Talent Cultivation in Software Service Supply Chain - Taking India as an Example

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Abstract

The purpose of this study is to explore talent development in the software service supply chain, taking India as an example for discussion. This study was conducted concerning India has reputation on its excellent achievements in the field of software services. The main questions of this study mainly discuss the following: 1. What are the contents of the software service supply chain? 2. What capabilities should software service talents have? 3. What are the complete software service courses? And 4. What are the characteristics and advantages of India in cultivating software service talents? This research adopts the method of expert interview to carry out the research of this paper. During the research period, a total of ten people including five industry professionals and five university teachers were interviewed. The understanding of India is interpreted through the collection of public information and the conclusions of expert interviews. The results of this study show that the complete software service talent supply chain includes online personnel and product service personnel. Depending on the difficulty of the program, the service personnel need to have different levels of program service capabilities. This research also designs the basic courses required for cultivating software service talents at this stage. As for why India can occupy a place in the software service industry, it should be attributed to the way of education in India and the unique thinking habits of Indians.

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Introduction

Composition and Value Chain of Information Products

The concept of value chain was first proposed by Michael Porter in 1985. (Porter, 1980; Porter & Kramer, 2011). Originally, the value chain Porter was referring was primarily aimed at vertically integrated firms, emphasizing the competitive advantage of individual firms. With the development of international outsourcing business, Porter further proposed the concept of value system in 1998, extending the research perspective to different companies, which is similar to the concept of global value chain that emerged later, have something in common (Kaplinsky, 2000; Pandey, et al. 2004)

Later, Kogut (1985) also put forward the concept of value chain, and his view reflects the relationship between the vertical separation of value chain and the reconfiguration of global space more than Porter's view. In 2001, Griffin put forward the concept of global value chain when analyzing the problem of international division of labor and industrial linkages on a global scale. The concept of global value chains provides a network-based analytical method for analyzing the geographic and organizational characteristics of international production, revealing the dynamic nature of global industries (Fu, 2013; Tsai, 2021)

The production of information products is also processed through a series of division of labour and industrial links. The simplest division is to divide it into two parts: hardware and software. Hardware refers to the physical part that has an image, while software refers to the system that causes the hardware to operate. This is mainly the computer program and human-machine interface. In the past, because only the appearance of the body was seen, it was often overlooked that the software was the main part that made the hardware work. And because the soft body is invisible and intangible, people who don't understand it can't put a beak on it. In addition, the entry barrier to making soft works is also high, which makes many people discouraged.

To extend the concept of division, the value chain of information products is also composed of hardware and software. The value-added activities of the value chain can be divided into basic value-added activities and auxiliary value-added activities. The basic value-added activities of an enterprise, that is, the "production and operation links" in the general sense, such as material supply, finished product development, production operation, finished product storage and transportation, marketing and after-sales service. These activities are directly related to the processing and circulation of commodity entities. The value of software services is mainly the value-added part that promotes the multiplication of information products.

Cultivation of Software Service Talents

Since the function of software is to promote the rapid value-added of information products, the cultivation of software service talents becomes very important in the field of high-tech. How to cultivate good software service talents is the most important issue in the high-tech industry.

From the perspective of today's software service field, there is no doubt that India plays a very important role. Indians account for a large proportion either in software service industry or an individual software enterprise. Why does India have such good achievements? If other countries want to catch up, what are the factors that must be learned? These are the answers worthy to know (Arora & Bagde, 2010; Humphrey, 2004).

Research Questions

This research will focus on the following four parts:

1. What does the supply chain of software services include?

2. What abilities should software service talents have?

3. What does the complete software service course include?

4. What are the characteristics and advantages of India in cultivating software service talents?

Innovation and Contribution of this Research

Due to the fierce competition in the high-tech industry, how to maintain a competitive advantage in this rapidly changing world depends on continuous innovation and improvement. Therefore, this study discusses the core competitiveness of the software service supply chain and the cultivation of software service talents. In addition, this study also discusses what are the main reasons why India has a place in the software service industry? (Zhang & Feng, 2018; Mani, 2013)

Literature review

Contents of the Software Industry

The software industry has always been classified into confusion. The Internet Lab has combined the product characteristics, technical characteristics, market characteristics and historical development characteristics of software to synthesize the above table. The entire software product is divided into four categories: (Patibandla & Petersen, 2002)

1. Hardware + embedded application software

2. Hardware + operating system + general application software

3. Hardware + operating system + basic software + general industry application software

4. Hardware + operating system + basic software + business basic software + complex industry application software

It basically summarizes the entire process and course of the evolution of the software industry from the primary stage to the advanced stage in four categories. Moreover, it must be pointed out that the emergence of each high-level stage does not simply replace the original low-level stage, but various stages coexist at the same time, and each of them is developing rapidly. Therefore, this map also represents the current (including the near future) of the software industry in its entirety.

From the first to the fourth category, there are obvious changes:

- The software integration degree increases, and the application complexity increases;

- Increased value-added space and enhanced personalization;

- The development cost increases and the competition barrier increases;

- The organic degree of informationization increases, and the value generated by applying it increases.

Of course, from another point of view, the versatility is reduced, the number of users is reduced, and the number of competitors is reduced.

The Value of the Software Industry

The software industry is the core of the information industry and the basic and strategic industry of the information society. The software industry can not only create considerable economic benefits, but also play an important role in promoting the adjustment and optimization of the economic structure, the transformation and upgrading of traditional industries, and the building of a well-off society in an all-round way due to its strong penetration and radiation effect. and the "multiplier" of social development (Guan, 2001).

The software market is mainly divided into three parts: software services (writing software for one customer, no intellectual property rights), software products (compiling software, selling it to many customers, and having its own intellectual property rights) and self-sufficient software (enterprises apply for themselves or Open software for its own supporting products). Generally speaking, the so-called software industry mainly includes the first two parts. Although the number of programmers employed in the third part is not lower than the sum of the first two categories, but because their labour products are not used for trading or direct use. Buying and selling is therefore generally not included in the scope of the industry. But when the bubbles pop, how to calculate becomes an art.

There are at least the following ways to calculate software revenue:

1. Software product × (water exchange coefficient)

2. (software product + software service) × (water exchange coefficient)

3. (software product + software service + self-sufficient software) × (water exchange coefficient)

4. (software product + software service + self-sufficient software + hardware income) × (water exchange coefficient)

5. (software products + software services + self-sufficient software + hardware income + real estate income and other income) × (water exchange coefficient) (Fubon Securities, 2002, January)

The History of Software Service Education

Taiwan's Ministry of Education calls the new generation of software education courses the "Smart Innovation Cross-domain Talent Cultivation" program, which includes: (Ministry of Education, 2022)

Smart Innovation Micro Program

New-type digital talent development model

These include

1. Smart perception and interactive experience

2. Big data analysis (data science)

3. E-commerce financial technology

4. Cultural creativity and multimedia.

It can be seen that the development of software services will keep pace with the times. It must also cooperate with the surrounding products.

Software Service Supply Chain

The software service industry can be divided into application/system software design and development, system integration services, data processing services, channel distribution and other industries. Application/system software design and development companies are engaged in application software in various fields, system integration service providers are responsible for the integration of hardware and software services and technical services, e-commerce is the use of the Internet to conduct business transactions, and data processing service providers are Provide database information establishment, retrieval and analysis services, website hosting and other related businesses, channel distributors are engaged in various software agency sales business (Saraswati, 2012).

Research Methods

Expert Interviews

To conduct an interview with experts, first give them an open-ended questionnaire, including the following questions:

1. What do you think the content of the software service supply chain should include?

2. What do you think the software service course should include?

3. What do you think are the advantages of the Indian education system in software services?

Fuzzy Evaluation Method

After opening the questionnaire, through the method of fuzzy questionnaire, it is decided which courses should be introduced in the software service.

Results and Discussion

What is the Content of the Supply Chain of Software Services?

The contents of the software service supply chain are as follows:

Application/system software design and development

Application/system software design and development companies mainly develop specific application/system software in accordance with the operational needs of customers. There is application software developed according to specific industries, such as finance, medical care, and distribution; or special application software developed according to software functions, such as Business Intelligence (BI), Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), Information Security, etc.

System Integration Services

System integration service providers build software and hardware according to customers' specific operational needs. Their services range from front-end planning, design, execution, overall project management, consulting services, and integrated information system services. Most of the system integration service projects include different platforms and technologies, such as system and customized application development and integration of existing application software. Due to the high degree of customization of system integration projects, a contract must be established for each project. This defines the specifications of the solution and the output performance of different levels. The final project output is a complete system, which can meet the purpose and technical specifications of the project definition.

Data processing services

Data processing services refer to data backup, restoration, data duplication backup, and provision of website hosting services. Because the computer system is composed of many components, the failure of any one component may lead to data damage or loss, which will destroy the long-established data. Therefore, data processing services are a necessary part of maintaining enterprise information security, and due to the demand for information security, market opportunities for solving enterprise information security solutions are driven; as enterprises gradually become electronic, the product and service ecosystem of the information security system is gradually increasing. With the difference between emerging technologies and emerging scenarios, in the future era of cloud computing, 5G and the Internet of Everything, firewalls, user and physical device behaviour analysis, endpoint detection and response, information security coordination, automation and response, Network traffic analysis and other related technologies, with different scenarios such as cloud computing, 5G, Internet of Things, big data, Internet of Vehicles, Metaverse, and industrial control, have quite different information security practices. It is estimated that it will drive a new wave of Information security technology development and market opportunities.

Channel Distribution

Channel distributors provide packaged software sales, including commercial software, development software, office application software, etc. for domestic and foreign brand operators. They also provide education and training on customer-related software to help customers and consumers use the software they sell as agents.

What are the Capabilities that Software Service Talents Should Have?

We divide the abilities that software service talents should have into soft and hard. described as follows:

Soft skills

According to the expert questionnaire and fuzzy evaluation results, the following ten abilities are obtained, which are the skills that software service personnel must have.

Table 1. Soft skills that software service personnel must have,

No.	Skill	Description of skills
1.	ability to innovate	Software service personnel must have the ability to come up with creative ideas on a regular basis.
2.	ability to communicate	Software service personnel must have good communication skills with customers and know the needs of customers.
3.	ability to listen	Software personnel need to know what is in the mind of the customer? What do they want? Therefore, they must have good listening skills.
4.	Ability to interview and ask questions	Software service personnel should have the ability to interview and ask questions. For some problems, perhaps the customer does not know where the problem is. At this time, the software service personnel must have the ability to ask questions about the problem.
5.	analytical ability	Software service personnel must have the ability to analyze problems in detail.
6.	enabling ability	For some problems, sometimes software service personnel are required to facilitate them to be successful, so the ability to facilitate the success of things is one of the abilities that software service personnel must have.
7.	ability to observe	Whether a software can run smoothly or not depends on the service personnel to observe its subtleties and understand whether it can work. Therefore, the ability to observe is also one of the skills that software service personnel need to have.
8.	ability to write	Only by putting ideas into words can ideas not be fleeting. This is the ability of writing. It can faithfully record various ideas and turn them into experiences that can be accumulated.
9.	organizational capacity	Organization is one of the conditions that make software work smoothly. Therefore, software service personnel must have the ability to assist the organization to operate smoothly.
10.	interpersonal skills	The interpersonal relationship is the key to discovering the smooth functioning of software. Therefore, good software service personnel, of course, must also have this ability.

Hard skills

The professional knowledge required by software service talents can be roughly divided into three categories: software engineering, project management and business areas.

First of all, due to the importance of requirement analysis, many important technologies and methods have been developed for requirement analysis in software engineering, such as use case and data modelling, which should be learned by software service professionals and flexible use in the project.

In addition, software service talents must also be proficient in the so-called requirements engineering and management skills, understand that in addition to establishing requirements, they also need to be managed. Process analysts must also possess expertise in sound project management, risk management, and quality requirements, and how to apply this knowledge at different stages of the software development life cycle to ensure project success.

What should be Included in the Software Service Course

Professionally, the required courses are as follows:

Table 2 Basic compulsory courses

Course Title	Course name for different courses	credits
programming	computer programming	3
	Computer Programs and Applications	
	Advanced Language Programming Internship	
	Computer Programming Internship	
Object Oriented Methods	Object Oriented Programming	3
data structure	data structure	3

Table 3 Intermediate elective courses

Course Title	Course name for different courses	credits
Internet Technology and Application	database system	3
	Introduction to Databases	
	Database management	
	Database Systems and Applications	
database system	Internet Services Software Engineering	3
software engineering	software engineering	3
	Introduction to Software Engineering	

| Application software design | Application software design | 3 |
| | Applied Software Design Internship | |

Table 4 Advanced elective courses

Course Title	Course name for different courses	credits
Advanced Object-Oriented Programs	Object Oriented Programming	3
Object Oriented Software Engineering	Object Oriented Analysis and Design	3
	software engineering	
	Software Testing and Verification	
	Object Oriented System Analysis	
Internet Services Software Engineering	Internet Services Software Engineering	3
Personal software program	Personal software program	3
software architecture	software	3

Advantages of India's Education System in Software Services

From the abilities and courses that software talents must have above, let's look back and see why India's education system can give him a great advantage in software services? (Tilak, 2013).

India, where 70% of the population is illiterate, is an important canter for the cultivation of global software talents. How can poor India cultivate the world's hottest software engineers? What kind of education method can make students show competitiveness as soon as they leave campus?

One-third of software engineers in the US are Indian. It is not news that 250,000 Indians have penetrated into Silicon Valley (Vijayabaskar & Babu, 2022).

Nearly half of the high-tech talent work visas (H1-B) in the United States are issued to Indians, and the remaining half are divided among dozens of other countries.

Ask Indian engineers why they are strong in software, and the first answer must be: "We are good at math."

Mathematics deduces from definitions and theorems, and solves problems step by step, which is consistent with the analysis, logic, and ability required to write software.

Indians not only invented numbers and arithmetic, but also discovered many important mathematical theorems, such as the formula for the area of a triangle and pi. From ancient India to modern times, mathematics is the driving force behind the logical thinking of Indians and is as precious as Indian religious philosophy.

Strong communication skills are an important part of Indian software talents. Most of the Taiwanese engineers are "reticent, do more and talk less", but the Indian engineers can talk for an hour, still radiant, with

dark faces and bright eyes. And I have to admit that they have something to say and are coherent. This is actually part of software education.

Most Indian engineering colleges have a class: communication skills. "We have to keep giving speeches on stage," said Prakash, a junior at the Hyderabad Institute of Information Technology, with a smile. "At first I was nervous and shivering, but now I'm used to it."

The family system of schools and industries has also created the unique software capabilities of Indians. In addition to the students' hard work and excellent professional ability, software education in India has a special feature, that is, it has a very close interaction with the industry, and students are completely independent of the development of new technologies. This is one of the reasons why Silicon Valley has a particular preference for Indian engineers. (Parthasarathy, 2000, 2004)

In addition, high English proficiency is also a forte of Indians. All intellectual Indians can speak fluent English, which can be said to have an innate advantage in a world where most of the software world uses English to communicate.

Conclusion

This study explores how the software supply chain can cultivate outstanding talents, and draws the following conclusions from the results of the study:

1. The supply chain of software services, including application/system software design and development, system integration services, data processing services, and channel distribution, etc.

2. The abilities that software service talents should possess, including both soft and hard abilities, are indispensable.

3. The content that the software service course should include includes three parts: basic, intermediate, and advanced.

4. The advantages of India's education system in software services are reflected in their education system and thinking, which also enables their software service industry to develop rapidly.

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