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Business



APPLICATION OF ARTIFICIAL INTELLIGENCE TECHNOLOGY

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Abstract

Because of the rising level of computer development in our country at present, computer network technology has begun to integrate more and more deeply into all aspects of social life, including production, education, life and so on, which has a great impact on everyone's life. The integration of computer network technology and AI technology has not only promoted the perfection and development of this new technology, but also helped the computer network, which has been developing for a period of time, with a relatively complete technology system can make a breakthrough and develop to a new level. By adding AI technology, it fills up the deficiency of computer network in intelligence, and also provides a development direction with technical foundation, which lays a solid foundation for the maturity of computer network technology.

Keywords: artificial intelligence; computer network; applied research

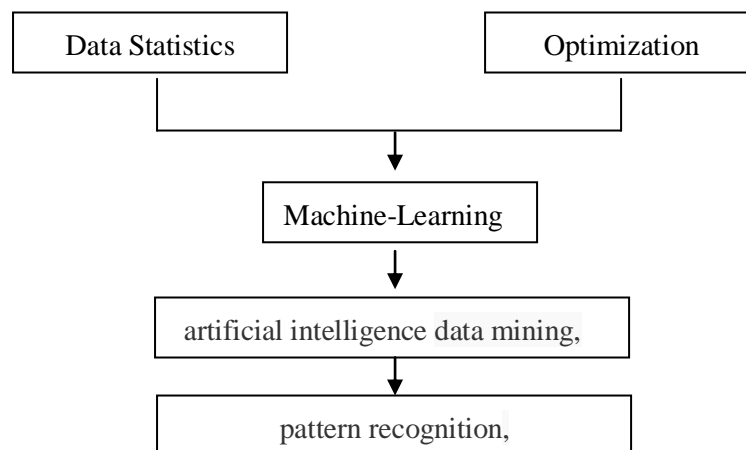
Introduction:

With the development of information technology, the core problems to be solved are not the same. In the stage of rapid development of information technology, information has become a very important social resource, teaching progress, enterprise development. Social reform cannot be separated from the analysis of a large number of information, interpretation of the development trend behind a large number of information. Therefore, how to collect information and deal with information as a useful resource is an important direction to be solved by computer technology. Nowadays, information technology is looking forward to higher development, so what is seen is the continuous breakthrough of computer network technology itself, such as higher code efficiency, more intelligent system, more diverse functions and so on. In order to achieve this goal, we must move towards new development directions, such as Internet of things technology, big data and cloud computing, and AI technology to be talked about today.

I. Brief introduction to artificial intelligence technology

AI technology is a newly developed technology. It uses computer technology to simulate and model human thinking methods in order to achieve the intelligent function of machines. In fact, AI technology refers to the use of technology and technology to replace the human brain and human to a

certain extent to complete some operational tasks, from the direction of human intelligent mechanization research, improve the efficiency of intelligent machines and devices. With the further development of contemporary information technology, human research in the field of AI technology, as well as the emergence of a lot of new theoretical technology, scientific research achievements, excellent ideas on the whole road of exploration, these elements have laid the foundation for the continuous improvement and progress of AI field, so that mechanical intelligence becomes the theme of scientific and technological development. AI use of technology in computer networks and his integration in people's daily life is the same, one is for the continuous development of technology, the other is for the convenience of life. Effectively improve people's way of life and quality of life. There are many such examples, such as smart speakers that simply implement the function of people using voice control machines, as well as simple dialogue functions. Today's voice speakers can not only control themselves but also control other related devices. Through these smart home devices, the daily life is increasingly intelligent.



II. Advantages of artificial intelligence technology in computer networks

First of all, AI technology does not need to describe rigorous data models, mainly using fuzzy logic for reasoning and processing, so it can achieve efficient processing of unknown problems. However, the computer network system contains a lot of unclear information, and this information is also unstable information, which brings great inconvenience to the processing of this information. Application of AI technology in computer network system can help to improve the ability of computer information processing.

Secondly, the control cooperation ability of AI technology is outstanding, and the use of AI technology to process all kinds of data and information existing in the network can help computers to improve the efficiency of information collection, information processing, information use and so on. By using information technology to complete a large number of information processing work, we can not only realize the separate detection and function adjustment of different modules for the whole

processing system, but also make the whole system more intelligent and intelligent. After AI technology is added, the information processing system is controlled by machine.

At the same time, the work of AI technology will be much less expensive than the labor period. By using AI technology to calculate and analyze the data information in all aspects of computer system, it can reduce the corresponding resource loss and greatly improve the efficiency of computer. After each program in the computer network is controlled by the AI technology, the rate of computer work will be greatly improved, and the unique computing task can be realized by optimizing the scheme, so that the computing resources can be used economically. Improve the application performance of computer processing information technology. For example, in order to determine the popular orientation, a company needs a lot of random and real data to determine the direction the public likes. The traditional solution is to do a market research, in which the paper questionnaire is the most time-consuming and inefficient, it is difficult to ensure the validity of the data; In the big data era, this kind of thing also has a new solution, that is, through people browsing traces on the Internet to analyze the corresponding sniper orientation, so that the analyzed data is true and reliable, and the efficiency is greatly improved. The only drawback is that each company needs a custom system, which makes the investment more large and the process more verbose; Nevertheless, if the AI system is added to the system, the AI system will automatically complete the last step that requires manual analysis, lighten the burden of manpower, and if the artificial intelligence function is perfect, a system can solve several needs. Then the cost will be reduced and the data processing efficiency will increase.

Fourth, AI technology is strong in dealing with nonlinearity and learning. AI technology is the most prominent feature of its autonomous learning ability, which is a powerful advantage different from other emerging technologies. The network is full of a lot of information, some of which are simple and low-level information. It is the most useful information in the process of information processing. Many large manufacturers do such information processing when developing new products to help their products determine the direction of production to get more audience. Use the results of such information processing to confirm the trend of product development to promote the accuracy and efficiency of product development and positioning. The simplest way is to look at the relevant hot words that are searched. A high search frequency in that direction means that the audience in that direction is wider and that the public access points of current public concern can be known. And then understand the company in the solution development process to see industry problems, relevant policies and so on.

表 1: 2013-2018 年中国人工智能行业投资金融及频次情况分析表（单位：亿元，次）

年限 / 频次 / 金额	2012 年	2013 年	2014 年	2015 年	2016 年	2017 年	2018 年
频次 (次)	27	49	124	214	308	352	602
金额 (亿元)	28	28	111	451	760	754	1278

表 2: 人工智能在各个新型产业融合应用情况表（人工智能所占百分比%）

企业技术集成 与方案提供	智能机器人	关键技术研发 和应用平台	新媒体和数 字内容	智能医疗	智能硬件	金融科技	智能商业和 零售	智能制造领 域企业	智能农业的 占比最低
15.43%	9.66%	8.91%	8.91%	7.65%	7.03%	6.65%	6.52%	6.15%	0.75%

III. Importance of applying AI technology to computer networks in the age of computer networks

Computer network information system refers to a huge set of information which is related to people's behavior on the Internet, but in order to make effective use of computer network, It is necessary to process the massive information contained in computer network effectively and apply computer network technology. But the interface of the computer is as numerous as the information it contains, so the security of the computer is difficult to be well guaranteed in the case of so many entrances. In this case, the information circulated and stored in the computer is easy to be attacked and destroyed. AI technology is based on computer technology to produce and develop, AI technology can be used to overcome the problems encountered in the use of computer to process massive data information, It can optimize all aspects of computer network to ensure that it can operate better in practical application. AI the application of technology in computer network, it can also improve the hierarchy of computer network management, divide computer network management into three modules: application, operation and security, and ensure that the three modules can communicate and transmit information to each other, so as to improve the security and efficiency of computer system. With the development of AI technology, in the management and control of computer network, the control objects in computer network can be effectively analyzed, and the path and flow can be allocated intelligently, so as to solve the problem of computer network management quickly.

IV. Application of artificial intelligence technology in computer networks

With the vigorous development of Internet technology, all kinds of new technologies are rising like spring shoots after rain. Computer technology has been applied to all aspects of social life. Nowadays, the AI technology that used to be marveled is also beginning to appear in people's life. It brings convenience to people's daily life, such as smart home, smart speaker, and all kinds of guided robots, all belong to their posts, silently glowing and heating, to promote social development, Improve the convenience and comfort of social life to provide a solid material basis. AI the development of technology must be combined with other existing technologies, which not only enables the development of this new technology to have a more solid foundation, but also provides a new breakthrough direction for the existing technology. To help the old technology and the old industry to upgrade, mutual benefit can be a better direction of life.



4.1 Application of AI Technology in Network Management

In a period of time, network security has been a concern. It involves a wide range of aspects, complex content, huge receptor, which leads to network security management is a difficult problem to eradicate, and to achieve a better network security management effect is also a lot of manpower and material resources, so the economic benefits of doing so are very low. AI the stage of technology integration, however, this situation can be improved very well, because AI technology can greatly replace the work that needs manpower operation in the past. Through the functional interaction and information exchange between the scheduling network system of machine program, it can reduce a lot of manpower input and reduce the cost of use. At the same time, network management is not only computer network security management, but also evaluation management system. The advantage of system evaluation is to combine computer network technology with various services, to realize interaction and feedback, to strengthen information sharing and control. However, this artificial intelligence processing method is likely to be affected by the subjective factors of the operator, and its behavior is completely unreasonable; the application of artificial intelligence technology will improve the applicability of computer network technology. Provide technical support for network management and system evaluation. Application of artificial intelligence technology can make IT system self-diagnosis, feedback, calculation error information. The application of artificial intelligence technology in the evaluation of computer network system can help users understand the performance of computer network system, effectively solve the problems in computer application, and evaluate computer system comprehensively and efficiently. After the computer is hacked or warned by the virus, the AI technology creates corresponding operation instructions to ensure the operation of the network security system. For example, the knowledge base technology also reflects the application of artificial intelligence technology. The main purpose of the knowledge base is to acquire, encrypt and process direct or indirect knowledge about computer network systems so that network management decisions can be supported by experts and properly managed and evaluated by experts. Through the application of knowledge technology, we can carefully analyze and evaluate various network structures of network systems, analyze their functions, quickly discover errors in the system, and apply knowledge technology to improve the system. In order to improve the effectiveness of computer network technology and the system can be improved.

4.2 Application of artificial intelligence technology in communication interaction management

The application of computer network technology has greatly changed people's lives, but it is based on network technology. Because the function of network itself is interaction and connection, network technology has the characteristics of "inclusiveness" and "openness ". While appreciating the convenience of interactive connection between networks, people should also prepare for the potential use crisis caused by this open and interoperable technology. In the network world, security often means encapsulation, invariance, solid state, which is not satisfied with the theme that the computer wants to express, that is, at the original technical level, It is impossible to carry forward

the advantages of the network while taking into account the security of the network. Therefore, the network operation environment, the input and output port of the handover connection and all the algorithms cover places, need the external operation protection mechanism to ensure the safety and effectiveness of the whole operation environment. In the context of network applications, when there are serious operational security problems in the network that people are using, people usually use the relevant network technology to manually process the information in the computer system, but manual processing can easily lead to the original effective and useful data information being incorrectly processed into false and incomplete data. When the data is re-entered into the computer network, it has lost the value of use, not only affects the value of the system, but also the data is difficult to be cleaned out, resulting in the waste of internal space of the system, and the wrong data may also lead to the algorithm when accessing the data, Causes the algorithm to run the program to appear the breakdown, affects the normal use. To a certain extent, the application of AI technology to computer network technology can ensure the security of computer network information. Using artificial intelligence technology to control the operating environment of computer network, The application of artificial intelligence system can improve the security of computer network information, Reduce data loss and manipulation and ensure the stability of computer system. To ensure the stability of the system, through the application of artificial intelligence technology, we can identify the security risks in the computer network system, improve the efficiency of security risk response, and improve the security and efficiency of the computer network system.

4.3 Application in system management and evaluation

(1) Application in solving problems

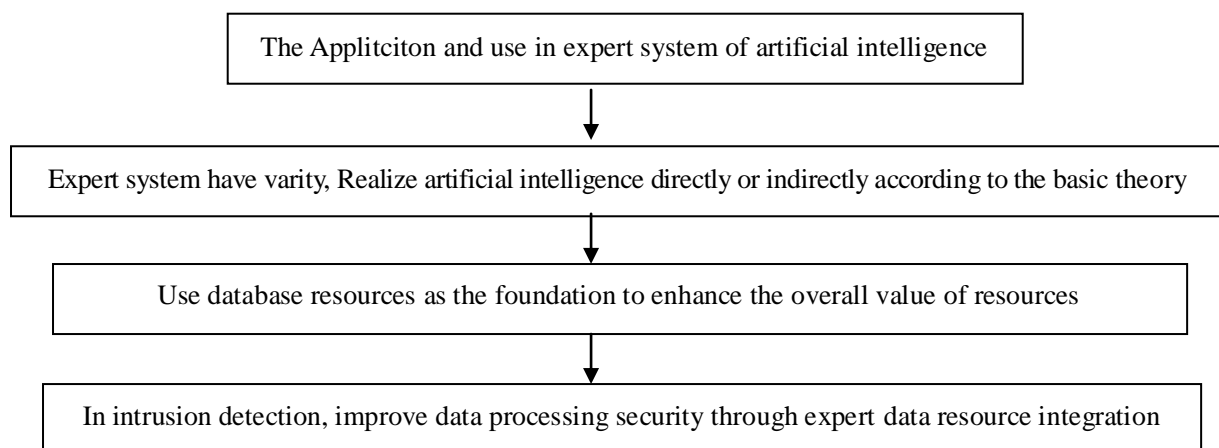
The research of algorithm is to realize the modeling, analysis and solution of practical problems in the field of computer. The ability to solve problems is also a decisive factor affecting the true effectiveness of an algorithm. In the period of computer network development, the efficiency of this algorithm for problem solving has been regarded as an important research and development object by relevant technicians. When AI solve the problem, AI find the right solution path to find the fastest and best solution by reasoning and analyzing the given information. When it comes to functional evaluation, it focuses on whether the solution can be reached quickly and is the most reasonable, which can be expressed by the following formula 1(the shortest path from s to n is equal to the path from n to g). By evaluating in this way, AI technical solution can find the best solution to the problem and greatly improve the efficiency of computer operation.

$$f^*(n)=g^*(n)+h^*(n)$$

(2) Application of knowledge base

There is a special system for the application of knowledge base. How to use it is not difficult. What is important is what the knowledge base should contain and how to build it. These

include the first steps that anthropologists propose to use, and then communicate with programmers to improve the knowledge base through the consideration of experts and programmers, and then the coding framework of the system. Such a knowledge base is complete. For the whole knowledge base, this process is only from learning "graduation", it only has a lot of theoretical knowledge, but these knowledge is very difficult, but it is not necessarily comprehensive, at this time need the system itself in the future practice process, Through the AI technology blessing self-study ability, to achieve continuous improvement, adaptation and development. Such a knowledge base has a longer-term use value.



Concluding remarks:

Technology is always constantly innovating and developing. Therefore, in this case, the test of time is the real excellent technology, and it is for this reason that there is a AI technology and computer network technology fusion technology breakthrough. The combination of the two makes today's use of a huge foundation of computer network technology has been injected into a tube of "strong needle ". AI the autonomous learning ability of computer network technology, it helps computer network technology to complete faster and better technology reform, and at the same time strengthens the expansibility of computer network technology. AI technology is the most advanced science and technology. It is a powerful means for the development of computer technology and an important direction for the development of computer in the future.

References:

- [1] Chen Jiayin. On the Development Direction —— Computer Network Technology from Internet of things to Brain Network [J]. Analysis Light Industry Technology, 2020, 36(12):42-43 46.
- [2] Zhang Jun. Application and Prospect of Computer Network Management System [J]. Light Industry Technology, 2020, 36(12):49-50.



- [3] Zhan Xinyi, Wang Xia. Application of artificial intelligence in computer network technology in the era of big data [J]. 5 Science and Technology Innovation and Application, 2020(33):168-169.
- [4] Wang Guannan. On Artificial Intelligence and Computer Network Technology[J]. Digital World, 2020(11):22-23...
- [5] Liu Zhun. Analysis on the Application of Artificial Intelligence Technology in Computer Network Security Management [J]. Computer knowledge and Technology, 2020, 16(30):34-35.
- [6] Zhai Chunjie. A Case Study on Machine Learning in Artificial Intelligence Course [J]. Fujian Computer, 2020, 36(10):161-164.
- [7] Jiang Zhien. A Study on the Application of Artificial Intelligence in Computer Network Technology [J]. Digital Communications World, 2020(10):188-189.
- [8] Zhang Xiaochuan. A Study on the Application of Artificial Intelligence in Computer Software Development [J]. Microcomputer Applications, 2020,36(09):163-165.
- [9] Liu Qingjie, Wang Jinfeng, Feng Yanru. Research on Artificial Intelligence Technology in Computer Network Big Data —— Review of Reality Interaction: Human-Computer Interaction Technology under Artificial Intelligence [J]. Mechanical Design, 2020, 37(09):157.
- [10] Chai Xiang Yu. Design of Computer Network Security Defense System Based on Big Data and Artificial Intelligence Technology [J]. Network Security Technology and Applications, 2020(09):52-53.

BUSINESS IMPACTS AND GOVERNMENT SUPPORT FOR FIRMS' UPGRADING AND INNOVATION UNDER COVID-19 IN SOUTHEAST ASIA

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Abstract

This paper attempts to identify the impacts of the coronavirus disease 2019 (COVID-19) pandemic and the challenges posed to the business sector in the context of Southeast Asia. Due to the crisis and subsequent containment measures, most enterprises in the region had to suspend their businesses either temporarily or permanently and, consequently, suffer from a liquidity crisis. Although most enterprises realised the importance of innovation and technological upgrading and promoting new businesses like e-commerce, financial technology (fintech), and teleworking, not many could make these measures a reality. In response to the COVID-19 pandemic, all countries have been heavily focusing only on short-term policy issues, such as economic lifelines and short-term recovery. In contrast, longer-term and structural issues have not paid enough attention. Without the structural adjustment of business models and operations to the new normal, enterprises are vulnerable and less resilient to future risks. Hence, there is still substantial room for policymakers to develop and improve longer-term policy measures that can potentially reform the structure of both the public and private sectors. Although half of the countries in the region have started initiatives regarding technological upgrading and innovation, the depth and dimension of the policy measures are still limited. On the one hand, less developed countries, i.e., Cambodia, the Lao PDR, Myanmar, the Philippines, and Vietnam, have not explicitly initiated policy measures related to innovation and technological upgrading. On the other hand, Brunei Darussalam, Indonesia, Malaysia, Singapore, and Thailand, to at least some extent, utilise support measures to promote innovation and technology in both the public and private sectors. In general, sporadic incentive programs (rather than holistic measures), generic capacity-building programs (rather than targeted innovation-capability development), and economy-wide innovation policy measures (rather than industry or sector-specific measures) are observed in most countries.

Keywords: COVID-19, Southeast Asia, technological upgrading, innovation, innovation policy

1. Introduction

Since the first quarter of 2020, most countries worldwide have been hit hard by the ongoing coronavirus disease 2019 (COVID-19) pandemic, posing great challenges to global public health systems. As of 10 December 2020, 67.8 million cases have been confirmed worldwide, while the total number of casualties has surpassed 1.5 million people. Several countries have resorted to a series of lockdowns and severe restrictions on public activities to contain the scope and scale of the disease. Consequently, the pandemic has caused short-term fiscal shocks and long-term adverse shocks to the growth of the global economy, disrupting global value chains, discouraging domestic and international consumption and investment, and imposing uncertainties in financial and foreign exchange markets. The world is facing a great trade-off between a health emergency and economic crisis from social distancing policies and the global and national lockdowns.

The economic impacts of the COVID-19 pandemic are expected to be substantial. Due to the initial direct impact of lockdowns, several economies could experience a decline in the level of output of between one-fifth to one-quarter and a drop in consumer expenditure by one-third (OECD, 2020a) and face negative per capita income growth in 2020. Developed countries, such as France, Germany, Italy, Japan, South Korea, and the United States (US), are predicted to be in a recession with the gross domestic product (GDP) at -5% , -6.8% , -1.5% , -1.8% , and -2.8% , respectively (EIU, 2020). The World Bank (2020a) projects at least a 2% drop in global GDP, while the International Monetary Fund (IMF) expects global GDP to fall by 4.9%. In addition, the Organisation for Economic Co-operation and Development (OECD) (2020b) is more pessimistic and predicts that global GDP will fall by 6%–7.6%, depending on the possibility of a second wave of the pandemic in the fourth quarter. However, a modest rebound in the growth of the global economy of 2.8%–5.4% is expected in 2021 (IMF, 2020a; OECD, 2020b). International investment and trade are also anticipated to slow down. In its recent forecast, the United Nations Conference on Trade and Development (UNCTAD) (2020) indicates a clear fall in global foreign investment by up to 40% in 2020, potentially leading to a drop of 45%–50% in 2021. According to the World Trade Organization (WTO) (2020), the volume of world trade is estimated to decline by 3% and 18.5% in the first quarter and the second quarter of 2020, while the drop in global merchandise trade may reach 32% by the end of the year. In terms of global employment, 5.3 million–24.7 million people are expected to lose their jobs due to the impact of COVID-19 (ILO, 2020). Equivalent to 195 million global full-time workers, a 6.7% fall in working hours will further aggravate the global employment situation.

The pandemic has triggered drastic changes in consumption patterns (e.g., higher reliance on online and delivery services) and employment (e.g., the prevalence of working from home and virtual meetings), posing significant uncertainty for all economic actors. The risks are even more pronounced among consumers and producers who have no access or limited access to technology and innovation. Even though the underlying costs and benefits of a “new normal” economy are still unclear, one positive side of the pandemic is that it transforms the global economy and accelerates the progress of Industry 4.0 in unprecedented ways. The affected private sector is forced to adjust its business model as well as upgrade the existing processes, products, functions, and positions in value chains through the adoption of new technology and innovation. Against this backdrop, this study realises the importance of technology as well as relevant policies and, therefore, places the topic of firms’ upgrading and innovation at the centre of the analysis and discussion.

This paper does not cover health issues related to containing the spreading of the virus or attempts in developing test kits, drugs, vaccines, or medical equipment. Instead, it aims to identify the impacts of the COVID-19 pandemic and challenges posed to the business sector in the context of Southeast Asia. Economic forecasts of key economic indicators such as GDP, trade, investment, and investment are presented, while a discussion of the results of business surveys conducted in some countries in the region is provided. Moreover, the paper explores the current policy responses to the pandemic shock and economic shocks, particularly those related to firms’ upgrading and innovation. Previous studies (IMF 2020b, OECD 2020a, OECD 2020c) have focused more on general policy responses to the COVID-19 pandemic rather than innovation policies, especially long-term ones promoting the transformation of businesses and innovation after the pandemic. By comparing the existing challenges with the current policy responses, this paper finds that all countries in the region have been heavily focusing only on short-term policy issues, such as economic lifelines and short-term recovery. In contrast, the longer-term and structural issues have not been paid enough attention. Moreover, although half of the countries have started a few initiatives regarding technological upgrading and innovation, the depth and dimension of the policy measures are still limited. Only

sporadic incentive programs (rather than holistic measures), general capacity building programs (rather than targeted innovation capability development), and economy-wide innovation policy measures (rather than industry or sector-specific measures) are observed in most countries.

The paper is organised as follows. The next section briefly discusses the economic impact of the pandemic shock on the overall economy and the business sector in Southeast Asia. Furthermore, the challenges that have emerged from and are accelerated by the COVID-19 pandemic are also identified. Section 3 presents the current pandemic policy responses by each Southeast Asian country. Section 4 concludes the paper and provides policy recommendations.

2. The Impact of COVID-19 and Challenges in Southeast Asia

2.1 Overall impact

Despite the global scale of confirmed COVID-19 cases and the related death toll, the pandemic situation seems to be under control in the Southeast Asian region, except for Indonesia, Myanmar, and the Philippines (Figure 1). Initially, countries in the region were criticised due to their late responses to COVID-19 before the disease quickly started to spread in the region. After March 2020, the number of confirmed cases started rising in several countries, including Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam. With a time lag, the number of COVID-19 cases in Myanmar started to rise in August and soared to 17,794 cases within a month, ranking fourth within the region. However, since then, most countries have been able to prevent the further expansion of the COVID-19 pandemic thanks to effective lockdown and containment measures. The number of new cases is either zero or very low in many countries. For instance, even though Singapore was suffering from a high number of cases during the past few months, it has finally been able to flatten its COVID-19 curve since the beginning of August. In contrast, Indonesia, Myanmar, and the Philippines still have not reached the peak of their COVID-19 curves; therefore, these countries urgently need more effective policy responses.

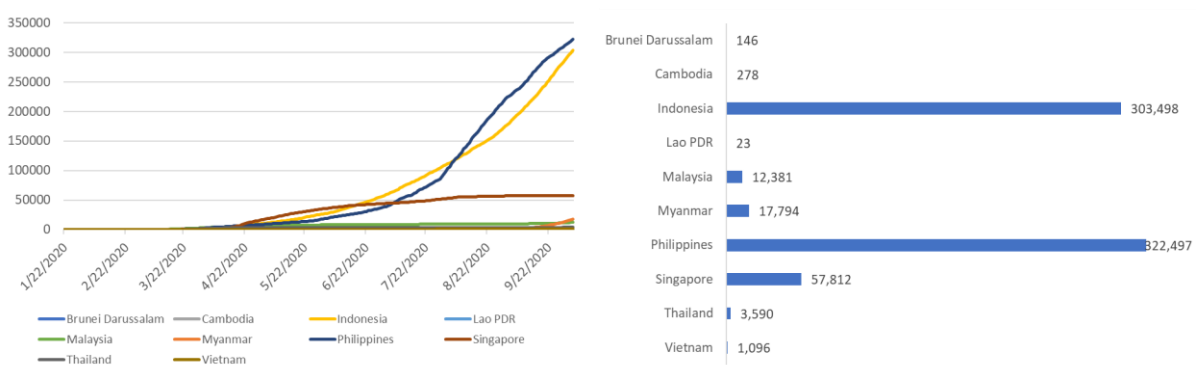


Figure 1: COVID-19 pandemic curves and the number of confirmed cases (as of 4 October 2020)

Lao PDR (Lao People's Democratic Republic).

Note: The date format on the horizontal axis is month/date/year. COVID-19 = coronavirus disease.

Source: Adapted from Dong, E., Du, H., & Gardner L. (2020) (accessed 4 October 2020).

While reducing the scale and scope of the pandemic as well as saving the lives of citizens, the implementation of lockdown, containment, and social distancing measures come with great costs, such as economic crisis, a disruption of regional and global value chains, and a collapse in consumption and confidence, among others. Economic forecasts issued in November 2019 depicted a

moderate economic growth at 4.9% for the region for the period 2020–2024 (OECD, 2019). In May 2020, the Asian Development Bank (ADB) released a policy brief on an updated assessment of the economic impact of COVID-19 and projected a 4.6% drop in the region’s GDP in the case of a shorter-containment scenario (where the outbreak lasts for three months), compared with a world without COVID-19, and a 7.2% fall in the case of a longer-containment scenario (where the outbreak lasts for 6 months), with a double-digit decline in some of the worst-hit countries, i.e., Cambodia (13.8%–20.2%), Malaysia (11.27%), the Philippines (11.52%), Singapore (10.26%), and Thailand (17.22%) (Table 1). Under the two scenarios, output in the region will be down by \$163 billion–\$253 billion (4.6%–7.2% of the regional GDP). The initial direct impact of the shutdowns and quarantines largely came from the sharp decline in international tourism demand, followed by the drop in domestic demand and global spillovers. Even before the COVID-19 outbreak, with some exceptions, consumer sentiments across the region had been on a decline since the last quarter of 2018 or the first quarter of 2019. The pandemic led to a further deterioration of consumer confidence with a sharp drop after the first quarter of 2020 (Figure 2). Moreover, due to border closures, travel restrictions, and lockdowns, a significant impact of the outbreak is also observed for international trade. In Southeast Asia, a trade loss under the two scenarios is estimated to be approximately \$229 billion–\$344 billion (Table 2). Regarding the impact on employment, the pandemic will lead to employment losses equivalent to 11.6 million–18.4 million jobs under the shorter-containment and longer-containment scenarios, respectively (Table 2). Additionally, wage incomes will drop between \$25 billion and \$39 billion across the region (Table 2).

Table 1: Impact of COVID-19 on the GDP and GDP Growth of Southeast Asia, 2020

Country	Economy-wide Impact (as % of GDP)		Forecast of GDP Growth
	Shorter Containment	Longer Containment	
Southeast Asia	-4.6	-7.2	na
Brunei Darussalam	-5.68	-8.45	na
Cambodia	-13.79	-20.19	-3.21
Indonesia	-5.77	-8.61	-1.74
Lao PDR	-5.94	-8.78	-2.15
Malaysia	-7.62	-11.27	-2.09
Philippines	-7.73	-11.52	-2.46
Singapore	-6.92	-10.26	-2.08
Thailand	-11.71	-17.22	-3.03
Vietnam	-5.96	-8.84	-2.69

na (not available).

Notes: Data for Myanmar are not available. The impact of COVID-19 on GDP and GDP growth is reported as the number compared with a world without COVID-19. A shorter-containment scenario represents a scenario where the outbreak lasts for three months, while a longer-containment scenario represents a scenario where the outbreak lasts for six months.

Source: Adapted from Abiad et al. (2020), Park et al. (2020), and World Bank (2020a).

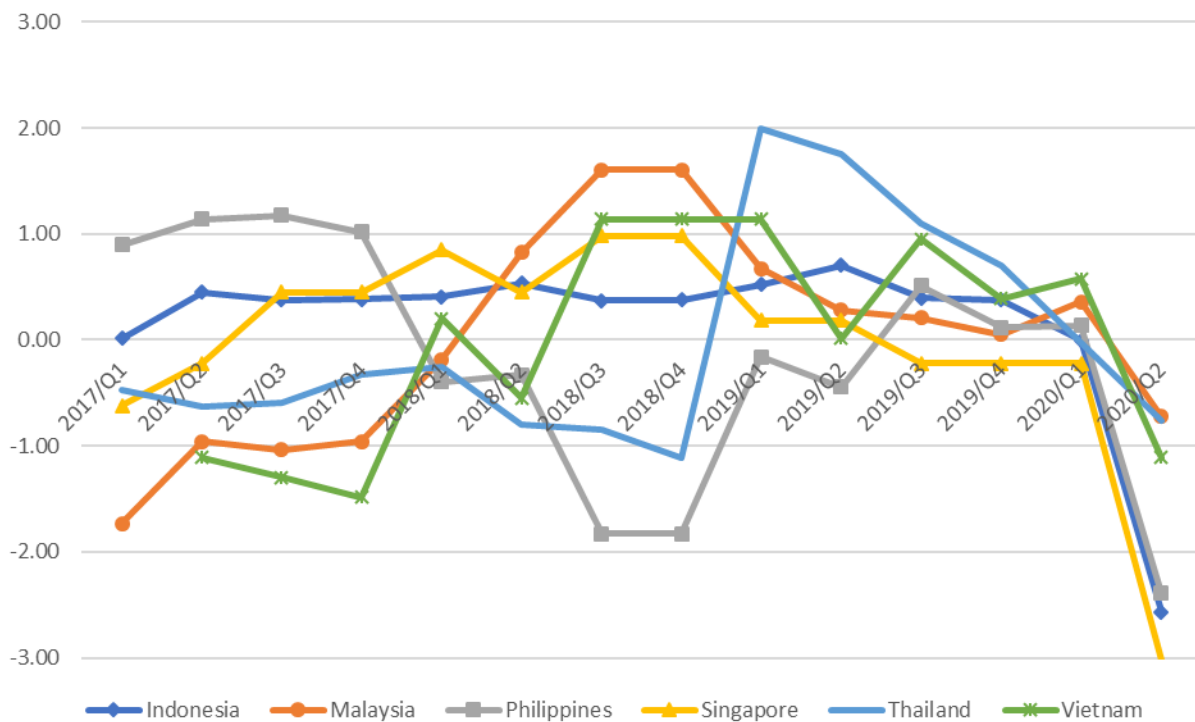


Figure 2: Consumer Confidence in Southeast Asia (2017–2020)
Q (quarter).

Note: Due to differences in the scales used, the consumer confidence data are standardised.

Source: Consumer confidence survey data from TheGlobalEconomy.com (2020).

Table 2: Major Economic Impacts of COVID-19 on Southeast Asia under Two Scenarios

Impact	Shorter Containment	Longer Containment
GDP (\$ million), excluding policy measures	–163,223	–252,899
GDP (%)	–4.6	–7.2
Trade (\$ million)	–229,495	–344,434
Trade (% of GDP)	–6.5	–9.7
Employment (million)	–11.6	–18.4
Wage Income (\$ million)	–25,047	–38,986

Note: The estimates were released in May 2020.

Source: Adapted from Abiad et al. (2020) and Park et al. (2020).

2.2 Impact on the business sector

Based on multiple firm-level surveys in each country, this section briefly discusses the current situation of the business sector and identifies its challenges and assistance needs under the COVID-19 pandemic. Even though the surveys' methodology of data collection, such as sample size, timeframe, and scope of questions, vary significantly, the survey results, to some extent, can provide valuable information regarding the impact of the COVID-19 outbreak on enterprises in the region. To the best of our knowledge, enterprise surveys in Brunei Darussalam and Cambodia could not be identified.

Indonesia (ILO, 2020)¹: Overall, two-thirds of enterprises reported temporarily or permanently closing their operations, with small enterprises being worst hit by COVID-19. Over a quarter of respondents reported a drop in revenue of more than 50% in the first quarter of the year, while 90% of firms experienced cash-flow shortages, creating a liquidity crisis and making access to finance and the deferral of payments (e.g. utility bills, social security premium, and taxes) among the top priorities for government assistance. The significant drops in revenues and temporary business closures put pressure on the capacity of enterprises to retain their employees. Approximately 63% of the respondents had already let go of some of their workers, and some respondents noted they would need to do so in the future. In response to the crisis, nearly one-third of companies highlighted online business as a key strategy, while one-fifth of companies resorted to product diversification to respond to emerging demand. However, the firms' capacity is still limited as more than two-thirds of enterprises cited teleworking or work-from-home (WFH) connectivity as a major challenge. Government assistance for survival and adaptation to “after-corona” is ranked the most needed support measures from the government.

Lao PDR (LNCCI, 2020)²: Firms in the tourism sector were worst hit by COVID-19, with 62% of respondents reporting a high risk of ceasing business operations instead of, on average, 45% in other sectors. Part of the uncertainty came from the reduction of revenue. 83% of enterprises reported lower sales due to COVID-19, with 27% facing sharp declines of more than 80% of their normal revenue in the first quarter of the year. The situation is particularly severe in the services sector, with 37% of enterprises losing revenue of over 80% compared to the same period in 2019. Due to temporary shutdowns, the most reported challenges were payments of salaries and loan and interest payments. Therefore, approximately 70% of firms are considering furloughing some employees, while almost 40% will need to reduce more than 50% of their employees. To resume their operations and continue operating after the pandemic, enterprises require government assistance in five areas: tax relief packages, rent and utility fee relief measures, soft loan and loan guarantees, grants and subsidies, and employment-related measures.

Malaysia (Department of Statistics Malaysia, 2020)³: As enterprises are facing constraints on cash and working capital, liquidity potentially becomes a serious concern. Two-thirds of respondents reported no sales or revenue during the movement control order (MCO) period, while more than half expected to permanently shut down their businesses after 1–2 months of the MCO, given that they have to provide full-time or half pay leaves to their employees. Constraints on additional credit were also alarming, as almost 70% of enterprises use their own savings as the main source to accommodate operating costs and working capital, implying high credit demand in the future. In response to a liquidity crisis, some enterprises (3.8%) have already terminated their employees' contracts. Another 5.8% reduced the working hours of their employees, and 16.5% resorted to mandatory unpaid leave. Salary payments posed the greatest challenge to enterprises (76.6%). Additionally, a lack of customers and rental payments were the second and third most-concerning issues, cited by about two-thirds of respondents. During the MCO period, firms' adaptation can be observed through operation adjustment, e.g., 12% of enterprises utilised an online platform to boost their sales, and 33.5% allowed their employees to work from home. Relating to government relief measures, 83.1% of enterprises stated that financial assistance and subsidies

¹ Sustaining Competitive and Responsible Enterprises (SCORE) Programme Indonesia of the International Labour Organisation (ILO) and its partners conducted a survey of 571 enterprises in April 2020.

² Lao National Chamber of Commerce and Industry (LNCCI) commissioned a survey of 474 enterprises in April 2020.

³ Department of Statistics Malaysia carried out an enterprise survey of over 4,094 responses in April-May 2020.

were the most needed measures, followed by policies on taxation (67%), policies on loan programs (39.1%), and the amendment of policies and related laws (30.6%).

Myanmar (World Bank, 2020b)⁴: According to the survey, 16% of businesses closed temporarily for an average of two months and anticipated that it would take at least a month to resume their operations. Moreover, the survey results revealed that over one-third of firms anticipated suspending business operations temporally or permanently within 1–3 months. Over 80% of respondents had experienced a drop in sales, while almost half-faced cash-flow shortages. Constraints on additional credit were also pronounced among local firms: around one-third of firms experienced a reduction in access to credit, with almost two-thirds relying mainly on loans from friends and family. The agriculture sector was the most affected by cash-flow shortages (64% of agriculture firms) and diminished access to credit (42% of agriculture firms). Overall, 69% of the respondents reported over a 55% drop in year-on-year profits in the second quarter. The services sector had the highest share (71%) of companies reporting a decline in profits compared to last year. To adapt to COVID-19, enterprises took several different measures. About 36% of enterprises tried to survive by starting or increasing delivery services. Moreover, around one out of five enterprises changed their production or services partially or wholly to meet consumer behavior changes and emerging demand. Only a few firms adopted online or digital platforms (19%) and WFH (6%). Regarding government support, almost half of the businesses were not aware of support programs for firms affected by COVID-19, and only 9% of firms applied for the programs. Access to loans and credit guarantees was the most common policy support desired, cited by 38% of respondents. The second and third most common requests were tax deferral/deduction or relief (11%) and utility subsidies (9%).

The Philippines (ADB, 2020)⁵: About two-thirds of the surveyed enterprises suspended business operations temporarily, while 29% were currently operating below their normal capacity, of which 78% were operating at or below 50% of their capacity. Over 75% of respondents estimated a negative impact to their April sales (80.4% on average by value) compared with March. The temporary suspension resulted in a liquidity crisis for most businesses (70%) as they did not have enough cash to remain operative. Difficulties in obtaining loans have exacerbated the situation as over half (57.3%) reported that it was more difficult to borrow than in 2019. Moreover, the crisis forced enterprises to go through employment restructuring and redundancy by either furloughing their employees (41.9%), reducing working hours (41.4%), reducing salaries and benefits (32.0%), or laying off employees (14.7%). Regarding the firms' adaptation to the COVID-19 situation, over 80% were not ready for WFH, particularly microenterprises. Even though digitalisation and technological upgrading have not been observed much among Philippine enterprises, e.g., only 14% of the enterprises utilised online platforms to sell their products, the business sector showed their interest in digital transactions (42.5%) and relevant skill training for workers (36%). Of the concerns facing enterprises, the biggest reported challenges involved payroll subsidies for workers (57.3%), the deferment of payments to the government (51.7%), and low-interest and subsidised loans (36%).

Singapore (EuroCham (Singapore), 2020)⁶: Almost one-third of respondents reported that they were significantly affected by COVID-19, whereas 48% were moderately affected, particularly in terms of sales, canceled activities, events, and meetings, among others. Overall, 88% of enterprises experienced a reduction in revenue, with 18% facing declines of 30% or above their normal revenue and 40% moderately experiencing higher operating costs. Corporate tax rebates and the delay of

⁴ The World Bank conducted a firm-level survey covering 500 firms from a wide range of industries and firm sizes during May-June 2020.

⁵ The Asian Development Bank carried out an enterprise survey from 28 April to 15 May 2020, covering 2,481 enterprises.

⁶ European Chamber of Commerce (Singapore) commissioned a poll of 50 representatives of European organisations in Singapore in February 2020. Although the survey does not represent all enterprises in Singapore, the survey results could be considered lower-bound estimates of the current business environment in Singapore.

planned goods and services tax increases were ranked the most preferred support measures from the government, at 52% and 40%, respectively. Moreover, the extension of training grants and incentives for companies for upskilling and subsidies (28%) and relief for import-export companies (22%) were the next preferred measures.

Thailand (UNIDO, 2020)⁷: The survey results revealed that one out of two surveyed small-size and domestic downstream enterprises expected to only survive for 1–3 months if containment measures are extended. Firms with a small size and low technology were worst hit by the COVID-19 pandemic and had very limited access to government support (only 26%). The automotive sector was affected the most in the manufacturing sector, showing the lowest production since 1987. The two most commonly reported impacts of COVID-19 were demand reduction and the shortage of inputs. Lower demand led to cash-flow shortages and reduced credit access; therefore, enterprises have been facing difficulties in making payments to their employees and social security as well as repaying loans to commercial banks. Overall, more than 90% of firms experienced a reduction in sales of more than half of their normal sales in the same period of the year. Despite the great concern for payments to employees, the majority of enterprises (above 80%) did not consider layoffs as the highest priority mitigation measure. The utilisation of advanced technology was the main strategy adopted as a countermeasure to the COVID-19 pandemic, particularly in the shortage of workers. Interestingly, almost 90% of large firms resorted to advanced technology, while half of the SMEs could use similar technology. Tax-rate reductions or tax deferrals and reduced social contributions were the two most common policy support measures desired, cited by 49% and 35% of respondents, respectively. The third most common request was to reduce rent and utility costs (32%) followed by better loan terms (27%).

Vietnam (Hill, Baird, and Seetahul, 2020)⁸: According to the survey, almost half of the enterprises, particularly those from the services sector, have suffered considerably from the COVID-19 pandemic and containment measures. Due to the containment measures, over 60% suspended their businesses or operated at partial capacity. The decline in customer demand posed the biggest challenge to most enterprises (84%), followed by the disruption of the supply chain. Cash-flow shortages led to the closing down of the business operations (53%), work rotation (50%), WFH (47%), and layoffs (16%). Remarkably, enterprises found emerging opportunities from new technology, such as teleworking, electronic commerce (e-commerce), and digital platforms. E-commerce and digitalisation were the most common adjustment mechanisms adopted by enterprises in response to the impacts of COVID-19, with more than one-fourth of firms reporting adopting these measures. However, one in five firms experienced internet connection problems when working from home.

Overall, most enterprises in Southeast Asia, especially SMEs, have suffered from the crisis and containment measures and, therefore, temporarily or permanently suspend their operations. Among the firms remaining operating, two in three enterprises are operating at half capacity or less. One in three enterprises face a severe liquidity crisis and may have to close their businesses within three months. The sharp drops in demand and revenue were among the greatest concerns and the main cause of cash-flow or liquidity problems. In response to the COVID-19 pandemic, most of the enterprises are aware of the benefits as well as the importance of innovation and technological upgrading, such as e-commerce, financial technology (fintech), and teleworking. Nevertheless, a very

⁷ In collaboration with Ministry of Industry, Industrial Estate Authority of Thailand and Small and Medium Enterprise Institute under Federation of Thai Industries, United Nations Industrial Development Organization (UNIDO) carried out an online survey from 15 April to 15 May 2020, receiving a complete respond from 314 firms.

⁸ The survey funded by the Australian Government, collected information regarding the impact of the pandemic and the challenges faced by private sector employers from 38 enterprises during May and July 2020.

limited number of enterprises are ready to adopt the technology. Short-term economic lifelines and recovery, e.g., grant and subsidies, soft loans, tax relief packages, deferment of debt, rent, utility fee payments, and employee-related measures, were the most common policy support measures desired by the private sector. Additionally, enterprises also call for government assistance in terms of long-term or post COVID-19 business models and operations with an emphasis on human resource development, innovation, digitalisation, and e-commerce. Table 3 summarises the policy issues under COVID-19.

Table 3: Policy Issues under COVID-19

Time frame	Policy issue
Short-term	Economic lifelines
	Short-term recovery
Long-term (post COVID-19)	Human resource development
	Business strategy and business plan development
	Innovation and upgrading (e.g., new process, new product, new function, and new sector)
	Digitalisation and e-commerce
	New market creation
	Industry 4.0-related technologies (e.g., blockchain, artificial intelligence, robotisation, and 3D printing)

Source: Authors.

3. Policy responses to COVID-19

3.1 General policies supporting the business sector

In response to the needs of the business sector, governments in Southeast Asia have initiated a wide array of measures to support enterprises, particularly SMEs, to alleviate the economic impacts of the COVID-19 pandemic on businesses. Table 4 captures the overview of policy instruments in several countries in Southeast Asia. In general, the policies can be divided into short-term and long-term ones. Short-term policies focus on firms' survival and recovery. Long-term ones aim at structural adjustment, innovation, and new business creation. Policy instruments include both financial and non-financial support, like government-organised consultancy, training, and information services. Financial support can be direct measures (providing subsidies to firms) or indirect measures through tax exemption or reduction. For Southeast Asia, policy instruments were initially applied only to certain industries or sectors affected the most by the pandemic, e.g., tourism, logistics, food, and medical supplies, among others. However, nearly all countries later expanded their policy coverage to all industries. Overall, to sustain enterprises' liquidity, current measures focus on **short-term stimulus**, including direct and indirect financial supports together with information and guidance services during the crisis. In terms of **direct financial support**, all countries deploy **grant and subsidies** (money directly given to firms), while six countries initiate **loan guarantees** (promises by the government to assume the debt obligation of a borrower if that borrower defaults), and all countries except Brunei Darussalam provide **soft loans** (loans with interest lower than market rates). For instance, Brunei Darussalam provides grants worth BND20,000 (USD 14,700) for enterprises considering adopting e-commerce and delivery services. Unconditional cash transfers, including wage subsidies, are adopted in Cambodia for specific sectors (i.e., the garment and tourism sectors); Indonesia for financial incentive programs and subsidies for loans and taxes; Malaysia for digitalisation

(RM500 million or USD 120 million) as well as the technological upgrading (RM100 million or USD 24 million) of SMEs; Singapore for short-term liquidity and long-term capacity building; Thailand for workers, farmers, and entrepreneurs; and Vietnam for enterprises with temporary closures and yearly revenues below VND100 million (USD 4300). Additionally, several countries have introduced soft loans or direct lending to enterprises via public institutions, whereas some countries provide loan guarantees to ensure access to financial resources for enterprises, especially SMEs.

Similarly, countries in the region also commonly utilise **indirect financial support**, including debt moratoriums, tax relief packages, employee-related policy instruments, and measures regarding rent and utility fees. All countries have been engaging with all kinds of indirect financial measures, except Indonesia and Myanmar, in which policy measures either to reduce, defer, or exempt rent and utility payments have not been deployed (Table 4). **Debt moratoriums** (delays in the payment of debts or obligations) also include loan restructuring and reduction or exemption of bank fees and charges. **Tax relief packages** typically involve corporate income tax, value-added tax (VAT), customs and excise duties, and other government charges, such as foreign worker fees. The government may resort to either tax reduction, tax deferral, tax exemption, or a mixture of the three methods. Due to temporary business closures and employment redundancy, all countries have introduced **employee-related measures**, e.g., measures related to social security and pension and wage and income support for enterprises to secure necessary employment and temporarily unemployed workers. Even though the introduction of indirect financial support is different across countries, the measures are generally implemented economy-wide and last for at least six months to one year.

As most enterprises do not have a sufficient capacity for crisis management, **information and guidance services** are considered the most effective and useful **short-to-long-term measures** that governments can offer during a pandemic. However, only three-fifths adopted these measures (Table 4). Indonesia, for instance, established call centres for SMEs and cooperatives affected by COVID-19 to advise businesses on how to adjust their operations during the crisis. Meanwhile, Malaysia introduced a recovery plan designed for all business categories to ensure the sustainability and rapid recovery of business operations. In the Philippines, business advisory assistance and services have been provided to affected SMEs under the Livelihood Seeding Program, with a budget of PHP203 million (USD 4.2 Million). Singapore also developed a guide on business continuity planning for enterprises. Within the guide, comprehensive information on both the management of potential operational risks and sanitation was provided. Like Indonesia, Thailand set up a hotline for SMEs with queries about government support programs, e.g., soft loans, tax deductions, rent, and utility payments, among others. Vietnam emphasises more on domestic and foreign employees as the government facilitates enterprises to find alternative employee resources in case of a lack of foreign experts.

In sharp contrast to shorter-term stimulus measures, **longer-term stimulus measures** are still lacking and are shallow in many cases. Long-term stimulus measures or structural measures possibly help enterprises address short-term challenges, e.g. a reduction in demand and changes in consumption patterns. While supporting enterprises structurally adjusting their business models and operations to the new normal and build resilience against future pandemics and other risks. The long-term stimulus measures include capacity building and training programs, market-related measures, consultancy, and formalisation.

Among the long-term stimulus measures, **capacity building and training programs** were the most common policy supports offered by governments in the region (Table 4). All countries except for the Lao PDR started to offer capacity building and training programs to enterprises,

particularly SMEs. Nevertheless, the programs' focus and depth vary across countries. For example, Brunei Darussalam offers over 300 free online courses on marketing and sales, finance and accounting, innovation, design, and data skills to enterprises. Similarly, the Philippines also offers free online courses while implementing scholarship programs amounting to PHP3 billion (USD 62 million) to finance upskilling and reskilling programs. Out of USD 64 million, part of the budget was spent on skill training programs in the garment and tourism industries in Cambodia. Indonesia and Vietnam provide stimulus funds to enterprises offering training programs to their employees, while Thailand organised training programs for affected workers and assisted local technology start-ups. Meanwhile, Malaysia and Singapore are among the most active countries that put forth automation, digitalisation, firm-level technological upgrading, and individual-level skill upgrading through various capacity building programs in combination with grant and subsidy programs. Digitalisation was indirectly promoted in Myanmar as government applications were moved to an online platform.

The second most common long-term stimulus measure is related to the **development of existing market efficiency and the promotion of new market access**. Seven out of ten countries resort to these measures and intensively assist enterprises to access larger and new markets, including international markets, through the promotion of digital solutions (Singapore), e-commerce platforms, and virtual business matching and networking (Table 4). Additionally, governments also ensure the existing market efficiency, especially in terms of the supply of raw materials for manufacturing as well as the production and distribution of goods to meet the current domestic demand under the crisis.

One of the issues posed to micro and small enterprises is the difficulty of receiving government support and accessing financial resources, as most of them are still concentrated in the informal sector. According to Table 4, only one-third of countries in Southeast Asia utilise support measures to promote **formalisation** (changing informal to formal/legal form of businesses). Cambodia gives an incentive stimulus package to informal SMEs on the condition that they are formally registered, whereas Malaysia and Singapore explicitly include the informal sector in their recovery plans designed to promote company formalisation simultaneously.

Table 4: Overview of Policy Instruments Responding to Covid-19 in Southeast Asia

Policy instruments			Brunei Darussalam	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Shorter-term stimulus measures	Direct financial support	Loan guarantees			○		○	○	△	△	△	
		Soft loans		△	○	○	○	○	△	○	○	○
		Grants and subsidies	○	○	○	△	○	△	△	○	○	○
	Indirect financial support	Debt moratorium	○	□	○	○	○	△	○	△	○	○
		Tax relief package	○	○	○	○	○	○	○	○	○	○
		Employee-related measures	○	○	○	○	○	△	△	○	○	○
		Rent and utility payments	○	□		○	○		○	○	○	○
Shorter to longer-term stimulus measures	Information and guidance				△		○		△	○	△	○

Table 4: Overview of Policy Instruments Responding to Covid-19 in Southeast Asia (cont.)

Policy instruments		Brunei Darussalam	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Longer-term stimulus measures	Capacity building and training programmes	○	□	△		○	△	○	○	○	△
	Market-related measures	○		△		△		○	○	△	□
	Formalisation		△			△			△		

ASEAN (Association of Southeast Asian Nations)

Notes: ○ = Measures cover all enterprises, with emphasis on SMEs

△ = Measures cover only SMEs

□ = Measures cover all enterprises, without emphasis on SMEs

Source: Adapted from IMF (2020b), OECD (2020c), OECD and ACCMSME (2020), UN ESCAP (2020).

3.2 Policies related to innovation and technological upgrading

In response to the new normal during and after the COVID-19 pandemic, innovation and technological upgrading, particularly in terms of digitalisation, are expected to empower individuals to adapt their working styles, including reskilling and upskilling, and to allow enterprises to adjust their operations in order to stay competitive, relevant, and resilient in the domestic and global markets. Thus, the pandemic is considered an accelerator of digitalisation and upgrading in all economic sectors. Despite the importance of innovation and technological upgrading, policymakers in Southeast Asia demonstrate different engagement levels in the technological development process. On the one hand, less developing countries, i.e., Cambodia, the Lao PDR, Myanmar, the Philippines, and Vietnam, have not explicitly initiated policy measures related to innovation and technological upgrading. This is mainly due to the lack of government capabilities in terms of finance and human capital. More urgent and pressing issues, such as the short-run cashflow and liquidity crisis as well as insufficient ability to formulate and implement effective technology and innovation policies themselves, may prevent the governments from issuing such policies. On the other hand, Brunei Darussalam, Indonesia, Malaysia, Singapore, and Thailand, to some extent, utilise support measures to promote innovation and technological development in both the public and private sectors.

Brunei Darussalam: The government mainly resorted to incentive programs to promote digitisation in the financial sector and business enterprises. For instance, transfer fees and charges were waived for six months for all customers using digital or online banking services. Moreover, the government provided co-matching grants of up to BND 20,000 (USD 14,700) for businesses planning to move their operations offline to online or e-commerce. **To facilitate the process of digitalisation.** On 1 April 2020, the Authority and Info-communication Technology Industry together with Darussalam Enterprise launched Brunei Darussalam's first local online e-commerce directory, www.ekadaiBrunei.bn, while offering more than 300 free business-related online courses to improve the technological competences of employees and business owners.

Indonesia: Similar to Brunei Darussalam, Indonesia also utilised incentive programs to induce the business sector to adopt more digital technologies, including e-commerce and digital payments (fintech). The government created a demand for online products by funding a 25% discount for online goods, which, in turn, encouraged both consumers and producers to utilise e-commerce platforms. Additionally, e-commerce was further promoted among producers through a wide range of virtual business-matching events organised by the government and relevant agencies.

Malaysia: Malaysia put serious effort into the promotion of innovation and technological upgrading through several grants and loans such as the SME Digitalization Matching Grant (RM 100

million or USD 24 million), the SME Technology Transformation Fund (RM 500 million or USD 120 million), and the Smart Automation Grant (RM 100 million or USD 24 million). RM 300 million (USD 72 million) was allocated as SME Automation & Digitalisation Facility Grants for SMEs to upgrade their production. These grants allowed SMEs to invest in technologically advanced hardware and software, machinery, infrastructure, connectivity, cybersecurity, and system integrations to raise their productivity and efficiency. To be in line with higher technological advancement, the government helped workers and business owners cultivate their digital skills through short courses under the Human Resources Development Fund (RM 50 million or USD 12 million). Moreover, the government established the Malaysia Digital Economy Corporation (MDEC) to serve as a focal point to devise digital strategy and solutions for SMEs. Managing the grant worth RM 10 million (USD 2.4 million), MDEC's current mission is to promote e-commerce platforms. An additional RM 40 million (USD 96 million) was allocated to further develop e-commerce platforms that involve the traditional agricultural sector, which in turn potentially benefits from the market expansion of agriculture and food products.

Singapore: Several support programs strengthening digitalisation and operational resilience have been in place in Singapore. Like Malaysia, Singapore has emphasised the promotion of innovation and technological upgrading, particularly for SMEs and fintech firms. Enterprise Singapore launched an E-Commerce Booster Package in April 2020 to support SMEs' business transformation efforts to utilise e-commerce service platforms such as Amazon, Lazada Singapore, Qoo10, and Shopee, while ensuring knowledge transfer between the platforms and SMEs. With the grant's help, SMEs bear only 10% of the qualifying costs and directly receive assistance from e-commerce service platforms on product launching, promotion activities, order fulfillment, and sales data analysis. Furthermore, SMEs Go Digital Programme offered government funding of up to 80% for pre-approved solutions, both foundational and advanced digital solutions, to enhance SMEs' digital transformation and capabilities. Through the Productivity Solutions Grant, the program has covered a wide array of costs, including developing the entire digital system such as basic hardware and software, digital infrastructure, Internet connectivity, cybersecurity, integration between traditional production, and digital technology. In May 2020, Singapore introduced the Digital Resilience Bonus to endorse enterprises that plan to further digitalise their operations and collaborate with digital platform solution providers. Additionally, more programs, namely SG Together Enhancing Enterprise Resilience (STEER) Programme, Enhanced Productivity Solutions Grant (PSG) for SMEs, and Enhanced Enterprise Development Grant (EDG), were implemented to strengthen enterprises in a wide range of areas, e.g., business growth, capacity and capability upgrading, digitalisation, innovation, and productivity upgrading, and market access. Enterprises were also supported through the SGUnited Traineeships program, which mainly aims to bridge the gap between skills developed throughout the educational system and skills needed in the labour market and therefore boosts employability for new graduates.

Thailand: Thailand's policies regarding innovation and technological upgrading, specifically under the COVID-19 pandemic, are not well articulated in terms of actual implementable programs, compared with those of Malaysia and Singapore. Specific policy measures and programs for supporting innovation in enterprises under and after COVID-19 are still under the process of policy planning. So far, the government has promoted digitalisation through a 10 GB free Internet subsidy and empowered local tech start-ups through training programs. Nevertheless, since 2016, Thailand has been pursuing Industry 4.0. Upgrading existing industries and stimulating the emergence of new industries are among the objectives of Thailand 4.0. There are twelve targeted industries, namely, new-generation automobiles; smart electronics; affluent medical and wellness tourism; agriculture and

biotechnology; food; robotics for industry; logistics and aviation; biofuels and biochemicals; digital; medical services; education; and defence. To implement, the *Eastern Economic Corridor Project (EEC)*, covering three provinces in the Eastern part of Thailand (Chachoengsao, Chonburi, and Rayong) was initiated in 2016. Tax incentives for firms and individual specialists and researchers, matching grants, land ownership permission, and others are given for investment promotion in the targeted industries (Korwatanasakul, 2019; Lee, Wong, Intarakumnerd and Limapornvanich, 2019). Apart from the manufacturing and services sectors, the government has also supported SMEs in the agricultural sector by connecting the industry with technology start-ups to promote smart urban farming.

To a large extent, the ability of a country to focus on long-term innovation policies depends on the country's position in global value chains. Lesser developed countries are at the bottom of global value chains. They are concerned more about jump-start the industry and attracting foreign direct investment, while more developed countries like Malaysia and Singapore are trying to functionally upgrade their positions in global value chains from production to innovation and R&D hubs. In addition, formulating long-term innovation policies requires the bureaucratic capacities of government agencies to understand and leverage business sectors, which are lacking in lesser developed countries or even more developed ones in Southeast Asia.

4. Conclusion and Policy Recommendations

Amid the coronavirus disease pandemic, enterprises worldwide are experiencing disruptions in global value chains and sharp declines in domestic and international consumption and investment. Southeast Asia's GDP is predicted to drop by 4.6%–7.2% during the lockdown period of 3–6 months, while a double-digit decline in GDP can be observed in half of the countries in the region. The pandemic also resulted in substantial deterioration of consumer sentiment, international trade, employment, and wage incomes. Due to the crisis and subsequent containment measures, most enterprises in the region had to suspend their businesses either temporarily or permanently and, consequently, suffer from a liquidity crisis. Consumption patterns and, therefore, business operations changed drastically in response to the new normal in which technology and innovation, particularly digitalisation, seem to be the common solutions to the current crisis. For instance, enterprises have found it necessary to modify their business models and operations while utilising technology and innovation to upgrade their existing processes, products, functions, and positions in value chains. Even though most enterprises have realised the importance of innovation and technological upgrading such as e-commerce, fintech, and teleworking, not many enterprises have been prompt to implement changes.

This study identifies policy issues from the enterprise surveys conducted within each country. The most common policy support proposed by the business sector is short-term economic lifelines and recovery, such as grants and subsidies, soft loans, tax relief packages, the deferment of debt, rent, and utility fee payments, and employee-related measures. Moreover, long-term policy issues regarding post COVID-19 business operations were also among the greatest concerns of enterprises. Government support in terms of human resource development, business strategy and business plan development, innovation and upgrading (e.g., new processes, new products, new functions, and new sectors), digitalisation and e-commerce, new market creation, and Industry 4.0-related technologies (e.g., blockchain, artificial intelligence, robotisation, and 3D printing) are commonly discussed and can be identified from the surveys.

In terms of the overall policy responses to COVID-19, the current policy measures mainly focus on short-term stimulus, i.e., direct and indirect financial support, covering all enterprises

emphasizing SMEs. Most countries resort to direct financial support, including grants and subsidies (all countries), soft loans (nine countries), and loan guarantees (six countries). Similarly, indirect financial support, i.e., debt moratoriums (all countries), tax relief packages (all countries), employee-related policy instruments (all countries), and measures regarding rent and utility fees (eight countries), are also implemented commonly among countries in Southeast Asia. Despite the significance of information and guidance services as effective and useful short-to-long-term measures, only six out of ten governments in Southeast Asia adopted these measures. In contrast, longer-term stimulus measures are still lacking and shallow in many countries in which capacity building and training programs are the most utilised policy measures. Policy measures regarding formalisation, systematic consultancy, and business development programs were barely observed during the crisis period. Regarding the policies related to innovation and technological upgrading, less developed countries, including Cambodia, Lao PDR, Myanmar, the Philippines, and Vietnam, show insufficient engagement levels as no explicit policy measures in this area have been initiated. On the contrary, Brunei Darussalam, Indonesia, Malaysia, Singapore, and Thailand, to some extent, have explicitly adopted policy measures to promote innovation and technological upgrading among enterprises and enhanced digital and technological skills among workers.

In conclusion, in response to the COVID-19 pandemic, all countries have been heavily focusing only on the short-term policy issues, such as economic lifelines and short-term recovery, while the longer-term and structural issues have not been paid enough attention. It is necessary to implement short-term policy measures initially to ensure the survival of businesses. Nevertheless, without the structural adjustment of business models and operations to the new normal, enterprises are vulnerable and less resilient to future risks. The new normal in business behaviour can be seen from the embracement of digital technology, either through online services or information-sharing platforms like Zoom, which have kept people connected worldwide. Digital savviness will become a necessity, rather than an alternative, for schools, businesses, and healthcare providers. Hence, it is imperative for policymakers to develop and improve longer-term policy measures that potentially reform the structure of both the public and private sectors to fit the new normal. Even though half of the countries in Southeast Asia have started a few initiatives regarding technological upgrading and innovation, the depth and dimension of the policy measures are still limited. Most countries except Singapore and Malaysia, for instance, do not have concrete policy measures on innovation and upgrading in response to the new normal under and after COVID-19. In addition, only sporadic incentive programs (rather than holistic measures), capacity building programs (rather than targeted innovation capability development), and economy-wide innovation policy measures (rather than industry or sector-specific measures) are observed in most cases.

We propose a few policy recommendations.

Firstly, it is reasonable to have short-term policy measures to guarantee firms' survival during the pandemic. However, it is also increasingly important to provide more resources and time to formulate *long-term* policies for the post-COVID-19 era and the “new normal”, as firms will be more digitalized and new business activities and business models will emerge.

Secondly, to help firms to seize new opportunities under the post-COVID-19 era, it is necessary for governments to provide *holistic* measures to support innovation. Targeted financial incentives, especially in the form of grants to encourage firms to develop and deepen their technological capabilities underpinning several types of innovations (new products, new processes, new business models) should be encouraged. Non-financial incentives like government-subsidised training programs, digital infrastructure (like 5-G telecommunication networks), consultancy/guidance services, conducive regulation, and market-creation measures like government procurements

for innovative products/services (i.e., providing ‘first market’ for innovation from the private sector) should be simultaneously initiated.

Last but not least, apart from economy-wide or generic innovation policy measures, it is essential to develop and implement *industry-specific* policy measures. However, the impact of changes derived from COVID-19 encompasses most, if not all, industries, the nature of business opportunities and concomitant innovation processes differs across industries. It is imperative for governments to study how innovation happens or will happen in different industries (both traditional and emerging), and later devise appropriate policy measures to promote and facilitate innovation processes in those industries. The priorities of each country to develop industry-specific policy measures will vary. In general, countries should develop strategic policies for their important existing industrial sectors first. To some extent, they can spend time and resources to develop strategic policies for their future industries, especially emerging ones, as a result of the arrival of Industry 4.0-related technologies. For example, the electronics industry is very important for Singapore, Malaysia, Thailand, the Philippines, and Vietnam. Meanwhile, the automotive industry is a prioritised sector for Thailand, Indonesia, and Malaysia. Cambodia is a significant production base for the garment industry. Singapore and Thailand are relatively performing well in biotechnology research and tourism.

Finally, there is a limitation to this study. As the pandemic is not over, it is too early to thoroughly and systemically assess the business impacts from the pandemic and government-supporting policies. The evaluation of policies for industrial sectors whose specialization may vary across countries requires in-depth surveys and field research. Future studies should be encouraged.

References

- Abiad, A., Arao, M., Lavina, E., Platitas, R., Pagaduan, J., & Jabagat, C. (2020). The impact of COVID-19 on developing Asian economies: The role of outbreak severity, containment stringency, and mobility declines. In S. Djankov & U. Panizza (Eds.), *COVID in emerging and developing countries* (pp. 86-99). London: Centre for Economic Policy Research. <https://data.adb.org/dataset/covid-19-economic-impact-assessment-template>
- ADB. (2020). The COVID-19 impact on Philippine business: Key findings from the enterprise survey. Manila: Asian Development Bank. <http://dx.doi.org/10.22617/SPR200214-2>
- Department of Statistics Malaysia. (2020). *Report of special survey on effects of COVID-19 on companies and business firms (Round 1)*. Kuala Lumpur: Department of Statistics Malaysia. https://www.dosm.gov.my/v1/uploads/files/covid-19/Report_of_Special_Survey_COVID-19_Company-Round-1.pdf
- Dong, E., Du, H., & Gardner L. (2020). An interactive web-based dashboard to track COVID-19 in real time. *Lancet Infectious Diseases*, 20(5), 533-534. doi: 10.1016/S1473-3099(20)30120-1
- EIU. (2020). *Covid-19 to send almost all G20 countries into a recession*. London: The Economist Intelligence Unit. <https://www.eiu.com/n/covid-19-to-send-almost-all-g20-countries-into-a-recession/>
- EoruCham (Singapore). (2020). *The economic impact of the COVID-19 outbreak on European companies in Singapore and ASEAN*. Singapore: European Chamber of Commerce (Singapore). <https://eurocham.org.sg/wp-content/uploads/2020/03/DORSCON-Survey-Report-1.pdf>
- Hill, E., Baird, M., & Seetahul, S. 2020. *Vietnam and COVID-19: Impact on the private sector*. Sydney: University of Sydney.

- ILO. (2020). *ILO Monitor: COVID-19 and the world of work* (6th Edition). Geneva: International Labour Organization. https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/briefingnote/wcms_755910.pdf
- ILO. (2020). *The clock is ticking for survival of Indonesian enterprises, jobs at risk: Key findings of the ILO SCORE Indonesia COVID-19 enterprise survey* (Research Brief May 2020). Bangkok: International Labour Organisation. https://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/---ilo-jakarta/documents/publication/wcms_745055.pdf
- IMF. (2020a). *A crisis like no other, an uncertain recovery* (World Economic Outlook Update June 2020). Washington, DC: International Monetary Fund. <https://www.imf.org/~media/Files/Publications/WEO/2020/Update/June/English/WEOENG202006.ashx?la=en>
- IMF. (2020b). *Policy responses to COVID-19*. Washington, DC: International Monetary Fund. <https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19#B>
- Keun Lee, Chan-Yuan Wong, Patarapong Intarakumnerd and Chaiyatorn Korwatanasakul, U. (2019). *Global Value Chains in ASEAN: Thailand* (Paper 10). Tokyo: ASEAN-Japan Centre. https://www.asean.or.jp/ja/wp-content/uploads/sites/2/GVC-in-ASEAN-paper-10_Thailand.pdf
- Limapornvanich (2019): Is the Fourth Industrial Revolution a window of opportunity for upgrading or reinforcing the middle-income trap? Asian model of development in Southeast Asia, *Journal of Economic Policy Reform*, DOI: 10.1080/17487870.2019.1565411
- LNCCI. (2020). Survey Report on Impact of COVID-19 on Businesses. Vientiane: Lao National Chamber of Commerce and Industry. <https://lncci.la/?mdocs-file=9269>
- OECD (2019), *Economic outlook for Southeast Asia, China and India 2020: Rethinking education for the digital era*. Paris: OECD Publishing. <https://doi.org/10.1787/1ba6cde0-en>
- OECD and ACCMSME. (2020). *Enterprise policy responses to COVID-19 in ASEAN: Measures to boost MSME resilience*. Jakarta: the ASEAN Coordinating Committee on Micro, Small and Medium Enterprises and the Organisation for Economic Cooperation and Development. <https://asean.org/storage/2020/06/Policy-Insight-Enterprise-Policy-Responses-to-COVID-19-in-ASEAN-June-2020v2.pdf>
- OECD. (2020a). *Evaluating the initial impact of COVID-19 containment measures on economic activity*. Paris: Organisation for Economic Co-operation and Development. https://read.oecd-ilibrary.org/view/?ref=126_126496-evgsi2gmqj&title=Evaluating_the_initial_impact_of_COVID-19_containment_measures_on_economic_activity
- OECD. (2020b). *OECD economic outlook* (Volume 2020 Issue 1). Paris: OECD Publishing. <https://dx.doi.org/10.1787/0d1d1e2e-en>
- OECD. (2020c). *Coronavirus (COVID-19): SME policy responses*. Paris: OECD Publishing. <http://www.oecd.org/coronavirus/policy-responses/coronavirus-covid-19-sme-policy-responses-04440101/#section-d1e258>
- Park, C.Y., Villafuerte, J., Abiad, A., Narayanan, B., Banzon, E., Samson, J., Aftab, A., & Tayag, M.C. (2020). *An updated assessment of the economic impact of COVID-19* (ADB Briefs No. 133). Manila: Asian Development Bank. <http://dx.doi.org/10.22617/BRF200144-2>
- TheGlobalEconomy.com. (2020). *Consumer confidence survey by country: The latest data* [Data set]. TheGlobalEconomy.com. https://www.theglobaleconomy.com/rankings/consumer_confidence_survey/



- UN ESCAP. (2020). Policy responses to COVID-19 in Asia and the Pacific. Bangkok: United Nations Economic and Social Commission for Asia and the Pacific.
<https://www.unescap.org/covid19/policy-responses>
- UNCTAD. (2020). *World investment report 2020: International production beyond the pandemic*. Geneva: United Nations Publications. https://unctad.org/system/files/official-document/wir2020_en.pdf
- UNIDO. (2020). *Impact assessment of COVID-19 on Thai industrial sector*. Bangkok: United Nations Industrial Development Organization. https://thailand.un.org/sites/default/files/2020-06/Impacts%20of%20COVID19%20on%20Thai%20industrial%20sector_UNIDO.RO_UNCT_16JuneLaunchVersion.pdf
- World Bank. (2020a). *World Bank East Asia and Pacific economic update, April 2020: East Asia and Pacific in the time of COVID-19*. Washington, DC: World Bank.
<http://hdl.handle.net/10986/33477>
- World Bank. (2020b). The firm-Level impact of the COVID–19 pandemic: Summary of results from round 1 (Myanmar COVID–19 Monitoring Brief No. 2). Yangon: World Bank.
<http://hdl.handle.net/10986/34635>
- WTO. (2020). Trade statistics and outlook: Trade falls steeply in first half of 2020 (Press Release PRESS/858). Geneva: World Trade Organization.
https://www.wto.org/english/news_e/pres20_e/pr858_e.pdf

DESIGN OF OPTICAL GATE DEVICE BASED ON THE EQUIPMENT OF YAG PULSE LASER

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Abstract

With the consecutive development of technology, YAG pulse laser machines have been widely used in industry and have good prospects for developing; YAG crystal has many good laser performances such as absorbing bandwidth, long life fluorescence and high quantum efficiency, but YAG crystal will produce a large amount of heat in the process of photoelectric conversion, the thermal lens effect in laser resonator is apparent, which affects the quality of laser beam and will bring great trouble in the application of elaborate processing. In order to improve the quality of laser beam of YAG laser, an optical gate device is designed in this article to eliminate the thermal lens effect of laser crystal, which can better improve the laser beam quality and extend the application scope.

Keywords: YAG pulse laser Optical gate

Introduction

In a solid-state laser, the thermal effect of crystal cannot be avoided. The thermal effect of laser crystal contains three aspects:

When pump light is injected into laser crystal, pump light is gradually absorbed by crystal in the axis; this will lead to the phenomenon of thermal accumulation. At same time, due to the uneven energy distribution of the pump light itself and the faster heat conduction outside the crystal, there in line direction will cause uneven thermal stress. The refractive indexes of laser crystal along the direction of radius changes under the duel action of axial thermal stress and radial temperature gradient, which make laser crystal, produce optical character like transparent lens.

Uneven temperature distribution will produce thermal stress, which will affect the refractive index so that the isotropic crystal materials show anisotropic properties, resulting in thermal-induced stress birefringence effect.

When the temperature of the laser crystal increases, the quantum efficiency of the laser crystal decreases, which leads to the increase of the efficiency and the thermal depolarization and distortion of the laser beam, which seriously affects the performance of the laser.

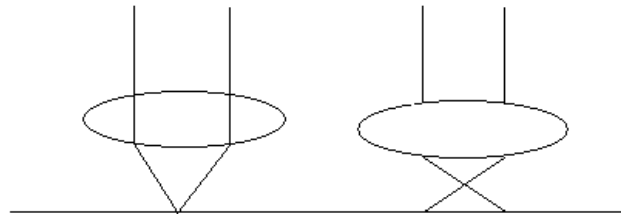
Thermal lens affect all aspects of laser performance, such as cavity stability, cavity size, mode coupling rate, output beam quality, and even the rupture of laser rod.

In practical application, it is necessary to focus the laser beam in many cases. For a laser beam of the same power, the better the beam quality is, the smaller the focal point will be and the lager the power density of the focal point will be. For the same laser beam, the shorter focal length focusing mirror can be used to obtain a smaller focal point and a larger focal power density.

Beam quality as one of the most important parameters of beam characteristics, focal size, focusing the beam energy distribution and power density has a great impact on the important

parameters, such as size, is to evaluate the key parameters of laser manufacturing system, it not only marks the machining ability of laser manufacturing system, but also has important influence on laser materials processing.

For example in drilling, marking, laser precision processing and so on. When thermal lens effect exists, it has a great influence on focusing behavior, as shown in picture 1. Therefore, thermal lens effect should be minimized in practical application.



Picture 1: Effect of thermal lens on focusing

Research Objective

The thermal lens effect in laser crystal, lens, such as location, this design is aimed at pulse laser equipment in the most significant thermal lens effect of laser during the thermal lens effect, after a certain period of time from the light path, laser exit after cavity oscillation, eliminating negative influence of the thermal lens effect of laser crystal, obtain more stable beam quality.

Literature Review

The paper, on the basis of China National Academic Magazine Data-Base and China Excellent Doctor&Master Degree Thesis-Base, tries to analyze the documents of pulse laser.

At present, in the condition of high-power, with the increment of pump power, the internal abandoned heat prompt the temperature of machines to increase, as the result of causing a serious of thermal effect which influences the output characteristics of the laser and restricts the application of the laser when they work in the high-power conditions.

In the paper of “Theoretical and experimental investigation of dual-wavelength continuous-wave Yb: YAG laser”, the theoretical results of the oscillated threshold for dual-wavelength, continue-wave Yb:YAG laser were presented, and its output was experimentally investigated. In their experiment setup, a plane-concave cavity was employed for laser oscillating by end-pumping with a 940nm fiber coupling laser diode. A Yb:YAG crystal was taken as the laser crystal in the cavity. The single wavelength and dual-wavelength laser were respectively obtained by using the Output Coupling (OC) of 10%, 15%, and 20%. At the highest pump power of 20W, the maximum output power at 1 050 nm is 3.94 W at the OC of 10% and the maximum output power at 1 030 nm is 3.40 W at the OC of 20%. The corresponding optical to optical conversion efficiencies are 19.7% and 17.0%, respectively. At the output coupling of 15%, the dual-wavelength output power of 0.79 W was obtained at the pump power of 11.7 W, corresponding to an optical-to-optical conversion efficiency of 6.8%. It is experimentally found that the output power ratio $P_{1\ 030\ \text{nm}}/P_{1\ 050\ \text{nm}}$ was about 1:1.3. The central wavelengths of the dual-wavelength laser were located at 1 030.31 nm and 1 047.50 nm by using a grating spectrometer. At an output power at 1 030 nm of 3.0 W, its output power stability of RMS is determined to be better than 0.18% in a 30 min operation. The proposed model gives results that agree fairly well with the experimental data.

In the paper of “Process Optimization and Design of Fiber Laser Cutting Aluminium-Lithium Alloy”, the effect of the process parameters on the quality of laser cutting, such as defocus, gas pressure, laser power and cutting speed is studied. Cutting qualities under continuous laser mode and pulsed laser mode are compared. The results reveal that pulsed laser mode can achieve a better cutting quality.

The above research experience provides valuable experience for my subject research.

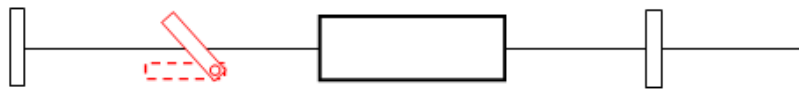
Methodology

The position of the optical brake on the optical path in the resonant cavity is analyzed, and there are two schemes as follows:

Scheme 1: the optical gate is located between the all-mirrors and the condenser chamber.

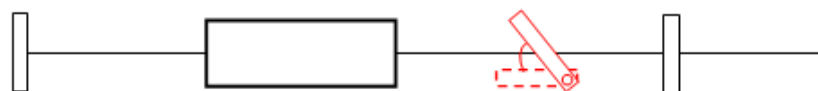
In picture 2, when the optical brake is located between the all-reflection mirror and the condenser chamber, part of the laser will be emitted by the output mirror after oscillation, which is difficult to effectively control.

Therefore, it is not advisable to place the optical brake here.



Picture 2: The optical brake is located between the all-reflection mirror and the condenser chamber

Scheme 2: the optical brake is located between the output mirror and the condenser cavity. In picture 3, when the laser crystal is in the thermal lens effect time gate, it blocks the laser from emitting from the output end. Plan two is OK.



Picture 3: The optical brake is located between the output mirror and the condenser cavity

Results

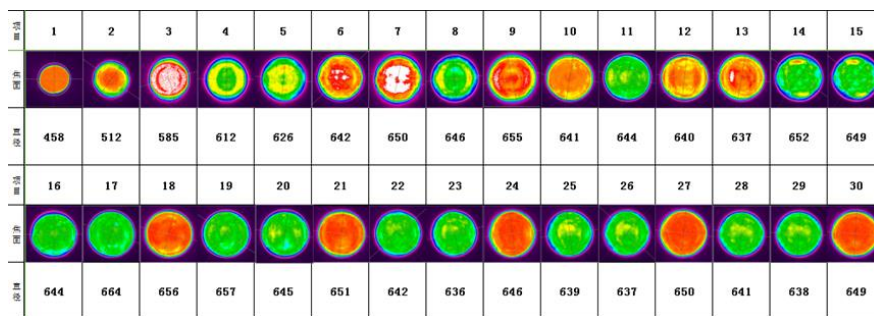
In the apparatus, the initial position of the barn door on the optical gate is on the optical path. As shown in figure 3, assume that the angle between the barn door and the optical path is α , block out the laser, after the laser crystal is stabilized, deflect the barn door to an angle of α , make it deviate from the optical path and parallel to the optical path, let out the laser, the state of the optical gate is working.

Rotate the motor so that the optical gate switches between shielding and working state. When the angle of rotation of the motor is α , the optical gate is transformed from occlusion state to working state, the laser is still excited during the conversion. In order to ensure that the optical gate does not block the laser during the conversion process, the conversion time shall be less than the interval time between the adjacent laser pulses. When the rotation angle of the motor is fixed, different values are selected for the output frequency of the laser, get the maximum rotational angular velocity of the motor.

In the apparatus, the duration of the optical gate is blocked should be greater than that of the thermal lens effect. The duration of the thermal lens effect is measured as follows: without eliminating the thermal lens effect, set different output frequencies, the laser beam analyzer is used to measure each laser pulse from the beginning of the light to a certain time, the performance parameters of each laser pulse in the same focal plane are obtained, for example, beam diameter, shape and energy distribution. Compare the data to get the number of laser pulses that start to stabilize. When the diameter difference of different laser pulse images is no more than 5%, the shape tends to be round and the color is close to the same, the laser is in a stable state.

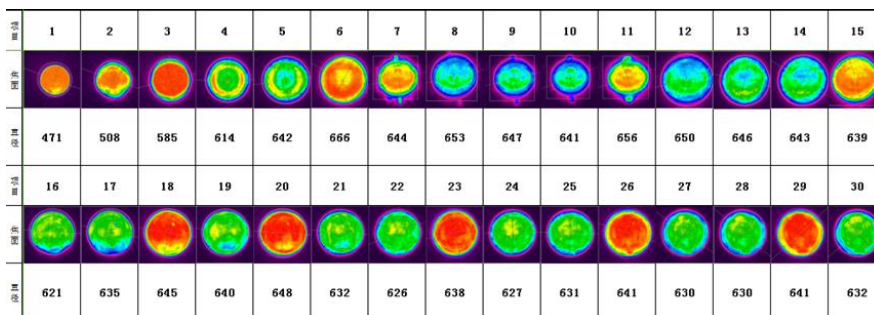
Based on the above principles, the cavity type, crystal and hardware conditions that may cause changes in spot diameter and energy distribution of the laser equipment are guaranteed to remain unchanged. Set three output frequencies: 5 Hz, 10 Hz and 15 Hz.

When the output frequency is 5 Hz, according to the sequence of pulse excitation, the laser beam analyzer is used to measure the beam diameter, shape and energy distribution of the first to 30th pulses. In picture 4, the laser pulse stabilizes from the fifth.



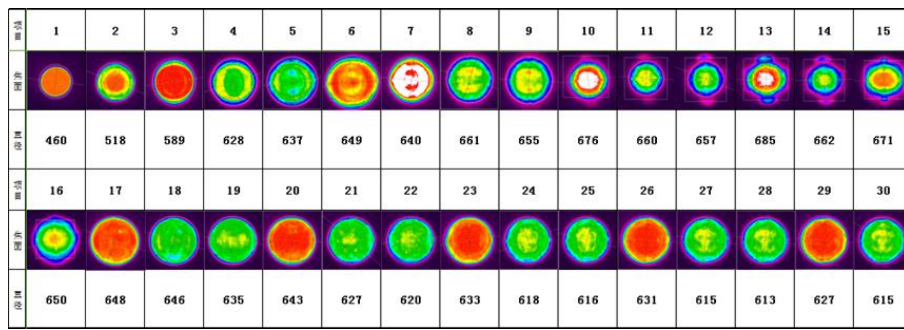
Picture 4: The output frequency is 5 Hz

In picture 5, when the output frequency is 10 Hz, the laser pulse stabilizes from the 11th.



Picture 5: The output frequency is 10 Hz

In picture 6, when the output frequency is 15 Hz, the laser pulse stabilizes from the 17th.



Picture 6: The output frequency is 15 Hz

Conclusion

The main advantages of the gate are as follows: the thermal lens effect of laser crystal can be eliminated and the quality of laser beam can be improved without changing the main configuration of pulse laser equipment; the optical brake device is small in size, modularization design, easy to install and debug; the cost of the optical gate device is low, and the existing equipment can be improved and the application range of the equipment can be expanded.

The main application fields of the gate include: the main optical path of YAG pulse laser equipment; the application of a YAG pulse laser device in the field of precision and fine processing.

References

- Daping Wan., Yumin Wang.& Zhenxing Gui. (2007). A novel method for stability analysis and design of laser folded cavity. *Chinese Journal of Lasers*, 9:1217-1221.
- Fengjiang Zhuang., Xiang Li.& Zhiyang Lin. (2017). Theoretical and experimental investigation of dual-wavelength continuous-wave Yb: YAG laser. *Acta Photonica Sinica*, 46(2):0214002.
- Jiaojuan Wen. (2008). *Theoretical analysis on the thermal effects of laser medium*. Ph.D. Donghua University, China.
- M N Hu., L C Ge.& J P Zhang. (2016). Hole-Drilling with high Depth-Diameter ratio using Multi-Pulse Femto second Laser. *Chinese Journal of Lasers*, 43(4):0403006.
- W Zhang., G Z Li.& C M Wang. (2015). Process optimization and design of fiber laser cutting aluminium-Lithium alloy. *Chinese Journal of Lasers*, 42(2):0203003.

EXPLORATION OF AUTONOMOUS LEARNING TEACHING MODE OF SIGNAL AND SYSTEM COURSE BASED ON “INTERNET PLUS”

基于“互联网+”的信号与系统课程自主学习教学模式探究

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摘要

信息技术飞速发展,“互联网+教育”的思维在高等教育中不断推广应用。针对高校信息类专业中信号与系统课程难教、难学问题,提出将慕课资源和微助教教学平台引入课程教学,构建线上、线下结合的自主学习型教学模式,有助于提高学生的学习兴趣、自主学习能力和学习效果。

关键词: “互联网+”, 信号与系统, 自主学习, 教学模式

Abstract

With the rapid development of information technology, the thinking of "Internet Plus Education models" is constantly promoted and applied in higher education. How to solve the problem that signal and system courses are difficult to teach and learn in information majors, this paper has proposed to introduce MOOC resources and micro-teaching assistant (Micro-TA) platform into course teaching, and has constructed an autonomous learning teaching mode with the combination of online and offline, which could help improve students' learning interest, autonomous learning ability and learning effect.

Keywords: Internet Plus, Signal and System, Autonomous learning, teaching mode

Introduction

In the current "Internet Plus" era, the development of technologies such as the Internet of Things, cloud computing and big data has not only diversified the ways and means for people to obtain knowledge and information, but also brought new changes in the mode of higher education. "Internet Plus" technology changes the single way of learning, expands the sources of knowledge and the way of information exchange, and provides basic guarantee for students' autonomous learning.

As an important basic course for majors such as communication and information, signal and system have strong professional theoretical property and engineering practicability, which is based on the background of engineering problems such as signal characteristics and processing, and is formed through mathematical abstraction and theoretical generalization. The traditional teaching mode is undifferentiated, one-way knowledge imparting, lack of interaction and individuation, boring course content, low learning enthusiasm and poor learning effect. Under the background of educational informationization, a variety of teaching tools and resources, such as multimedia, QQ, WeChat,



MOOC, Micro-TA and so on, have been introduced into signal and system course teaching. Constructing the autonomous learning teaching mode combining online and offline will help to improve students' learning interest, autonomous learning ability and learning effect.

Content

1. Autonomous learning teaching means of signal and system course

1.1 *The characteristics of signal and system course*

Signal and system is a basic theory course with highly theoretical professional. It is generally 64-72 class hours in domestic colleges and universities. The overall knowledge framework that students need to establish in this course includes: (1) basic signals and responses. (2) different decomposition methods of signals. (3) different analysis methods of LTI system.

Signals and systems are highly theoretical and conceptual, involving a large number of mathematical formulas and theoretical deductions. With the continuous exploration and practice, the transition from traditional teaching mode to modern teaching mode has gradually adopted richer teaching methods, such as multimedia teaching, MATLAB simulation demonstration and so on. For the signal and system course, centralized classroom blackboard writing teaching is an important part of formula deduction and mathematical modeling, and other teaching means and methods are more suitable to be used after class. Therefore, we can make full use of the resources and tools of the network platform to enrich the teaching means of signal and system course.

1.2 *MOOC resources*

MOOC is a large-scale open online course, which has the characteristics of large audience and openness, which can make students have more freedom to learn the course without the restriction of time and place, and can also study some important and difficult contents repeatedly. At present, it is the development trend of curriculum construction in colleges and universities to strengthen the sharing of various resources of courses by taking the rise of "MOOC" as an opportunity. In the initial stage of MOOC construction, the support of the network platform is insufficient, the means are single, the effect of students' autonomous learning is not good, and the effect of mixed teaching needs to be further improved. With the deepening of the informationization of "Internet Plus education" in our country, MOOC platform and resource construction are becoming more and more abundant, and more attention is paid to quality and application. As shown in picture 1, China University MOOC is a high-quality Chinese MOOC online education platform in China, which is jointly created by NetEase Cloud Classroom and Higher Education Press to undertake the task of national high-quality open courses of the Ministry of Education, and to provide the public with more than a thousand MOOC courses from well-known universities. Based on the introduction of MOOC resources in signal and system course teaching, it can realize the transformation from teacher-centered to student-centered, and emphasize students' subjectivity, which is conducive to improving students' initiative in learning and improving teaching effect.



Picture 1: China University MOOC platform

1.3 Micro-TA platform

Micro-TA is an interactive support platform jointly launched by the professional team of Huazhong normal University and Huazhong University of Science and Technology, which integrates the functions of pre-class teaching resources release, in-class teaching interaction and after-class teaching evaluation management. Teachers and students can interact with each other on the Micro-TA platform through Wechat, computer Web and classroom big screen. Teachers and students do not need to download any software. Teachers can operate on the web and mobile phones, while students only need to follow the official account of Micro-TA on their mobile phones. After logging in to the Micro-TA home page, click "Add Classroom", fill in the relevant information about the class, and complete the creation of the class, as shown in picture 2. Click on the created class, the class number and QR code will be displayed. Students can join the class by scanning the QR code on Wechat and filling in their personal information.

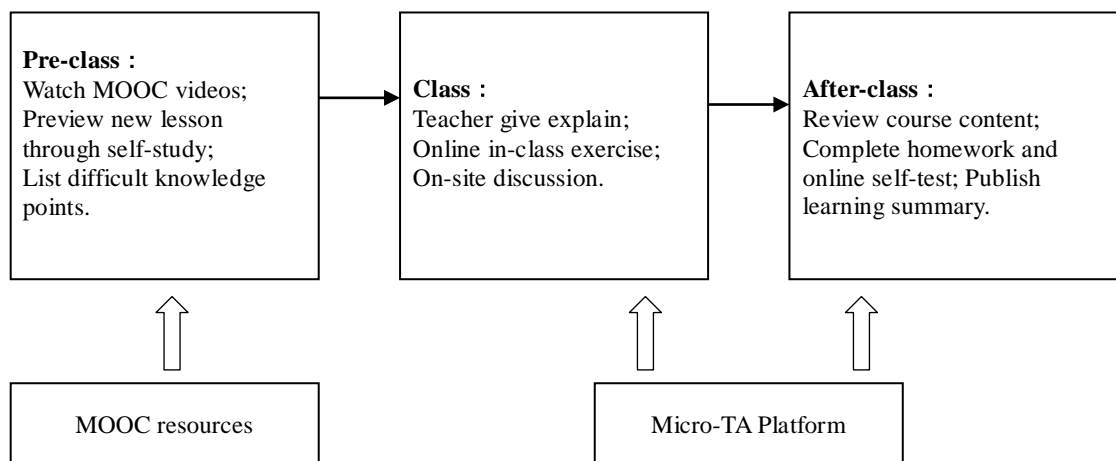


Picture 2: Class home page of Micro-TA platform

By combining ordinary multimedia classroom with Micro-TA, and by means of advanced information technology, effective communication channels between teachers and students are established in various links, such as pre-class preparation, classroom teaching and after-class consolidation, so that both teachers and students can timely feedback and solve problems. Micro-TA also record the data of students' attendance, classroom discussions, homework and tests, which is convenient for teachers to continuously observe the whole process of students' classroom learning and offline autonomous learning, and make a final developmental and scientific evaluation.

2. Autonomous learning teaching mode of signal and system course

Based on information technology, the autonomous learning teaching mode of signal and system course is constructed by organically combining MOOC resources, Micro-TA platform and offline classroom teaching. As shown in picture 3, the whole teaching process is divided into three links: pre-class online autonomous learning, classroom teaching combined with network platform and after-class online self test. Each link needs to be carefully designed by teachers to guide students to complete the study in different forms.



Picture 3: Schematic diagram of autonomous learning teaching mode

2.1 Pre-class online autonomous learning

Students' autonomous learning before class is the basis for the realization of the whole teaching activity, which determines whether the classroom teaching can be carried out smoothly in the later stage. Teachers should inform the teaching plan, teaching arrangement and schedule of the course before teaching, and remind students to make preparations. Relying on the Chinese universities MOOC platform, students learn the knowledge points of the next class by watching the MOOC video, so as to carry on the knowledge reserve and preliminary thinking. Based on MOOC platform, students can actively choose teaching resources according to their knowledge base and learning interests, flexibly arrange their learning time for one or more repetitive learning, and realize personalized autonomous learning. Students can also search for more detailed materials and tutorials on the Internet for obscure knowledge points during the learning process, so as to improve their "Internet Plus Autonomous Learning " ability. After finishing the previewing task, students complete the test on the Micro-TA to test their mastery of basic knowledge. Students can also post problems they cannot understand or solve on the Micro-TA platform for discussion with other students and teachers in class.

2.2 Classroom teaching combined with network platform

According to the situation of students' online preview test and combined with the Micro-TA platform, a student-centered teaching environment is established for classroom teaching. Teachers adopt multimedia teaching, and post real-time quick answer or discussion on the Micro-TA platform to observe the students' mastery. As shown in picture 4, After explaining the important and difficult knowledge, teachers release online exercises and students finish them at the specified time. The Micro-TA can make real-time statistics of students' participation scores, and teachers can show the data of the answer results to the students. According to the on-site students' participation rate and correct answer rate, teachers can answer questions or organize on-site discussion, so that students have no doubts and teacher has a good idea of the students' mastery.



Picture 4: Online in-class exercise

2.3 After-class online self test

After class, teachers post assignments or test questions on the Micro-TA platform, and set the submission deadline, scoring deadline, scoring guidance and scoring methods. After the homework is opened, it will be pushed to the WeChat terminal of students' mobile phone. The result will be published after the score is finished. Students can check the result and view the recommended excellent assignments on the mobile phone. Students complete the consolidation of knowledge points through after-class self test, test their learning effect, in order to form self-evaluation, sum up experience for improving the autonomous learning of subsequent chapters, and constantly improve the autonomous learning ability. On the one hand, teachers fully pay attention to students' performance in class, on the other hand, they collect students' homework, tests, question-answering, discussion and other data on the Micro-TA platform, constantly summarize experience and innovate methods, thus forming a virtuous circle of teaching and learning.

3. The course evaluation method and the teaching feedback

3.1 The course evaluation method

In order to test the learning effectiveness of students more accurately, the process evaluation method is adopted, which pays attention to the assessment of students' autonomous learning process. The evaluation for students is an comprehensive evaluation program based on the

"examination + process evaluation", and the course score is composed of two parts: the usual performance with the proportion of 40%, and the final examination with the proportion of 60%. Among them, the usual performance include the Micro-TA platform check-in status, online preview test scores, classroom discussion and the problem solving performance, homework performance and online review test scores. The final examination focuses on the students' mastery of basic concepts, principles and methods, and weakens the examination of mechanical calculation of mathematical formulas. Through the supervision and evaluation of students' autonomous learning process, The process evaluation method enables students to work hard continuously during the learning process and improves the teaching quality and effect.

3.2 The teaching feedback

In order to test the effect of this teaching mode, two experiments were carried out on the scale of a natural class, and the effect was understood in the form of a questionnaire. The questionnaire results show that the vast majority of students believe that this teaching mode is helpful to improve the teaching effect, and that it is better than the traditional teaching mode of full classroom explanation, as shown in Table 1 and Table 2. Most of the students in the pilot class think that autonomous learning ability has been improved, and recognize the importance of improving autonomous learning ability to the cultivation of comprehensive ability. It can be seen that the autonomous learning teaching mode based on network resources and platforms is of great significance to the improvement of students' interest in self-learning, self-learning ability and comprehensive ability.

Table 1: The questionnaire result of "whether the autonomous learning teaching mode contributes to the improvement of teaching effect"

Options	Very effective	Effective	More effective	Little effect
Percentage	27.87	40.98	22.95	8.20

Table 2: The questionnaire result of "which is better between the autonomous learning teaching mode and the traditional teaching mode"

Options	Autonomous learning teaching mode	Traditional teaching mode
Percentage	91.80	8.20

At the same time, the comparison of examination results shows that the average final exam score of the pilot class is 72.46 points, while that of the traditional class is 63.74 points. It can be seen that this teaching mode not only trains the students' comprehensive ability, but also improves their academic performance. This teaching mode has the application value and feasibility of carrying out in an all-round way.

Conclusions

During the course teaching of Signal and System, the autonomous learning teaching mode based on information technology is adopted, the students have completed knowledge preparation based on the MOOC resources, and then the teacher explains the key knowledge in the class, set up the classroom discussion and assessment based on Micro-TA, help the students to complete the internalization of knowledge. The students complete the consolidation of knowledge through online



testing after class. This teaching mode is student-oriented, and advocates active learning, which is conducive to improving students' learning interests and the abilities of autonomous learning, which could satisfy students' personalized learning needs, and facilitating the improvement of students' comprehensive ability. At the same time, it also puts forward higher requirements for teachers, which requires teachers could design teaching links carefully, have solid professional knowledge and exquisite teaching skills.

Suggestions

Under the background of educational informationization, how to make full use of the high-quality network resources on the MOOC platform and mobile Internet technology, reform teaching methods and models, further improve the quality of higher education is one of the directions for every teacher to explore and practice. The autonomous learning teaching model of signal and system courses introduced in this paper can be used for reference to the teaching of related courses. How to use the big data produced by MOOC platform and Micro-TA to excavate students' learning behavior and characteristics and realize data-driven individualized teaching is the next research objective.

Fund Project:

This paper is the extended research achievement of Research on The Teaching Mode of Signal Processing Course Based on Web-based Autonomous Learning (JY201604), the teaching research project of Hubei Business College in 2016.

References

- Fu, J. M., et al. (2020). Teaching of independent learning + point teaching in digital signal processing. *Journal of Science of Teachers' College and University*, 40(10), 73-77.
- Liu, J. (2019). Constructing an Open and Autonomous Learning Teaching Model under Modern Educational Technology. *Contemporary Education Research and Teaching Practice*, (22), 3-4, 13.
- Xu, X. B. & Yu, H. Q. (2019). Mobile Internet Applied to College Classroom Teaching: Effectiveness and Reflections. *Journal of Yangzhou University (Higher Education Study Edition)*, 23(2), 115-120.
- Tan, L. L., et al. (2017). On the Teaching Reform of Signal Processing Course under the Background of "Internet Plus Education". *Journal of Shaoguan University (Education Science)*, 38(5), 90-93.
- Yin, X. Q., et al. (2017). Research on diversified teaching and autonomous learning mode of information courses. *Experimental Technology and Management*, 34(10), 12-14.
- Lin, K., Li, Y. L. & Huang, Z. J. (2017). Research On the Ability of University Teachers to Use Digital Teaching Resources In the Era of "Internet Plus Education". *Jiangsu Higher Education*, (10), 56-59.
- Wu, X. X., et al. (2015). Reciprocal Teaching System Modeling for Signals and Systems Course. *Journal of Electrical & Electronic Education*, 37(1), 26-28.



EXPLORING APPLICATION TALENT TRAINING MODEL FOR INTERNET OF THINGS ENGINEERING

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Abstract

In the context of current New Engineering, Internet of things (IoT) technology is as a strategic emerging industry in China, becomes the banner of New Engineering construction. Aim at these problems such as not clear training target, not perfect talent cultivation system and not rich teaching practice of the IoT, this paper puts forward a new talent training model based on school-enterprise cooperation in order to trains the innovative and applied talents to meet the requirements of the new era from these aspects of perceiving the connotation of knowledge structure,, determination of training objectives, formulation of training programs and design of teaching links of the IoT.

Key Word: new engineering, IoT engineering, applied interdisciplinary talents, training mode

1. Construction background of new engineering

At present, China promotes innovation-driven development, pursues the major strategic such as “One Belt, One Road”, “Made in China 2015”, “Internet Plus” and so on, the new economy is booming, and represented by new technologies, new forms and new models and new industries, puts forward higher requirements for engineering and technology talents, it is urgent need to accelerate the engineering education reform innovation.

In February 2017, the No.6 Letter(2017) of Department of Higher Education of the Ministry of Education proposed that "higher engineering education occupies an important position in China's higher education. Deepening the reform of engineering education and building a strong country in engineering education are of great significance to serving and supporting China's economic transformation and upgrading"^[1,2]. In April of the same year, Wu Aihua, the director of the Department of Higher Education of the Ministry of Education in China, pointed out that we should accelerate the development and construction of new engineering and stressed that the development of new economy needs the support of new engineering talents in the "Construction and Development of New Engineering"^[3].

New engineering is a kind of new industrial discipline which is produced to adapt to the talent training of new economy. The development of new economy depends on the joining of high-tech talents. High-tech talents with innovative ability can better drive the development of new economy.



Since 2017, many domestic scholars have carried out a series of researches on what new engineering projects are and how to build them. Zhong denghua expounded the connotation of the new engineering from the perspective of the goal of educating people, and believed that the new engineering should cultivate diversified and innovative talents in the future^[4]. Li Hua and other scholars, starting from the development context of new engineering, believed that new engineering is a new form of engineering generated by injecting new connotations into engineering to meet the needs of new economic development^[5]. Generally speaking, there is no unified qualitative standard for the connotation definition of new engineering.

In March 2018, the Ministry of Education issued a "Notice on the announcement of the first batch of" new engineering "project research and practices, identified the first batch of 612 projects, taking this as an opportunity, the new engineering construction and excellent engineer education training program 2.0 are deeply integrated, entering a new stage of exploration and practice. Under the guidance and support of these projects, "new engineering" major has become a new round of construction focus of colleges and universities. At present, the construction of "new engineering" has become the consensus of many colleges and universities in China, expecting to respond to the new technological revolution and industrial change with the Chinese model of engineering education.

2. The current situation of The IoT engineering

The IoT Engineering is a short supply major of the national strategic emerging industry in China. It is a new applied discipline developed on the basis of the integration of computer, electronics, information, communication and other disciplines. At present, more and more colleges and universities in China offer the IoT major, but because the policy implementation time is too short, there is not much practical experience to use for reference, the IoT major construction is still in the exploration stage in many colleges and universities in China, the talent training model is not mature, there are problems in the construction and implementation of the talent training model^[6].

A. The training objective is not clear

As a newly established major in colleges and universities in China, the IoT is a combination of electronic technology, communication engineering, computer science, automatic control technology and other interdisciplinary integration, which covers a wide range of majors and radiates many industries. At present, the major still in exploring stage, still not mature, don't have enough mature and effective practical experience to draw lessons from, the orientation of training objectives is not strong, and there is a lack of clear training objectives and positioning. The establishment of relevant theoretical courses is based on the prediction information analysis of the enterprises requirements. This mode relies too much on the prediction of industrial development and cannot effectively cultivate professional innovative and applied talents.

B. The talent training system is not perfect

At present, the IoT technology is in the stage of continuous development, and the current new economy also puts forward new requirements for engineering education, engineering and technical personnel also need to further improve their ability, with higher innovation and entrepreneurship ability and cross-border integration ability. Colleges and universities in China have no mature talent training system to support them when they formulate their talent training programs for the IoT, the collection and integration of effective data is still relatively small, which is insufficient to provide necessary data support for the hierarchy and integrity of the talent training system, and can not be very good from the shallow to the deep, and gradually improve the students' innovative practice ability.

C. The teaching practice link is not rich

The IoT is a network that uses network equipment to connect objects to the Internet under the condition of abiding by a certain protocol, advocating the connection of everything. Take smart home as an example, the electronic products of smart home and the controller through wireless signal to complete data transmission, processing, output, etc., to complete the corresponding operation, and the data information analysis to make a relatively intelligent processing. At present, due to the emerging opening of the IoT, the software and hardware of the courses related to the IoT in some colleges and universities fail to meet the course requirements, and there is more emphasis on theory than practice, which leads to the low quality of teaching practice.

3. Talent training mode reform of the IoT engineering

A. Talent training based on school-enterprise cooperation

Talent training jointly built by the school and enterprise is a widely recognized education way of application-oriented talents, it supports the industry background, with a combination of production and learning, to train the IoT talents who meet social requirements and the actual need of enterprise production.

The significance of talent training jointly built by the school and enterprise are as follows: a) real-time grasp of market dynamics and train the talents according the needs. The IoT technology is updated rapidly. Only when we know the needs of the enterprise at any moment and grasp the dynamic demand of talents can we make the trained students not to be out of touch with the talent market. Enterprises can also put forward training methods according to their own needs, strengthen the pertinence and practicability of talent training, and cultivate their need talents for enterprises. b) Strengthen the practice training. The IoT engineering has strong engineering practice, and students should have practical engineering experience after learning theoretical knowledge. Strengthening school-enterprise cooperation can promote the complementary advantages of enterprises and



universities, integrate engineering practice into professional education teaching and training, and achieve the purpose of combining production and learning. c) Blend in with the actual working environment. The practical training of colleges and universities provide good conditions for the students' practical ability, but the actual project development and cases are relatively few. In order to enable the graduates to blend in with the real work scene, and adapt to the actual work. School-enterprise cooperation could provide the students with opportunities to practice in the first line of enterprise production, and improve the students' practical ability and professional quality.

To sum up, it is more beneficial to the application-oriented talent training of the IoT engineering in the background of new engineering that we further enhance the cooperation of school and enterprises.

B. The implementation of the application-oriented talent training mode for the IoT engineering

Under the new economic situation, China's Internet profoundly change all walks of life, the informatization and industrialization integrate deeply, the innovative-type businesses spring up, with new energy, the new technology represented by new energy, new materials, biological science is upgrading continuously, new engineering concept as the current research hotspot new, promote the education reform in colleges and universities.

Profession follows the industry development, so we should fully investigate the market's demand for professional talents of IoT engineering, understand the need of professional talents under the current new economic society, combine with the college existing resources, formulate the talent training plan which conforms to the professional development of IoT engineering, and the new mode of talent training.

a) Perceiving the connotation of knowledge structure of IoT engineering

For the IoT application, it mainly includes four elements such as information generation, transmission, processing and application and so on, the system architecture of the IoT divides into the perceptual recognition layer, network construction layer, service management layer and integrated application layer, as shown in Figure 1.

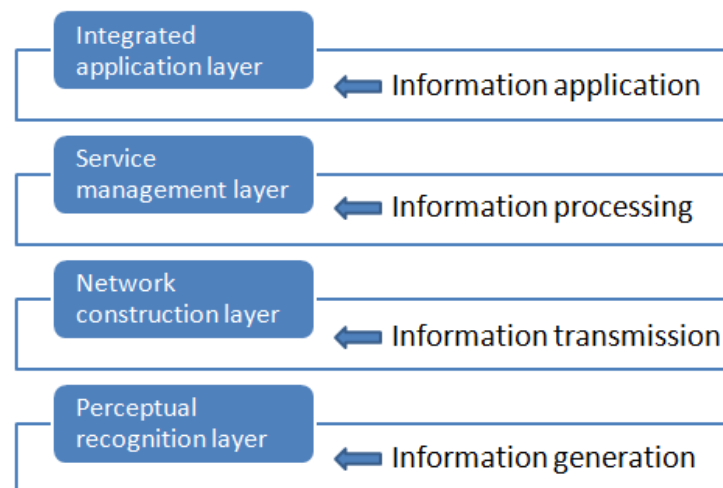


Figure 1: The system architecture of the IoT

The perception recognition layer locates in the most low-end of the IoT system architecture, is the foundation of all the upper structures, is one of the most important aspects of the fusion of the physical world and information world, is the most unique part for the IoT which is different from other networks. The network construction layer connects the perceptual recognition layer and the service management layer in the IoT system architecture, has a powerful bond effect, can transport the data of the upper and lower levels efficiently, stably, timely and safely. The service management layer is the source of the IoT wisdom, solves the problems such as how to store data, to retrieve, to use, and how not to be abused, etc. The integrated application layer is the extension application of created by the rich connotation of the IoT, centered on "things" or the physical world, covers things tracking, environmental awareness, intelligent logistics, intelligent transportation, smart grid, etc.

As a multidisciplinary specialty, colleges and universities determine the connotation of knowledge structure of the IoT engineering and set up the corresponding professional direction based on school-enterprises cooperation, which also combine with the orientation of the school itself, teachers' conditions, software and hardware conditions as well as teaching and research characteristics, this is the primary problem.

b) Determining the training objectives of the IoT engineering

At present, there is a large gap between the professional talents of the IoT engineering and the market. According to the requirements of industry development and the needs of talent skills, the colleges should strive to develop application-oriented talent of the IoT engineering under new engineering background, which adapt to the development needs of the IoT technology, and adapt to the modern industry, national economic development, and the social development needs.



c) Formulating the talent training program of the IoT engineering

Colleges further clear the application-oriented talent training program of the IoT engineering after determining the training objective, make the students understanding the core competences they have when graduating, such as applying ability of cross knowledge, experiment data interpretation ability, strong professional ability, good foreign language application ability, ability to solve complex problems, and the team cooperation ability, etc.

On this basis, colleges should set the curriculum system structure with scientific, reasonable, in view of the different direction of specialty construction, integrate the basic courses and professional core courses, it is that the students lay a solid foundation of professional and have the scientific thinking as the goal, determine the ultimate talent training program of the IoT engineering.

d) Designing the implementation scheme of teaching process

For school-enterprise cooperation of the IoT engineering under new engineering background, it is must clear the power and responsibility of colleges and enterprise firstly, they rely on both their respective industry resources, complement their respective advantages and come true the close school-enterprise cooperation, so as to ensure the smooth implementation of teaching process. The implementation scheme of the teaching process designed is as follows:

1. Professional knowledge integration

School and enterprise take some courses mutual recognition (credits replacement) way to cultivate talents, enterprise transplants the knowledge and skills needed by industry to the school class on the basis of keeping the original subject and professional basic course, highlights the practical work skills of students, while the school puts their corporate programs participated in by students into the credit system.

2. Learning and working alternation train

During the school period, the students mainly focus on theoretical teaching and complete the study and train of the basic knowledge, professional knowledge and technical skills. Relying on the resources of industry advantages, enterprise arranges the elite students of IoT engineering to go the enterprise industrial park, and forms an open and flexible talent training mode of learning and working alternation, this makes the students' theoretical knowledge combined with practical experience, help the students as early as possible to realize the role change from student to professionals, it is beneficial to the cultivation of professional skills and professional accomplishment, also beneficial to the improvement of the employment competitiveness and employment quality, more close to the "quasi-professionals" standard.

3. Professional skills certification

The enterprise introduces the complete unified professional skills certification system facing the specific needs of professional construction and student employment in colleges and universities. Certification training center is established in colleges and universities, whose teachers team is provided by the enterprise, and do certification training for all students, and employee related



professionals, so doing like this could promote the labor market competitiveness and social recognition for school students.

4. Joint construction of training base

The school and enterprise jointly construct the training base and jointly manage the base. The bases introduces the practical training platform and the laboratory solution of the corresponding cooperation specialty, and improves students' research, innovation and practical ability through practical training; At the same time, the base also introduces the mature certification system of enterprises, and provides the engineers training for the relevant students, so as to ensure the implementation of the teaching plan taking the practical application ability as the main line.

5. Double-qualified teacher train

Enterprise sends the technical staff with experienced production practice as a part-time teacher, which could lead to improve the professional quality of professional teachers at school, and build the double-qualified teacher team through the school-enterprise cooperation. Enterprises and school establish a cooperation mechanism for the college teachers training, and set up the interactive communication platform for enterprise excellent technicians and professional teachers form the win-win cooperation mechanism of complementary advantages, resource sharing, and mutual benefit.

6. Conclusion

Under the current new engineering background, the IoT technology influences every aspect of the society and promotes the teaching reform in colleges and universities in China. This paper analyzes the existing problems in the current situation of the IoT engineering major under the background of new engineering, puts forward the talent training mode based on the school-enterprise cooperation, and makes some exploration on the reform of the IoT engineering talent training mode.

References

- [1] HUANG Bin, ZOU Xiaobing. Quality Standards for Engineering Application-oriented Talents Cultivation[J]. Higher Education Development and Evaluation, 2015, 31 (3):48-56.
- [2] Lin Jian. New Engineering Construction for the Future of China[J]. Research on Education of Tsinghua University, 2017, 38 (2) :26-35.
- [3] Wu Aihua, Hou Yongfeng, Yang Qiubo, et al. Accelerating the Development and Construction of New Engineering and Actively Adapting to and Leading the New Economy [J]. Research in Higher Engineering Education. 2017(1):1-9
- [4] Zhong Denghua. Conception and Action of New Engineering Construction[J]. Research in Higher Engineering Education, 2017 (3) : 1-6
- [5] Li Hua, Hu Na, You Zhensheng. New engineering: form, connotation and direction [J]. Research in Higher Engineering Education, 2017 (4) : 16-19



- [6] Wang Dong, Zhao Hongwei, LIU Yan. Exploration on talent Training Mode of Internet of Things Engineering Under the Background of New Engineering [J]. Industry and technology forum, 2020,19 (23):160-161

INTERNAL FACTORS AFFECTING THE PERCEPTION OF ENTREPRENEURSHIP OPPORTUNITIES IN STARTING NEW BUSINESS.

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Abstract

In Thailand, there are small and medium entrepreneurs' 35.3 percent of the gross domestic product, which plays a role in driving the country's economy. The research team has collected data for small and medium entrepreneurs 350 people. In which the researcher focused on the funding sources, Education and Training, Research and innovation by using multiple linear regression for the analysis. The analysis results that the operator provides the most educational awareness followed by research and development. The results starting a new business requires entrepreneurial skills, the ability to analyze business elements and understand the business structure. Moreover, the business without innovation in the development of product models or even service businesses. It may cause businesses to grow slower than organizations with research and innovation.

Keywords: Entrepreneurial, Funding Sources, perception, opportunity

Introduction

According to current Thai entrepreneurship situation which Ministry of Commerce identify the important statistic as new business will collapse for 90% in first year, other 7% will stop their business within 7 years and just only 3% can survive. This makes the importance of opportunity finding in entrepreneurs very important.

The Global Entrepreneurship Monitor (GEM) is a survey of entrepreneurship held annually around the world. There are more than 73 countries around the world participating in the program. And coherent conceptualization, survey tools, and applied methods have led to the creation of the largest database of entrepreneurship in the world. GEM surveys create a wide range of key information relevant in various aspects of being an entrepreneur and provide consistent measures on individual attributes and activities at different stages of starting a business. GEM also provides insights into how the ecosystem component of an entrepreneurship is perceived. The measure of support from the public and private sectors affects the economy. (Singer S, Amorós JE, & Moska D, 2015)

Several studies have shown that entrepreneurship is the driving force behind everything. Entrepreneurs play an important role in innovation, diversity, increase competitiveness, generate new ideas, employment opportunities, social adaptation and economic growth in industries and developing countries. Entrepreneurship is not only beneficial for an adaptive economy. There is growing evidence to suggest that there is a strong causal relationship between entrepreneurship, economic growth, and poverty reduction. The emergence of entrepreneurs arises from the formation of opportunities for entrepreneurs. Operator An understanding of entrepreneurial ambitions that form new businesses (Syed Zambari Ahmad & Siri Roland Xavier, 2012)

The entrepreneurial environment faced by young entrepreneurs from developing countries may differ from those of developed countries. Developed countries may receive more institutional and educational support, more progressive training systems that will support entrepreneurial and environmental activities. Because Thailand has differences in economy, culture, values, education Political and social environment the study of the environment entrepreneur's impact on opportunity and growth is of practical importance in promoting Regional entrepreneurial activities the reason for the above conditions is so difficult to measure entrepreneurial environment, opportunity and growth, so it is so important for research.

Entrepreneurs in Thailand play an important role in driving the country's economy. By the Office of Small and Medium Enterprises (OSMEP) surveyed entrepreneurs across the country The total number of enterprises is 2,968,042, with a total of 2,961,364 small and medium enterprises (SMEs), accounting for 99.77 percent of enterprises in the country.

Research Objective

To study opportunities for entrepreneurs to open new business from internal environmental factors.

Research scope

This research aimed to study the internal factors of entrepreneurship include entrepreneurship finance, entrepreneurship education and training, knowledge transfer for research and development. To make the better understanding the relationship between these factors toward entrepreneurship opportunity in starting new business.

Population boundaries

The operators used in this research are Entrepreneurs registered with the Department of Business Development Ministry of Commerce in Thailand

Population scope

From information of newly established entrepreneurs from the Department of Business Development Ministry of Commerce There are 1,475,967 entrepreneurs registered for new business establishments. This target group selection is entrepreneurs in Thailand. The method of selecting a Purposive sampling of 350 people was used in the categories of business groups as follows: Manufacturing, Service and Wholesale-Retail.

Literature Review

Entrepreneurial Framework Conditions (EFCs)

The Entrepreneurial Framework Conditions (EFC) defines the conditions of an entrepreneur's ecosystem that increase or hinder the creation of new businesses and affect the country's economic growth. While being affected by the social, cultural and political context of a particular country EFC have a direct impact on entrepreneurship activities and entrepreneurship ability. Therefore, these conditions are important factors in assessing business dynamics and the environment for creating new businesses.

An annual report on the research of individual entrepreneurial activities, social values, and personal characteristics in the Global Entrepreneurship Monitor (GEM) assessment is a large number

of individual characteristics each year. Around the world, environmental support is divided into nine areas as follows: (1) Entrepreneurial funding (2) Government policy (3) Government support measures (4) Entrepreneurship education and training. (5) Knowledge Transfer for Research and Development (6) Commercial and Professional Infrastructure for Entrepreneurs (7) Marketing Opportunity (8) Physical Infrastructure for Entrepreneurs (9) Social Norms and Cultural (Singer S et al., 2015)

Entrepreneurial Funding Sources (Finance)

Access to funding Usually, most entrepreneurs doing business with their main working capital. When the economy is bad or business interruption Does not meet the target, set Is often faced with the problem of lack of financial liquidity Lack of working capital Some businesses may support themselves. But if there is a problem of a severe lack of liquidity that it has to close the business These are the cycles that entrepreneurs have to face. The only way to avoid these problems is to find working capital to tackle the lack of liquidity each time. Which of course Would not be out of borrowing from banks (SME-Inspiration, 2018)

Education & Training for Entrepreneurs

While taking advantage of the available knowledge and skills, it is important to rely on familiar people who may make it easier to look for new opportunities, entrepreneurs have to study the unknown information. Because opportunities are often born out of new ideas, new technologies and markets, where entrepreneurs have to spend time and effort learning, progress and empowering them. In short, entrepreneurs seek to acquire new talent and information and turn them into entrepreneurial opportunities. When establishing a new venture, entrepreneurs may be called upon to learn and new skills, either discovering or creating opportunities. (Neill Stern Metcalf Lynn E. York & Jonathan L., 2017)

Transfer of Knowledge for Research and Development (R&D Transfer)

Important factors for industrial development for sustainable growth Is to develop and strengthen entrepreneurs Since entrepreneurs are important in driving the economy of the country Therefore, entrepreneurial development is very important from community enterprises (OTOP), emerging entrepreneurs (Startup), small and medium enterprises (SME: Small and Medium Enterprises), with the Thailand 4.0 model focusing on national development as well. Technology and innovation Therefore, entrepreneurs at all levels must be promoted to apply innovation to their businesses. To develop into an innovation-driven enterprise (IDE: Innovation Driven Enterprise) (Ministry of Industry, 2016)

Entrepreneurship where innovation is the primary driver is vital for economic growth and wealth creation. And the contribution to the GDP of the country. Economic development consists of changing the volume and nature of the added economic value. These changes result in increased productivity and an increase in per capita income and often coincide with the migration of workers across different economic sectors in economically developed countries' societies. At low levels, there is often a large agricultural sector where the majority of the population can survive. Surplus workers want to create independent career opportunities to earn a living. The focus is on basic needs such as public health infrastructure and basic education.

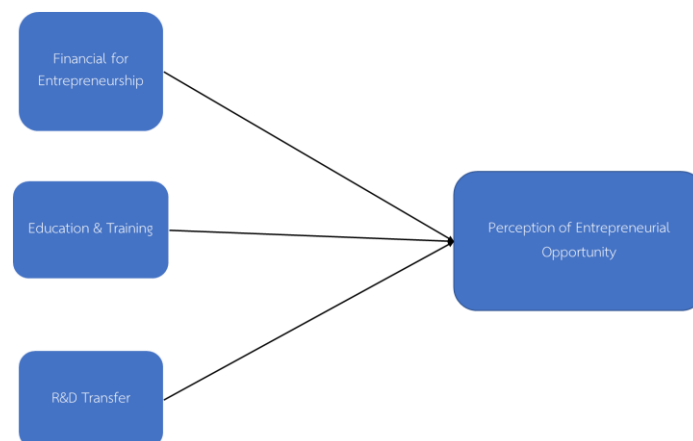
As the economy grows and wealth increases, one might expect focus on industrial activities that will gradually shift to the expanding service sector. The industry has evolved and has been

successful in improving diversity and complexity. Such developments would normally involve increasing research and development. Cognitive concentration Is an institution that builds knowledge in the economy (Mai Yiyuan & Gan Zhilong, 2007)

Cognitive resources affecting the perception of opportunity

Cognition and social cognition theory Entrepreneurial cognition refers to "The knowledge structure people use to evaluate, judge, or make decisions about assessing opportunities, building opportunities, and growth." The content of the later developed literature illustrates the intellectual resources described. How entrepreneurs perceive opportunities to review cognitive research in entrepreneurship. Indicates the amount of knowledge that has been examined for the operator. These groups of people have cognitive abilities, make decisions. (self-efficacy) Bias in decision-making, pre-learning knowledge and experience. These authors recommend that future research examines earlier of entrepreneurial cognition, especially cognitive resources that help perceive opportunities. While the latest research has begun to provide behavioral and cognitive explanations for finding opportunities (Dyer, Gregersen, & Christensen, 2008). This study explores the capabilities of a set of intellectual resources. (Such as self-efficacy Uncertainty Risks, exploits, surveys, and experience) to differentiate between the methods that entrepreneurs use to perceive opportunities.

Another point that can be indicative of the operator's characteristics. It is the quality that has the intention of actions that lead to the establishment of the company Another reason the company that is being formed is its own desire to take on business opportunities. The more positive social motives you notice, the more advantageous the entrepreneurial situation is. There hasn't been any research yet. That is about business success in a long-term perspective. Entrepreneurship education could be considered a solution to those gaps. However, the opportunity or need to create an individual career path requires an adequate level of potential. Education in entrepreneurship not only influences capacity building. But also, development This should begin as quickly as possible, and many individual and academic stakeholders are involved in the process of improving entrepreneurial competence in society (Tomasz Kusio & Mariantonietta Fiore, 2020).



Picture 1: Conceptual Framework

Methodology

The researchers adopted the Global Entrepreneurship Monitor (GEM) theoretical model that demonstrates the causal mechanisms developed to represent the impact of entrepreneurship on global

entrepreneurship growth. The national economy is the main variable that depends on the responsibility (Reynolds PD et al., 2004) To develop to fit the context of Thai society the research team chose the quantitative research methodology by using questionnaires from a random sample of entrepreneurs in Thailand Which uses a method for selecting a specific sample (Purposive sampling) by dividing the entrepreneurs operating the business Type of production, service and wholesale trade - retail, 350 people

Data analysis the research team has collected the examinations from 350 samples of the questionnaires that were collected by the researcher to verify their reliability, we used snowball sampling method which start from business owner in Thai Chamber of Commerce. By means of Cronbach's Alpha Coefficient, the reliability of the questionnaire was 0.929, meaning that the questionnaire's data was more than 0.7, the test data was reliable (J Martin Bland & Douglas G Altman, 1997). The research team used the data obtained for statistical analysis. By using Multiple Linear Regression analysis.

Research hypothesis

H1: The perception of the source of funds for entrepreneurs has a positive influence on entrepreneurial opportunities.

H2: The perception of educational and training factors for entrepreneurs has a positive influence on entrepreneurship opportunities.

H3: The perception of knowledge transfer factors for research and development has a positive influence on entrepreneurial opportunities.

Results

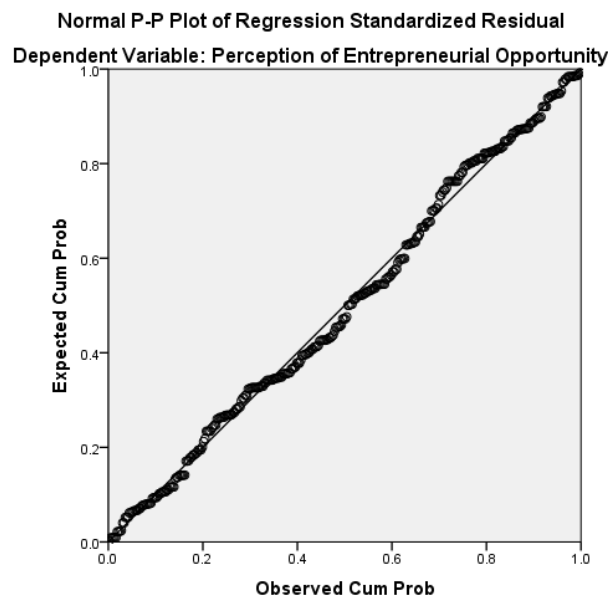
The software that researchers use is SPSS version20.

The sample consisted of 163 males (46.6 percent) and 187 females (53.4 percent). The majority of the respondents were aged lower than 25 years (18.3 percent), next were between the ages of 35 – 39 years (16.6 percent), followed by the age range of between 25 – 29 years (16.3 percent), followed by the age range of between 40 – 44 years (15.7 percent)

	B	Std. Error	Beta	t	Sig.
Entrepreneurial Funding Sources	.115	.063	.121	1.838	.067
Education & Training for Entrepreneurs	.311	.074	.335	4.206	.000*
Transfer of Knowledge for Research and Development	.169	.074	.184	2.277	.023*

From the table explaining the analysis results, after entering multiple linear regression using enter 3 independent variables, it was found that some independent variables had statistically significant effect on the dependent variable at the 0.05 can be ordered as follows: Education and Training for Entrepreneurs Knowledge transfer for research and development

It shows that education and training for entrepreneurs. Knowledge transfer for research and development It was a variable that had a statistically significant influence on chance of entrepreneurship at the 0.05 level.



Test the correlation model of independent and dependent variables as a linear relationship. When considering the Normal Probability Plot of the actual data produced with the expected value, it is found that the actual values of the sampled data are placed around a straight line, slightly above and below the line. But most of the points are fixed in a straight line. Therefore, it can be considered that the aberration has a normal distribution.

Discussion

From the analysis results it was clear that Most entrepreneurs recognize the importance of entrepreneur training education. And knowledge transfer for research and development This is because these factors affect the establishment of the business more than the importance of the source of funds. Many works indicate the impact of an entrepreneurial environment in an entrepreneurial environment. Governments can drive market forces, enabling them to function more effectively by eliminating conditions that create market imperfections or tightness of administration. Socioeconomic factors can be just as important as financial readiness. Technical assistance, physical facilities Entrepreneurship is an interesting career option. Successful entrepreneurs can develop through short courses of study and training. It also goes to government agencies for providing training and consulting services to entrepreneurs starting their business. To increase opportunities for developing new businesses (Mai Yiyuan & Gan Zhilong, 2007)

Conclusion

There are two factors that generate positive effect to perception of entrepreneurial opportunity which is Education & Training and Research & Development transfer. On the other hands, financial for entrepreneurship is the only one factor that do not affect to perception of entrepreneurial opportunity. Financial institutions and the government sector should encourage foreign investors to invest in Thailand. It also encourages new start-ups to be able to compete in the market. Startup entrepreneurs may still lack capital. Subject of entrepreneurial networks and access to foreign investors the state should be a means of matching new entrepreneurs with investors so that they can access sufficient funding for market competitions. New Entrepreneurs Restrictions for Public



Relations The mediator government should encourage operators to exhibit, where the government may provide funding for exhibition booths at various locations. To enable new entrepreneurs to save costs in this section and enable entrepreneurs to present their products and make their businesses known.

References

- Dyer, J. H., Gregersen, H. B., & Christensen, C. (2008). Entrepreneur behaviors, opportunity recognition, and the origins of innovative ventures. *Strategic Entrepreneurship Journal*, 2(4), 317-338.
- J Martin Bland, & Douglas G Altman. (1997). Statistics notes: Cronbach's alpha. *BMJ*, 314(7080), 572. doi:10.1136/bmj.314.7080.572
- Mai Yiyuan & Gan Zhilong. (2007). Entrepreneurial opportunities, capacities and entrepreneurial environments. *Chinese Management Studies*, 1(4), 216-224. doi:10.1108/17506140710828505
- Ministry of Industry. (2016). Thai Industry 4.0 Development Strategy for 20 Years (2017 - 2036).
- Neill Stern Metcalf Lynn E. York & Jonathan L. (2017). Distinguishing entrepreneurial approaches to opportunity perception. *International Journal of Entrepreneurial Behavior & Research*, 23(2), 296-316. doi:10.1108/ijebr-05-2016-0162
- Reynolds PD, Bygrave WD, Autio E, Arenius P, Fitzsimons P, Minniti M, . . . Roche F. (2004). Global entrepreneurship monitor (GEM) 2003 global report. *coordinated by Babson College and London Business School, sponsored by Kauffman Foundation*.
- Singer S, Amorós JE, & Moska D. (2015). Global Entrepreneurship Monitor-2014 Global Report. Global Entrepreneurship Monitor. In (pp. 17-21): Global Entrepreneurship Research Association.
- SME-Inspiration. (2018). Interesting articles | How to help SMEs reach "Source of funds" | SCB SME. Retrieved from https://scbsme.scb.co.th/sme-inspiration-detail/SCB_TCG
- Syed Zamberi Ahmad, & Siri Roland Xavier. (2012). Entrepreneurial environments and growth: evidence from Malaysia GEM data. *Journal of Chinese Entrepreneurship*, 4(1), 50-69.
- Tomasz Kusio, & Mariantonietta Fiore. (2020). The perception of entrepreneurship culture by internal university stakeholders. *European Business Review*.



THE TEACHING MODE OF COMPUTER LANGUAGE COURSES BASED ON COMPUTATIONAL THINKING

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Abstract

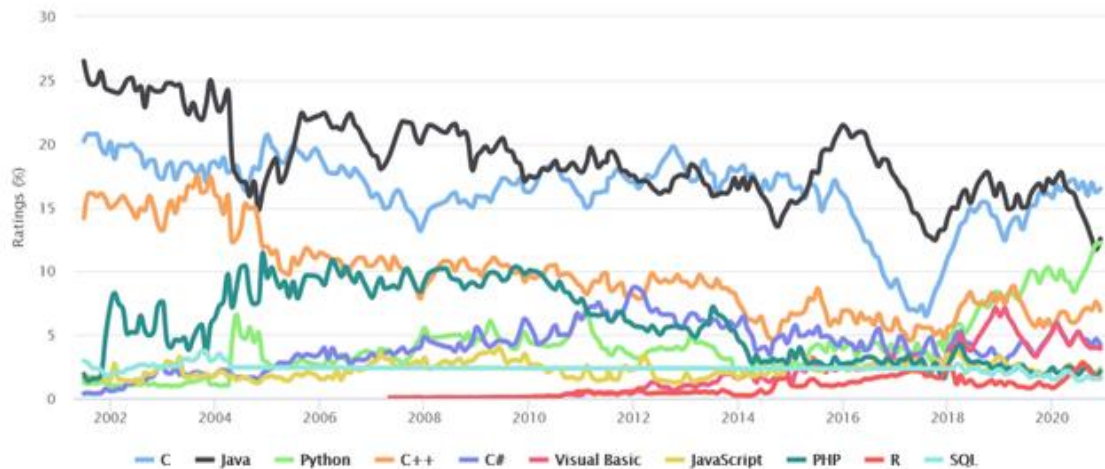
Aiming at the problems existing in the teaching of computer language courses in colleges and universities, this paper has fully analyzed the inner link between the computational thinking and computer language classes, introduced into the teaching method with task-driven and diverse algorithm, and reconstructed the theory and practice teaching mode of computer language courses in order to achieve the purpose of cultivating the students abilities of innovative and information literacy.

Keywords: computational thinking, computer language, teaching mode, task driven

Content

At present, most colleges and universities take computer language courses as the compulsory basic courses for computer majors. The learning objectives of these courses can be divided into two levels: The first one is to learn object-oriented programming language, which lays a foundation for the next professional course; The second one is to cultivate computational thinking and lay a good foundation for future professional development. Computational thinking is a series of thinking activities that apply the basic theories of computer science to analyze and solve problems, design and plan systems and guide people's behaviors. With the extensive application of information technology, computational thinking has penetrated into everyone's life. Good computational thinking can enable people to have better social adaptability and stronger creativity.

According to Professor Yizhen Zhou of Carnegie Mellon University in the US, computational thinking should not only be an ability for computer scientists, but also a skill that everyone must have. In order to cultivate world-class information innovation talents, the United States, The United Kingdom, New Zealand and other countries have written computational thinking into the curriculum standards of the basic education, and invested a lot of money to promote the education of computational thinking. In Our country, we have gradually realized the importance of computational thinking ability. In 2017, The State Council pointed out that the overall level of social understanding and application of artificial intelligence technology should be improved in an all-round way, and the general intelligence education program for all citizens should be implemented the Development Planning for the New Generation of Artificial Intelligence.



Picture 1: Market share of the top 10 TIOBE programming languages over the past 18 years as of December 2020

Source: www.tiobe.com

In order to cultivate the ability of computational thinking, we must reform the traditional curriculum. The courses with the closest connection with artificial intelligence technology, computer language courses bear the brunt. As a basic professional course in most universities, it is necessary to reform the teaching mode of computer language courses. The following figure shows the top 10 TIOBE computer programming languages for December 2020 and the rankings over the past 18 years, which shows the richness and change of computer programming languages. The computer language courses offered by each university are not the same.

1. The prominent problems in the teaching of computer language courses at present

1.1 The teaching objectives of computer language courses are too single

At present, in our higher education system, computer language courses are the specialized basic courses. And the class hours of the professional basic courses commonly are not much, on the one hand, the difficulty is not so big as professional courses, on the other hand, the course design are also arranged. Generally, a theoretical class and an experimental class are arranged once a week. The theory course mainly introduces the basic data types and basic grammar of the computer, while the experiment course mainly verifies the knowledge points learned in the theory course by writing programs. Under the guidance of such teaching objectives, computer language teaching in many colleges and universities is still confined to teaching students to apply technologies and tools, without paying attention to cultivating students' thinking mode and ability to analyze and solve problems with computers.

1.2 The professional quality of teachers are not enough to fully cultivate students' computational thinking ability.

In higher education, it is of course important for students to study actively and independently. However, it is undoubtedly very important for the growth and success of students if they can get the correct guidance from teachers in their learning process. Especially in the cultivation of computational thinking, the guiding role of teachers is more obvious. It can be said that the professional quality of teachers plays a decisive role. Only the teachers have the abilities of



computational thinking, could they better cultivate students' abilities of computational thinking. However, since the computational thinking has attracted extensive attention in the educational world, all kinds of related researches are basically centering on how to carry out teaching mode and teaching method reform to cultivate the students' computational thinking abilities. However, there are little researches on how to train teachers' computational thinking and how to improve teachers' computational thinking abilities.

2. The teaching mode based on the cultivation of computational thinking

In order to develop students' computational thinking and improve students' problem solving ability, in the computer language courses teaching, the teaching target should not aim at that the students master a skill through theoretical study and practical operation, but the teaching goal should be to make students acquire a kind of thinking mode through solving problems, which can actively applying the way of thinking, and effectively solve the problem of study and work in the future study and work.

For theoretical teaching, we adopt task-driven teaching method. Under the integration of task-driven teaching methods, first of all, we need design the accurate teaching task, which include all the knowledge in this or some course, of course, it also can just design a teaching task, during the task-driven, the students can take the initiative to raise questions, analyze questions, and finally clarify the knowledge points involved in the questions, and they could learn knowledge points under the teachers' guidance, and then the purpose of solving problems is achieved. Using such teaching links not only can make the boring knowledge points become simple, easy to learn, easy to understand, easy to operate, but also can stimulate the students' interests in the course.

Aiming at experimental teaching, on the basis that students can master the confirmatory experiment, we advocate the diversity of the algorithms. Teachers should attach importance to the cultivation of the diversity of students' computational thinking. This kind diversity can expand the students' thinking and stimulate their thinking activities. In fact, the implementation of any algorithm may have some limitations, the program written by an algorithm only needs to ensure the correctness of the running results and the readability of the code. When guiding students in computer experiments, the teachers could encourage the students to write programs through various algorithms in order to achieve the same task, and the students can also use for reference or modify programs written by the other classmates, so as to cultivate students' diversity of computational thinking.

3. A feasible scheme to cultivate students' problem solving ability

Computational thinking is implicit in the ability of solve practical problems by use of the computers. Therefore, the focus of theoretical teaching of computer language courses should be shifted from knowledge memory and skill mastery to the cultivation of computational thinking ability, which cultivate the students to analyze, solve problems in this subtle way by using of the computer science thinking and technology, so as to gradually cultivate students' information literacy and improve their problem-solving abilities. The ability of computational thinking is very great important to improve their abilities of problem solving. For cultivating students' computational thinking ability, it is to cultivate students' awareness and ability of solving practical problems actively by computers. The way of thinking contained the ability of solving problems by computers is computational thinking. Teachers can extract it from the surface knowledge system and then map it to teaching activities to accelerate the formation of students' computational thinking ability. However, there is no unified training system and educational standard about how to train computational thinking ability. But, a large number of studies have shown that the formation of students' innovative consciousness and cultivation of innovative ability can be taken as the starting point for the cultivation of computational thinking, which can be started from the following aspects.



3.1 Changing the teaching orientation of teachers

First of all, the teaching orientation of teachers should be changed, that is, teachers should change from knowledge disseminators to guiders of learning knowledge. Teachers should help students to find problems, guide them to analyze problems, and inspire them to explore the solutions of problems. A teacher is no longer a simple transmitter of knowledge, but a mentor who guides them how to learn and how to mine the information. To be specific, teachers should not merely retell or repeatedly verify a certain theoretical knowledge, but also elaborate the background of the theory and what problems that the theory could solve, so as to stimulate students' motivation to further study.

3.2 Training teachers with computational thinking

Secondly, it need to train teachers with computational thinking. For cultivating students' ability of computational thinking, teachers with the ability of computational thinking are needed. Teachers may not only stimulate students' innovative thinking, but also kill students' innovative thinking. If teachers only serve as disseminators of knowledge, it will virtually stifle students' enthusiasm and ability to innovate; But if the teachers are the student's companion, the guiders, encourages the students to boldly explore the questions, freely expresses their thoughts, which will enhance the students' creation enthusiasm and their abilities.

3.3 Changing the course review mechanism

Finally, changing the course review mechanism is needed. In order to develop students' computational thinking abilities and the ability of problem solving, there must be a corresponding review mechanism to evaluate students' innovative thinking ability. If the standardized test is still adopted for the purpose of examining knowledge memory and simple application, it is obviously unable to make a reasonable assessment of students' innovative thinking ability in justice and equity, therefore, we must adopt the diversified evaluation scheme, pay attention to students' individual differences and their own characteristics, attaches great importance to the assessment process rather than the assessment results.

Conclusions

The training and cultivation of computational thinking can not only enable students to understand the process of computer programming, but also facilitate the cultivation of students' innovative ability. More importantly, it can further improve students' information literacy ability. Of course, it is not practical to improve students' computational thinking ability only through the study of a certain courses, also necessary to gradually integrate the computational thinking into the whole knowledge system of talent cultivation. In a word, the teaching mode of computer language courses based on computational thinking can not only improve students' learning interest and enthusiasm, but more importantly, help cultivate students' correct thinking methods, analysis and problem-solving abilities.

Suggestions

More effective teaching models include the following categories.

1. *Theme-guided teaching model.*

The connotation characteristic of theme-guided teaching mode is that teachers give students a theme according to the teaching content, students fully explore and use different resources around this theme, and follow the general norms and steps of scientific research to learn. In this process, students first need to deeply analyze the topic, and then collect extensive resources based on the results of topic analysis. This process is undoubtedly the cultivation of students' ability to analyze problems. In

order to better achieve the training objectives, teachers should integrate the theme into certain situations when designing the theme. In this way, in order to complete the task accurately, students must first identify the information in the scene, identify the real problems to be solved in the topic, and then solve the problems according to the collected resources. This process also cultivates students' information awareness of transforming data into information. In addition, if the theme design can span the knowledge of this discipline and effectively integrate the knowledge of other disciplines, this process will undoubtedly be very beneficial to cultivate students' critical thinking and creative thinking.

2. Problem heuristic teaching model.

The connotation characteristic of the problem heuristic teaching mode is that the course teaching is led by the teacher through the problem, and then lead the students to analyze the problem, simplify the complex problem, abstract the problem model, and finally discuss the solution method of the problem on this basis, so as to design the solution. In this process, students' abstract thinking ability and computational thinking ability have been exercised. Secondly, if teachers skillfully set problems in connection with life examples through careful design, they can guide students to gradually explore ways to solve problems based on the goal of problem solving, so as to cultivate students' logical thinking and innovative thinking. Therefore, it can be seen that the problem heuristic teaching mode can train the computational thinking ability throughout the whole process of problem solving, and it is an effective teaching mode for cultivating the computational thinking ability.

3. Project-driven teaching model.

The connotation characteristic of project-driven teaching mode is that the teacher presents the teaching content in the form of a complete project, and the implementation of the whole project is mainly guided by the teacher and completed by the students through group discussion. Therefore, this teaching mode can guide students to take the initiative to think, students learn the ideas and methods to solve problems in the process of thinking, and understand how to apply the thinking mode of computer science to solve problems in practice. Therefore, project-driven teaching model is a teaching method to cultivate students' computing thinking ability in an imperceptible way.

4. Case driven teaching model.

The case driven teaching model is very similar to the project-driven teaching model, the most significant difference is that the project-driven teaching is usually through a project to string together some relatively complete knowledge, to achieve the purpose of comprehensive use of knowledge, involving a wide range of knowledge. However, the case driven teaching mode involves a narrow range of knowledge, which is mainly suitable for the explanation and application of knowledge points. The general operation steps are case presentation, case analysis, key points explanation, knowledge points introduction, imitation exercises, comprehensive application. In other words, teachers use cases to draw out knowledge points, and students discover knowledge, acquire rules, expand application, and master thinking and methods through cases. Finally, in order to further consolidate the knowledge learned, the teacher can also give similar cases, and let the students use the method of learning in this class to carry out expansion training, so as to internalize the thinking mode of solving problems into a habit.



References

- [1] Jing Ren.(2020). Cultivating students' computational thinking by Python teaching. Fujian Computer Science,36(11),174-175.
- [2] Haifeng Luo, Jian Liu, Yang Luo.(2019). Essential Mental Literacy in the era of Artificial Intelligence: Computational Thinking . Modern Educational Technology,29(6),26-33.
- [3] Liqing Lin.(2020). Discussion on the teaching reform and key links of computer language courses . The Science Education Article Collects,167(11), 101-102.
- [4] Zhidan Wang.(2020). Research on Teaching Reform of C Language Program Design based on Computational Thinking . Technology and Economy Guide,28(33),120-121.
- [5] Mingxia Zhang(2020). Discussion on the Teaching of Common Course of Python Advanced Programming Language . Computer Knowledge and Technology,16(35),169-170.



UNIVERSITY MATHEMATICS MOOC TEACHING IN BIG DATA ERA

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Abstract

With the progress of society and the continuous development of science and technology, not only the way of life but also that of teaching has changed greatly. More and more teaching staff will use modern information technology in the process of teaching. Under the background of big data, MOOC teaching is a very common teaching method in modern universities. There are not only a large number of teaching resources for students to watch, but also a very fine teaching plan, so more and more colleges and universities will teach together with the course. The combination of higher mathematics and MOOC can not only reduce the students' boring feeling when learning higher mathematics, but also ensure that students can learn more scientifically and comprehensively.

Key words: big data era; college mathematics; MOOC teaching

Introduction

MOOC is a very common teaching method in recent years. It is the product of the background of big data, which has brought great impact on the traditional teaching mode and teaching concept. Under the background of the information age, more and more new teaching models have been introduced. The appearance of MOOC not only improves the students' learning quality, but also helps them to develop a good self-study habit and self-study consciousness. In colleges and universities, how to improve the enthusiasm and quality of students' learning is always a key problem for teaching staff. The appearance of MOOC can not only assist teachers in teaching, but also enable students to obtain more perfect and scientific learning. Although the teaching of MOOC has made certain achievements in the actual teaching, teachers should pay attention to certain skills and strategies in the process of practical application to ensure that it can serve the teaching better.

I. An overview of the advantages and characteristics of MOOC teaching

1. The concept of MOOC

MOOC teaching is a kind of teaching method which combines traditional teaching with Internet technology. It is a bridge between students and high quality teaching resources on the network and a new type of online learning method. With the continuous development and progress of science and technology and the rapid popularization of Internet technology, these technical supports



have laid a solid foundation for the application of the course. Under the background of the continuous development and progress of society, people pay more and more attention to the development of teaching. Each student is a different individual, they have different needs for knowledge, but at present, colleges and universities basically teach in a class system, which is not conducive to the individualized development of students. The course can balance this contradiction well and ensure the students' independent choice in the process of learning. There are not only the courses of famous teachers in China, but also the courses of many famous teachers abroad, which makes students no longer limited by time and place, and can make full use of the teaching resources on the network.

2. The characteristics of MOOC

First of all, MOOC has the characteristics of large scale. The courses are strictly screened and tested by professional teams. This work involves people, technology, financial input. Therefore, it can be said that MOOC is a large-scale network platform. Secondly, the remarkable characteristic of MOOC is openness, The courses are basically free, not only open to domestic students, but also to scholars in the world. Finally, MOOC as a network platform, can fully ensure that the scope of communication is large enough. Anywhere in the world, producers can upload their own videos via MOOC. Scholars can also watch videos of their interest through the course, so convenience and wide range of dissemination are also the outstanding characteristics of the course.

II. The importance of the application of MOOC in college teaching in the era of big data

1. MOOC is rich in resources, complete in form, flexible in content and systematic in knowledge organization.

The teaching resources on the platform are very rich, There are not only domestic famous teachers but also international famous school courses, which greatly improves the richness of the courses, This fully ensures that students can choose flexibly according to their own interests. Students choose independently according to their own needs, which can fully ensure the integrity of their learning. In the process of learning higher mathematics, integrity is a very important prerequisite, and the course can make students have their own weaknesses to choose the appropriate content to learn, thus ensuring the integrity and consistency of higher mathematics teaching to the greatest extent. As a kind of teaching method which has been popularized in recent years, MOOC can not only avoid the one-sidedness of students when they study higher mathematics, but also can provide students a more systematic, scientific and comprehensive learning platform so as to lay a solid foundation for their future study.

2. MOOC can improve students' interest in learning and develop students' ability to learn independently.

There are abundant learning resources on the platform. Students can search the key words on the system. There will be many related videos and learning materials on the platform, students can watch selectively according to their own interests. In addition to the rich teaching resources, there are



many related exercises in MOOC. Students can systematically self-test and self-evaluation. This process is different from the way in the traditional classroom teachers force students to inculcate knowledge and check the students' knowledge mastery through the examination, it ensures that the students have sufficient autonomy to be able to self-study, self-evaluation which will enable them to develop a good habit of self-study and self-study awareness. Geometry is a very important part of higher mathematics. In the process of learning this section, students are not only required to have certain logical reasoning ability, but also to have rich imagination. In the traditional teaching process, it is difficult for students to imagine geometric relationships through teachers' descriptions. MOOC can ensure that the students are the masters of the study, and let them fully digest and master the knowledge points by their own understanding through the way of short video. This learning mode has a positive effect on the cultivation of students' comprehensive literacy.

3. MOOC can provide individualized learning environment to meet the different learning needs of different students.

Because of its rich teaching resources, MOOC is easier for students to accept. Students can find their own interesting content on this platform to learn and watch. For example, in the process of higher mathematics learning, students can consolidate and review the knowledge points that are not understood and mastered in the classroom with the help of MOOC to improve their mastery of knowledge. For students with weak learning ability, they may not be able to understand the content of the teacher in time in class, and the course provides a good platform for these students to learn. For students with good academic performance, they prefer to have an opportunity to improve and learn deeply. For this part of the students, the teacher can actively encourage them to study with the help of MOOC. In order to ensure that students can better improve and develop. MOOC can meet the learning needs of different students more individualized, and provide enough convenience for teaching, so more and more higher mathematics teachers will use MOOC to teach.

III. The advantages and disadvantages of college mathematics MOOC teaching

1. The Advantages of Mathematics Teaching in Colleges and Universities

The courses on the platform are usually more than ten minutes of micro-lessons, each section of micro-lessons will have key or difficult points. Each different video will usually be a post-class problem or problem discussion to link up. This fully ensures that students can always follow the teaching arrangements. For example, many different formulas are involved in the section of the sequence of numbers. If students do not fully master and understand any of the formulas, they are likely to lead to a variety of problems in the process of solving problems. Teachers can encourage students to choose some teaching videos to watch. There are sometimes answers between different videos, and only the students who get the questions right will be able to continue with their studies. In this link, the teacher can understand the students' learning situation according to the their answers so as o carry out more scientific teaching arrangements and teaching planning. Compared with the

traditional teaching mode, MOOC first has sufficient teaching resources. There are a large number of teaching resources and learning videos for students to watch on the Internet platform, but students often have poor ability to choose online videos which leads them not to make good use of online resources. The course can help students to learn online, not only to reduce the time for students to screen learning videos on the Internet, but also to enable them to quickly obtain the video they want to watch according to the way of entry search. Higher mathematics has always been an efficient and important course, but often due to teachers' too rigid and monotonous teaching method, students will have a great sense of difficulty and resistance in higher mathematics learning. At the same time, students can choose their favorite teacher style independently, which ensures them to keep their initiative and enthusiasm.

The course has the characteristics of large scale, which ensures that it can run under the operation of a professional team. It is because of the advantages of teamwork that makes the course more professional and reliable. Higher mathematics is one of the basic courses in many colleges and universities, so its teaching quality is also a concern of many colleges and universities. In many colleges and universities, there is a special teaching team of higher mathematics, and every member of this team does his duty and rigorous work to ensure the quality of the course. In addition to the advantages of large scale, there is a certain competition in the video in the course, and students have the right to choose their favorite teaching style in it, which encourages lecturers to constantly change the teaching mode and teaching ideas to ensure that students can have a better learning experience in the process of higher mathematics learning. This group of college students is a group of active thinking, vigorous one, they are not interested in the traditional single way of teaching, but like the humorous teaching style, and like a more novel way of teaching. There are a large number of teaching videos on the platform, students can choose according to their own preferences when choosing the video to watch. For some teachers' videos with clear thinking of solving problems, interesting teaching methods and strong logical content, students' click rate will often be higher. It is this competition of the course platform that makes more teachers pay more attention to their own teaching methods and teaching thinking, which makes the course have more continuous good quality teaching resources, thus attracting more learner to learn.

2. The problem of mathematics MOOC teaching in colleges and universities

Although the teaching of MOOC has some remarkable advantages, it is a widely used teaching mode in recent years, so the teaching experience for teachers' reference is less. Teachers should also fully consider the actual teaching situation in teaching, combined with the actual learning level of students to apply. In the process of higher mathematics teaching, the problem of teaching with MOOC may not be able to teach according to their aptitude. The video is recorded in advance by the relevant teacher team or individual teacher, not according to the actual learning situation of the students, which results in the lack of pertinence to the students' education. There may be a large gap between students. Mathematics itself is a learning process from shallow to deep. It is very likely that



every small problem in learning will lead to the difficulty of carrying out the next step, and it is difficult to solve this problem in the course of recording and broadcasting.

Secondly, the self-discipline requirement of the students is high. Although the group of college students has a certain ability of self-restraint and self-study, in the actual teaching situation, college students usually show lazy and difficult emotions, which are not conducive to the development of teaching. Higher mathematics itself has a certain difficulty, and the students' logical thinking requirements are raised. If the students do not have enough consciousness and self-discipline, it is difficult to successfully complete the study. In addition to the high requirements for students' self-discipline, the application of MOOC in higher mathematics teaching is in the early stage, there are many fields and plates to be improved, and teachers are required to strengthen the guidance and monitoring before and after class. Teachers need to invest more time and energy to supervise in the use of MOOC teaching. So it is necessary for colleges and universities to give teachers enough support to ensure that the teaching of MOOC can be smoothly integrated with higher mathematics teaching. However, in many ordinary colleges and universities, teachers receive the constraints of the school assessment system, many of them are not highly motivated to introduce MOOC teaching. Therefore, although there are many advantages in the MOOC teaching of higher mathematics, it can not completely replace the traditional teaching. So it is necessary for teachers to balance the MOOC teaching of higher mathematics with the traditional teaching to promote the quality of higher mathematics teaching can be better improved.

Many teachers in colleges and universities do not have a thorough and complete understanding of the course, but regard it as an ordinary network course, which leads to the difficulty of obtaining the expected teaching effect in the practical application. Because the teacher's attention is not enough, the students are only attracted by the famous teachers and famous schools, but ignore their own interests, so it is difficult for the students to make good use of the lessons to learn efficiently and reasonably. The time of integration of MOOC and mathematics teaching in colleges and universities is still short, so many teachers and students do not really realize the principle of MOOC mode.

IV. Effective integration of mathematics MOOC teaching and traditional teaching

In the process of higher mathematics teaching, the teacher should design and change according to the content of the teaching, so as to ensure that the teaching activities can serve the teaching. The way of teaching also needs to be innovated to ensure that MOOC teaching and traditional teaching can be better integrated.

1. Sharing mathematics teaching resources

Mathematics is a very important basic course in many colleges and universities. Teachers should pay attention to the supplement of relevant knowledge in teaching so as to ensure that students can obtain more comprehensive learning. The teaching resources about higher mathematics are very



rich in the MOOC, and there are all kinds of videos of teaching styles to choose. These high quality teaching resources greatly enrich the students' choice and fully guarantee the students' autonomy in the process of higher mathematics learning. Many mathematics teaching videos in MOOC provide teachers with reference teaching experience, which also has a positive guiding role for teachers to carry out traditional teaching, and can encourage teachers to reform their teaching methods. Sharing teaching resources can enrich students' learning materials to a great extent, so as to ensure that students can obtain more comprehensive learning. For teachers, we should balance MOOC teaching and traditional teaching, so as to ensure that the two teaching models can promote each other and improve each other, so as to ensure that students can get better learning experience and learning effect.

2. A mutual reference of teaching model

In the traditional teaching mode, the most prominent feature is interactivity and teaching students according to their aptitude. Because of the face-to-face relationship between students and teachers, students' problems can be helped and solved by teachers in time in class, while MOOC is recorded. For example, when the teacher teaches some chapters with higher difficulty coefficient, the teacher can learn from the explanation mode of some excellent teachers in MOOC, so as to ensure that the students can better understand the contents of higher mathematics. For example, when teaching the contents related to calculus, teachers can first watch some relevant teaching videos from MOOC, fully learn from the teaching mode of excellent teachers in the class, and help themselves to improve their teaching level.

3. A mutual reference of learning patterns

With the appearance of MOOC, the relationship between teachers and students has changed a lot. Teachers are no longer the authority in traditional teaching, but the friends and guides of students. Even the group of students who acquire knowledge can also explore the identity of knowledge independently, which fully ensures that students can constantly expand and improve their understanding ability and thinking level. Due to the strong requirement of logical thinking in mathematics curriculum, teachers need to fully consider students' understanding ability, and ensure that the rhythm of teaching can meet the students' cognitive level and ensure that students can fully participate in the teaching process.

4. Improving the quality of MOOC design

In many colleges and universities, teachers' understanding of the teaching mode of MOOC is still at a low level. They have confused the concept of MOOC and online classes. Therefore, many college teachers' videos do not meet the curriculum standards but still upload to the class. This leads to confusion of teaching resources and waste of resources. When recording the video, there should be a professional team to shoot to ensure the rationality of lighting, editing and modeling. Secondly, the teacher's teaching method should be innovative, not too rigid and single, and the teacher can also record according to his own characteristics. Finally, the teacher should ensure the correctness and rigor of the recording course and avoid misleading students.



5. Training excellent teachers with the concept of MOOC teaching mode

Under the background of big data, the way of learning by using the Internet is already a very common way, which requires teachers to constantly change their teaching concepts so as to ensure the concept of keeping pace with the times and the advanced nature of teaching methods. In the process of higher mathematics teaching, the teacher's teaching level determines the students' learning effect and school quality to a great extent, so colleges and universities should train high quality and high standard teachers as the most goal. For colleges and universities, they should be given sufficient financial support to encourage teachers to study, or regularly train teachers to ensure that they can update teaching resources and teaching materials in time. For teachers and teachers, they should be strict with themselves and their teaching, and dare to innovate teaching methods, so as to ensure that their teaching level can be continuously improved.

Concluding remarks

Under the background of the information age, more and more classes become more intelligent, scientific and technological, and the higher mathematics teaching in colleges and universities also needs to be carried out with the help of Internet technology. The appearance of MOOC has brought great influence and change on teaching, and promoted teachers to carry out teaching reform as well. The introduction of MOOC can greatly enrich the ways and means for students to acquire knowledge which can more help them to develop a good habit of self-study and self-study awareness. Although MOOC is the product of big data background, it can play a good role as the assistant of traditional teaching. The combination of MOOC teaching and traditional teaching can make students get better learning experience and learning effect, and at the same time, they can constantly improve their autonomous learning ability.

References

- [1] Xu geni. An inquiry into the MOOC teaching of colleges and universities mathematics in the era of big data [J]. *Education and Teaching Forum*, 2018(16):196-197.
- [2] Xia Fei, Ma Lin, Zheng Pengdan. Discussion on the MOOC teaching of colleges and universities mathematics in the era of big data [J]. *Modern Vocational Education*, 2018(28).
- [3] Li Jialin. Research on college mathematics education based on MOOC [J]. *Education Modernization*, 2020, v.7(13): 68-69 76.
- [4] Wu Dayong. Research on the teaching of mathematical analysis in colleges and universities under the background of MOOC [J]. *Journal of the Inner Mongolia Finance and Economics University* ,2019, v.17;No.92(06): 126-128.,2019
- [5] Li Jiao. Research on professional teaching method under the background of MOOC teaching in colleges and universities [J]. *Good Parents* 2019(31):11-12.

B 公司建筑设计团队薪酬计划研究

THE SALARY PLAN OF B COMPANY'S ARCHITECTURAL DESIGN TEAM

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摘要

为解决 B 公司建筑设计团队的员工激励困难问题, 进行团队薪酬计划设计。以项目的各个阶段和各专业的劳动定额为根据进行团队薪酬的两次分配的方式。以项目产值量化的方式进行一次分配, 以按贡献分配的方式进行二次分配。标准的项目产值量化, 让员工可以明确知晓自身产值, 同时解决公司薪酬不规范的现象。辅以团队竞赛制和专业竞赛制激活工作氛围, 将新的薪酬形式纳入团队薪酬分配的过程, 将薪酬分配的选择权交给员工。虽然员工不能参与薪酬设计的过程, 但是可以让员工拥有选择权, 增强员工主人翁意识。对设计团队以鼓励为主, 对于表现不佳的团队设置半惩罚式奖励, 强制学习。力求形成团队对内积极合作交流, 团队对外竞争的工作氛围。

关键词: 团队薪酬 建筑设计团队 二次分配

Abstract

Design team compensation plan to solve the problem of employee motivation difficulty of B company architectural design team. The twice distribution of team salary is based on the workload of each stage of the project and each specialty. The first distribution is carried out by quantifying the output value of the project, and the second distribution is carried out according to the contribution. By quantifying the standard project output value, employees can clearly know their own output value, so as to solve the phenomenon of non-standard salary of the company. The right to choose salary distribution is given to employees, team competition system and professional competition system activate the working atmosphere as an auxiliary, and the new salary form is incorporated into the team salary distribution process. Although employees can't participate in the process of salary design, they can give them the right to choose and enhance their sense of ownership. The design team is mainly encouraged, and the team with poor performance is given a semi punitive reward and forced learning. This is to form a working atmosphere of active cooperation and communication within the team and competition outside the team.

Keywords: Team compensation Architectural design team Twice distribution

一、引言

团队薪酬在工作任务互依性高的企业中受到较多的重视。建筑设计团队为庞大且复杂的建筑项目负责，需要面对诸多工作中的合作问题。建筑设计中的方方面面都离不开合作，所以避开团队只谈个人薪酬在建筑设计企业是不合适的。刺激团队中的成员合作可以减少不必要的施工成本，有效降低建筑预算。虽然建筑设计企业越来越重视设计人员的薪酬问题，但由于市场薪酬竞争，员工能力评估复杂，个人劳动难以量化等问题，建筑设计团队并没有科学有效的团队薪酬计划。

如何对建筑设计团队设定统一标准，如何选择合适的方法对标准进行测量，并设计其团队薪酬计划，就成为了建筑设计企业急需解决的问题。其中，如何在薪酬分配流程中保障公平，就成为了团队薪酬计划设计的难点。

二、研究目的

在建筑设计企业，一个完整的项目需要经由建筑设计师，结构设计，给排水设计，暖通设计，电气设计等多个专业的设计师进行。最少 5 个人便可构成一个项目团队，而一些大型企业还包括，总工程师，建筑设计师助理等多方面协同。B 公司项目设计构成如下图所示：

一般一个项目由项目负责人负责接收分配任务给各个团队，团队中的各个专业则有各自的负责人负责工作质量。并且团队外设有各专业的审核人和校对人以确保项目设计的正确性。设计审核、校对和负责人需要经手多个项目，不直接影响设计进度，属于设计团队外的监管人员。所以本文研究的设计团队由建筑设计师，结构设计师，给排水设计师，暖通设计师，电气设计师构成。其中建筑设计师负责建筑风格、主体和景观等总体设计，统筹整个项目。结构设计师负责对项目的合理性和经济性进行专业把关，并解决遇到的结构专业技术问题。给排水设计师、暖通设计师、电气设计师各自负责自身专业相关的技术问题，并在初步设计的过程中与其余专业做好接触，完成项目施工图。目前企业内无明确清晰的团队薪酬计划。B 公司设计人员的主要薪酬构成为基本薪酬、项目产值提成薪酬、津贴。

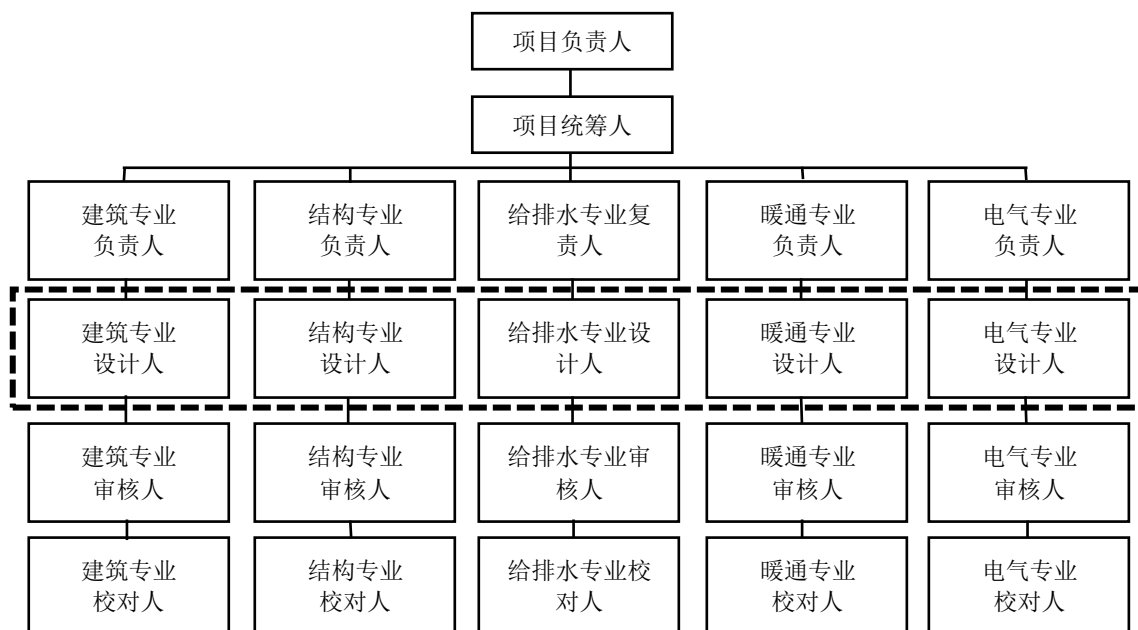


图 2-1: B 公司项目设计人员构成图

表 2-1: 设计人员薪酬构成

设计人员薪酬构成			
总体薪酬			相关性回报
基本薪酬	项目产值薪酬	津贴	
岗位薪酬 工龄薪酬	(项目产值-不提成产值) *提成系数	注册证书津贴	

此时若是将其纳入团队薪酬计划设计中, 必然也会扰乱计划的规范性, 模糊计划的意图。但是产值提成作为建筑设计企业不可忽视的产业现象, 已经与设计人员息息相关且不可分割。在团队薪酬计划的设计中, 必须将项目产值提成薪酬纳入考虑。对于一个团队而言, 若是不能在奋斗的过程中, 明白团队追求的目标和方向, 那团队也必然走不远。在个人薪酬层面的项目产值提成计算过程本就模糊, 即没有公司发文明确规定, 也没有专人对基层员工进行指导教育, 更没有应对多种情况的解决方案。但是在团队层面则更需要提出明确的绩效计量方式。因为在需要二次分配的情况下, 若不能解决这种种问题, 会让本就模糊的规则更加看不清。团队薪酬计划必须要解决模糊计算规则的量化和规范问题, 只有明确了基础规则, 才能它的基础上进行适应企业的扩展与落实方案。总而言之, 目前 B 公司的项目产值提成薪酬仅在个人层面进行了计算, 缺乏对团队整体的薪酬设计。缺少明确的规范与准确的计算方式, 并且存在计算过程模糊, 奖金发放分配情况笼统追求平均主义等情况, 导致公司难以推行团队薪酬计划。

在 B 公司, 员工主要以设计所为单位, 各专业设计人员各所均有配备, 并且大多数情况下, 各所的工作任务并不交叉或是有直接关系。在部分情况下会存在从各所抽调人员组合临时项目团队。在这样的公司结构中, 基层员工之间几乎不存在直接竞争关系。所以对于大多数员工而言, 做好本职工作便可, 缺乏突破进取的动力和横向比较。而团队薪酬计划的设计, 可以帮助公司奠定构建团队机制的基石。只有通过团队薪酬的设计, 将个人层面的竞争关系引导到整个团队的竞争。才能通过外部压力促进团队内的进步, 以及个人的提升动力。

本文从团队薪酬角度对设计人员进行工作岗位以及职能进行分析, 针对 B 公司现状提出团队薪酬计划方面的改动, 并在计划的实施层面提出注重实际测量的保障措施, 确保计划的实施, 力求向员工准确传达企业对其岗位价值的认可, 对团队合作的需求。同时帮助公司各团队内的相互合作, 促进个人与公司共同成长。

三、文献综述

当企业开始需要考虑协同工作的员工, 注重团队薪酬计划时, 便不可避免的需要考虑团队设置问题以及团队薪酬问题。徐露丝(2019)认为建筑企业因大环境影响, 偶读紧张的资金链问题从企业角度对薪酬管理产生了重要影响, 让原有薪酬体系难以延续。张正堂(2014)认为在中国情境下, 对团队进行两次分配更可能直接影响个体而使团队绩效提升, 并且在团队薪酬计划中, 任务互依性是不可忽视的。Steiner(1972)提出了团队任务的四种类型分别为: 累加性任务、互补性任务、隔离性任务、结合性任务。建筑设计团队为累加性任务, 团队中的每个人处于建筑设计的各个环节上, 相互之间的产出互为对方的投入, 且具有一定的流程顺序缺一不可。Cohen 和 Bailey(1997)认为团队类型具有四种, 分别为工作团队、平行团队、项目团队、管理团队。其中工作团队便是指由稳定成员构成的生产团队。目前建筑设计企业中部分企业还

没有形成良好的团队体系，企业内仍以部门进行分类，让各部门具有多样的员工，在工作中交叉配合形成针对项目的平行团队。陆峰（2016）认为建筑设计企业薪酬体系的激励效果不明显，是否认了企业内团队的存在，仅注重个人绩效。而郑倩（2020）认为只有了解团队工作的本质以及团队各构成要素，并设计适应团队发展的薪酬策略才能促进团队效能的提升。虽然在部分建筑企业则有成熟的工作团队，负责了项目设计的方方面面，从投标到初步设计等，但是在B公司仍然是处于没有团队制度的状态。张正堂（2012）提出观点认为传统个体薪酬计划只认可个人绩效，而不认可有利于团队整体绩效提高的信息共享和合作行为。但是对于建筑设计这类协同需求较高的工作，团队的出现是不可避免的。刘颖（2019）认为随着任务互依性的增强，合作性努力的中介作用得到加强，团队的努力方向更趋向于合作。在这样的背景下，建筑设计企业的团队薪酬计划则显得尤为重要。本文主要针对B公司的全职工作团队进行研究设计团队薪酬计划。

四、研究方法

本文通过查阅、收集和整理大量有关建筑企业团队薪酬问题的文献资料和理论著作作为理论支撑，结合薪酬管理优化研究的相关研究进行学习和总结。同时对B建筑设计有限公司进行统一的问卷收集，收集其对目前企业团队薪酬现状的看法和意见，获得B公司团队薪酬的真实客观的信息，分析企业团队薪酬的现状问题及原因，为后续的团队薪酬计划研究提供更为坚实的依据。

（1）文献分析法

本文通过查阅、收集和整理大量有关建筑企业团队薪酬问题的文献资料和理论著作作为理论支撑，结合团队薪酬优化研究的相关研究进行学习和总结。为本文奠定研究基础，为写作做好准备。

（2）问卷调查法

对B建筑设计有限公司进行统一的问卷收集，收集其对目前企业团队薪酬现状的看法和意见，获得B公司员工对企业团队工作的真实客观的信息，分析企业团队薪酬的现状问题及原因，为后续的团队薪酬优化措施提供更为坚实的依据。

（3）案例研究法

围绕B建筑设计有限公司员工的团队薪酬问题，进行持续性的调查，发现企业对员工的团队薪酬问题出现的典型案例，进行反思和总结，研究其存在的问题，并对其进行剖析提出对策建议，掌握问题解决的全过程。促使企业对团队薪酬进行优化，使得薪酬制度对员工产生实际有效的激励作用。

依据发现、研究、解决问题的思路，对B建筑设计有限公司团队薪酬计划进行优化研究。第一部分为引言与研究目的，主要阐明文章的研究背景与研究目的及意义，阐述论文的主要贡献。第二部分为文献综述与研究方法，为文章后续优化团队薪酬计划提供理论依据。第三部分为研究结果，针对团队薪酬计划的两个分配层面问题进行讨论，说明团队薪酬计划具体的优化方案。第四部分为总结与讨论，对薪酬体系的施行阶段进行保障措施建议，同时形成研究结论，并对下一步研究进行展望。

五、研究结果

团队薪酬设计需要从两个层面进行考虑。分别是公司对设计团队的整体绩效评估，这是一次分配。再是确定团队中的个人对团队绩效的贡献，这是二次分配。一次分配可以提高团

队的整体认知和凝聚力，二次分配则可以直接影响员工的工作态度。特别是针对目前 B 公司设计人员的薪酬体系缺少详细构成规范的问题，通过明确的薪酬分配流程设计，提出明确清晰的规范制度，让员工的薪酬有据可考，让绩效有处可查。

(1) 团队薪酬一次分配

团队层面的一次分配主要涉及三个方面，团队绩效测量、绩效目标确定以及薪酬绩效敏感性。以项目设计面积以及工时作为标准对公司的设计团队进行绩效测量，可以准确计算出团队在一段时间内的绩效。所以采用团队计件的方式则更为直观，利于一次分配的绩效计算和薪酬分配公平。采用团队有限计件工资制，在直接计件制的条件下对超额工资进行限定。张正堂（2014）认为在企业中，个人计件工资制会导致员工互动不和谐，但是在团队层面则有相反的现象。同时在公司范围内的团队管理中加设竞赛制，对于优秀团队进行表彰奖励，对于表现不佳的团队予以警告和鼓励。以此打破原有的员工之间互不相关的工作环境，构建鼓励合作竞争的工作环境。

设计团队的薪酬形式主要分总体薪酬和相关性回报两部分。总体薪酬为项目产值提成，仅根据团队所实际完成的项目数计算，为计件制。相关性回报为团队整体福利津贴等，受竞赛制控制。根据《全国建筑设计劳动（工日）定额》（2015 年修编版）规定，建筑设计项目从任务复杂程度上进行区分，主要分为：简单工程，一般工程，复杂工程，特别复杂工程。其中主要工作包括方案设计、初步设计、施工图设计三个阶段。所以为鼓励团队积极性，面对不同难度的项目设立不同的提成系数。以简单工程的工日为基准，根据各类工程的工日进行计算，并以此为提成系数的计算方式。根据 B 公司以往数据设定基础提成系数 K_0 为 0.25。各类工程难度从简单工程到特别复杂工程共分别为 D1-4 四个级别。

表 5-1：各专业 1#图平均工耗（工日）

专业 复杂程度	建筑	结构	给排水	暖通	电气
简单工程（1）	8.0	5.1	0.9	1.3	1.9
一般工程（2）	8.9	5.1	1.2	1.5	2.1
复杂工程（3）	9.3	5.8	1.5	1.7	2.4
特别复杂工程（4）	10.2	6.0	1.6	1.8	2.6

来源：《全国建筑设计劳动（工日）定额》（2015 年修编版）

以下为各类工程完成项目产值提成系数计算公式，其中 K_n 为产值提成系数， K_0 为基础提成系数，D为工程难度系数：

$$K_n = K_0 \times D \quad (\text{式 2-1})$$

表 5-2: 各类工程完成项目产值提成系数

复杂程度	总工日	难度系数 D	产值提成系数 K
简单工程 (1)	17.2	1	0.25
一般工程 (2)	18.8	1.1	0.275
复杂工程 (3)	20.7	1.2	0.3
特别复杂工程 (4)	22.2	1.3	0.325

以下为设计团队项目产值提成计算公式，其中 R_n 为团队项目完成产值提成， n 为团队完成的第 n 个项目， P_n 为团队完成的第 n 个项目的设计费， K_n 为团队完成的第 n 个项目对应的产值提成系数。

$$R_n = \sum_1^n (K_n \times P_n) \quad (\text{式 2-2})$$

这是对于完成项目所得的设计费的产值提成。在建筑设计公司存在一部分项目未完成或仅到方案设计阶段，难以继续的项目。所以，因项目未完成与项目完成的工作量以及收益上有差距，所以需要未完成项目进行单独计算。在项目不成功时，存在只收取了方案设计费，而没有初步设计和施工图设计的费用。项目未完成存在多种情况，有项目团队竞标失败，有甲方拒绝继续合同等多方面可能。所以对于项目未完成的情况，不能一概而论的惩罚，要对设计团队多予以鼓励的形式避免惩罚性激励。但对于特别复杂工程，公司管理部门需要承担较大损失，所以鼓励提成系数增幅稍小。

表 5-3: 方案设计阶段工作量占总工作量分配参考比例

复杂程度	简单工程	一般工程	复杂工程	特别复杂工程
方案阶段占比	0.15	0.2	0.25	0.25

来源：《全国建筑设计劳动（工日）定额》（2015年修编版）

以下为各类工程未完成项目产值提成系数计算公式，其中 K_i 为产值提成系数， K_0 为基础提成系数， D 为工程难度系数：

$$K_i = K_0 \times D \quad (\text{式 2-3})$$

表 5-4: 各类工程未完成项目产值提成系数

复杂程度	方案阶段工日	难度系数 D	产值提成系数 K
简单工程 (1)	2.6	1	0.25
一般工程 (2)	3.8	1.5	0.375
复杂工程 (3)	5.2	2	0.5
特别复杂工程 (4)	5.6	2.2	0.55

以下为团队项目未完成产值提成公式， R_i 为团队项目未完成产值提成， i 为团队未完成的第 i 个项目， P_i 为团队未完成的第 i 个项目的设计费， K_i 为团队未完成的第 i 个项目对应的产值提成系数。

$$R_i = \sum_1^i (K_i \times P_i) \quad (\text{式 2-4})$$

以下为设计团队全部项目产值提成计算公式，其中 R 为团队产值提成， R_n 为团队项目完成产值提成， R_i 为团队项目未完成产值提成。

$$R = R_n + R_i = \sum_1^n (K_n \times P_n) + \sum_1^i (K_i \times P_i) \quad (\text{式 2-5})$$

由此可得，设计团队的产值提成为完成项目的产值提成加上未完成项目的产值提成，其中完成的项目与未完成的项目采用不同的提成系数。

对于相关性回报则在公司内设立竞赛制，以设计团队一定周期内的设计面积为考核标准，每季度，每年度进行一次评分排名。对于表现优秀的团队提供认可与社会地位相关，学习机会相关，以及下一个周期内优先选择高复杂度工程的机会等。对应多个级别设定多套奖励方案，供团队选择。在这个环节，虽然团队成员不参与薪酬分配规则的制定，但是具有选择权，可以选择自身需要的奖励。排名越靠前的团队则拥有更多的选择权，如此刺激团队内的合作交流以及对外竞争。

表 5-5: 团队排名奖励

排名	100%-81%	80%-41%	40%-11%	10%-0%
选择奖励次数	0	1	2	3
额外奖励调节	公司定制奖励	可选 1 级组合	可选 2 级组合	可选 2 级组合 挑战性项目优先

表 5-6: 奖励组合

2 级组合	管理团队培养，团队合作培训，考证培训等	带薪休假，专业培训，考试补助
		出差津贴，加班津贴，路费津贴
		环境美化，设备升级，住房补助
1 级组合	软件技术学习培训	加班津贴，设备升级
		路费津贴，住房补助
		出差津贴，带薪休假
定制奖励	软件技术学习培训	

对于前 10% 的优秀团队可获得三种 2 级奖励组合，并且获得挑战性项目优先选择权。对于前 40%-11% 的团队可以从 2 级组合中选择两项作为奖励。对于前 80%-41% 的团队则仅可在 1 级奖励组合中选择一项。最后 10% 的团队则做半惩罚式奖励，强制学习，以提高其专业技术能力。对于所有团队一直采用鼓励学习和合作的方式，促进团队成长，增强员工和公司之间的粘性。

(2) 团队薪酬二次分配

在团队薪酬的二次分配中，存在不同团队可能存在人数不同等情况，但专业搭配的专业数是一定的。并且，各专业主任设计师必定只有一位，其余为助理或实习生，各专业负责人不直接参与项目设计。所以个人层面的二次分配主要涉及两个方向，一是根据在团队项目中不同的阶段进行按劳分配，二是根据员工所在专业进行排名计算绩效系数。赵海霞(2012)认为团队薪酬的二次分配中，按照成员的贡献分配对团队公民行为具有积极的影响。设计团队的工作任务属于互补性任务，团队内的成员缺一不可，但是建筑设计对最终设计的表现又具有重要影

响。在不同环节中各个团队成员的参与度各不相同。以下表格是各专业单个项目设计的工作量分配参考比例。

表 5-7: 各专业工作量分配参考比例

专业 工作阶段	建筑	结构	给排水	暖通	电气	合计	阶段占比
方案设计(A)	0.75	0.1	0.05	0.05	0.05	1	0.25
初步设计(B)	0.4	0.3	0.1	0.1	0.1	1	0.25
施工图(C)	0.3	0.4	0.1	0.1	0.1	1	0.5

其中方案设计阶段建筑专业占主要地位，建筑设计师起到了协调整体工作，对整个方案进行布局规划的工作要求。初步设计阶段各专业参与，完善设计，便于投资方以及政府各主管部门审查。施工图阶段团队内各专业成员参与进来，将方案完善，解决所有困难，为现场施工与安装提供依据等。

以下算式为设计人员以工作量为依据进行计算的分配系数，其中 K_n 为团队项目完成分配系数， a 为方案设计阶段占比系数， b 为初步设计阶段占比系数， c 为施工图阶段占比系数， K_a 为方案设计阶段该专业员工所占比例， K_b 为初步设计阶段该专业员工所占比例， K_c 为施工图阶段该专业员工所占比例：

$$K_n = a \times K_a + b \times K_b + c \times K_c \quad (\text{式 2-6})$$

表 5-8: 各专业完成项目团队分配系数

专业	建筑	结构	给排水	暖通	电气	总计
分配系数	0.43	0.3	0.09	0.09	0.09	1

以下为设计人员完成项目的薪酬分配公式，其中 R_n 为设计人员项目完成薪酬， n 为项目完成的第 n 个项目， K_n 为团队项目完成分配系数， R_n 为团队项目完成产值提成。

$$R_n = \sum_{i=1}^n (K_n \times R_n) \quad (\text{式 2-7})$$

方案未完成时因情况众多，为保障团队内的和谐合作，所以对参与程度较低专业予以部分补偿，以兹鼓励。朋震(2011)认为在项目团队风险更高的同时，虽然团队成员收益也更高了，但是不公平和负面效应也会更明显。所以适当在团队失败时给予员工少量补偿，以提振士气是必要的。同时因未完成项目只包含方案设计阶段，所以根据完成项目的情况进行各专业协调分配，直接得出分配系数。

表 5-9: 各专业未完成项目团队分配系数

专业	建筑	结构	给排水	暖通	电气	总计
分配系数	0.65	0.14	0.07	0.07	0.07	1

以下为设计人员未完成项目的薪酬分配公式，其中 R_i 为设计人员项目未完成薪酬， i 为项目未完成的第 i 个项目， K_i 为项目未完成分配系数， R_i 为项目团队未完成产值提成。

$$R_i^{\square} = \sum_1^i (K_i^{\square} \times R_i) \quad (\text{式 2-8})$$

以下为设计人员全部项目的薪酬分配公式，其中 R^{\square} 为设计人员全部薪酬， R_n 为团队项目完成产值提成， R_i 为项目团队未完成产值提成。

$$R^{\square} = R_n^{\square} + R_i^{\square} = \sum_1^n (K_n^{\square} \times R_n) + \sum_1^i (K_i^{\square} \times R_i) \quad (\text{式 2-9})$$

完成成员在团队项目中不同的阶段进行按劳分配的过程后，采用竞赛制的形式对个人在专业内的排名进行系数划分。利用公正型的薪酬分配方式刺激员工形成团队内积极合作，团队外努力竞争的工作态度，避免搭便车行为。能力指标，态度指标，业绩指标转化为绩效薪酬系数，在保证员工基础薪酬的情况下，做到有奖有罚。对优秀团队的懈怠成员表示惩罚，对表现较差的团队优秀员工表示鼓励。最终在年度或季度奖金发放时进行绩效排名计算，用年度或季度奖金乘以绩效系数，求得员工实际绩效薪酬数。

以下为设计人员实际绩效薪酬数计算公式：

$$(R^{\square} - 12 \times \text{基本薪酬}) \times \text{绩效薪酬排名系数} = \text{实际绩效薪酬数} \quad (\text{式 2-10})$$

表 5-10：绩效薪酬排名系数

专业排名 团队排名	100%-81%	80%-41%	40%-11%	10%-0%
100%-81%	0.6	0.8	1	1.2
80%-41%	0.8	1	1.2	1.4
40%-11%	1	1.2	1.4	1.6
11%-0%	1.2	1.4	1.6	1.8

六、总结

本文从产值提成量化的角度，进行了建筑设计企业的团队薪酬计划优化研究，选择具有代表性的 B 公司作为研究对象。根据 B 公司的现状，制定了新的团队薪酬计划。本文主要结论如下：

主要以项目的各个阶段和各专业的劳动定额为根据，以两次分配的步骤对团队薪酬进行了统一分配。将原本不宜说明，且不宜计算的绩效单独提出进行量化。其中在一次分配阶段以项目产值量化的方式，量化员工的产值，通过明确的公式和系数，让员工在知晓自身工作量的基础上可以明确计算出自身产值。二次分配阶段以按贡献分配的方式进行分配，主要以劳动定额为根据进行适当调整，确保整个分配流程的公正。让产值提成的计算方式不论在何种情况下均可利用，仅需对基础系数和工程难度系数进行调整。如此计算公式在不透露系数时可以极大的保护公司商业机密的同时指导员工理解自身绩效，从而缓解绩效计算困难问题，也解决了建筑设计企业长期以来产值薪酬因计算困难导致的激励作用缺失问题。严格量化的分配流程，保障了员工的利益，确保了公司有规范可以依据施行。

同时辅以团队竞赛制和专业竞赛制带动传统的建筑企业的工作氛围，通过将薪酬分配的选择权交给员工的方式，增强员工的自主意识。用相关性回报将具有巨大竞争压力的竞赛制转为，相对较为和谐的团队竞争，对于团队减小竞争失败的惩罚措施，更多的是在团队间强调奖励的激励效果。利用团队竞赛增强员工的跨专业合作积极性，利用个人竞赛增强员工跟本专

业员工进行专业技能方面的竞争。如此形成的良性竞争使得员工会更有积极性和企业认同感。虽然本文对团队产值薪酬的两次进行了量化，对竞赛制薪酬进行了构思，但是研究上仍有可以拓展的方向。目前仅解决了 B 公司的团队薪酬产值规范问题，对设计团队成员间的薪酬关系研究缺乏，在二次分配是不是有使用公平型分配等其他方式的可能，这些都有待讨论。

七、讨论

为保障 B 公司团队薪酬计划的顺利实施，确保新的薪酬计划可以发挥实际的激励效果，关键在于制定有效的反馈沟通机制，以及周期性的观察和计划调整修正。

(1) 团队薪酬计划实施过程

首先便是对规范的严格执行。团队薪酬计划是公司运用来激励员工向组织设定的目标而奋斗的管理方式，所以一旦在实施过程中遇到问题便得过且过，便会让计划流于表面，让计划与预期的激励效果相差甚远。在团队薪酬计划实施的过程中，人力资源部门完成自身工作的同时，必须严格参考计划设定的员工相关考核依据进行周期性的数据收集。其次人力资源部门要与财务审计部门，做好考核数据的审核工作，确保数据真实有效。在这个过程中，若被考核人存在异议，管理部门需要做好及时沟通并进行流程审查，确保将问题解决以做到公平公正。严格根据规范执行不仅可以形成良好的公平竞争环境，同时也利于公司从新计划中发现可能存在的问题。

目前经调查发现，大多数员工在入职时并不能通过合同了解到公司待遇的详细信息，并且因劳动合同中仅注明每月基础薪酬，导致员工在离职时，合法权益得不到保障。员工不清不白的便上岗工作，在工作中也缺乏薪酬分配方面的专业指导。这都导致员工对薪酬管理缺乏认知，让员工对于工作任务，对于岗位价值，对于自身价值的认知模糊。所以必须新的团队薪酬计划实施时，首先公示团队薪酬计划的实施细则。主要注重三个方面，面试以及入职时做好一定范围的尽职规范的解释，阐明公司对员工的薪酬规划。其次在公司内对薪酬管理方面的工作人员进行辅导教育，设立薪酬管理咨询点，并帮助其余员工解决薪酬方面的疑难。最后将团队薪酬计划细则公示，在公司的系统内明确公示计算方式，并以文件的形式通知到个人。种种薪酬分配流程的公示会让员工对公司的规范性产生清楚的认识，让员工在需要薪酬方面的帮助时均有渠道去获取来自公司的间接或直接的帮助。

新团队薪酬计划在推行过程中必定会因影响部分员工的利益从而产生阻力，所以推行团队薪酬计划的培训与宣传指导便非常必要。不仅仅是要训练团队的设计人员，对于团队外的监管人员，审核人员，公司的薪酬管理人员都需要及时的辅导教育。针对团队内的设计人员，重点要辅助员工理解并接受新计划的内容，并且帮助他们理解薪酬计划改动的必要性。对于监管人员以及审核校对人员则需要针对性的培训薪酬计划的考核要点，以及考核方式。同时全方面的培训薪酬管理人员，让薪酬管理人员做好基层员工与领导之间的桥梁。如此确保团队薪酬计划内外施行的一致，为建立良好的监管机制和反馈机制打好基础。

团队薪酬计划并不是一成不变的，很多时候，不同时期的团队适应不同的计划，并不能一概而论。长期保持固定的团队薪酬计划不利于团队与公司的发展，所以必须根据实际情况适时的调整员工薪酬，做到周期性检查，周期性调整。在公司内从上往下，在团队薪酬计划推出后，要注意周期性抽取员工样本，通过与员工交流，获知团队发展状况。通过定期交流以期提前发现团队问题，通过调整团队薪酬的薪酬形式与员工个人薪酬的薪酬比例，确保团队的活力。并在可能的情况下，设立薪酬管理小组，具有针对性的实时监控整个系统的运行。如

此做到尽力减少搭便车行为,通过不断的调整,明确每个人的自身价值,和对团队所产生的贡献。这将使得团队薪酬计划越来越符合公司的实际运营需求,并且使得团队可以更加长远。

(2) 团队薪酬计划实施的保障措施

在公司的管理体系中,绩效考核是团队薪酬激励效果的重要影响因素。如何优化完善绩效考核系统则尤为重要。重点在于两个方面:绩效考核内容和绩效考核周期。对于 B 建筑设计公司而言,设计人员的能力素质和工作态度是最为重要的,这直接影响了项目完成的质量和速度,对公司的品牌声誉都有重要影响。其中能力素质指标和绩效考核相关,所以设定定期专业的能力素质评定是尤为重要的。同时需要持续关注员工的工作态度,包括但不限于工作满意度,工作环境的评定等,这些因素都需要考虑进管理层的绩效考核中。而绩效周期则主要集中与季度考核和项目考核,改变曾经产值薪酬的年度考核。利用更加频繁细致的考核,增强员工对自身近期工作成果的认知,明确自身优缺。使得绩效考核能够辅助团队薪酬计划,形成良性的竞争机制,帮助每位员工明确自己的能力与目标,促使团队和员工发挥主观能动性和创新能力。

需要针对薪酬多次分配流程,设立完善的监管机制。目前 B 建筑设计公司监管制度缺失,在薪酬分配的过程中存在较多的关系影响,不同的管理人员对薪酬分配的不同理解,让同层级的员工间薪酬分配的结果存在差异。间接导致平均主义的出现,让员工出现懈怠情绪,所以监管机制必须存在。从薪酬计划的全流程进行监督,包括实施和改进的整个周期。通过监督绩效考核人员、薪酬分配流程让团队薪酬计划的存在具有实际意义,避免流于形式。并给予员工在改进过程中的发言权,通过匿名,座谈会等公开或半公开的形式进行讨论,从而监督上级的薪酬分配公平。对于员工需要设置让员工安全放心的反馈通道,让信息可以直达管理者,而保护员工自身。避免公司内部的信息流通困难和消息封闭。

参考文献

- 陆峰. (2016). YD 建筑设计院项目团队薪酬激励体系研究. 石河子大学硕士论文.
- 刘颖 & 张正堂. (2019). 团队薪酬对团队质量绩效和效率绩效的影响——合作性努力和竞争性努力的中介效应. 华南师范大学学报(社会科学版). 04, 120-129.
- 朋震. (2011). 项目团队的薪酬体系设计:问题、方法与条件. 中国人力资源开发, 2, 22-30.
- 徐露丝. (2019). D 建设集团有限公司薪酬管理优化研究. 上海外国语大学硕士论文.
- 赵爽 & 林柳君. (2019). 薪酬公平的文献综述. 区域治理. 39, 236-238.
- 中国勘察设计协会建筑设计分会. (2015). 全国建筑设计劳动(工日)定额. 北京.
- 张正堂. (2012). 团队薪酬计划的设计要素与模式. 经济管理, 34(8), 89-96.
- 张正堂. (2014). 团队薪酬、任务互依性对团队绩效的影响研究. 南开管理评论, 17(3), 112-121.
- 赵海霞. (2012). 团队薪酬体系对团队绩效的作用机制研究. 华中科技大学博士论文.
- 郑倩. (2020). 团队薪酬对团队效能的影响机制研究. 江西财经大学硕士论文.
- Cohen, S. G. & Bailey, D. E. (1997). What makes teams work: Group effectiveness research from the shop floor to the executive suite. *Journal of Management*, 23(3), 239-290.
- Steiner, I. D. (1972). *Group Process and Productivity*. New York: Academic Press.

变革型领导与员工追随行为的影响研究

THE INFLUENCE OF TRANSFORMATIONAL LEADERSHIP ON EMPLOYEE FOLLOWING BEHAVIOR

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摘要

在当今企业竞争愈加激烈的时代，培养员工积极的追随行为对企业的生存发展及组织实践而言十分重要。本文基于社会认同理论，探讨了变革型领导对员工追随行为的具体影响及潜在的作用机制。基于对 412 份有效问卷的数据分析，研究结果显示，变革型领导会正向影响员工的追随行为，其中，员工组织认同中介了变革型领导与员工追随行为之间的关系。本研究揭示了变革型领导与员工追随行为之间的积极关系，并表明了员工追随行为对现代企业管理实践的重要性。文章在最后给出了具体可行的实践启示，旨在推动领导力相关研究领域的深化及发展。

关键词： 变革型领导；追随行为；组织认同

Abstract

In today's era of increasingly fierce corporate competition, cultivating employees' active following behavior is very important for the survival and development of the company and organizational practice. Based on the theory of social identity, this article explores the specific impact and potential mechanism of transformational leadership on employee follow-up behavior. Based on the data analysis of 412 valid questionnaires, it is concluded that transformational leadership has a positive impact on employee following behavior. Among them, employee organizational identity mediates the relationship between transformational leadership and employee following behavior. This study reveals the positive relationship between transformational leadership and employee following behavior, and shows the importance of employee following behavior to modern corporate management practices. At the end of the article, it gives concrete and feasible practical enlightenment, which aims to promote the deepening and development of leadership related research fields.

Keywords: Transformational leadership, following behavior, organizational identification

引言

企业在发展的过程中就是高楼逐渐耸立的过程，高楼的建立不仅要依赖于领导的蓝图设计，也离不开每一位员工的群策群力，员工的工作能力同样决定着企业是否能顺利发展。普通员工不仅影响着领导的决策是否顺利推进，也影响着企业的发展。Uhl-Bien 和 Carsten(2007)提出，领导者意图能否成功变现（成为现实）依靠于追随者的积极回应。Uhl-Bien, Riggio,

Carsten(2014)也指出,领导力的存在依赖于追随者的存在,积极追随行为是领导力发挥其效应的前提,离开追随谈领导就是无稽之谈。张宝燕(2019)在中国的情景中,诸如命令型领导、任务型领导等传统的领导类型主要还是以领导本身意识心态为主,企业难以在中国经济转型的大环境中推进改革措施,变革型领导类型更适合当今日新月异的社会发展。因此,追随行为作为领导力研究中的关键组成部分,对于拓展领导力相关研究至关重要。此外,如何激励下属产生积极追随行为是组织行为领域始终关注的问题,值得深入探讨。

研究目的

内在中国的社会情境下,本研究试图解释变革型领导与员工追随行为之间的联系,因此,本研究引入组织认同这一中介机制,以研究两者之间的关系,揭开背后的“黑箱”,拓展和延伸这一领域的研究内容。具体而言,本研究主要有两个重要研究内容:第一,在中国经济转型背景下,传统的控制型领导不能在组织转型中发挥最大的作用,然而变革型领导可以更好地激发员工的工作热情,提升工作绩效,并使员工更愿意留在组织(李超平,时勘,2005)。因此,在如今的环境下研究变革型领导对员工追随行为的行为尤其重要。第二,本研究基于社会认同理论,探讨组织认同在变革型领导与员工追随行为之间的中介作用,以探究变革型领导风格影响员工追随行为的具体作用路径。

文献综述

“站在巨人的肩膀上才能看得更远”,牛顿的经典名言启示学者,需要在前人的基础上不断创新才可能得到新的科学研究成果,要想在研究上更进一步,必须清晰和全面地了解相关研究主题的研究现状。变革型领导提供了领导与员工进行高质量互动的前提和条件,这种类型的领导者对激发员工更高层次的需求更为注重,能够有效促进员工对组织的信任,并取得超乎预期的绩效(闫佳祺,贾建锋,罗瑾琰,2017)。其中代表性的有李超平和时勘(2005)的研究,他们总结了变革型领导的四个维度:即领导魅力、德行垂范、愿景激励和个性化关怀,“德行垂范”这一维度充分体现了中国儒家文化思想中的“修身”和“以身作则”的观念。此外,“个性化关怀”不仅体现了领导对员工工作上的关怀,还体现了对员工生活上的关怀,展现了更为广泛的内涵。

追随行为是指员工在与领导进行互动时所展现的相对稳定的行为倾向和行为方式(赵慧军,席燕平,2015)。其中,代表的有周文杰等人(2015)的研究,他们通过追随者行为方式将追随行为划分为六个维度:尊敬学习行为、意图领会行为、权威维护行为、有效沟通行为、忠诚奉献行为及积极执行行为。Ashforth(1992)将组织认同定义为个体依据特定组织的成员身份进行自我定义,在心理上与组织达成一致,并产生对组织的归属感和共命运感知,员工与组织之间的共命运超越了雇佣关系,成为了组织发展过程中不可或缺的关键要素。

1. 变革型领导研究评述

现有的研究已经对变革型领导的中介和结果进行了大量讨论,由此说明变革型领导作用的过程本身是一个复杂的系统,学者在变革型领导的理论中不断引入新的情景进行剖析变革型领导的边界效应与作用机制,变革型领导的实际作用机制在国内外学者的共同努力下逐渐浮现。本研究通过引入组织认同这一中介机制,以探究来探变革型领导作用的原理。

2. 追随行为研究评述

以往的研究表明,不同的学者对追随行为的定义源于不同的理论视角,然而目前为止,还没有一个概念得到广泛认同。本文尝试以社会认同理论的角度探索追随行为的机制,其

中领导类型与追随力的研究是近几年比较流行的研究，而追随行为可以具体划分为积极的追随行为和消极的追随行为，已有研究通过一些个人特质变量研究这两种追随行为的特征（许晟，2017）。

3. 组织认同研究评述

通过文献回顾可以发现，已有研究主要探究了变革型领导与员工组织绩效，员工劝谏行为，组织凝聚力等之间的关系，而组织认同与员工追随行为之间关系的研究相对匮乏。员工积极的追随行为体现在对领导的相信、对组织的信任（卞政明，瞿畅，陈光玖，2017）。本文尝试基于社会认同理论引入组织认同，探索变革型领导与追随行为间影响机制和影响效应。

研究方法

本文主要采用的是问卷调查法、文献回顾法和基础的统计分析法，研究方法的选取取决于研究问题，这关系到方法的科学性和结果的有效性，对于检验构建的理论模型和提出的假设非常重要。运用 SPSS22.0 软件对数据进行了描述性统计分析、信度效度分析、相关分析、回归分析等。

本论文根据成熟量表（变革型领导的测量参考李超平和时勘(2005)开发的 4 个维度，有 26 个测量题项的变革型领导量表；对于追随行为的测量，本文参考周文杰、宋继文和李浩澜(2015) 在中国文化情境下开发的追随行为量表，该量表包含六个维度，有 21 个测量题项；组织认同的测量参考 Mael 和 Ashforth (1992)开发的组织认同单维度问卷，包含 6 个测量题项），遵循主题明确、问卷问题和答案设计合理、题项数量适中、容易理解等问卷设计原则进行问卷设计。正式问卷的派发与回收集中于 2020 年 9 月 1 日至 10 月 20 日，历时近两个月。参与者主要来自上海，广东，北京，四川，甘肃等多个地区，具有较高的覆盖性和代表性。本研究采用线上填答问卷来采集样本数据，主要使用问卷星平台收集问卷，并最终得到问卷共 433 份。在数据录入之前，作者对问卷进行了仔细排查，问卷的删除主要遵循三个原则：（1）个人基础信息严重缺失；（2）答案呈现出明显作答规律；（3）问卷漏填、空缺、填写不完整。经过严格筛选，共删除了 21 份无效问卷，得到有效问卷 412 份，问卷有效回收率为 97.40%。

研究假设

1. 变革型领导与追随行为

首先，参照 Carsten 等研究者(2010)给出的定义，员工追随行为并不包括员工自身的活动及与其他同事的互动，而是指与领导互动中表现出的一系列行为，主要包括尊重学习行为、意图领会行为和贯彻执行行为等等。已有研究探讨了大量的关于影响员工态度和行为的前因变量，其中，领导者风格是一个很重要的前因。其次，社会认同理论认为当员工对变革型领导的认同会在心理上和行动上表现出积极的追随行为，比如积极执行领导的指令、崇拜领导的个人魅力、对领导的决策表现出极大的信任等等。社会交换理论认为当员工得到领导者的关心、支持和信任时，会出现回馈的意愿和行为，员工因为受到变革型领导者的真实对待，会基于互惠的原则表现出领导者期待的行为，表现之一便是积极地追随领导者。最后，已有研究指出，变革型领导行为能够有效促进员工的创造力（Wang & Rode, 2010），例如，变革型领导期待追随者提出质疑，挑战现状，并尝试潜在的更好的工作方法（Bass et al., 2003）。再如 Shin 和 Zhou（2003）认为，变革型领导能够增强追随者对个人能力、方向及责任的感知，从而产生内在的动机去更好地投入工作。因此，变革型领导能够积极影响员工的工作方式及行为。基于以上阐述，本文提出如下假设：

假设 1: 变革型领导对员工的追随行为有显著的正向影响。

2. 变革型领导与组织认同

在社会认同理论的基础视角里, 员工和领导者之间被看作是一种社会的和心理的连带关系和情感关系 (Burke P.J., 1991)。因此, 员工认同变革型领导的思想以及行为, 间接的对组织也存在认同的情感因素。

Wang & Howell (2010) 对愿景激励进行了界定, 是指变革型领导在工作中尊重员工, 允许员工表达自己的想法和意见, 在员工遇到工作问题时及时给予指导和帮助, 通过对组织美好未来的描述和规划使得员工清楚自己工作的方向和目标, 从而产生对组织强烈的认同感。变革型领导通过激励追随者像他们自己一样认同组织的愿景, 并将精力集中在实现集体目标上 (Moriano et al., 2014)。

首先, 变革型领导者制定了明确的组织愿景和运行机制, 可为员工指明工作方向以寻找更多机会 (Eyal & Kark, 2004); 其次, 变革型领导者鼓励追随者学会独立思考, 产生新的想法, 以帮助组织更好的发展; 最后, 变革型领导者通过提供追随者设计和实施新对策的支持, 增强了追随者的信心和技能, 以解决当前面临的管理问题 (Howell & Higgins, 1990; Jung et al., 2003)。由此可知, 变革型领导能够提升员工对组织的认同感。基于以上分析, 本文提出如下假设:

假设 2: 变革型领导对组织认同有显著的正向影响。

3. 组织认同与追随行为

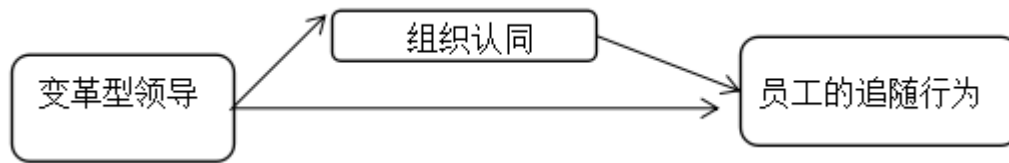
社会认同理论提出个体一旦形成对某个客体(组织、领导者或者同事等)的认同, 便会自发地从该客体的视角看待问题, 愿意将该客体的价值观和利益进行内化 (Burke P.J., 1991)。组织认同是社会认同理论在组织管理领域的具体应用, 组织认同的对象指向具体的组织, 当员工产生了对组织的认同之后, 便将自己的信念、感觉和行为主动地向组织靠拢, 认为自己的身份是与组织紧密连结在一起的, 愿意与组织共同面对成功与失败, 进而表现出相应的行为 (严鸣, 徐红伟, 李骥, 2011)。员工对组织的认同将自己与所在组织中的各种人财物等要素紧密联系在一起的一种动态过程。这种认同感越强, 员工越容易把组织看作是自己的延伸, 将组织的目标作为自己行动的指南, 并表现出相应的追随行为。过去的很多研究强调了员工组织认同对组织的重要性 (Ashforth & Mael, 1989; Haslam, 2001; Hogg & Terry, 2001)。例如, Decoster 等研究者(2013)研究发现, 高组织认同的员工遇到问题时能更多地站在组织的立场思考, 也可以更多地进行对组织有益的行为。因此, 一旦员工认同组织的文化、组织的价值观、组织的行为等, 员工会进一步对组织产生积极的追随行为。基于以上分析, 本文提出如下假设:

假设 3: 组织认同对追随行为有显著的正向影响。

4. 组织认同的中介效应

社会认同的应用主要体现在有关组织认同和领导认同的研究当中。在过去几十年, 东西方学者做了大量有关社会认同的研究, 组织认同也已经成为组织行为学研究中的一个重要变量。Ashforth (1989)最早提出组织中领导行为会对员工的组织认同感产生影响。原因在于, 领导者占据着组织中举足轻重的位置, 领导的一举一动牵动着员工的心理感知, 并可能对员工的心理感知造成影响, 进而影响员工对组织的归属感和自我定位。因此, 组织认同是变革型领导与追随行为的桥梁, 能够把这两个变量搭建在一起。基于以上分析, 本文提出如下假设:

假设 4：组织认同在变革型领导与员工追随行为间发挥中介效应。
本文的提出的理论模型如下：



数据分析

1. 变革型领导对追随行为的影响

本文采用多层次回归分析的方法来检验变革型领导与追随行为之间的关系，使用 SPSS22.0 软件进行回归分析。模型 1 包括人口统计学变量（自变量）和追随行为（因变量），模型 2 为加入变革型领导（自变量）后的回归模型。其检验结果如表 1 所示：

表 1： 分层回归分析结果 (n=412)

	模型 1				模型 2			
	B	SD	t	p	B	SD	t	p
常数	3.404**	0.272	12.501	0.000	1.297**	0.200	6.494	0.000
您的性别	-0.037	0.053	-0.707	0.480	-0.061	0.035	-1.775	0.077
您的婚姻状况	-0.144*	0.067	-2.144	0.033	-0.144**	0.044	-3.269	0.001
您的年龄	0.004	0.048	0.091	0.927	0.003	0.031	0.094	0.925
您的教育程度	0.049	0.047	1.044	0.297	0.016	0.031	0.530	0.597
您与目前的直接领导的共事时间	0.144**	0.038	3.760	0.000	0.034	0.025	1.336	0.182
您目前所在单位的性质	-0.010	0.028	-0.366	0.715	-0.024	0.018	-1.346	0.179
变革型领导					0.692**	0.030	23.282	0.000
R ²	0.108				0.619			
调整 R ²	0.095				0.613			
F 值	F (6,405)=8.214,p=0.000				F (7,404)=93.879,p=0.000			
ΔR ²	0.108				0.511			
ΔF 值	F (6,405)=8.214,p=0.000				F (1,404)=542.034,p=0.000			

注：因变量：追随行为；*p<0.05 **p<0.01。

在模型 1 的基础上加入变革型领导后，F 值变化表现出显著性(p<0.05)，这表示变革型领导加入后对模型具有解释意义。另外，R 方值由 0.108 上升到 0.619，意味着变革型领导可对追随行为的解释力度为 51.1%。结果显示，变革型领导的回归系数值为 0.692，并且呈现出显著性(t=23.282, p=0.000<0.01)，这表明变革型领导会对追随行为产生显著的正向的影响。由此假设 1 得到支持。

2. 变革型领导对组织认同的影响

本文采用多层次回归分析的方法来检验变革型领导与组织认同之间的关系，使用 SPSS22.0 软件进行回归分析。模型 1 包括人口统计学变量（自变量）和组织认同（因变量），模型 2 为加入变革型领导（自变量）后的回归模型。其检验结果如表 2 所示：

表 2: 分层回归分析结果 (n=412)

	模型 1				模型 2			
	B	标准误	t	p	B	标准误	t	p
常数	2.307**	0.449	5.140	0.000	-0.361	0.410	-0.881	0.379
您的性别	-0.016	0.087	-0.179	0.858	-0.046	0.071	-0.648	0.517
您的婚姻状况	-0.118	0.111	-1.062	0.289	-0.117	0.090	-1.299	0.195
您的年龄	-0.054	0.079	-0.689	0.491	-0.056	0.064	-0.874	0.383
您的教育程度	0.149	0.077	1.931	0.054	0.108	0.063	1.712	0.088
您与目前的直接领导的共事时间	0.237**	0.063	3.748	0.000	0.097	0.052	1.860	0.064
您目前所在单位的性质	0.052	0.046	1.146	0.253	0.034	0.037	0.920	0.358
变革型领导					0.877**	0.061	14.374	0.000
R ²	0.068				0.383			
调整 R ²	0.054				0.373			
F 值	F (6,405)=4.905,p=0.000				F (7,404)=35.854,p=0.000			
ΔR ²	0.068				0.315			
ΔF 值	F (6,405)=4.905,p=0.000				F (1,404)=206.607,p=0.000			

注：因变量：组织认同；* p<0.05 ** p<0.01。

在模型 1 的基础上加入变革型领导后，F 值变化表现出显著性(p<0.05)，意味着变革型领导加入后对模型具有解释意义。此外，R² 方值由 0.068 变化到 0.383，表明变革型领导可对组织认同的解释力度为 31.5%。具体来看，变革型领导的回归系数值为 0.877，并且呈现出显著性(t=14.374，p=0.000<0.01)，意味着变革型领导会对组织认同产生显著的正向影响关系。由此假设 2 得到支持。

3. 组织认同对追随行为的影响

本文采用多层次回归分析的方法来检验组织认同与追随行为之间的关系，使用 SPSS22.0 软件进行回归分析。模型 1 包括人口统计学变量（自变量）和追随行为（因变量），模型 2 为加入组织认同（自变量）后的回归模型。其检验结果如表 3 所示：

表 3: 分层回归分析结果 (n=412)

	模型 1				模型 2			
	B	标准误	t	p	B	标准误	t	p
常数	3.404**	0.272	12.501	0.000	2.500**	0.215	11.636	0.000
您的性别	-0.037	0.053	-0.707	0.480	-0.031	0.040	-0.774	0.440
您的婚姻状况	-0.144*	0.067	-2.144	0.033	-0.098	0.052	-1.905	0.057
您的年龄	0.004	0.048	0.091	0.927	0.026	0.037	0.701	0.484
您的教育程度	0.049	0.047	1.044	0.297	-0.010	0.036	-0.265	0.792
您与目前的直接领导的共事时间	0.144**	0.038	3.760	0.000	0.051	0.030	1.723	0.086
您目前所在单位的性质	-0.010	0.028	-0.366	0.715	-0.031	0.021	-1.444	0.150
组织认同					0.392**	0.023	16.992	0.000

表 3: 分层回归分析结果 (n=412) (续。)

	模型 1				模型 2			
	B	标准误	t	p	B	标准误	t	p
R ²	0.108				0.480			
调整 R ²	0.095				0.471			
F 值□	F (6,405)=8.214,p=0.000				F (7,404)=53.290,p=0.000			
ΔR ²	0.108				0.372			
ΔF 值□	F (6,405)=8.214,p=0.000				F (1,404)=288.731,p=0.000			

因变量: 追随行为; * p<0.05 ** p<0.01。

在模型 1 的基础上加入组织认同后, F 值变化表现出显著性(p<0.05), 意味着组织认同加入后对模型具有解释意义。另外, R 方值由 0.108 变化为 0.480, 表明组织认同可对追随行为的解释力度为 37.2%。具体而言, 组织认同的回归系数值为 0.392, 并且呈现出显著性(t=16.992, p=0.000<0.01), 意味着组织认同与追随行为之间的关系为显著的正向关系。由此假设 3 得到支持。

4. 组织认同的中介效应

通过以上的验证, 如下表 4 所示, 可分三步检验组织认同的中介效应: 第一步, 将变革型领导作为自变量, 而将追随行为作为因变量进行线性回归分析, 从上表可以看出, 模型 R 方值为 0.585, 意味着变革型领导对追随行为变化原因的解釋力度为 58.5%。对模型进行 F 检验时发现模型通过了 F 检验(F=577.221, p<0.05), 即表明变革型领导与追随行为之间的正向关系显著, 模型公式为: 追随行为=1.001 + 0.720*变革型领导。表 4 的分析结果显示: (1) 变革型领导的回归系数值为 0.720, p<0.01, 意味着变革型领导会对追随行为产生显著的正向影响; (2) 在模型 1 的基础上加入组织认同后, F 值变化呈现出显著性(p<0.05), 这表示组织认同加入后对模型具有解释意义。另外, R 方值由 0.585 变化到 0.652, 意味着组织认同可对追随行为的解释力度为 6.7%。结果显示, 组织认同的回归系数值为 0.201, 并且呈现显著性(t=8.860, p=0.000<0.01), 表明组织认同会对追随行为产生显著的正向影响。模型 3 将变革型领导作为自变量, 而将组织认同作为因变量进行线性回归分析, 模型 R 方值为 0.365, 表明变革型领导对组织认同变化原因的解釋力度为 36.5%。模型可以通过 F 检验(F=235.536, p<0.05), 则说明变革型领导与组织认同之间有着必然联系。模型公式为: 组织认同= -0.186 + 0.916*变革型领导。通过分析可知, 变革型领导的回归系数值为 0.916, 并且呈现出显著性(p=0.000<0.01); 第三步, 模型 2 变革型领导系数降低, 说明组织认同部分中介变革型领导与追随行为, 因此假设 4 成立。

表 4: 分层回归分析结果 (n=412)

	模型 1		模型 2		模型 3	
	B	SD	B	SD	B.	SD.
常数	1.001**	0.114	1.038**	0.104	-0.186	0.226
变革型领导	0.720**	0.030	0.535**	0.034	0.916**	0.060
组织认同			0.201**	0.023		
R ²	0.585		0.652		0.365	
调整 R ²	0.584		0.650		0.363	

表 4: 分层回归分析结果 (n=412) (续。)

	模型 1		模型 2		模型 3	
	B	SD	B	SD	B.	SD.
F 值□	F (1,410)=577.221,p=0.000		F (2,409)=382.424,p=0.000		F (1,410)=235.536,p=0.000	
ΔR^2	0.585		0.067		0.365	
ΔF 值□	F (1,410)=577.221,p=0.000		F (1,409)=78.507,p=0.000		F (1,410)=235.536,p=0.000	

注: * p<0.05 ** p<0.01。

5. 假设检验结果汇总

本文一共有 4 个假设, 下表是假设检验结果汇总表 5

表 5: 研究假设汇总表

编号	假设内容	检验结果
H1	变革型领导对员工的追随行为有显著的正向影响。	成立
H2	变革型领导对组织认同有显著的正向影响。	成立
H3	组织认同对员工追随行为有显著的正向影响。	成立
H4	组织认同在变革型领导与员工追随行为间发挥中介效应。	成立

研究结果

1. 研究局限

本文基于社会认同理论, 构建了一个以变革型领导作为自变量、追随行为作为因变量、组织认同作为中介变量的理论模型, 通过研究数据收集和分析, 并最终得到验证。然而, 本论文尚存在以下几个方面的局限性, 同时也提供了一些研究的方向:

首先, 变革型领导受个体年龄、性别、行业、地域、企业性质的影响, 未来可以考虑从不同行业、区域、企业性质、性别方面进行研究。

其次, 变量过于单一, 研究得出的结果过于简单, 可以考虑在变革型领导和追随行为之间加入其它的中介变量或者增加调节变量以揭示更多的变革型领导和追随行为的作用机理。

最后, 本论文主要采用变革型领导的单一的领导类型探讨其对追随行为的影响, 未来可以尝试研究不同类型领导对下属追随行为的影响。

2. 实践启示

尽管本文有一定的局限性, 但是本文在实践方面也做了有益的尝试。针对当前中国企业谋求改革与重视人才的现状, 本论文的提出的管理建议是:

第一, 在中国政府主导的改革潮流中, 越来越多的企业因其扁平化、团队化的运作方式而更加依赖员工的追随行为, 领导者受到员工自发地追随是企业前进的动力, 保障企业高效率运行的源动力。领导应当深入基层, 了解员工的生活和工作情况, 了解员工的特点, 尤其是善于能力出众的带头人, 动员员工工作的积极性和热情, 发挥每一个员工的潜能。对敢于突破创新的员工给予鼓励和肯定, 坚定员工的信心和勇气。

第二, 员工对组织的认同感尤为重要, 员工对领导甚至对组织的情感是一个动态的过程, 只有员工把组织当成自己的家, 员工才能尽全力完成领导给予的工作任务, 不断为组织创造更高的价值。企业从内部出台一些对员工利好的激励政策, 激励政策可以保证员工的高效



率工作，另外可以领导需要多多了解员工的内心需求，保障员工没有后顾之忧。

第三，员工产生积极的追随行为往往是对组织有认同感、归属感。反之，对组织认同的员工往往能产生积极的追随行为。因此，组织重点关注员工对组织的情感变化是非常重要的。一方面，组织调查员工对生活品质的需求，比如提供运动场所、舒适的休息场所等。另外一方面，领导及时关注员工的精神面貌，让员工在企业工作如同家一般温馨。

总之，经过实证分析得知变革型领导对追随行为起到正向促进作用，变革型领导通过组织认同与正向促进员工积极的追随行为。应当重视培育企业家变革型的思维，激发普通员工积极追随行为，更应重视两者之间的传导和影响作用，发挥两者最大效用，共同促进企业转型升级，推动中国经济发展。

参考文献

- 卞政明,瞿畅,陈光玖.企业变革型领导行为对员工心理资本开发的影响[J].中国管理信息化,2017,20(10):113-114.
- 冯彩玲,刘兰华,张丽华.国内变革型领导近十年的研究进展[J].心理与行为研究,2016,14(01):134-139.
- 李超平、时勘:《变革型领导的结构与测量》,载《心理学报》,2005年第6期,第803-811.1页.
- 李浩澜,宋继文,周文杰.中国文化背景下变革型领导风格对员工追随力的作用机制[J].中国人力资源开发,2015(15):47-55.
- 申平玉,刘永恒.组织认同的概念界定、理论观点和形成机制综述[J].商业经济研究,2016(23):94-96.
- 许晟,李元清 & 曹元坤.(2017).个体人格特质对追随行为的影响:一个调节的中介模型建构.中国人力资源开发(07),6-15+24. doi:10.16471/j.cnki.11-2822/c.2017.07.002.
- 闫佳祺,贾建锋,罗瑾琰.变革型领导的跨层级传递与追随力:人力资源管理强度和企业性质的调节效应[J].科学学与科学技术管理,2017,38(10):147-157.
- 张宝燕.(2019).变革型领导对下属积极追随行为的影响:信任的中介作用(硕士学位论文,电子科技大学).<https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD202001&filename=1019853906.nh>
- 赵慧军,席燕平.员工追随行为结构验证及其对工作绩效的影响[J].中国人力资源开发,2015(15):40-46+74.
- 赵慧军,席燕平.组织体系中的追随研究述评[J].首都经济贸易大学学报,2014(6):104-108.
- 赵慧军.追随行为的探索性研究[J].经济与管理研究,2013(4):106-110.
- 周文杰,宋继文,李浩澜.中国情境下追随力的内涵、结构与测量[J].管理学报,2015(3):355-363.
- Ashforth, B. E. Mael, F. (1989). Social Identity Theory and the Organization [J].Academy of Management Review, 14 (1).
- Bass B M. (1985). Leadership and Performance beyond Expectations[M]. New York: Collier Macmillan.
- Benson, M., & Campbell, J. (2007). To be, or not to be, linear: An expanded representation of personality and its relationship to leadership performance. International Journal of Selection and Assessment, 15,232-249.



- Blonigen, D. M., Patrick, C. J., Douglas, K. S., Poythress, N. G., Skeem, J. L., Lilienfeld, S. O., Krueger, R. F. (2010). Multimethod assessment of psychopathy in relation to factors of internalizing and externalizing from the Personality Assessment Inventory: The impact of method variance and suppressor effects. *Psychological Assessment*, 22, 96–107.
- Boddy, C. R. (2011). The corporate psychopaths theory of the global financial crisis. *Journal of Business Ethics*, 102, 255–259.
- Decoster S, Camps J, Stouten J, et al. (2013). Standing by Your Organization: The Impact of Organizational Identification and Abusive Supervision on Followers' Perceived Cohesion and Tendency to Gossip[J]. *Journal of Business Ethics*, 118(3): 623-634.
- Ferrell, B., & Gaddis, B. H. (2016, April). How well does the Dark Triad capture dark side personality? Presented at Society for Industrial and Organizational Psychology, Anaheim, California.
- Frieder R E, Wang G, Oh I S. (2018). Linking job-relevant personality traits, transformational leadership, and job performance via perceived meaningfulness at work: A moderated mediation model[J]. *Journal of Applied Psychology*, 103(3): 324.
- Furnham, A., & Crump, J. (2016). A Big Five facet analysis of a psychopath: The validity of the HDS mischievous scale of sub-clinical psychopathy. *Scandinavian Journal of Psychology*, 57, 117–121.
- Landay K, Harms P D, Credé M. (2019). Shall we serve the dark lords? A meta-analytic review of psychopathy and leadership[J]. *Journal of applied psychology*, 104(1): 183.
- Lord R G, Day D V, Zaccaro S J, et al. (2017). Leadership in applied psychology: Three waves of PIM 4th International Conference March 3rd, 2021 theory and research[J]. *Journal of Applied Psychology*, 102(3): 434.
- Miller, J. D., Watts, A., & Jones, S. E. (2011). Does psychopathy manifest divergent relations with components of its nomological network depending on gender? *Personality and Individual Differences*, 50, 564–569.
- Moriano, J. A., Molero, F., Topa, G., & Mangin, J. P. L. (2014). The influence of transformational leadership and organizational identification on intrapreneurship. *International Entrepreneurship and Management Journal*, 10(1), 103-119.
- Nandkeolyar, A. K., Shaffer, J. A., Li, A., Ekkirala, S., & Bagger, J. (2014). Surviving an abusive supervisor: The joint roles of conscientiousness and coping strategies. *Journal of Applied Psychology*, 99, 138–150.
- Neo, B., Sellbom, M., Smith, S. F., & Lilienfeld, S. O. (2018). Of boldness and badness: Insights into workplace malfeasance from a triarchic psychopathy model perspective. *Journal of Business Ethics*, 149, 187–205.
- Pace, V. L., & Brannick, M. T. (2010). How similar are personality scales of the “same” construct? A meta-analytic investigation. *Personality and Individual Differences*, 49, 669–676.
- Padilla, A., Hogan, R., & Kaiser, R. B. (2007). The toxic triangle: Destructive leaders, susceptible followers, and conducive environments. *The Leadership Quarterly*, 18, 176–194.
- Rosen C C, Simon L S, Gajendran R S, et al. (2019). Boxed in by your inbox: Implications of daily e-mail demands for managers' leadership behaviors[J]. *Journal of Applied Psychology*, 104(1): 19.
- Uhl-Bien, M., Carsten M K. (2007). Being Ethical When the Boss is Not[J]. *Organizational Dynamics*, 36(2): 87-201.
- Uhl-Bien, M., Riggio, R.E., Carsten, M. K. (2014). Followership Theory: A Review and Research Agenda[J]. *Leadership Quarterly*, 25(1): 83- 104.



- Wang G, Van Iddekinge C H, Zhang L, et al. (2019). Meta-analytic and primary investigations of the role of followers in ratings of leadership behavior in organizations[J]. *Journal of Applied Psychology*, 104(1): 70.
- Wang, P., & Rode, J. C. (2010). Transformational leadership and follower creativity: The moderating effects of identification with leader and organizational climate. *Human relations*, 63(8), 1105-1128.
- Wang, X.-H., & Howell, J. M. (2010). Exploring the dual-level effects of transformational leadership on followers. *Journal of Applied Psychology*, 95(6), 1134-1144.

城市居民参与社区音乐活动的因素研究

FACTORS OF URBAN RESIDENTS PARTICIPATING IN COMMUNITY MUSIC ACTIVITIES

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摘要

随着中国经济的高速发展, 城市化进程明显加快, 人民日益增长的生活水平逐渐提高, 目前构建和谐社会成了中国全面建设小康社会的必然要求, 而构建和谐社会的前提是要大力发展社区活动, 促进人与人之间和谐相处。而音乐作为所有艺术文化中最具代表性, 现如今音乐的相关活动的参与度降低, 逐渐呈现老龄化, 小区广场随处可见的广场舞、戏曲, 没有一丝年轻的朝气。本研究的目的就在于探讨城市居民对社区音乐活动的参与度以及其影响因素。因此本研究先通过了解居民对活动的参与现状, 然后将对文献进行分析得到影响城市社区居民的参与度的因素, 随后对城市社区居民进行问卷调查, 将收集到的数据进行定性研究分析, 对资料首先做对访谈资料做开放式编码, 然后进行主轴编码, 建立不同的范畴, 最后评估不同的影响因素与参与度之间的关系。从而得出结论, 建立影响居民参与度因素, 对小区音乐活动提出相应的建议, 也更好促进和谐社会的发展。

关键词: 城市居民 音乐活动 参与度 自我效能

Abstract

With the rapid development of China's economy, the process of urbanization has accelerated significantly, and the people's growing living standards have gradually improved. At present, building a harmonious society has become an inevitable requirement for China to build a well-off society in an all-round way. The prerequisite for building a harmonious society is to develop communities. Activities to promote harmony between people. Music is the most representative of all art and culture. Nowadays, the participation in music-related activities is decreasing, and it is gradually showing an aging population. Square dances and operas can be seen everywhere in the community square, without a trace of youthful vigor. The purpose of this research is to explore the participation of urban residents in community music activities and its influencing factors. Therefore, this study first understands the status quo of residents' participation in activities, and then analyzes the literature to obtain the factors that affect the participation of urban community residents, and then conducts a questionnaire survey on urban community residents, and conducts qualitative research and analysis on the collected data. The data is firstly coded openly for the interview data, then the main axis is coded to establish different categories, and finally the relationship between different influencing factors and participation is evaluated. In this way, it is concluded that the establishment of factors affecting residents' participation and corresponding

suggestions for community music activities will also better promote the development of a harmonious society.

Keywords: City residents, Music activities, Participation, Self-efficacy

研究背景

改革开放以来，随着中国经济的高速发展，城市化进程明显加快，人民日益增长的生活水平逐渐提高，目前构建和谐社会是中国全面建设小康社会的必然要求。王思斌（2006）指出，在 1955 年，世界联合国社会局在《社会发展经由社区发展》一文中，强调社区的发展是要由公民们积极参与，才能促进社区繁荣以及社会的进步。而在 1960 年，联合国在《社区发展与经济发展》中，指出社区发展需要公民和政府一起配合，从而改善社区的经济、文化等环境。

随后，在 2018 年 9 月中国举行的全国教育大会中，习近平总书记发表了重要讲话，提出“培养德智体美劳全面发展的社会主义建设者和接班人”（中华人民共和国中央人民政府，2018），这其中的“美”说的便是要提高中国公民们的审美，而古希腊伟大的哲学家柏拉图（Plato）曾说过“音乐教育除了非常注重道德和社会目的外，必须把美的东西作为自己的目的来探求，把人教育成美和善的。”

李莉莉（2011）研究指出，目前中国社区音乐活动未广泛普及；形式较为单一且无组织性；参与者主要是老年人，其次是青少年儿童，且较为被动；举办活动的场地有限且设施欠缺；音乐活动没有资金保障；专业人才匮乏。李小缨（2012）研究指出，目前社区音乐类的活动在资金方面缺少政府的扶持，并且社区音乐教育这一方面专业指导教师资源匮乏。赵朋冲（2016）研究表明，目前中国社区音乐活动存在最主要的问题就是社区居民教育观念较为陈旧，对音乐教育的认识不足，从而导致社区音乐教育资源的不足，教学内容较为单一。杜乡（2018）研究表明，现阶段社区音乐文化活动的筹备经费紧缺，以至于严重制约了社区音乐相关活动的发展，并且社区音乐类的人才匮乏，导致目前社区音乐类的活动质量不是很高。张坤（2019）指出，目前社区音乐类的活动规模都较小；社区宣传力度不足，居民参与度较低；且居民之间沟通贫乏。傅懿薪田，肖益清（2019）研究指出，目前社区音乐活动缺乏专业性，活动场地条件欠缺。任广明，张英莉，佟桂影（2019）指出，现阶段的社区音乐活动缺乏民族特色。

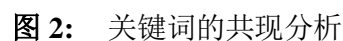
本研究者也在前期进行了对中国社区居民的社区活动现状的探索性调查，采用网络随机发放问卷调查，将收集上来的 200 份问卷调查进行年龄和参与频率的交叉分析显示，61-75 岁的年龄段的居民参与频率较高，29-48 岁的居民参与频率度较低，由此可见参与社区活动的居民逐渐老龄化，年轻的居民参与度不高。如表 1 所示：

表 1: 中国社区活动参与度网络调查

年龄 参与频率	从未参与	偶尔参与 (每半年一次)	有时参与 (每季度一次)	经常参与 (每月一次)	总是参与 (每周一次)	小计
16 岁以下	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)	0
17-28 岁	20(55.56%)	13(36.11%)	3(8.33%)	0(0.00%)	0(0.00%)	36
29-48 岁	51(49.51%)	42(40.78%)	5(4.85%)	4(3.88%)	1(0.97%)	103
49-60 岁	7(23.33%)	15(50%)	4(13.33%)	3(10%)	1(3.33%)	30
61-75 岁	1(3.33%)	3(10%)	3(10%)	20(66.67%)	3(10%)	30
75 岁以上	0(0.00%)	0(0.00%)	0(0.00%)	1(100%)	0(0.00%)	1

Response	Percentage
没有 (No)	48.5%
有 (Yes)	31.5%
不知道 (Don't know)	20%

根据网络调查显示,现阶段中国社区居民的参与度较低且逐渐老龄化,音乐类的活动较少,而根据中国知网现有的所有研究资料中更多的是对社区音乐文化活动发展现状的相关研究(如图2所示),少有对社区音乐活动中城市居民参与度的研究。



综上所述的文献中并没有提及有关社区居民对社区音乐活动的参与度方面的研究，因此，笔者研究社区居民对社区音乐活动的参与度研究，其意义实则为了激发社区居民的活动，了解是什么原因会导致居民是否参与社区音乐活动？从而加以改善，使得邻里之间和睦相处，以此来更好地实现社会主义和谐社会的目标，同时也是为了要补充这方面研究的文献。

研究目的

本研究在已有的国内外学者研究的基础上，以城市社区为研究情境，以城市社区居民为研究对象，其研究目的具体包括以下几点：

（1）基于公民参与理论的基本观点，调查社区居民在社区音乐活动中的参与现状，从而探讨城市居民对社区音乐活动的参与度，再找出影响城市社区居民对社区音乐活动参与度的因素。

（2）基于社区认知理论中的结果期望以及自我效能两个因素以及环境因素，来探究城市居民是否受其影响参与度。

（3）综上所述得出影响居民参与的因素，提出修改意见，以此提高居民的参与度，以期更好地促进和谐社会的建设。

文献综述

3.1 中国内外社区音乐活动发展现状

在 1600 年至 1750 年间，古典音乐发展到了巴洛克时期，这一时期的巴洛克风格的音乐在北欧盛行，Sørensen（1997）曾提到在十九世纪六七十年代里，“社区音乐”在北欧兴起，以挪威和瑞典代表的城市建立起了世界史上第一批社区音乐学校，并且得到政府的支持。Renaud（2019）随后北欧政府制定一系列带有强制性的政策促使地方社区招募具备专业音乐水平的教师从而加强地方社区的音乐教育活动，要求每个学生都必须掌握相关的音乐技能以及音乐的理论知识，政府每年也会投入大量的资金用于社区音乐活动的发展。较为出名的社区音乐活动就是瑞典一年一度的“Festspel i Pite Älvdal”音乐节、还有挪威为传播北欧民间音乐文化而建立的“Ole Bull Academy”组织机构（吴宜辰、张业茂，2015）。

Mary, A.L., David, S.S.（2010）指出，美国的社区音乐发展历史悠久，可以追溯到二战时期，那时社区音乐活动是以一种运动展开，直至 18 世纪初，美国的社区音乐教育下政府的支柱下得以发展，最先是歌咏为主要形式的社区音乐学校。而且政府对每个社区都设立专门的社区学院管理委员会，并且所有的人都可以来就读社区音乐学校，不受年龄的限制。刘沛（2001）提到，美国政府在 1965 年设立国家艺术基金会，基金会支助社区开展音乐教育机构，在 1988 年，美国的音乐教育者和美国艺术理事会组成了“艺术教育国家联盟”，大力发展社区音乐教育，至今已有 400 多家社区音乐教育机构，并成立了许多社区乐队，乐队会定期在社区举办音乐会。较为出名的社区音乐活动有：墨西哥流浪者乐队（Mariach Band）、美国伯克利音乐学院开设的音乐在线课程等。

Sheldon（1998）指出，日本的社区音乐文化是从明治维新时期开始的，当时日本的社区音乐活动主要是由一些音乐的自由爱好者自发组织的音乐祭奠活动。吴宜辰、张业茂（2015）提到，日本社区的音乐活动主要是以发扬日本本土音乐的民间音乐为主，日本政府会赞助社区音乐活动举行的经费。Kari K.Veblen（2013）指出，日本政府强调社区音乐学校的发展，并且会定期举办社区音乐节，其目的是为了宣扬日本传统的音乐文化，目前日本最出名的音乐节就是 Fuji Rock 和 Summer Sonic。

武艳（2011）指出，中国的社区音乐文化相对于其他国家来说，起步较晚，在2010年8月，国际音乐教育学会（International Society of Music Education）的第29届会议在北京召开，会议的主要内容是为了大力发展中国社区音乐教育事业。李莉莉（2011）提到，在2018年7月6日，国民音乐教育大会首次在中国中央音乐学院召开，大会强调将音乐审美教育和中国国民的素质结合在一起。黄晨（2010）、李莉莉（2011）、杨芳（2019）研究发现，目前在中国最普遍的社区音乐活动就是在社区的广场、或者公园等宽阔的场地由群众自发组织的歌舞活动、弹唱、或者一些戏曲类的活动，形式较为单一，但参与者的年龄层次较为单一，以中老年为主，其次是青少年，参与者呈现老龄化。

3.2 城市社区居民社会认知研究

社会认知理论（Social Cognitive Theory）也被称之为“社会学习的认知理论”，最早是由美国著名心理学家阿尔伯特·班杜拉（Albert Bandura）在上世纪五十年代提出的，班杜拉也被称之为“社会认知理论之父”，在1977年班杜拉首次提到社会认知理论中的“自我效能（self-efficacy）”这一概念，并于1997年在其著作《自我效能：控制的实施》中提到，自我效能是社会认知理论中动机理论的重要概念，1986年班杜拉在其著作《思想与行动的社会基础——社会认知论》中对“自我效能”这一理论进行了更详细的论述，认为自我效能是认知与行为的中介，其包括结果预期（outcome expectation）和效能预期（efficacy expectation），并且效能预期是在结果预期发生之前，其结果预期是人的某种行为所产生的某种结果的个人预测；而效能预期是人本身是否对自己进行的某种行为产生一定的顺利结果预期。（任锴，2015）

Ying-Yu Chao 等（2013）基于社会认知理论中的自我效能理论，利用 Wii exergames 游戏对老年人进行八周的测试，研究结果表明老年人在这一过程中战胜了主观对跌倒的恐惧因素以及改善了老年人的行动能力。

周芳（2017）通过实验选取毫无基础的学生，研究得出，视频拓展学习比传统的教学更有助于提高学生的主动性，也有助于提高学生的学习行为。

彭锋（2019）基于社会认知理论研究，采用自我效能量表对居民跳广场舞的重视程度进行分析研究，通过回归分析法得出居民的性别、月收入、以及自我效能等是影响其去跳广场舞的关键因素。

徐顺（2019）基于社会认知理论构建影响大学生素养的因素模型，并采用半结构访谈方式以及使用数字公民素养量表进行问卷发放，得出影响大学生公民素养因素有个人因素、环境因素、以及行为因素。在个人因素上，大学生的个人因素（自我效能感和对互联网态度）与公民素养的水平呈显著正相关；在环境因素中，教师互联网自我效能感和学生感知的学校组织支持感与公民素养水平呈显著正相关；而在行为因素上，学生的人际沟通能力和公民素养水平之间没有显著相关性。

3.3 城市社区居民参与度研究

Lane J（1995）指出“参与（Participate）”一词的概念非常的广泛，Claridge, T.（2004）也在其研究中提到“参与”一词在不一样的场合下则有不一样的含义，没有统一的定义。并且夏晓丽（2014）研究也指出公民和参与是不可分割的。魏星河等（2007）提出最早的公民参与是起源于西方国家的民主政治。俞可平（2006）指出，公民所有可以影响其公共环境的生活和政策的的活动皆可被称之为公民参与。

陈炳水（2005）指出，最早提出“公民参与理论（Participation theory）”是由美国整骨医学协会的执行理事谢里·菲莉斯·阿恩斯坦（Sherry Phyllis Arnstein）在1969年在其著作《公民参与的阶梯》中提出的。

何雪松和侯秋宇在 2019 年研究指出兴趣和利益以及情感是影响社区居民的参与活动的动机，并基于 Sherry R. Arnstein 的公民参与的八个阶梯模型再根据中国的国情画出居民参与的阶梯模型，认为中国居民参与活动时不能脱离党的引领，最后都会趋于平衡，如图 4 所示。

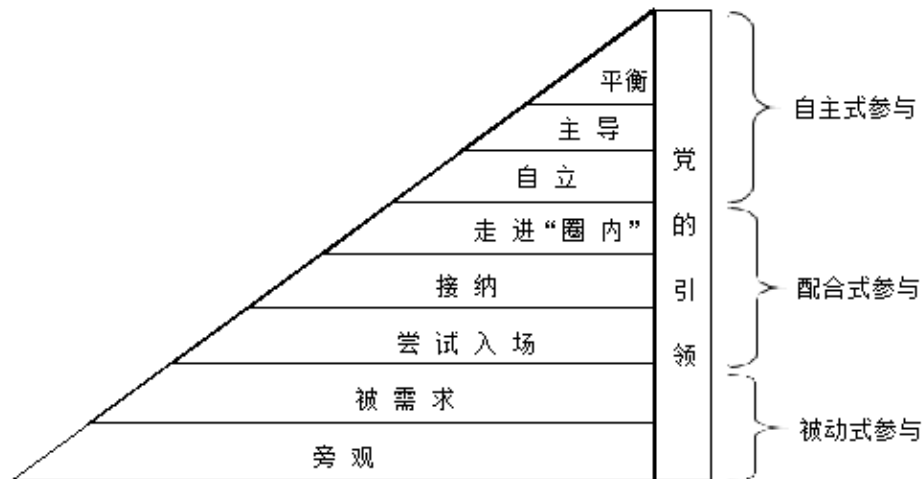


图 4：居民参与的阶梯模型

Morris, J. H. (2017) 研究指出居民自我效能感很大程度上会影响其参与度，研究者对社区中风幸存者进行 6 个月的跟踪研究发现，起初幸存者会因能力有限经常会有沮丧、不愿意参加的现象出现，到最后研究者根据幸存者遇到的障碍进行干预措施指导，强调自我效能的重要性，要多给参与者一些信心。

Pfeiffer, B. 等 (2019) 强调了环境对参与度的重要性，表明居民与环境之间的适应程度增加，则参与度也会随之增加。

Hollingsworth, H., & Gray, D. B. (2010) 根据参与和环境因素之间的关系使用结构方程模型（如图 2.12 所示），指出身体是否健康的居民会影响其活动的参与度，以及对外人对活动的评价也会影响其参与度，而且在环境因素上，政府支持、人际关系和居住关系是最重要的影响因素，认为社区活动应该考虑到身体是否健康的居民。

申可君 (2013) 和张若玮 (2011) 研究指出，现如今城市社区居民参与度较低且热情不高，而影响居民参与的因素有内、外部因素，其内部因素则是指居民的个人基本特征（包括性别、年龄、宗教、收入、婚姻状况、身体状况、户籍）、社区认同感，而外部因素是指社区的资源。认为居民的社区认同感与居民参与存在显著正相关，所有社区活动应该围绕居民的社区认同感展开。此外，王莹 (2015) 提出居民的居住时间、住房类型也会影响其参与度。

综上所述，本研究将影响居民参与度的因素分为个人基本因素（包括性别、年龄、职业、收入、宗教、户籍、身体状况、婚姻状况、住房类型、居住时间）认知因素（自我效能、结果期望）、社会环境因素（社区资源、住房类型、活动硬件设施、活动指导、邻里关系）三个部分展开，如下图 5 所示：

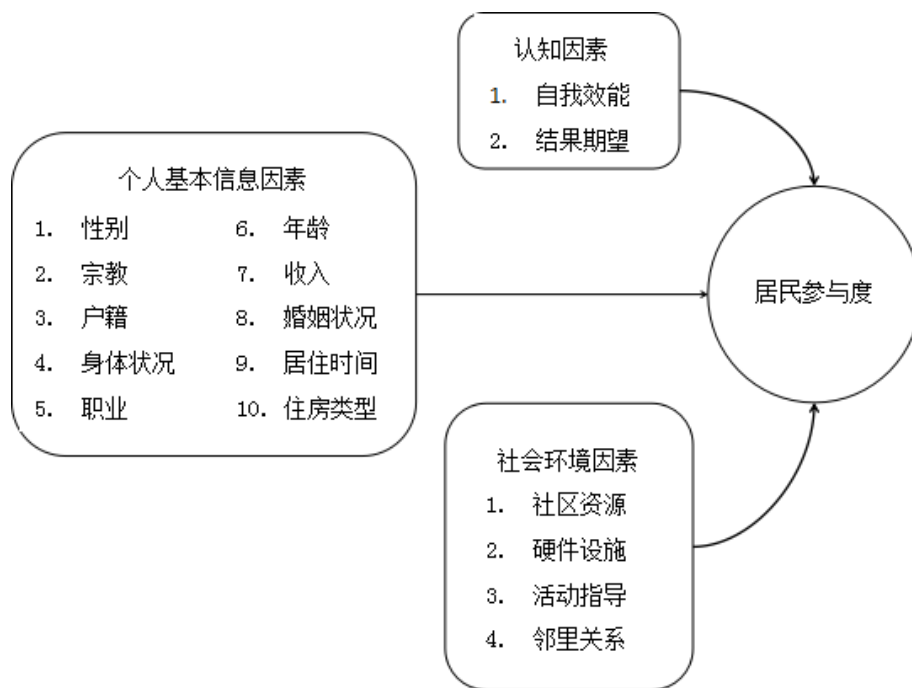


图 5： 影响居民参与度的因素

研究方法

国内外关于社区音乐活动参与度因素的研究较少，并且关于社区音乐活动的研究大多数是量化的研究方法。所以本研究将对社区居民采用深度访谈的方法，寻找居民参与社区音乐活动的影响因素为何？深度访谈法（In-depth interview）是质性研究的方法，分为书面上的口头形式的高结构化访谈（Structured interview）、开放式问题的半结构化访谈（Semi-structured interview）、以及探测性的非结构化访谈（Unstructured interview）三种方式。（Spradley, J., 1979、Weller,S.C. et al, 1988、马晓君, 2011）

而本文采用的是半结构化的深度访谈，其目的是为了了解影响居民参与音乐活动的因素有哪些？。本研究在 2020 年 8 月到 2020 年 9 月之间采用便利抽样的形式，居民群体是一个数量庞大的群体，本研究尽量选取年龄、职位不同的受访者，为了能够反应更多不同特征的居民对参与音乐活动的影响因素为何，本文从身边的邻居、朋友、长辈以及从事音乐教育的老师中寻找经常参与活动的 13 名居民，分别进行面对面形式的半结构化的深度采访，每例访谈需要 25-40 分钟。为了能够得出不同的影响因素，本研究设计的访谈提纲分为两部分，第一部分为基本信息收集，第二部分为半结构化问题（主要内容包括参与活动的频率、对目前音乐活动的看法等问题）。访谈提纲见附录 1，访谈内容整理见附录 2。

研究结果

根据深度访谈情况，进行二级编码分析归总——开放式编码、主轴编码。通过调查获取原始访谈记录后进行数据整理以及分析。表 2 对采访对象的基本特征进行初步分析。

表 2: 访谈对象信息表

研究对象	性别	年龄	每月可支配金额	教育程度	职业
1 号	女	36	3650	本科	教师
2 号	男	42	6000	本科	企业人员
3 号	男	30	5200	硕士	警察
4 号	女	44	8000	本科	医生
5 号	女	27	4000	硕士	个体户
6 号	男	33	7200	硕士	企业人员
7 号	男	48	5000	本科	政府机关
8 号	女	56	5000	小学	自由
9 号	男	58	4000	本科	自由
10 号	女	35	5400	本科	企业人员
11 号	女	20	2000	本科	学生
12 号	男	10	100	小学	学生
13 号	女	70	3000	高中	自由

由上表 1 可以看出, 一共选取了 13 位有代表性的采访对象作为被访者, 并对其进行逐一采访, 用半结构化深度采访收集相关数据。研究员首先按照采访提纲提问, 再由被采访者回答, 然后在一些关键问题上进行追加提问, 被采访者再进行回答。本研究针对此次采访共涉及两个部分问卷, 其中包含十一个问题, 具体采访提纲见附录 1。每场采访, 根据研究者与被采访者的交流而定, 控制在 30 分钟, 采访前研究者将采访内容进行简单的概念解释, 并将注意事项提前告知被采访者, 同时被采访者如果在采访前有疑问也可以进行提问, 或对采访过程中有疑问也可以向研究者提出, 研究人员给与解答, 在被采访确定准备就绪的情况开始采访。采访过程, 采访人员首先根据采访大纲逐一进行提问, 被采访者逐一进行回答。随后, 采访人员在确认和有疑惑的地方进行寻问, 被采访者再次作答。最后, 采访者有阐述和解释自己观点的自由时间。采访结束后, 研究人员与采访者进行探讨一些相关问题。采访过程均已录音、网页形式保存, 后续整理为文字资料以供分析使用。

4.1 开放式编码

开放式编码是研究院具有开放性的研究态度 (Glaser, 1978), 为了排除干扰信息、聚焦研究的问题, 先对资料进行逐段逐句分析, 把访谈记录中无关本文问题的信息剔除, 然后对整理后的数据进行划分与归纳编码。在编码过程中, 尽可能使用访谈对象自己表达出的一些独特词语, 即原生代码作为反映居民这一群体的观点。通过归纳和抽象提炼等方法对访谈内容进行多次整理分析之后, 得到 26 个频繁出现的初始代码, 即开放编码形成的范畴, 如表 3 所示。

表 3: 访谈资料 A1 的开放性编码示例

原始资料	初始概念
我觉得影响我选择参与音乐活动的最主要的原因就是音乐活动的节目有没有特色会不会吸引我，然后就是要看活动举办的场地环境怎么样，最后应该就是要看我的年龄，有的时候带孙子啊，还有自己有没有时间去。	A1-1 活动有没有特色 A1-2 场地环境怎么样 A1-3 有没有时间 A1-4 年龄
要看活动宣传的好不好，然后就是工作忙不忙，如果宣传的很不错，工作又不忙，我会选择参加。	A1-5 活动宣传的好不好 A1-6 工作忙不忙
看我朋友们或者家人去不去吧，他们去的话，我身体条件允许的话，可能会去凑热闹。	A1-7 朋友或者家人去不去 A1-8 身体条件允许的话
看我对活动的期望值吧，如果活动宣传不错，我对它期望值如果高，朋友们也说好，我会去参加。	A1-10 对活动的期望值 A1-11 朋友们也说好
那就要看我敢不敢上台去表演了，要是我有专业的人组织训练就会去参加。	A1-12 敢不敢上台表演 A1-13 有专业的人组织训练
看我在这住多久吧，如果刚来，又不是本地人，谁都不熟也不想去，如果跟邻居们都熟了，我会考虑去看，不然会尴尬。	A1-14 住多久 A1-15 本地人 A1-16 跟邻居们都熟了
看我自身吧，我要工作不好，收入又低，又离婚了，我去了怕人家说闲话。	A1-17 工作不好 A1-18 收入又低 A1-19 又离婚了
要看我要不要做礼拜，我是基督教的，有的时候要去教堂，然后还要看社区硬件设施怎么样。	A1-20 基督教 A1-22 社区硬件设施
学历、职业、年龄都有关系吧，可能年纪大了事情没有那么多还走得动就会去参加。	A1-23 学历 A1-24 还走得动
看住的什么房吧，像我住的是很旧的小区，都是老人，没有什么人一起去看活动。	A1-25 很旧的小区 A1-26 没有什么人一起去看活动

4.2 主轴编码

编码信息的第二个步骤为主轴编码，其主轴编码主要是在开放性编码的繁杂独立的编码资料的基础上，通过聚类分析，建立不同范畴之间的联系并对联系紧密的范畴进行归类，形成更具概括性的概念类属。本研究通过分析比较，最终形成三个概念类属，如表 4 所示。

表 4: 访谈资料 A1 的主轴编码示例

概念类属	范畴	范畴内涵
个人基本信息因素	职业 身体状况 婚姻状况 收入 年龄 户籍	A1-6 工作忙不忙 A1-17 工作不好 A1-8 身体条件允许的话 A1-24 还走得动 A1-19 又离婚了 A1-18 收入又低 A1-4 年龄 A1-15 本地人

表 4: 访谈资料 A1 的主轴编码示例 (续。)

概念类属	范畴	范畴内涵
	居住时间 学历 宗教	A1-14 住多久 A1-23 学历 A1-20 基督教
社会认知因素	自我效能 结果期望	A1-12 敢不敢上台表演 A1-10 对活动的期望值 A1-1 活动有没有特色
社会环境因素	社区资源 住房类型 邻里关系 专业指导 社交群体	A1-2 场地环境怎么样 A1-22 社区硬件设施 A1-25 很旧的小区 A1-16 跟邻居们都熟了 A1-13 有专业的人组织训练 A1-7 朋友或者家人去不去 A1-11 朋友们也说好 A1-26 没有什么人一起去看活动

由上表得到，在编码及概念类属的基础上，对概念类属间的关系进行辨析，归纳得出三个属于平行关系的三个概念类属，分别是个人基本信息因素、社会认知因素、社会环境因素。

居民参与社区音乐活动的因素主要体现在活动的专业性和活动的硬件设施上，一个具有专业团队的社区活动组织和一个具有较好的硬件设施，不仅能让居民更加踊跃的参加社区举办的音乐活动中，还可以令表演者有个更好的演出心情，也有利于更多的参与，无论是观看还是表演。

居民参与社区音乐活动是和居民本身也有着直接关系，身体的健康能直接影响居民是否会去参与，也会影响居民对活动的态度，根据调查现阶段参与社区音乐活动的居民逐渐老龄化，因此身体是非健康也是很重要的，会直接影响其参与度。还有就是居民的工作关系，有的居民表示很想参加但因为工作太忙需要加班因此而不能参加。

居民参与社区音乐活动还反映在其音乐活动主题等方面。因为随着德智体美劳的全面发展以及艺术被列入为高考加分项的政策出现，许多家长希望能通过社区音乐活动让自己的孩子能够更加了解音乐，也能随之带动孩子的音乐兴趣，因此会选择参与。

总结与讨论

本文根据对相关文献的梳理以及对 13 个受访者进行深度访谈，得到相关的数据，整理得出影响社区居民参与社区音乐活动的因素可分为三类，分别是包括年龄、职业、学历、收入、宗教、户籍、婚姻状况、身体状况等个人的基本信息因素；和包括社区环境、住房的类型、社区活动的硬件设施、专业的指导等方面的外部因素；再者是包括自我效能和结果期望两个方面的社会认知因素，其模型如下图 6 所示：

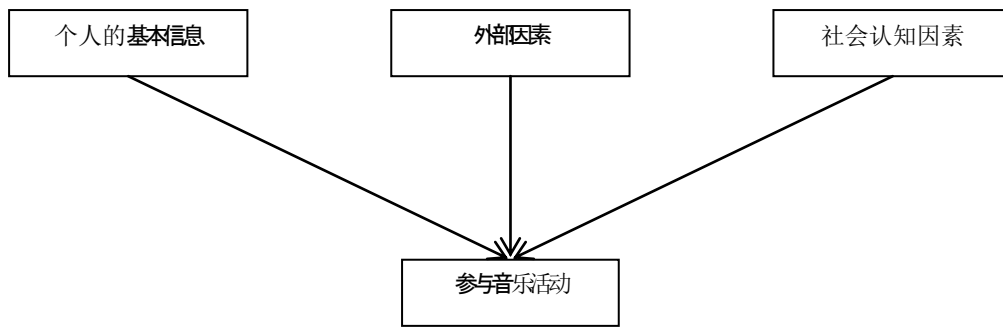


图 6：社区居民参与音乐活动的影响因素

绝大部分居民表示，社区举办的音乐活动非常少，但开过的音乐活动也都不满意，不少居民指出影响他们参加社区音乐活动主要的因素就是看活动的宣传效果，如果活动在宣传上达到居民的理想效果，那么他们就会选择去参加，那么理想效果是什么样的呢？根据调查发现，绝大的居民认为理想中的社区音乐活动应该有以下几点：

1. 应该拥有丰富多彩的节目，拒绝节目单一性

许多居民表示，在社区现有的音乐活动中，戏曲类的居多，而戏曲又是以方言为主，很多年轻一辈的居民表示听不懂，因此，可以丰富一下节目的类型。

2. 要有良好的活动场地，场地空旷，要设有座位

有居民表示，社区音乐活动一场也有一个多小时，但如果没有位置坐、场地还不够宽敞就不是很想观看也没有兴致，所以场地要场地空旷并且设有座位。

3. 活动的硬件设施要齐全，特别是音响设备

较多居民表示，社区举办活动的设施较为简陋，音响设备不好，活动音乐时强时弱很影响观看的心情，还有参加演出的演员表示，音响设备不好，很影响他们在台上的演出质量。

4. 工作人员要分配清楚，保持现场秩序

工作人员要分配清楚，这是非常有必要的，不少居民表示，根据以往的活动来看，观看演出的人很多，很拥挤，在没有排位的情况下，很容易会出现踩踏事件，有的时候看到这么拥挤，没有秩序也就不想去看。

5. 节目要有专业人指导，确保其音乐活动的质量

社区举办的音乐活动大多数都是居民自发的，而居民大多数都是音乐爱好者，所以较多的居民表示，应该要有专业人士的指导，这样节目就会更吸引人，更能让大家喜欢。平常排练也就有了目的性和方向性，有了专业人士的指导，节目也就有了质量。

参考文献

- A·班杜拉 (Albert Bandura). (2003). 自我效能：控制的实施 (上、下册) (缪小春、李凌、井世洁、张小林). 上海：华东师范大学出版社. (原著出版年：1997)
- 任广明、张英莉、佟桂影 (2019). 当代城市社区民族民间音乐发展探究. 当代音乐, 05, 88-89.
- 傅懿薪田、肖益清 (2019). 南昌市社区钢琴音乐活动现状和思考. 牡丹, 14, 36-39.
- 吴宜辰、张业茂 (2015). 国外社区音乐活动及社区音乐教育发展现状概述. 北方音乐, 35(23), 56-58+60.
- 宋文辉 (2013). 城市社区文化建设中居民参与意愿研究. 博士论文, 苏州大学.
- 李莉莉 (2011). 我国社区音乐教育的基本现状与发展思路的研究. 硕士论文, 湖南师范大学.



- 杜乡 (2018). 德州市德城区社区音乐文化建设调查研究. 北方音乐, 38(19), 241-242.
- 武艳 (2011). 国外社区音乐教育对促进我国音乐类大学生创业的启示. 继续教育研究, 02, 74-76.
- 张坤 (2019). 社区音乐发展现状研究. 北方音乐, 39(04), 226-227.
- 王思斌. (2006). 社会工作概论. 北京: 高等教育出版社.
- 玛格丽特·E.格雷德勒 (Margaret E. Gredle) (1994). 学习理论与教学应用 (吴幸宜译). 台北: 心理出版社.
- 赵朋冲 (2016). 新疆兵团石河子市社区音乐教育现状调查与研究. 硕士学位论文, 石河子大学.
- 魏莱、韩林彤、张业茂 (2015). 国内外社区音乐教育研究现状综述. 北方音乐, 35(23), 214-216.
- Heslin, Peter A. and Klehe, Ute-Christine., (2006). Self-Efficacy. S. G. Rogelberg (Ed.), *Encyclopedia of industrial organizational psychology* (chap. 2, pp. 705-708). Thousand Oaks: Sage. Available at SSRN: <https://ssrn.com/abstract=1150858>
- Hollingsworth, H., & Gray, D. B. (2010). Structural Equation Modeling of the Relationships Between Participation in Leisure Activities and Community Environments by People With Mobility Impairments. *Archives of Physical Medicine and Rehabilitation*, 91(8), 1174–1181. doi:10.1016/j.apmr.2010.04.019
- Ladewing H., & McCann G.C. (1980). Community satisfaction : Theory and measurement. *Rural Sociology*, 45, 10-131.
- Leglar, M. A., & Smith, D. S. (2010). Community music in the United States: An overview of origins and evolution. *International Journal of Community Music*, 3(3), 343–353. doi:10.1386/ijcm.3.3.343_1
- Martins, H., & Proença, M. T. (2014). Minnesota satisfaction questionnaire: psychometric properties and validation in a population of portuguese hospital workers. *Conferência - Investigação E Intervenção Em Recursos Humanos*, (3). doi:10.26537/iirh.v0i3.1825
- Morris, J. H., Oliver, T., Kroll, T., Joice, S., & Williams, B. (2017). Physical activity participation in community dwelling stroke survivors: synergy and dissonance between motivation and capability. A qualitative study. *Physiotherapy*, 103(3), 311–321. doi:10.1016/j.physio.2016.05.001
- Pavot, W., & Diener, E. (1993). The affective and cognitive context of self-reported measures of subjective well-being. *Social Indicators Research*, 28(1), 1–20. doi:10.1007/bf01086714
- Potter, J., & Cantarero, R. (2006). How Does Increasing Population and Diversity Affect Resident Satisfaction? A Small Community Case Study. *Environment and Behavior*, 38(5), 605–625. doi:10.1177/0013916505284797
- Renaud, Anastasia (Koutsoukis). (2019). Projective architecture: an approach to building an immersive Art Centre for Sudbury. Ph.D. Thesis, Ontario Laurentian University.
- Sheldon, D. A. (1998). Participation in Community and Company Bands in Japan. Update: Applications of Research in Music Education, 17(1), 21–24. doi:10.1177/875512339801700105
- Sørensen, Ø. (Ed.), & Stråth, B. (1997). *The Cultural Construction of Norden*. Oslo: Scandinavian University Press.
- Weller, S.C., & Romney, A. K. (1988). Systematic data collection (Qualitative Research Methods Series, No. 10). Newbury Park, CA: Sage.
- Yildiz, Ö. (2014). Financing renewable energy infrastructures via financial citizen participation – The case of Germany. *Renewable Energy*, 68, 677–685. doi:10.1016/j.renene.2014.02.038

附录 1：访谈提纲

尊敬的先生/女士：

您好！您辛苦啦！首先感谢您百忙之中能抽出时间认真填写调研问卷，我是泰国正大管理学院博士研究生林海敏，我正在写一篇关于中国社区音乐活动中影响居民参与因素的研究，这里有相关的问题想向您咨询。您的支持和帮助对于我完成本次研究，您提供的一切信息都仅限于学术研究使用。本人向您郑重承诺，绝不用于其他任何用途，绝不披露您的任何个人信息。一下问卷会占用您约 15 分钟时间，感谢您的人性和大力支持！

第一部分：受访者个人信息

1. 性别：
2. 年龄：
3. 您的月收入：
4. 您的教育程度：
5. 您的职业：

第二部分：

6. 您的社区有举办过音乐活动吗？
7. 您对社区举办过的音乐活动或者其他活动整体上有什么看法？
8. 您觉得什么因素会导致您选择参加社区音乐活动？
9. 参与音乐活动，您更希望是以表演者身份还是观看者的身份参加？
10. 您理想中的社区音乐活动应该是什么样的？