRP	1) Inventory Amount; 2) Inventory Quantity; 3) DOS for MOQ vs EOQ (By ADU 12); 4) DOS for MOQ vs EOQ (By ADU 3); 5) DDMRP Oppo. Improvement; 6) DDMRP Risk Improvement; 7) MOQ Oppo. Improvement; 8) MOQ Risk Improvement
LT-PDT	1) Actual Ave. PDT (By Month); 2) Actual Ave. PDT (By ABC/XYZ); 3) Actual PDT Distribution; 4) TOP 15 Suppliers (By Opportunity); 5) TOP 15 Categories (By Opportunity); 6) PDT Oppo. Improvement; 7) PDT Risk Improvement
LT-GR	1) Actual Ave. GR (By Month); 2) Failure of IQC Inspection; 3) Actual GR Distribution; 4) TOP 15 Suppliers; 5) TOP 15 Categories; 6) GR Oppo. Improvement; 7) GR Risk Improvement; 8) Failure of GR
LT-PLT	1) Ave. PLT; 2) Min. PLT; 3) Max. PLT; 4) Items; 5) 95% CONF.; 6) PLT Distribution (By Month); 7) Ave.LT Distribution (order create to release); 8) Ave.LT Distribution (order release to start); 9) Ave.LT Distribution (order start to finish); 10) PLT order Improvement; 11) Material Oppo. (order create to release); 12) Material Oppo. (order release to start); 13) Material Oppo. (order start to finish)

2.1 *Research on Information Needs of Planning Engineer*

In order to obtain the information elements required by planning engineers in the process of completing tasks, an information requirement and importance survey of the SAP system was conducted. This questionnaire consisted of 6 categories with a total of 58 indicators. A fifth order Likert scale was used to measure the importance of task information for planning engineers. In the questionnaire, users selected the importance score of each information based on their work content, with "1" indicating the lowest importance and "5" indicating the highest importance. A total of 37 questionnaires were distributed to 37 planning engineers from Department B, and 37 valid questionnaires were collected finally. The average importance of each information obtained by research is shown in Table 2.

Table 2: Summary of information importance of planning engineer

Tasks	Modules	information	Average importance
Task A	OTD&OFT	Actual Ave. OTDr	4.6
		Actual Ave. OTDc	3.8
		Actual Ave. OFT	4.8
		Actual Ave. Fill Time	4.2
		Actual Ave. OTDr (By Month)	4.4
		OTDr Failure Analysis (By Product Family)	4
		OTD Failure Improvement	4.8
		OTD Oppo. Improvement	4.8
		Actual OFT Distribution	4.4
		OTD Risk Improvement	4.6
Task B	Inventory	Total yield	2.5
		Finished Goods (FG) yield	1.5
		Raw Materials (RM) yield	1.4
		Work in Process (WIP) yield	1.25
		FG Amount (By Month)	4.8
		FG Amount (By Strategy group)	2.4
		FG Amount (By Product Family)	1.75
		RM Amount (By Month)	4.6
		RM Amount (By ABC/XYZ)	1.8
		RM Amount (By Buyer)	4.2
		FG Oppo. Improvement	4.8
		RM Oppo. Improvement	4.8
Task C	Inventory-DDMRP	DDMRP Oppo. Improvement	4.6
		Inventory Amount	4.4
		Inventory Quantity	3.6
		DDMRP Risk Improvement	4.6
		DOS for MOQ vs EOQ (By ADU 12)	4
		DOS for MOQ vs EOQ (By ADU 3)	4
		MOQ Oppo. Improvement	4.6
		MOQ Risk Improvement	4.6
Task D	LT-PDT	Actual Ave. PDT (By Month)	3.8
		Actual Ave. PDT (By ABC/XYZ)	4.4
		PDT Oppo. Improvement	4.4
		Actual PDT Distribution	3.8
		PDT Risk Improvement	4.6
		TOP 15 Suppliers (By Opportunity)	4.4
		TOP 15 Categories (By Opportunity)	1.7
Task E	LT-GR	Actual Ave. GR (By Month)	4
		Failure of IQC Inspection	4.6
		GR Oppo. Improvement	4.4
		Actual GR Distribution	3.8
		GR Risk Improvement	4.4
		TOP 15 Suppliers	4.6
		TOP 15 Categories	1.5
		Failure of GR	1.25
Task F	LT-PLT	Ave. PLT	3.8
		Min. PLT	1.3
		Max. PLT	1.4
		Items	1.3
		95% CONF	1.8
		PLT Distribution (By Month)	4
		PLT order Improvement	4.4
		Ave.LT Distribution (order create to release)	3.8
		Material Oppo. (order create to release)	3.8

	Ave.LT Distribution (order release to start)	4
	Material Oppo. (order release to start)	4
	Ave.LT Distribution (order start to finish)	4.6
	Material Oppo. (order start to finish)	4.2

According to the research results, it can be found that some information has a high demand, while others have a low importance. Further follow-up interviews would be conducted on this phenomenon. The reason for the low importance of some information was that it was unrelated to the work content and can be obtained through other means. It was ultimately decided to exclude information with an importance score less than 3. The high importance of information was due to its close correlation with work requirements. However, a large amount of data still made it difficult for users to search information, it is necessary to layer the collection of information and simplify the representation of information.

4.1 Information Correlation Analysis of SAP System

Effective information presentation is closely related to a reasonable and efficient information structure. Information is functional units of information structure. The information is able to be divided into target information and level information based on specific functions in interface information systems. The target information refers to the functional unit that can achieve the user's ultimate goal. The level information refers to the path nodes that may be needed to reach the target, whose function is to create associations between originally isolated information. Generally, information correlation can be classified into three types: index, parallel and linked. Index relationship refers to the clustering and grouping of information that could not have formed correlation attributes by artificially adding information nodes; Parallel relationship refers to the information under the same index; Linked relationship refers to the ability of information located at different levels or indexes to jump to each other.

In this SAP system, information correlation based on user research and task analysis included two aspects. On the one hand, it can be found that the meanings represented by the information between different modules have commonalities, such as information related to opportunity, risk, failure, and months. On the other hand, the presentation of information was closely related to the task flow. For example, if a planning engineer was asked to adjust the quantity of materials to fit the current production, they need to identify the specific material number based on the data of OTD Oppo. improvement of Module OTD&OFT firstly, and then view the assembly status of this material in the data of Actual OFT distribution, which meant that there was a correction between data of OTD Oppo. Improvement and data of Actual OFT distribution.

Therefore, the information correlation structure of Task A for planning engineers was divided into three levels. The level Two consisted of five types of information, including basic information, opportunity information, failure information, risk information, and monthly information, imported from the level one referred to homepage of Module OTD&OFT. The information of level Two would point to target information eventually. The information between levels were mutually indexed, which was an information association structure that can help users quickly find the desired content. Moreover, the information within the same level had parallel relationships with each other, that was, the information elements under the same index. The information correlation structure of the SAP system for the plan engineer is shown in Figure 3.

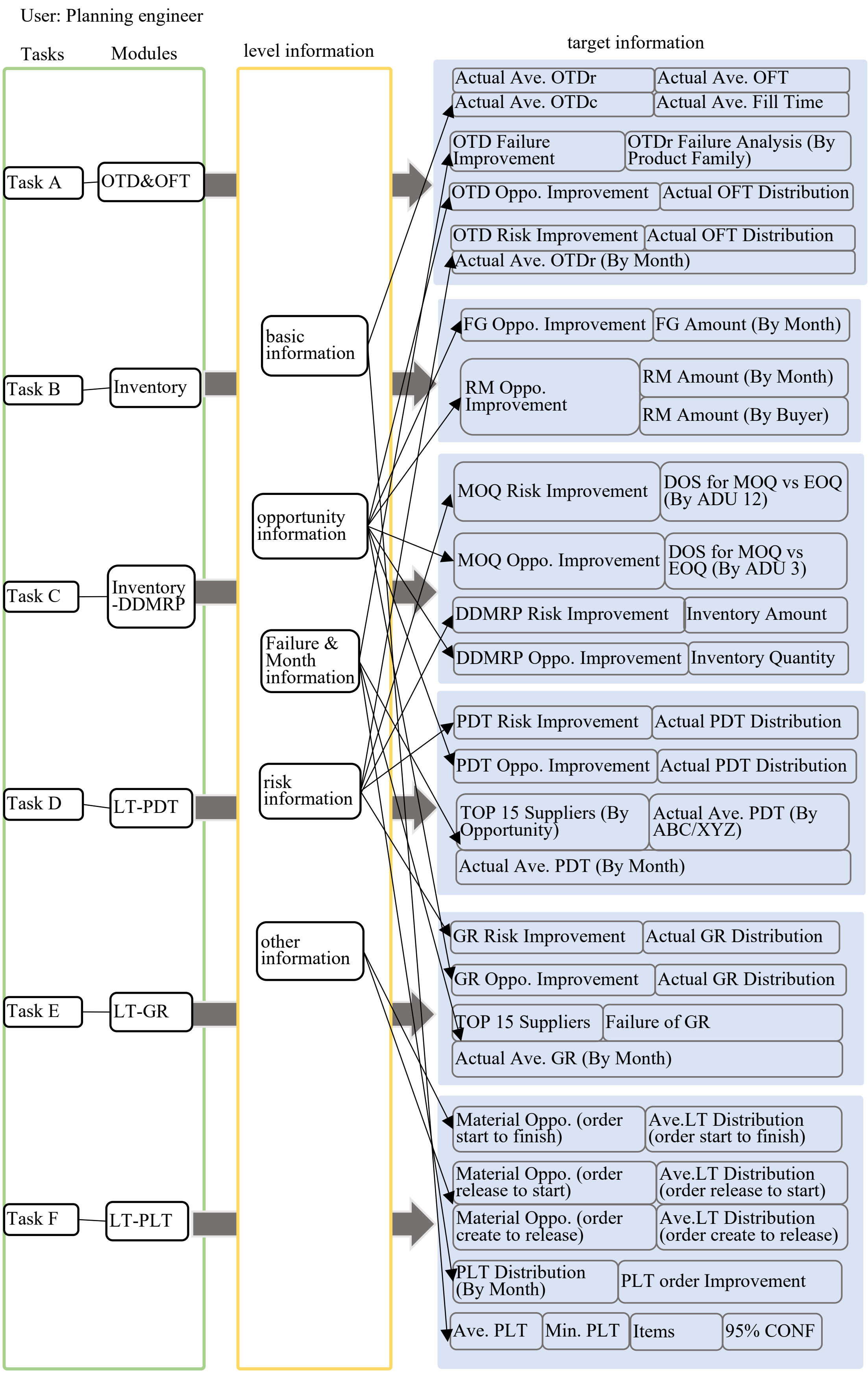
User: Planning engineer
Tasks
Modules
level information
target information
Task A
OTD&OFT
Task B
Inventory
Task C
Inventory -DDMRP
Task D
LT-PDT
Task E
LT-GR
Task F
LT-PLT
basic information
opportunity information
Failure & Month information
risk information
other information
Actual Ave. OTDr
Actual Ave. OFT
Actual Ave. OTDc
Actual Ave. Fill Time
OTD Failure Improvement
OTDr Failure Analysis (By Product Family)
OTD Oppo. Improvement
Actual OFT Distribution
OTD Risk Improvement
Actual OFT Distribution
Actual Ave. OTDr (By Month)
FG Oppo. Improvement
FG Amount (By Month)
RM Oppo. Improvement
RM Amount (By Month)
RM Amount (By Buyer)
MOQ Risk Improvement
DOS for MOQ vs EOQ (By ADU 12)
MOQ Oppo. Improvement
DOS for MOQ vs EOQ (By ADU 3)
DDMRP Risk Improvement
Inventory Amount
DDMRP Oppo. Improvement
Inventory Quantity
PDT Risk Improvement
Actual PDT Distribution
PDT Oppo. Improvement
Actual PDT Distribution
TOP 15 Suppliers (By Opportunity)
Actual Ave. PDT (By ABC/XYZ)
Actual Ave. PDT (By Month)
GR Risk Improvement
Actual GR Distribution
GR Oppo. Improvement
Actual GR Distribution
TOP 15 Suppliers
Failure of GR
Actual Ave. GR (By Month)
Material Oppo. (order start to finish)
Ave.LT Distribution (order start to finish)
Material Oppo. (order release to start)
Ave.LT Distribution (order release to start)
Material Oppo. (order create to release)
Ave.LT Distribution (order create to release)
PLT Distribution (By Month)
PLT order Improvement
Ave. PLT
Min. PLT
Items
95% CONF

Figure 3: information correlation structure of the SAP system for the planning engineer

3 SAP System Information Integration and Presentation

The information visualization solutions had designed based on the SAP system information correlation structure of four types of engineer, including icon, text, color, etc. The human-machine interface design scheme of the SAP system is shown in Figure 4. The semantic difference method and task performance task were applied to evaluate the usability of the human-computer interface of the SAP system. The evaluation results indicated that the information correlation structure can simplify the multidimensional information integration of SAP system, which were able to optimize the information interface and further improve work efficiency of users by combination and delaminating information.

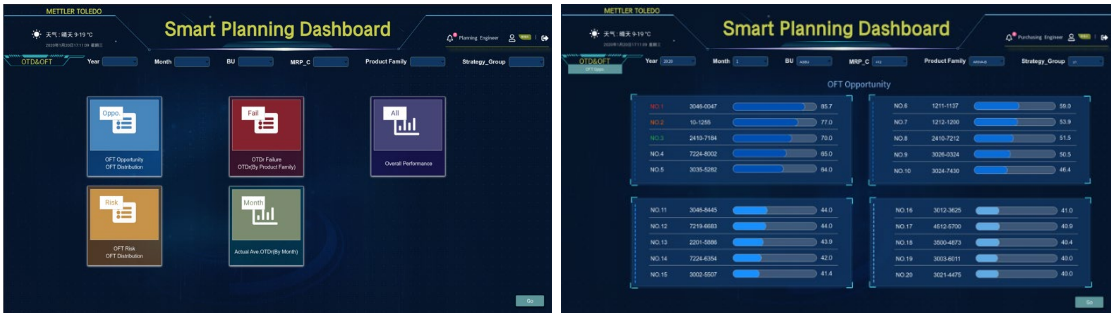

Figure 4: Design scheme for human-machine interface of SAP system

4 Conclusion

This paper focuses on the problem of SAP system having a large amount of information and complex information relationships. From the perspective of task flow and information requirements, four operator task models are constructed to help sort out the information architecture of SAP system and guide the effective presentation of human-machine interface design information, providing support for operators to reduce cognitive load and efficient operation of enterprises.

Acknowledgment

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