Patent One-Stop Service Business Model Based on Scientific and Technological Resource Bundle

Fanying ZHENG††††††††††, Yangjian JI††††††††††, Fu GU††††††††††, Xinjian GU††††††††††, Nonmembers, and Jin ZHANG††††††††††, Member

SUMMARY To address slow response and scattered resources in patent service, this paper proposes a one-stop service business model based on scientific and technological resource bundle. The proposed one-step model is composed of a project model, a resource bundle model and a service product model through Web Service integration. This paper describes the patent resource bundle model from the aspects of content and context, and designs the configuration of patent service products and patent resource bundle. The model is then applied to the patent service of the Yangtze River Delta urban agglomeration in China, and the monthly agent volume increased by 38.8%, and the average response time decreased by 14.3%. Besides, it is conducive to improve user satisfaction and resource sharing efficiency of urban agglomeration.

key words: scientific and technological resource bundle, one-stop service, patent service, business model

1. Introduction

Patent documents are a rich source of information about the latest technology, covering almost every field. More than 90% of inventions in the world are patented, and 70% of the technical information disclosed in patent documents has not been published elsewhere [1], [2]. According to the statistics reported by Innography (www.innography.com), the number of patents increase at a rate of 1 million per year in recent years [3]. Once being properly processed and analyzed, patent documents can render a wealth of information about R&D trends, emerging technological fields and collaborations, being particularly beneficial to a wide range of R&D activities [3], [4]. As a result, the demands for professional help in patent analysis and management have increased greatly in China [5], [6]. Hence, a number of institutions have emerged to provide services, such as patent analysis and patent creation, for enterprises or individuals [7]. However, these patent service agencies are slow to respond to users’ personalized needs due to the lack of resource integration and service modularity capabilities [8].

Patent services play an important role in promoting the creation, protection and management of intellectual property rights [9]–[11], especially in resource sharing within urban agglomeration [12]. Patent services involve many types of services and stakeholders, and their operational modes are cumbersome [13], [14]. Typically, the service mode of the existing third-party patent service organization is to collect the information of patent service organization, and to provide such information on request. This will lead to a decrease in user experience of service and insufficient satisfaction of needs. Especially with the explosion in user demand, this mode will suffer from low efficiency and poor resource integration.

Usually, one-stop service is a set of integrated services for business operators in one location or unified access port [16], [17]. For services involving multiple departments or resources, one-stop service not only boosts both service quality and service efficiency, but also promotes satisfaction of customers [18], [19]. Patent resource bundle is composed of personnel patent resources, institutional patent resources, document, data and software required by patent activities. It can quickly provide overall solution services, improve resource sharing efficiency, reduce service costs, and avoid the trouble of manually searching resources one by one. Owning to the above characteristics, patent resource bundle is a potential solution to realize patent service.

To quickly respond to the personalized needs of users, this paper constructs a patent one-stop service business model integrated by project model, resource bundle model and service product model, describes the patent resource bundle model in detail, and designs the configuration of patent service products and patent resource bundles, so as to quickly and accurately respond to user needs.

The rest of this article proceeds as follows. Section 2 describes the one-stop model of patent services based on science and technology resource bundle. Section 3 defines the technology resource bundle of patent services in detail from resource bundle content and resource bundle context. Section 4 establishes a configuration design process for patent service. In Sect. 5, a case study demonstrates the feasibility of the one-stop service model. The conclusion is conducted in Sect. 6.
2. Patent One-Stop Service Model

Due to the dispersion, specialization and complexity of patent resources [20], [21] and cross sectoral cooperation of patent services [22], it is impossible to obtain all kinds of needed resources within a short period of time. Therefore, it is necessary to quickly integrate relevant resources and provide one-stop service for patent service [23], [24]. Patent one-stop service is an advanced form of patent resource supply and demand matching service [25], [26]. It includes a deep understanding of the service object and process, and it can improve the value of the service. Based on Resource Integration, two kinds of one-stop asynchronous service modes of science and technology resources exist: the former is coordinated by a certain service structure, and the latter is connected by users themselves [27]. The patent one-stop service model proposed in this paper is from the perspective of third-party service organizations, belongs to the dominant one-stop asynchronous service. This model can coordinate the patent resources and meet the needs of users. The patent one-stop service model proposed in this paper is shown in Fig. 1. The patent one-stop service business model is the integration of a project model, a resource bundle model and a service product model through Web service integration. A detailed description of the one-stop business service model is given below.

2.1 The Project Model

The project model includes patent service project and patent service task.

The patent service project includes all the information used for the patent one-stop service project description and project control, which is stored in the project folder, resource folder, project team folder and project calendar respectively.

- The project folder is used to manage all kinds of information generated during the execution of the patent service project, such as the description of the service project, the process plan of the service project, the execution status of the service project, the document data formed during the progress of the service project, etc.
- The resource folder is used to store virtual service product models. With the continuous progress of the project, the virtual service resource model has been constantly improved, and more and more product technical documents, such as patent retrieval formulas, patent analysis method, patent value assessment method, patent software operation manual, etc., have been stored in the resource folder.
- The project team folder holds information about all members of the project team.
- The project calendar holds data on the progress and
The patent service task is a tree structure. According to the stage of patent life cycle, the service types can be divided into five categories: patent creation, patent application, patent protection, patent transaction and patent management. Different types of patent tasks can be classified according to their service contents. For example, patent creation tasks can be divided into patent writing sub-tasks, patent application sub-tasks, high-value patent cultivation sub-tasks and multilingual patent translation sub-tasks.

2.2 The Resource Bundle Model

Each task in the patent service task corresponds to a resource bundle. The resource bundle model consists of the series of activities required to complete the task and the patent resources required to complete the activities. The patent resources corresponding to the activity are composed of patent personnel, patent institutions, patent documents, patent data and patent software needed to complete the activity. To complete this task, multiple activities should be carried out in parallel or in turn, and corresponding resources should be transferred according to the content of patent resources required by each activity. In addition, whether patent personnel and patent institutions accept the call depends on their calendars, fields of expertise and regions. Section 3 will describe the patent resource bundle in detail.

2.3 The Service Product Model

According to the requirement description and requirement decomposition of patent service product model, one or more corresponding patent resource bundles will be called. The demand characteristics are used as the input of the patent resource bundle. The result of each resource bundle is part of the user’s one-stop service product. Multiple resource bundles are invoked and configured according to requirements, and finally meet users’ requirements in a one-stop way.

3. Description of Patent Service Resource Bundle Model

Patent resource bundle is a dynamic collection of orderly combination of patent service resources. According to the requirements of patent service content and service object, and following the property and configuration requirements of various resources, it configures and invokes personnel resources, institutional resources, document resources, data resources and software resources required by patent services. The resource bundle model based on patent service (PSRB) needs to combine the content of resource bundle with the usage scenario of resource bundle. The PSRB can be formally expressed as follows:

\[
\text{PSRB} = \{\text{PRBcontent, PRBcontext, PRBrelation}\}
\]

where PSRB denotes the resource bundle model based on patent service.

**PRBcontent** - refers to the content of resource bundle. The content of resource bundle is the specific content, meaning and connotation expressed and contained by resource bundle.

**PRBcontext** - refers to resource bundle context. PRBcontext refers to the conditions, background and environment related to the implementation of resource bundle. It not only includes external environment and background factors such as physical, social and business, but also includes internal factors such as cognition, experience and psychology of knowledge subject. It depicts the situation characteristics related to resource bundle and resource bundle implementation.

**PRBrelation** - indicates the relationship between the content of the resource bundle and the resource bundle context.

3.1 Resource Bundle Content Modeling

We model the content of resource bundle as follows:

\[
\text{PRBcontent} = \{\text{RBservice, RLevel, RBkeyw, RBsum}\}
\]

3.2 Resource Bundle Context Modeling

In order to better describe all aspects of situational elements, we propose a multi-dimensional context modeling method, that is, multiple context dimensions are used to describe the situation. Each situation dimension is composed of several situational elements and attributes under the dimension. Therefore, the formal representation of situation model is as follows:

\[
\text{PRBcontext} = \{\text{Goal, Process, Person, Institution, Documentation, Data, Software, Schedule, Location, Domain}\}
\]

The context elements and description of resource bundle are shown in Table 2.

(1) Goal

The goal is to use the resource bundle to solve the user’s problems and to complete the user’s tasks. For the same resource bundle, different users may apply it to different domains to achieve different purposes. A goal can be divided
into several sub-objectives, while the realization of one goal can support the realization of other goals, that is, there are a variety of relationships between goals. Through the annotation of the problems and key factors of the realization, the goal can be better explained. The Goal can be expressed as:

$$\text{Goal} = \langle R_{\text{Goal}} \rangle : \{ \text{GoalRelation}, [\text{Note}] \}$$

The Note feature in square brackets indicates that it is optional for different goals. The meaning and description of the elements are shown in Table 3.

(2) Process
A process consists of a series of subprocesses (also known as activities) and the events that drive these subprocesses, which can achieve certain goals. It is completed by specific roles in an organization at a specific time and place by invoking or consuming resources, creating or providing certain products/services through processes. There is a certain relationship between processes, such as one process followed by another. The process can be expressed as follows:

$$\text{Process} = \langle R_{\text{Process}} \rangle : \{ \text{PrGoal}, \text{PrSubProcess}, \text{PrRole}, \text{PrResource}, \text{PrProduction}, \text{PrTime}, \text{PrLocation}, \text{PrEvent}, \text{PrProcessing} \}$$

(3) Person
People should have an id or name. In patent service, a person is associated with a specific role or position to perform work in a specific position, perform certain tasks, have certain skills and experience, and have certain expertise. Therefore, personnel are formally expressed as:

$$\text{Person} = \langle R_{\text{Person}} \rangle : \{ \text{PeRole}, \text{PePosition}, \text{PeTasks}, \text{PeSkills}, \text{PeExperience}, \text{PeProfession} \}$$

(4) Institution
The institution shall have an identification or name. Among patent service agencies, the scope of service, industry involved, institution scale, service price and so on affect the choice and judgment of patent demander. The mechanism can be formally expressed as:

$$\text{Institution} = \langle R_{\text{Institution}} \rangle : \{ \text{IsRange}, \text{IsProfession}, \text{IsSize}, \text{IsCharge}, \text{IsVolume}, \text{IsGuestDep} \}$$

(5) Documentation
Documentation refers to written materials, such as patent writing templates and user manuals, that assist patent service personnel or institutions in providing services. The document should be described by identifying fields such as title, keywords, main content, etc. A document can be formally expressed as:

$$\text{Documentation} = \langle R_{\text{Document}} \rangle : \{ \text{DoTitle}, \text{DoKeyw}, \text{DoText} \}$$

(6) Data
Data represents the chivalrous definition of structured data generated during the life cycle of a patent and patent analysis data based on it. Data should be described by fields, data volume, and applicable scope. Data can be formally expressed as:

$$\text{Data} = \langle R_{\text{Data}} \rangle : \{ \text{DaField}, \text{DaAmount}, \text{DaScope} \}$$

(7) Software
Software refers to the computer system programs that assist patent services during the patent life cycle, such as patent analysis software and patent delivery software. The software shall be described by its name, function, user type and instruction manual. Software can be formally identified as:

$$\text{Software} = \{ \text{SoName}, \text{SoFunction}, \text{SoUser}, \text{SoInstruction} \}$$

(8) Schedule
The schedule includes the start time of the patented service. The description of the starting time should include details such as year, month, date, etc. A schedule can be formally identified as:

$$\text{Schedule} = \{ \text{ScID}, \text{ScStartTime}, \text{ScEndTime} \}$$

(9) Location
The main characteristics of a location include the type of location, the region in which a place is located, and the relationship between the locations. Therefore, the location can be formally expressed as:
Table 3  Domain elements and descriptions.

| Item       | Element | Description                                      |
|------------|---------|--------------------------------------------------|
| Location   | LoID    | The unique identifier or name of the goal.       |
|            | LoType  | The relationship between goals.                  |
|            | LoRegion| Notes on the problems and key factors of the goal|
|            | LoProcess| The unique identifier or name of the procedure   |
|            | PrGoal  | Objectives of the process.                      |
|            | PrSub – Process| The collection of all subprocesses (also known as activities) that make up a process|
|            | PrRoad  | The role in the organization responsible for the execution process |
| Process    | PrResource| Various resources used and consumed by the process|
|            | PrProduction| Products / services created and provided by services|
|            | PrTime  | Time of process execution.                      |
|            | PrLocation| Location of process execution.                  |
|            | PrEvent | The events that drive the execution of a procedure |
|            | PrProcessing| The relationship between process and process |
|            | gPerson | A unique identity or name of a person.           |
|            | gPosition| The role of a person in an organization         |
|            | gPosition| The position of a person within an organizational structure |
| Person     | gTasks  | A list of tasks that a person undertake in the enterprise |
|            | gSkills | A variety of knowledge and skills possessed by a person |
|            | gExperience| The experience of a person in various fields    |
|            | gInstitution| The expertise of a person in some area         |
|            | gIdentification| The unique identity or name of the institution|
|            | IsRange | Scope and type of patent services provided by the institution |
|            | IsVolume| The number of patent services provided by the institution per year |
|            | IsGuestDep| The distribution of customers served by the organization |
|            | gIdentify| The unique identity of the document             |
|            | DoTitle | Title of document.                              |

**Documentation**

| Item       | Element | Description                                      |
|------------|---------|--------------------------------------------------|
|            | DoKeyw | Keywords of the document                         |
|            | DoText | A note explaining the problems addressed by the document, the key elements of the implementation, and so on |
|            | gData  | Identification of data                           |
| Data       | DaField| A field that describes data                      |
|            | DaAmount| Description of data quantity                     |
|            | DaScope | Scenarios and fields for data application        |
|            | gName  | Name of software.                                |
| Software   | gFunction| The function description of the software         |
|            | gUser | The type of user that USES the software          |
|            | gInstruction| Software instructions                           |
| Schedule   | gID    | A uniquely identified schedule for a process     |
|            | gStart| Time value, with YYYY year MM month DD day for detailed description |
|            | gEnd   | Time value, with YYYY year MM month DD day for detailed description |
| Location   | gLocID | A specific location that is uniquely identified  |
|            | gType  | The category of a location that represents the functional features of the location |
|            | gRegion| The region in which a place is located, represented by a region hierarchy |
|            | gRelations| A relationship between locations, as of neighbors|
| Domain     | gName  | Domain name                                      |
|            | gCategory| The category to which the domain belongs         |
|            | gCateRelation| The hierarchical relationship between categories |

Location = \{LoID, LoType, LoRegion, LoRelations\}

(10) Domain
Domain refers to the domain covered by the scope of patent services. A domain can be formally expressed as:

\[
\text{Domain} = \{\text{DoID, DoName, DoCategory, DoCateRelation}\}
\]

4. Configuration Design for Patent Services

The patent service configuration design is a process of selecting, configuring and combining from the alternative components according to the constraint rules among the components under the premise of known composition structure, elements and specifications of patent service system. Via configuration optimization and configuration scheme evaluation, the optimal configuration scheme of patent service system can be obtained to meet the needs of users. The configuration design flow of patent service proposed in this paper is shown in Fig. 2.

The core of patent service configuration design lies in the following three parts:

1. Configuration of patent service tasks, that is, configuration design at the product level. When users put forward requirements, they need to decompose the requirements into different tasks and invoke the resource bundles corresponding to the tasks. In this case, each task is a module, which can be divided into basic module, optional module and required module according to the different module types. The configuration is designed according to the selection rules.

2. Resource bundle content configuration design, that is, resource level configuration design. Each resource
bundle contains resources for patent personnel, patent offices, patent documents, patent data and patent software. When the resource bundle is invoked, it is necessary to configure and design the patent resources according to the detailed requirements of users, including the content and context elements of the resource bundle, such as service field, pass rate, service price, service time and place, etc., so as to form a rapid combination of the patent resource bundles.

(3) Evaluation of one-stop service configuration. Evaluation index is the basis patent configuration scheme evaluation. The establishment of a quality assurance system for one-stop service configuration should follow the principles of comprehensiveness, scientific and operability, and be able to systematically and comprehensively reflect the attributes of service configuration. The establishment of the index system of one-stop service configuration evaluation should be evaluated from the two aspects of the configuration design within the resource bundle and the configuration design of service tasks, and the indicators such as manipulation, coordination, professionalism, matching and economy can be considered.

In the above sections, the configuration process uses Case-Based Reasoning (CBR) and Rule-Based Reasoning (RBR). The specific methods are as follows.

(1) The CBR method. First, build the service case matrix:

\[
\text{CaseResource} = \begin{bmatrix}
    c_{11} & c_{12} & \cdots & c_{1m} \\
    c_{21} & c_{22} & \cdots & c_{2m} \\
    \vdots & \vdots & \ddots & \vdots \\
    c_{n1} & c_{n2} & \cdots & c_{nm}
\end{bmatrix}
\]

The row vector \(C_{Sr_i} = (c_{i1}, c_{i2}, \ldots, c_{im})\) formed by the \(i\)-th row of the matrix represents the \(i\)-th service case. An element \(c_{ij}\) in the matrix can take the value 0 or 1.
means that the $j$-th resource is used in the $i$-th service case, otherwise the $j$-th resource is not used.

Then, establish the mapping of the user Demand to the specific Resource: $f: \text{Demand} \rightarrow \text{Resource}$. When the user puts forward the demand, find the resources $h$ and $k$ that need to be called according to the mapping. According to the matching algorithm: $c_{ih} = 1 \& c_{ik} = 1$, the service case $t$ that meets the conditions is found in the service case base, and the resource bundle required by the service case $t$ is provided to the user. If there is no service case that fully meets the user’s needs, for example, there are only cases that meet the following conditions: $c_{ih} = 1 \& c_{ik} = 0$, resource $h$ is provided to the user after adjustment.

(2) The RBR method. Extract the main architectural model of the service from the one-stop service model shown in Fig. 1. The service resources are configured according to the master architecture model and configuration rules.

1) All the resources of the basic module are provided to users;
2) For optional modules or required modules related to user requirements, the mapping relationship between Demand and resources $f: \text{Demand} \rightarrow \text{Resource}$ is used to determine the service resources one by one;
3) For the optional modules or required modules that have a configuration relationship with the second step, the configuration rules are used to determine the service resources one by one;
4) For other optional modules or required modules that have not been determined, it shall be determined according to the user’s budget or idle situation of resources.
5) Provide the basic resources, optional resources and required resources identified above to the customer in accordance with the service life cycle.

The above service resource configuration method can find the instance that is closest to the target product in the existing service case base through the matching algorithm of similar instances. Or use the depth-first method to traverse the product structure one by one to complete the service configuration quickly and accurately. This configuration method can make full use of existing resources such as data analysis results and document templates, avoiding the configuration of service resources from scratch. Thus, the product configuration design can adapt to the evolution of the product model more quickly, effectively, accurately and dynamically, meet the needs of users’ personalized customization, and shorten the response time (that is, the time from users’ submission of demand to the formation of service scheme).

5. Case Study

The Science and Technology Information Research Institute of N City is the city’s public welfare, comprehensive science and technology information research service organization, it is the patent service platform of the Yangtze River Delta Urban Agglomeration in China. It mainly provides services such as statistical monitoring of science and technology and industrial technology foresight. This research cooperates with the Science and Technology Information Research Institute of N City to integrate the patent resources of the Information Institute and establish a one-stop service platform for patent resources to provide one-stop services for patent service needs. After half a year of integration and operation, the monthly agent volume increased by 38.8%, and the average response time decreased by 14.3%, and customer satisfaction has been significantly improved.

The construction framework of the patented one-stop service platform is shown in Fig. 3. The framework is divided into data layer, data processing layer, resource bundle layer, business layer, front-end visualization layer and user layer from bottom to top. The core element of the service platform is process and data. The following is a detailed introduction to the various levels of the platform:

(1) Data layer: it includes personnel resource data, structure resource data, document resource data, data resource data and software resource data required by patent service. The data layer is the base layer for platform operation.

(2) Data processing layer: the data processing layer is the platform’s centralized data processing, including demand decomposition, configuration design and other services. The processing of the data can provide fast and accurate integration for the resource bundle layer.

(3) Resource bundle layer: it includes patent writing resource bundle, patent application resource bundle, etc. The establishment of resource bundle is the result of configuration design and integration of resource bundle structure according to patent data attribute and user demand.

(4) Business layer: it includes the five major businesses of patent creation, patent application, patent protection, patent transaction and patent management and their respective sub-tasks. The patent business layer corresponds to the project model of the one-stop service model.

(5) Front-end visualization layer: it includes visualization of service process, hierarchical directory, diagram display and resource content. The establishment of the visualization layer enables each user of the patent service to have a clear and intuitive understanding of the service content, service stakeholders, service resources and service process, so as to facilitate the coordination and cooperation of each user layer and grasp the project progress.

(6) User layer: it includes enterprise users, suppliers, customers, consumers, system administrators and other users. Different users have different system configuration and authority management.

For example, an enterprise user A puts forward the following patent service requirements: the analysis of the enterprise existing patents, with possible infringement behavior, set up enterprise overall patent layout, eventually form a pattern of advantageous to enterprise’s patent portfolio requirements. The Institute provides one-stop service specific process for:

(1) Determine the main structure of service products according to user requirements. The research institute
needs to divide the user requirements into different modules, which correspond to part of the product structure. The above requirements can establish a number of configuration rules: patent analysis task, patent litigant, patent layout task, etc., and then determine the structure of service products and optional and required modules from the five basic modules of patent creation, patent application, patent protection, patent transaction and patent management. The main structure of the product required by the user is determined according to the configuration rules. The configuration design case of the patent service product is shown in Fig. 4.

(2) According to the one-stop service model and the service tasks determined by the above process, the corresponding patent service resource bundle is called. The resource bundle configuration rules are established according to the detailed requirements of users. According to the main structure and configuration rules of the resource bundle model, the main structure of the service resource bundle is determined. The configuration design case of patent resource bundle is shown in Fig. 5.

(3) Configure, design and bundle and integrate the resource bundles corresponding to all activities involved in
process (1), and provide them to users according to the calendar, that is, one-stop patent services are provided to users.

We make statistics on the monthly agent volume and average response time before and after the application of patent one-stop service based on resource bundle in N Research Institute, as shown in Table 4. We found that the number of monthly agents increased from 205.5 to 283.2, with an average increase of 38.8%; the average response time decreased from 15.1 days to 12.9 days, with an average decrease of 14.3%. It shows that the patent one-stop service model proposed in this paper is scientific and effective.

The patent one-stop service business model based on resource bundle proposed in this paper is applicable to the third-party patent service platform. It can help the platform to construct a patent resource base and to conduct rapid configuration design. However, the method proposed in this paper has the following shortcomings: platform engineers not only need to understand the life cycle process of patent service, but also need to learn and be familiar with the knowledge of the applied field, and it is difficult to maintain the knowledge base.

6. Conclusions

In view of the characteristics of dispersed, professional and complex patent resources, as well as the existing problems of slow response and uneven resources of patent services, this paper established a patent one-stop service business model based on a resource bundle model. First, based on the classification of patent service types, the project model of patent service is constructed. Each task in the project activity corresponds to a resource bundle model, and the service product model is determined through configuration design according to user needs and product structure. In addition, this paper describes the model of patent service resource bundle in detail from two aspects: content and context. The patent resources of the institute are recombined to apply the one-stop service model proposed in this paper. Practice has proved that the patent one-stop service model has effectively improved the service efficiency and quality of the institute, and improved the satisfaction of the demanders.

Future research can be carried out in accordance with the following directions. First, similar instances can be merged to extract the main structure of patent services. Another aspect of interest is to evaluate the product configuration scheme from the aspects of resource quantity, coupling within resources and coupling between resources.

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Fanying Zheng received the B.E. degree in Industrial Engineering of Northeastern University in 2017. She is now a PhD candidate in industrial engineering at Zhejiang University, her research interests include knowledge management and sustainability evaluation.

Yangjian Ji is currently a Professor of Zhejiang University and a deputy director of the Key Laboratory of Advanced Manufacturing Technology of Zhejiang Province. He received the Ph.D degree in mechanical engineering from Zhejiang University in 2004. He is currently a member of Group Technology and Intelligent Integrated Technology of Chinese Mechanical Engineering Society. His research interests include manufacturing service, industrial big data, and advanced manufacturing mode.

Fu Gu is an associate professor in Department of Industrial and System Engineering, and in Center of Engineering Management, Polytechnic Institute, Zhejiang University. He is a member of Chinese Society of Optimization, Overall Planning and Economic Mathematics.
Xinjian Gu is currently a professor at Department of Industrial and System Engineering, Zhejiang University, Hangzhou, China. His research interests include knowledge management in technology adoption and big data analytics.

Jin Zhang received the B.E. degree in industrial engineering from Zhejiang University in 2017. He is currently pursuing his PhD degree from Zhejiang University. His research interests include artificial intelligence, knowledge management and intelligent manufacturing.