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Research on the Impact of Intelligent Manufacturing Technology on Business Model Based on CNKI's Evidence

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Abstract
Purpose: This article's purpose is founded based on the hotspots and scientific frontiers of intelligent manufacturing technology and customer demand, using the business model canvas theory to look for the opportunities and challenges brought by the advancement of intelligent manufacturing technology to a business model, the old concepts of business management is re-examined to provide a valuable reference for business model innovation.
Design/methodology/approach: A visual scientific knowledge graph of intelligent manufacturing and customer need was drawn through using the CiteSpace software based on the CNKI database, the relationship between them can be found visually and intuitively with the help of the visualisation function of the scientific knowledge graph.
Findings: Networking, Intelligence and Digitising are the hotspots of Intelligent Manufacturing. Big Data, Artificial Intelligence, Digital Twin and Cyber-Physical Systems are the scientific frontiers of Intelligent Manufacturing. Intelligent manufacturing and Customer Demand have the same hotspots keywords such as Big Data, Artificial Intelligence, and the Internet, this technology represented by these hotspots keywords brings opportunities to business management.
Research limitations/implications: The prospects of the research results of this article need to be improved since the publication of the article generally takes 3 months to 6 months.
Practical implications: This article provides useful theoretical references and practical guidance for governments, firms, universities, research institutions, science and technology service organisations, and technical managers.
Originality/value: This article demonstrates the relationship between technological change and business management, and further supplements the theoretical knowledge of business management, to provide a research foundation for follow-up researchers.

Keywords: Business management, Business model innovation, Business model, Intelligent manufacturing, Scientific knowledge graph, CiteSpace.

Introduction

The business model describes the basic principles of how a company creates value, delivers value, and obtains value (Honglei & Jianli, 2020; Osterwalder & Pigneur, 2011)**,** the business model is the "origin" of any firms' operation (Andreini & Bettinelli, 2017; Zhiqiang, 2010), a business model can bring advantages to firms in the competition and improve their operating performance (Xiangge, 2021).

Business model innovation is getting more and more attention in order to adapt to market changes, attract and retain customers to maintain continuous competitiveness in fierce market competition (Osterwalder & Pigneur, 2011), business model innovation requires a correct grasp of market competition conditions, customer behaviour, customer interests, and the firm's resource capabilities, and must match the level of science and technology (Kraus et al., 2020). As such, a business model is not only feasible and creative but also forward-looking, business model innovation means the reintegration of various resources or business elements on time.

New technology may bring changes to the elements of the business model such as customers, distribution channels, customer relationships, key resources, cost structure, partners (Munna, 2021), etc, thereby changing the way firms create value, deliver value and acquire value (Ning & Bo, 2021; Ziqiang et al., 2021), it is a most direct and effective way of business model innovation. Manufacturing is the most active field of technological innovation, its technological iterations are more frequent, intelligent manufacturing is the result of manufacturing technological innovation and application. Intelligent manufacturing is deeply integrated with the new generation of information technology and manufacturing, it has triggered far-reaching industrial changes, forming new production methods, industrial forms, business models and economic growth points (China, 2015). Intelligent manufacturing has become a typical new trend of new technology advancement and application (Bang et al., 2018), firms must keep up with the hotspots and scientific frontiers of new technologies and customer demand in a fierce market environment (Liu et al., 2021), and look at the revolutionary impact of intelligent manufacturing technology on business models from the perspective of the times, while also re-examine the possibilities that intelligent manufacturing technology brings to business management in order to avoid the ‘sluggishness’ or self-circulation of conventional technologies in the process of technological innovation. Firms can adopt new technologies on time to implement business model innovation to create more value for customers so that maintain their core competitiveness, and even stand out in the face of fierce market competition.

This article conducts a visual analysis and mining of intelligent manufacturing and customer demand through the citation analysis tool CiteSpace software based on the data of the CNKI database, it is found that the research hotspots, scientific frontiers and evolutionary context of intelligent manufacturing and customer demand. According to the business model canvas theory (Osterwalder & Pigneur, 2011), it is explored the changes brought by hotspots and cutting-edge technologies in intelligent manufacturing to 9 elements in the business model canvas including customer segmentation, value proposition, channel access, customer relationship, revenue source, key resources, key business activities, key partners and cost structure, to look for the opportunities and challenges brought by the advancement of intelligent manufacturing technology to a business model, and to re-examine the old concepts of business management to provide a valuable reference for business model innovation.

Literature Review

At present, academia does not have a unified definition of a business model, the concept put forward by Osterwalder and Pigneur (Osterwalder & Pigneur, 2011) is widely adopted, they believe that the business model describes the basic principles of creating value, delivering value and obtaining value, they also proposed the business model canvas theory to analyse the business model more intuitively, the business model is divided into 9 segments including customer segmentation, value proposition, channel access, customer relationship, revenue sources, core resources, key business, and important cooperation, cost structure. Lu Yan (Yan, 2018) believes that business model innovation is the most fundamental in all business management activities of firms, it is the foundation of firms' technological innovation and management innovation, other innovations will lose the possibility of sustainable development without business model innovation. Hu Shiliang (Shiliang, 2014) pointed out that the business model innovation is the key to improving the core competitiveness of firms, which can enable firms to achieve better development.

Intelligent manufacturing is based on the in-depth integration of a new generation of information, communication technology and advanced manufacturing technology; which runs through all aspects of manufacturing activities such as design, production, management and service (Liu et al., 2020), new production methods come with self-perception, self-learning, self-decision-making, self-execution, self-adaptation and other functions (Technology & Finance, 2016). Dong Weilong and Qu Qianru believe that intelligent manufacturing can realise the comprehensive interconnection of people, machines and things, and build a production and service system that is fully connected with all elements, entire industry chains, and entire value chains, it will have an all-around, in-depth and revolutionary impact on future commercial development (Weilong & Qianru, 2018), intelligent manufacturing is a new paradigm of industry 4.0 (Ghobakhloo, 2020; Neumann et al., 2021), it is a strategic choice for firms to adapt to the development trend of the scientific and technological revolution (Yin et al., 2017; Yuan & Minghuo, 2021).

Hypothesis Development

If two themes have the same or similar keywords, it means that they have common characteristics and there is some kind of connection between the two themes, and that they may influence each other. The complex relationships between their knowledge groups are implied through the aspects of network, structure, interaction, intersection, evolution or derivation, and others; and these complex knowledge relationships are giving birth to new knowledge (Chaomei et al., 2015).

This article explores the interactive, cross-cutting and evolutionary trends between intelligent manufacturing and customer demand through the hotspots and scientific frontier of their keywords, and then discovers the impact of intelligent manufacturing technology on business management, this has important reference value for improving business management methods and improving the efficiency of firm management.

Methods

1. Scientific Knowledge Graph

The Scientific Knowledge Graph is an effective analysis method that reflects the regular characteristics of the internal knowledge structure and evolutionary process of the research topic, it can be presented more intuitively to assist the development of related research through data statistics, text mining and visualisation (Luyao et al., 2020). CiteSpace is a diverse, time-sharing and dynamic citation visual analysis software developed by professor Chen Chaomei and his team, it is one of the most commonly used software for drawing Scientific Knowledge

Graph (Li Jie, 2017).

In this article, the Scientific Knowledge Graph of the research topic is drawn by using the citation analysis tool CiteSpace based on the data of the CNKI (China National Knowledge Infrastructure) database to find hotspots keywords of the research topic through the visualisation function of the Scientific Knowledge Graph, the research content can be visualised and analysed through the co-occurrence of keywords and the evolution of the theme path, the relationships between the research topics are displayed vividly and intuitively, and exploring the hotspots and scientific frontiers of the research topics, the Scientific Knowledge Graph can more deeply reflect and approximate the law of scientific development of the research topics, which not only helps explain existing scientific discoveries, but also facilitates the establishment of new discoveries (Chaomei et al., 2015).

2. Literature Research Method

A large number of existing literature on intelligent manufacturing and business management was consulted to in-depth analysis of the development process, theoretical basis and latest research results of they, and finding the research topic and innovative points of the research in this article.

On the basis of finding separately the hotspots of intelligent manufacturing and business management through the visualization function of the scientific knowledge graph, and then finding the same hot spots between them and discovering the relationship between them. Then, their interaction relationship is further discussed through highly cited literature, finally, discovering the opportunities and challenges that intelligent manufacturing technology brings to business management.

Data Sources

Setting the search conditions, article type, journal source type through the advanced search function on the CNKI's old version search page, and also setting the search interval from 2011 to 2020, a total of 10 years, while other options are set at default. After excluding non-research articles such as conference reports, notices and exhibitions, valid articles related to the research topic are finally obtained. All the articles retrieved are exported to the Refworks format, and the exported article data is cleaned by keyword merging and invalid word deletion. Then data conversion is performed using the citation analysis tool CiteSpace software to obtain the source data that can be used for CiteSpace software analysis, and to translate keywords from Chinese to English by adding language programs, Pruning method selection Pathfinder, Pruning Sliced Networks, and Pruning the Merged Network.

The CNKI is the most authoritative academic database in China, it provides readers at home and abroad with unified retrieval, unified navigation, online reading and download services, which include Chinese academic literature, foreign literature, dissertations, newspapers, conferences, yearbooks, reference books and other resources, the scope of this collection covers major fields such as basic science, literature, history and philosophy, engineering technology, social science, agriculture, economics and management science, medicine and health, and information technology.

Findings

1. The hotspots of Intelligent Manufacturing

It is called keyword co-occurrence when two or more keywords appear in the same article, it is a high-level generalisation and condensing of the subject of an article, and is also an important evaluation index for bibliometric research. The research hotspots and evolutionary trends of various periods can be observed through changes in the frequency of keywords (Baosheng & Xiaoting, 2018; Zhang Mei, 2020).

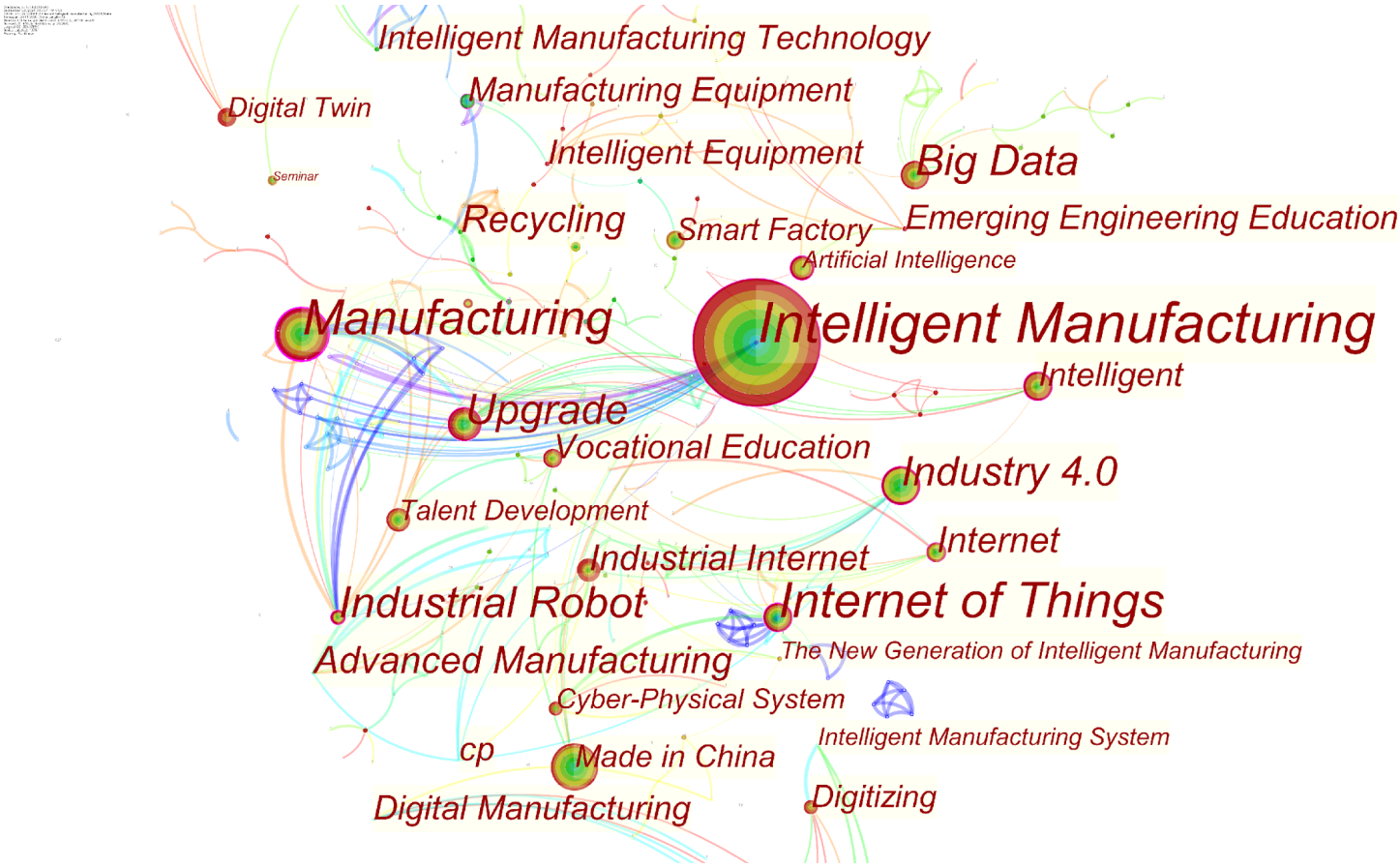

Figure 1 Co-occurrence Graph of Intelligent Manufacturing Keywords

On the CNKI old version search page through the advanced search function, it is possible to set the search conditions: subject = '智能制造', article type is set to 'journal', source type is 'core journal', and the search interval is set from 2011 to 2020, a total of 10 years, while other choices are set at default. The search time is updated to October 9, 2021, a total of 1,518 articles were retrieved. After excluding conference reports, notices, exhibitions and other non-research articles, 1,084 valid articles were obtained related to the topic of intelligent manufacturing. Import this data into the CiteSpace software for visual analysis of keywords, Pruning method selection Pathfinder, Pruning sliced networks, and Pruning the merged network, those main keywords are translated from Chinese to English, figure 1 is getting finally. The node N=444 and the connection line E=857 in the figure, the size of a node represents the frequency of occurrence of keywords, the larger the node, the more the occurrences of keywords. The thickness of the line represents the strength of the keyword relationship, the thicker the line, the stronger the relationship (Zhang Xiaodi, 2021).

In Figure 1 and Table 1, it can be seen that the top 20 keywords appearing in order are Intelligent Manufacturing, Manufacturing, Made in China, Industry 4.0, Intelligent, Big Data, Artificial Intelligence, Upgrade, Talent Development, Industrial Internet, Smart Factory, Internet of Things, Internet, Digitising, Digital Twin, Industrial Robot, Vocational Education, Manufacturing Equipment, Cyber-Physical System, and Emerging Engineering Education. Figure 1 also shows that there are many links between keywords, which means that these keywords are closely related.

At the same time, it can also be seen that except for the search subject term 'Intelligent Manufacturing', 'Manufacturing' appears the most times as a keyword, indicating that manufacturing is the most active area of intelligent manufacturing research. Made in China,

Industry 4.0, Upgrading, Talent Development, Vocational Education, Manufacturing Equipment, and Emerging Engineering Education appeared in the top 20 keywords, indicating that they are very active topics in intelligent manufacturing research.

In addition, these keywords related to technology can be summarised into the following three categories. The first direction is Intelligent, and the representative keywords are Intelligent, Artificial Intelligence, Smart Factory, and Industrial Robot. The second direction is networking, and the representative keywords are Industrial Internet, Internet of Things, Internet, and Cyber-Physical System. The third direction is Digitising, and the representative keywords are Big Data, Digitising, and Digital Twin, it proves that intelligence, networking and digitisation have become the hotspots of intelligent manufacturing research.

Table 1 The Hotspots Keywords for Intelligent Manufacturing

NO.	Count	Centrality	Year	Keywords
1	627	0.24	2011	Intelligent Manufacturing
2	60	0.61	2012	Manufacturing
3	49	0.03	2015	Made in China
4	47	0.32	2014	Industry 4.0
5	31	0.38	2013	Intelligent
6	30	0.15	2016	Big Data
7	30	0.23	2016	Artificial Intelligence
8	28	0.22	2015	Upgrade
9	27	0.08	2015	Talent Development
10	26	0.05	2015	Industrial Internet
11	26	0.07	2015	Smart Factory
12	26	0.26	2012	Internet of Things
13	25	0.24	2015	Internet
14	19	0.06	2014	Digitising
15	19	0.03	2018	Digital Twin
16	18	0.25	2012	Industrial Robot
17	16	0.16	2015	Vocational Education
18	13	0.22	2011	Manufacturing Equipment
19	13	0.08	2016	Cyber-Physical System
20	10	0.11	2017	Emerging Engineering Education

2. The Evolutionary Trend and Scientific Frontiers of Intelligent Manufacturing

As shown in Figure 2 on the theme of intelligent manufacturing, the research on

intelligent manufacturing in the early stage (before 2012) mainly focused on Manufacturing, Internet of Things, Industrial Robots, and Manufacturing Equipment. The focus of research in the mid-term (2013-2015) shifted to Made in China, Industry 4.0, Intelligent, Upgrade, Talent Development, Industrial Internet, Smart Factory, Internet, Digitising, and Vocational Education. In the later period (after 2016), the focus has shifted to Big Data, Artificial Intelligence, Digital Twin, Cyber-Physical Systems, and Emerging Engineering Education. Therefore, Big Data, Artificial Intelligence, Digital Twin, and Cyber-Physical Systems are the scientific frontiers for the future development of intelligent manufacturing.

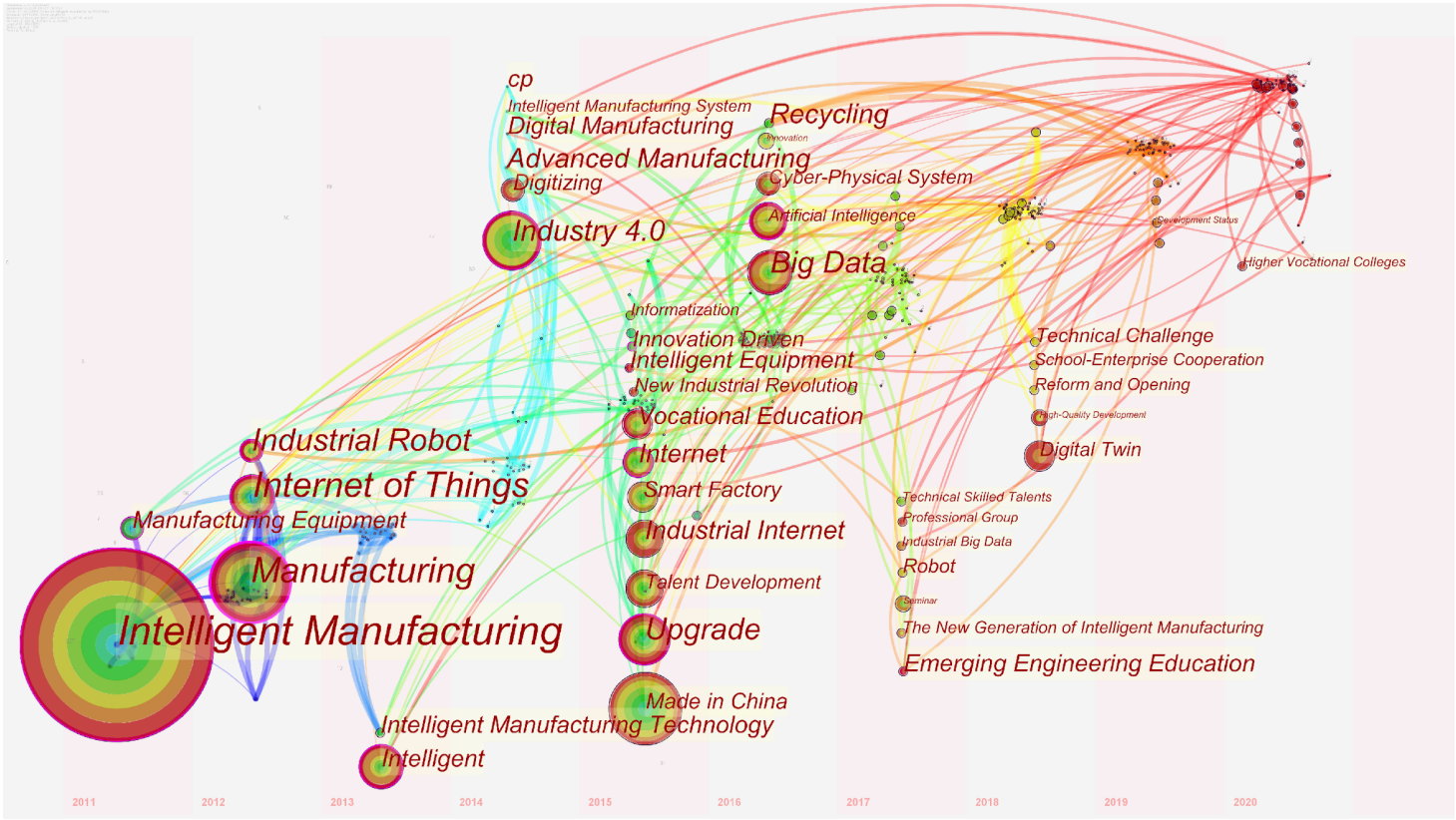

Figure 2 Thematic Path Graph of Intelligent Manufacturing Keywords

3. The hotspots of Customer Demand

In order to understand the hotspots of customer demand research, it is good to use advanced search functions on the old search page of the CNKI database. Set the search keywords = '客户需求' or '用户需求', the search interval is from 2011 to 2020, a total of 10 years, the article type selects 'journal', the article source selects 'core journal', and the other options are at default. The search time is updated to October 9, 2021. Then synonymous data are merged to make the data clear, and 3,153 valid articles were obtained finally, import the obtained effective data into CiteSpace for analysis. The keywords that are not related to customer demand is hidden for the convenience of viewing such as the library, university library, digital library, mobile library, public library, smart library, and subject Librarians. Then convert the keywords from Chinese to English, Pruning method selection Pathfinder, Pruning sliced networks, and Pruning the merged network. Finally, get a co-occurrence graph of the keywords of customer demand, as shown in Figure 3.

Table 2 The Hotspots Keywords for Customer Demand

NO.	Count	Centrality	Year	Keywords
1	513	0.11	2011	Customer Demand
2	105	0.07	2011	Knowledge Service
3	79	0.27	2011	Product Design
4	67	0.01	2013	Big Data
5	67	0.17	2011	Internet
6	60	0.11	2011	Information Service
7	59	0.03	2011	Quality Function Deployment
8	59	0.08	2012	User Experience
9	52	0.05	2012	Demand Response
10	49	0.04	2015	Kano Model
11	42	0.11	2011	Cloud Computing
12	38	0.28	2011	User
13	37	0.06	2013	Industrial Design
14	35	0.07	2011	Personalized Service
15	33	0.02	2011	Message Requirement
16	32	0.2	2012	Subject Service
17	31	0.08	2011	Service Innovation
18	30	0.11	2011	Service Model
19	26	0.31	2011	User Research
20	26	0.32	2011	Modular
21	25	0.13	2011	House of Quality
22	25	0.05	2011	Analytic Hierarchy Process
23	25	0.05	2011	Service Quality
24	24	0.05	2011	Demand Analysis
25	23	0.02	2011	Mass Customisation
26	20	0.13	2011	Customer Satisfaction
27	20	0.19	2012	Innovative Design
28	20	0.02	2011	Theory of the Solution of Inventive Problems (TRIZ)
29	19	0.06	2011	Product Innovation
30	18	0.04	2013	Artificial Intelligence

Figure 3 and Table 2 show that the top 30 hotspots keywords for customer demand are as follows: Customer Demand, Knowledge Service, Product Design, Big Data, Internet,

Information Service, Quality Function Deployment, User Experience, Demand Response, Kano Model, Cloud Computing, User, Industrial Design, Personalized Service, Message Requirement, Subject Service, Service Innovation, Service Model, User Research, Modular, House of Quality, Analytic Hierarchy Process, Service Quality, Demand Analysis, Mass Customization, Customer Satisfaction, Innovative Design, Theory of the Solution of Inventive Problems (TRIZ), Product Innovation, and Artificial Intelligence.

Figure 3 Co-occurrence Graph of Customer Demand Keywords

Comparing Figure 2 and Figure 3, Table 1 and Table 2, it can be seen that the hotspots keywords of customer demand are partly the same as the hotspots of intelligent manufacturing, the keywords of the same hotspots between them mainly include Big Data, Artificial Intelligence and the Internet. This explains that there is a close connection between intelligent manufacturing and customer demand, and in-depth exploration of the interaction mechanism between them, which plays an important role in carrying out business model innovation, in meeting a customer need, improving customer experience, enhancing customer satisfaction, and in promoting the development of business management.

Table 3 The common hotspots of Intelligent Manufacturing and Customer Demand

NO.	The same hotspots of Intelligent Manufacturing and Customer Demand	Main Meaning
1	Big Data	A tremendous amount of data is generated every day in the sectors of manufacturing, science, business and our personal lives, Big Data refers not to just large data volume, but to the ability to analyse, interpret and utilize those data, the Big Data could reveal new knowledge about our market, society and environment by proper processing, and it enables us to react to emerging opportunities and changes in a timely manner (Chen et al., 2013).
2	Artificial Intelligence	Artificial Intelligence is the technique that enables computers to mimic, strengthen, or replace human intelligence by applying logic, rules, expert systems, decision trees, and machine learning (Wang et al., 2020).
3	Internet	The Internet has developed into many subdivisions, such as Industrial Internet, Internet of Things and Mobile Internet. Industrial Internet is enabled by sensing, communication, cloud computing, and big data analytic technologies, and it has been receiving much attention in the industrial section due to its potential for smarter and more efficient industrial productions (Li et al., 2017). Internet of Things is leading a large number of benefits into human life by providing smart services (Asghari et al., 2019). Mobile Internet refers to the use of various types of mobile terminals as access devices and the use of various mobile networks as access networks, thereby realizing a variety of new business models that integrate innovative services (Jiyi et al., 2015).

4. The Interaction Mechanism Between Intelligent Manufacturing and Business Model

Through the visual analysis of the scientific knowledge graph of intelligent manufacturing hotspots and scientific frontiers, it can be seen that Networking, Intelligent and Digitising are the hotspots of Intelligent Manufacturing. Big Data, Artificial Intelligence, Digital Twin, and Cyber-Physical Systems are the scientific frontiers of Intelligent Manufacturing. Intelligent manufacturing and customer demand have the same hotspots keywords such as Big Data, Artificial Intelligence, and the Internet. So, intelligent manufacturing technology has brought many opportunities and challenges for business model innovation.

The customer-centric value propositions are easier to realise with the empowerment of digitisation and networking (Chenlin, 2020; Shengnan & Chenyan, 2018), and it is more convenient and faster to establish connections between firms and customers. Big data and the Internet make it possible to accurately identify the personalised and hidden customer demand (Yumeng, 2015; Zechuan, 2019). Customer relationship is manifested as the digital and networked connection between people and machines, machines and machines, machines and materials, and also factories and factories. Data becomes a means of connection and communication, communication between firms and customers is more effective and accurate. Customer behaviour can be collected and analysed on time through the internet and big data, the hidden customer demand can be accurately identified, new segmented customers can be discovered (Yumeng, 2015). Sales channels will become more intelligent, connection and

transactions will no longer be the main functions of channels, the new mission of channels has become to find and aggregate customer segments with the same needs, and to play greater value (Jing, 2005). Through big data, real-time monitoring, material traceability, process management, yield analysis, performance analysis, visual management and much other business management are carried out at the same time in the production process. It also contributes to realising the comprehensive management of production factors such as human, machine, material, method, and environment, cost management is more intelligent (Nanhai et al., 2019). Big data and the internet reduce channel circulation costs (Yantao, 2019). Intelligence improves work efficiency, saves costs, and optimises cost structure (Fengjiao, 2019). Personalised and implicit customer demand analysis, new product development and flexible production have become the key business of firms. Purely buying and selling customer relationships has been weakening, and the customer relationship has evolved from purely buying and selling, to joint research and development. Customers can become a community of interests, customers can become partners to realise value co-creation (Yue'e, 2019). Discovering customer demand and developing new products has become easier and easier with the application of intelligent manufacturing technology, developing new products and expanding new customers have become an important source of income (Shiquan, 2014). So, intelligent manufacturing technology has brought many opportunities to business management, it not only helps manufacturing firms to reduce costs and increase efficiency, but also gives them opportunities to rethink their value proposition and business model innovation, the impact of intelligent manufacturing technology on the business model is shown in the following Table 4.

Table 4 The Impact of Intelligent Manufacturing Technology on Business Models

<table>
<tr>
<td rowspan="2">Important Partner

The customers can become a community of interests and become partners of firms through value co-creation.</td>
<td>Key Business

It has become a key business to tap the personalised and hidden customer needs, extend the content of services, and increase the added value of products.</td>
<td rowspan="2">Value Proposition

Customer-centric, to meet customer's personalised customisation needs</td>
<td>Customer Relations

Through networking, digitisation, and intelligence, the customers can realise participation experience, customers' opinions on products were accepted, and realising value co-creation with customers.</td>
<td rowspan="2">Customers Subdivision

Accurately discover customers' hidden needs through networking and digitisation, and discover new segmented customers.</td>
</tr>
<tr>
<td>Core Resources

The implementation of networked, digital, and intelligent upgrades requires a large number of high-end talents. Highly knowledgeable and highly skilled talents become the core resources of the firms.</td>
<td>Channel Access

Use big data and the Internet to find and aggregate customer segments with the same needs to reduce circulation.</td>
</tr>
</table>

Cost Structure	Source of Income
Big data and the Internet have reduced channel circulation costs. Intelligence improves work efficiency and saves costs.	With the application of intelligent manufacturing technology, discovering customer demand and developing new products have become easier and easier; developing new products and expanding new customers have become an important source of income.

Discussion and Conclusion

The following three new trends are predicted for business management.

1. Intelligent Manufacturing Promotes Business Model Changes

Networking, digitisation, and intelligence will promote subversive innovation in firms manufacturing models, industrial organisation methods, and business operation mechanisms (Yuan & Minghuo, 2021). It is fully integrated the commercial activities of procurement, production, logistics, management, sales through networking and digitisation (Yong & Zhongcheng, 2020), the internal and external of the firms are fully interconnected through networking (Dapeng et al., 2005), and factory automation and flexible production can be realised through intelligence (Zhongde et al., 2021), thereby improving the efficiency of product design, manufacturing, logistics, sales and service, the whole process of the product can be traceability (Huanhuan & Zhi, 2019). These changes have greatly improved people's production, communication, and transaction methods through broking the limitations of time and space to realise the optimal combination of productivity, the production relationships are changed (Shengbing et al., 2018). This allows labour to be more intellectual, labour tools can be automated (Sihu, 2002; Wenhua, 2003), which all creates a revolutionary impact on the business model of firms, the role of tangible production factors such as capital, land and equipment in business declines, while the role of intangible production factors such as knowledge, technology, services and information increases.

At the same time, the development and prosperity of intelligent manufacturing technology have not only changed the relationship between firms and customers (Haixia, 2020), but also expands the level of commercial markets, the content of market exchanges are enriched, and promotes further segmentation of customer personalised needs and product differentiation, thereby enriching the level and structure of the exchange market (Yinyin, 2019), this also shortens transaction time and improves transaction efficiency (Liqun, 2020), it is changed the way of creating value, delivers value, and also obtains value for customers. It gives birth to a brand-new business model, and sets off a profound change in management decision-making and business models, which in turn, has a major impact on managers' cognitive thinking, and affects production and operation improvements, business model innovations, which force companies to abandon old concepts of business management and instead, actively adapt to new business management methods in the technology-driven era.

2. Personalised Customisation Will Become the Mainstream for Future Business

The productivity has greatly increased with the popularisation and application of intelligent manufacturing technologies such as the internet, big data and artificial intelligence (Liqun, 2020), however resulting in overcapacity, which there is too much product production and manufactured products cannot be sold (Xianxiang, 2014), coupled with fierce competition from similar products, the customers have more and more choices. The market shifts from the sellers' market to the buyers' market (Jiajia, 2011), meeting the individual customers' needs has become the core of firms competitiveness (Zhihui, 2010), decentralisation of firms production will become a trend (Wenwen et al., 2019), the customers become the centre of all businesses as businesses shifts from a standardised push model centered on manufacturing

firm to a personalised pull model centered on customers (Long, 2019), the private customisation may become a reality in the future. Therefore, the driving factors of the business model must rely on technological innovation so that provide more personalised services dependent on the product.

Today, only by creating more added value of products can the core competitiveness of the firms be improved because the value creation shifts from product-oriented logic to service-oriented logic (Yuan & Minghuo, 2021). In addition, the customers' individual characteristics become more and more prominent with the increase of the people's material wealth, they will gradually move from the quantitative consumption stage to the quality consumption stage, the customers more pay attention to the emotional experience consumption (Yuan & Minghuo, 2021), the customer demand for self-realisation and respect become stronger and stronger, and the various products offered will become more and more personalized. This only causes products and value creation of firms to move increasingly towards the personalised customisation mode of customer participation and customisation. This brings about customer participation and experience in the whole process of product production, and also complete product optimisation and innovation based on customer interactive feedback. Intelligent manufacturing provides small-batch, multi-variety and flexible production through intelligence that can continuously meet the individual needs of customers. In this way, the production methods of firms and the consumption methods of customers will undergo a revolutionary reconstruction, significant changes will take place in firm value propositions, value creation, value delivery, and value acquisition methods, which will in turn, force the innovation and reorganisation of firm business models to evolve, and as such, personalised customisation will become the mainstream of future business.

3. The Era of 'Production on Demand' is Coming

The firms not only can discover the hidden customer demand but also obtain customer opinions on products through intelligent manufacturing on time (Kang, 2019; Wenlian & Jianming, 2013), the firm's competitiveness can be maintained by quickly responding to market changes and providing personalised products that better meet customer demand and preferences. The time and space constraints between firms and customers have been broken with the help of networking, giving rise to the comprehensive interconnection between factories and customers (Xubin, 2019; Yuping et al., 2020). More and more diversified, small-batch, and customised productions can be realised with the help of artificial intelligence to meet the individual customers' needs to a greater extent (Rong, 2019). Over-capacity has reversed the focus of the business, the product has changed from 'factory to person' to 'factory to factory' and 'person to factory', the design, production, sales and service of the entire supply chain are reversed (Huizhong & Zongjie, 2014), channel links such as distribution and marketing in the supply chain may be crossed, the traditional long and narrow supply chain has become reversed and flattened (Guo et al., 2019). The value transmission, value creation, and value acquisition methods will undergo subversive changes, and the circulation value of channels will become weaker and weaker (Mingyang & Zihua, 2015), thus the value of connecting, finding and gathering customers becomes more and more important.

A personalised production model with extensive customer participation can be established, the customers can place orders and requirements together with suppliers in the supply chain, suppliers will start production after obtaining a large amount of customer information and product orders, it is delivered to the user after the product is produced through the most optimised path of powerful logistics systems in the supply chain, thus eliminating the inventory problem. The firms will know who the end-users are and what the demand is before every product is produced in the future, all products are produced after ordering, the manufactured products will be sent directly to customers through logistics firms on the

intelligent supply chain, and no more inventory will be needed. This is a reversal of the supply chain brought about by digitisation, networking and intelligence. Channels, customers and customer relationships are all being reversed. We are entering the era of 'on-demand production'.

Therefore, the firms should attach great importance to the possibilities that the emergence of intelligent manufacturing technology brings to business models, keep up with the hotspots and scientific frontiers of the industry, and stand in the era of the next decade to see the tremendous changes that intelligent manufacturing technology will bring to a business. The firms should also use new intelligent manufacturing technology to innovate at the level of customer value creation, and continuously meet the hidden customer demand to keep their business model up-to-date and forward-looking, seize the 'outlet' of technological innovation dividends, which will help firms stand out in a highly competitive market.

Theoretical Implications

This article uses the visualisation method of scientific knowledge graphs to display hotspots and scientific frontiers of intelligent manufacturing and customer need that we want to know but do not yet comprehend, it is convenient for users to better grasp the hotspots and evolutionary process of intelligent manufacturing and customer demand in the form of intuitive graphs, the opportunities were explored that intelligent manufacturing technology brings to business management reform, and enriches the content of business management. At the same time, from the perspective of scientific and technological innovation, it reveals the role of intelligent manufacturing technology in the paradigm shift of business models, this can help the majority of business managers to transform their perceptions of business models from an intuitive perception to visual analysis, it also helps firm managers to clarify firm strategic vision in firms management, in order to formulate a business model suitable for their unique development, the research results of this article have enriched the theories of firms in technological innovation and business model innovation.

Practical and Social Implications

First, this article will help relevant companies accurately grasp industry development trends by identifying the research hotspots and scientific frontiers of intelligent manufacturing and customer demand, better value will be created for customers through using the latest hotspots technology to promote business model innovation, this can gain competitive advantage and increase firms performance. Second, this article can assist firms in seizing market opportunities by accurately predicting the frontiers of scientific development, conforms to technological development trends, and the hidden needs of customers will be met through uses technological innovation, the research results have important guidances for business management such as the formulation of strategies, development of new products, and business decision-making of firms. Third, this article can also provide a high reference value for government science and technology management departments, universities, research institutions, and technical managers in policy formulation or business management.

Limitations and Suggestions for Future Research

This article is based on the analysis of the CNKI database, although it represents the most authoritative database in China, it is more a reflection of the business management phenomenon in the Chinese social background, the application of business management on a global scale needs further demonstration.

Since the publication cycle of research articles usually takes 3 months to 6 months, the information represented by the data used in this article still has a certain lag time.

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