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Identification of the Reverse Path of Science and Technology Intermediary in Innovation Activities

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Abstract

One of the important functions of science and technology intermediary is to focus on the SME market demand to guide research and development in universities and research institutes, which is needed not only for social development, but also for the transition of China's economic development to the domestic demand-led growth. Thus, "cloud model" and "Dandelion model" can be the expanded function of science and technology intermediary. The development of this reverse path can enhance the position of "industry" in the relations among industry, university and research.

Key word: Science and technology intermediary; Industry-university-research cooperation; Demand-led

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There are numerous research achievements on technology intermediaries, and overall, the vast majority of the content discussed aims to explore how the achievements of universities and research institutes can be transmitted to small and medium-sized enterprises, which is a one-sided and one-sided influence. Although it is occasionally mentioned that small and medium-sized enterprises transmit market demand to universities and research institutes, almost without exception, it is only briefly mentioned without in-depth research. In fact, this reverse or reverse transmission is necessary for the development of contemporary society, which helps to further resolve the chronic problem of "two skins", promote the growth of small and medium-sized enterprises and the development of universities and research institutes themselves, improve industrial structure, and stimulate domestic demand. The "cloud model" and "dandelion model" of technology intermediaries are two modes of reverse transmission.

THE REVERSE SOCIAL BACKGROUND

The background of "reverse" can be discussed from three levels: macro, meso, and micro. First, examine the macro level.

The traditional cultures of various ethnic groups around the world mostly advocate teleology. In ancient Greek natural philosophy, Aristotle believed that nature, like human craftsmanship, is meant for a purposeful existence that is attracted to a "future, but in the order of existence, a pre-existing good". China"s policy of "cultivating order and governing peace" also reflects a strong purpose. Since Newton, there has been a shift towards emphasizing causal determinism. The ultimate cause, apart from those involving human actions, cannot advance science but is only sufficient to undermine it. All science lies in studying the forces of nature from the phenomena of motion, and then verifying other phenomena from these forces. Force is the cause of phenomena, and the cause is the essence. Since the mid-20th century, with the emergence of systems theory and other "three theories", especially the rise of complexity science in the second half, on the one hand, causal determinism has loosened, proposing a series of new concepts such as uncertainty, fluctuation, bifurcation, and emergence. On the other hand, concepts such as attractors and intentionality located on the other end of the cause have emerged, and value judgments have intervened, emphasizing both causal determination and purpose guidance.

It is necessary for technology intermediaries to pay attention to another "direction" as an intermediary, which is the reverse macro social background. So far, the vast majority of technology intermediaries" work and research results on technology intermediaries have focused on the path from technology development to the market, from universities and research institutes to "production". It is necessary to leverage the "reverse" function of technology intermediaries as intermediaries to guide and drive technological development by meeting demand as the purpose of research and development. The concept of "mesoscopic" involves an understanding of technological rationality. Technical rationality has the following aspects: the most basic is effectiveness and controllability, and the ability to achieve expected goals through procedural operations; On this basis, the design and production team requires an input-output ratio, consumers require a functional price ratio, and the game between these two "ratios". Without the constraint of consumer function price ratio on the input-output ratio of the production side, there will be no complete technology, let alone technological development; The higher requirement is sustainability, considering ecological and social benefits, that is, examining society's acceptance and choice of technology, including its full impact, from a long-term and global perspective. When shifting towards goal guidance at the macro level, the meso level naturally emphasizes demand guidance. Technology is a whole, consisting of two parts: production and consumption. If only production and manufacturing are considered, or if the production side has overwhelming advantages, it is not a complete technology, at least not perfect. This is particularly important in contemporary China. In the era of planned economy, consumer demand was almost completely ignored. After turning to market economy, due to the relative scarcity of goods, manufacturers could still focus on production to a certain extent and always sell out. After joining the WTO, China has become the world's factory, with both ends outside, and producers do not have to consider consumers" feelings. The trade crisis, the disintegration of the global industrial chain, and the contraction of external demand require us to take the path of domestic demand driven development. Chinese entrepreneurs must seriously face the needs of Chinese consumers. From this, it can be seen that demand guidance is no longer just a temporary solution for a certain enterprise or technology, but a strategic choice related to China's economic and social development.

At the micro level, it is necessary to further segment the needs of consumers and pay attention to their personalized needs. Consumer demands are not only personalized, but also fashionable and versatile. In today's 21st century, the mass production and standardization of the industrial era have long been a thing of the past, and it is important to be close to consumers. Nowadays, the development of high technology can increasingly meet various personalized needs of consumers, and 3D printing is a typical example of this. In fact, small batch personalized high emotion is not only the need of consumers, but also the need of R&D designers themselves. For example, Malaysia's Twin Towers and Sydney Opera House not only meet the needs of consumers, but also invest the designer's efforts.

ONE OF THE REVERSE PATHS: CLOUD MODEL

Based on the above ideas, we can conceive the "cloud" model and "dandelion" model of technology intermediaries, starting with the former.

In the past, the main function of technology intermediaries was one-way and unilateral promotion from universities and research institutes to "production", with little or no reverse guidance from "production" to universities and research institutes. Reverse guidance, that is, small and medium-sized enterprises fully leverage their advantages in being close to the market, transmitting consumers" demand for new technologies and dissatisfaction with existing technologies through technology intermediaries to universities and research institutes. The latter find a combination point between the market and their own technological advantages, and then conduct targeted research to increase success rates. The research institute established by Zhejiang University in Taizhou serves as a technology intermediary[P], We have received over 800 batches of technical consultations from enterprises, organized more than 100 experts from Zhejiang University to conduct research in Taizhou, connected with enterprises, and reached more than 30 cooperation intentions in technology research and development, talent cultivation, and co construction of carriers. Reverse guidance also enhances the value of technology intermediaries in bilateral markets by increasing their openness and mobility. On the basis of discussing the two models in the following text, further elaboration is needed on the significance of reverse guidance.

The meaning of cloud models is not limited to this. In the past, although the activities and corresponding research results of technology intermediaries occasionally mentioned reverse guidance, they did not consider the further development of high-tech fields in which the achievements provided by universities and research institutes to technology intermediaries and small and medium-sized enterprises from a high position

[1] Zhejiang University Taizhou Research Institute (zju. edu. cn), the same below.

in reverse guidance, as well as the potential functions of technology intermediaries in such development. Technology intermediaries only play a role in the development of small and medium-sized enterprises in a one-way manner. For universities and research institutes, most of the time it's like a blind man breaking corn. An innovation that can be quickly transferred to small and medium-sized enterprises through technology intermediaries and then started anew; Just like a blind man holding the broken corn under his armpit, when he was breaking another corn, the corn that was originally held under his armpit fell to the ground. Although small and medium-sized enterprises pick up fallen corn and sell it to consumers by roasting or boiling it. But the corn that leaves the mother body of universities and research institutes is ultimately difficult to develop and grow. The cloud model refers to the fact that technology intermediaries not only act as intermediaries from universities and research institutes to "production", promoting the growth of small and medium-sized enterprises, but also allow small and medium-sized enterprises that are close to the market to reverse guide the research and development projects of universities and research institutes through technology intermediaries, promoting universities and research institutes to expand and strengthen their existing resources. Small corn can not only be sold to small and medium-sized enterprises, but can also grow into large corn in one's own hands. The reverse guidance of small and medium-sized enterprises is not limited to the first step. With the continuous communication of technology intermediaries and the participation of small and medium-sized enterprises in various forms, the initial stage of high-tech in universities and research institutes will mature, reach a certain scale, and then spread into new industries.

Under the reverse guidance of Zhejiang University Taizhou Research Institute as a technology intermediary, Zhejiang Rongpeng Pneumatic Tools Co., Ltd. invested 1.5 million yuan to establish a pneumatic tool laboratory with the Department of Mechanical Engineering at Zhejiang University to conduct research and development of key technologies for pneumatic tools. This not only meets the company's own development needs, but also promotes relevant research at Zhejiang University to a certain extent. Every step of Xiaobaomi's growth will gain additional commercial value. Zhejiang University Taizhou Research Institute focuses on high-tech highlight projects and adopts various cooperation methods such as sharing risks and benefits in product sales profits. For example, research and development projects such as high-precision electrical parameter testers for intelligent chip visual inspection machines based on machine vision, AGV automatic guided vehicles, and digital variable frequency generators involve interdisciplinary research and have high technical content. The project "Research on Key Technologies of Reconfigurable Mechanical Testing System for Automotive Components" has been approved by the National Natural Science Foundation of China. The research institute focuses on strengthening the research and development of key technologies, and doing a good job in the precipitation and summary of technologies during the project development process. The headquarters of the research institute has established the Institute of Electrical and Control, the Institute of Industrial Design, and the Institute of Industrial Economics. The projects developed by the research institute, such as the "planar secondary enveloping toroidal worm CNC equipment", "high-performance micro projection equipment", and "valve copper rod efficient heating and automatic feeding system", have completed core technology research and entered the sample trial production stage, and industrialization work is also being promoted.

In the technology intermediary service organization jointly established by the Taizhou Municipal Government and the Zhejiang Provincial Department of Education, the Taizhou Center of the Zhejiang University Industry Research Alliance plays a two-way guiding role[Q]. Zhejiang University of Technology and Taizhou Dajiang Industrial Co., Ltd. jointly applied for the major scientific and technological research project of Zhejiang Manufacturing Informatization Engineering - "Digital Industrial Design Platform for Product Innovation and Its Application in Pneumatic/Electric Tool Product Development", and obtained a project fund of 750000 yuan from the Provincial Department of Science and Technology. Zhejiang University of Science and Technology and Zhejiang Zhengte Group Co., Ltd. jointly applied for the Ministry of Science and Technology's scientific and technological personnel service enterprise action project - research and development of anti-aging waterproof tent hot-melt adhesive film, and obtained 3.3 million project funds.

With the reverse transmission and bilateral expansion of the technology intermediary function, the technology intermediary has developed from the original one-way and one-way relatively linear model to a two-way flow that covers both sides of the cloud, which is the cloud model of technology intermediaries. The setting sun and solitary birds fly together, and the autumn water and sky merge into one color. The former sentence refers to the complementary development of universities and research institutes with "industry", while the latter sentence implies the expansion and growth of technology intermediaries in the joint development of academia, research, and industry.

[2] Zhejiang Provincial Department of Education Higher Education Research (zj. gov.cn)

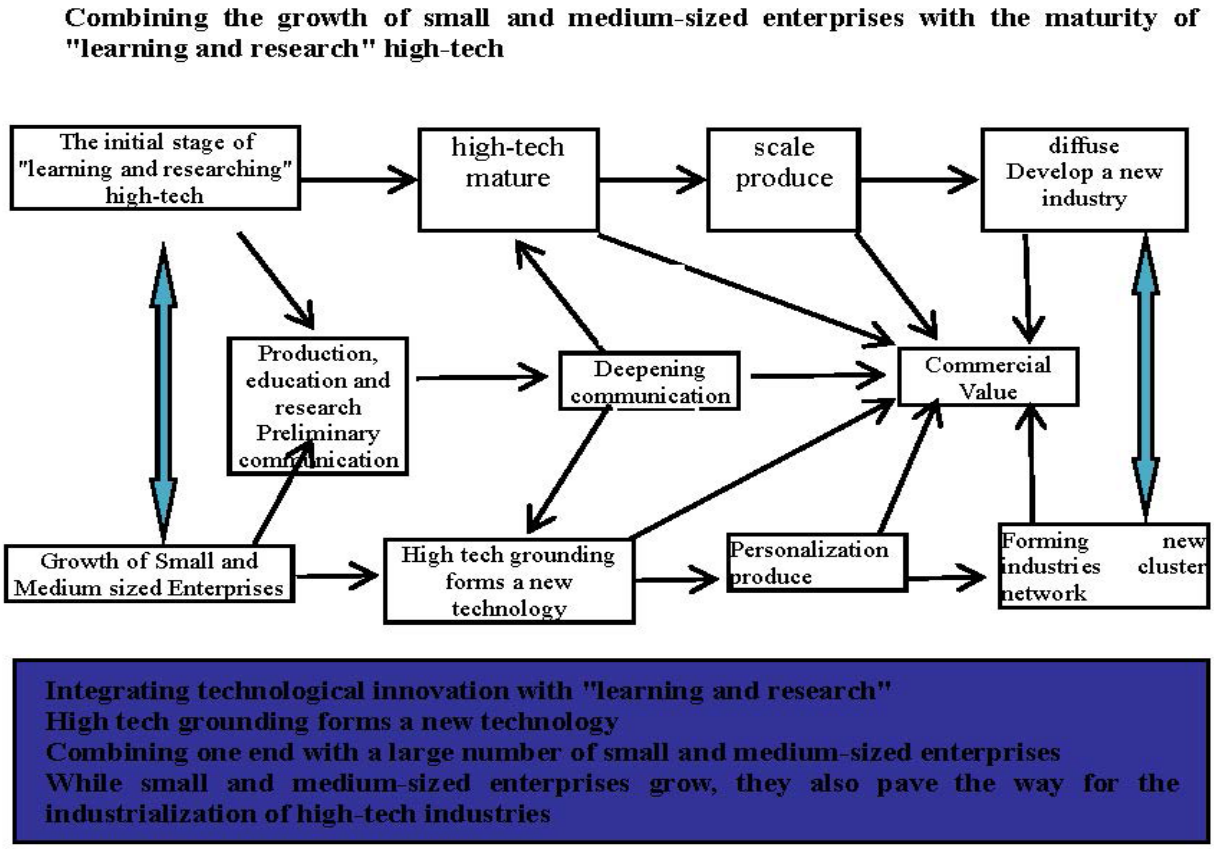

Figure 1
The "Cloud" Model of Technology Intermediaries

In the Figure 1, the main business of technology intermediaries is currently focused on the growth of small and medium-sized enterprises, from learning and research in the upper left corner to production in the lower part. The cloud model not only adds reverse guidance, but also, under the guidance and tracking of the market by small and medium-sized enterprises, accompanies and promotes learning and research, making "small corn" bigger and stronger, developing from mature and large-scale production to new industries, and obtaining considerable commercial value at every stage of this process. On one side of the bilateral market for technology intermediaries, it promotes the growth of small and medium-sized enterprises, while on the other side, it transmits market signals perceived by small and medium-sized enterprises, playing a sustained leading role in the maturation process of high-tech.

REVERSE GUIDANCE 2: DANDELION MODEL

The last part of this article discusses the personalized needs of consumers, which provides new insights into the function of technology intermediaries. Based on this, the "dandelion" model can be proposed. If the market demand is single and stable, technology intermediaries can take scientific research achievements from universities and research institutes on one side of the bilateral market, and only need to select one or two small and medium-sized enterprises in the "production" on the other side to cultivate the achievements to maturity, form a certain scale, and then push them to the market. However, if the market is segmented and volatile, it may involve more small and medium-sized enterprises, and technology intermediaries need to connect universities and research institutes with more small and medium-sized enterprises. This forms a dandelion model with relatively single universities and research institutes as one end, numerous small and medium-sized enterprises as the other end, and technology intermediaries in between. Universities and research institutes need to divide their achievements into numerous small and medium-sized enterprises, or the latter can choose from the original "library" of achievements that universities and research institutes have not yet commercialized and consider to have market prospects and preferences.

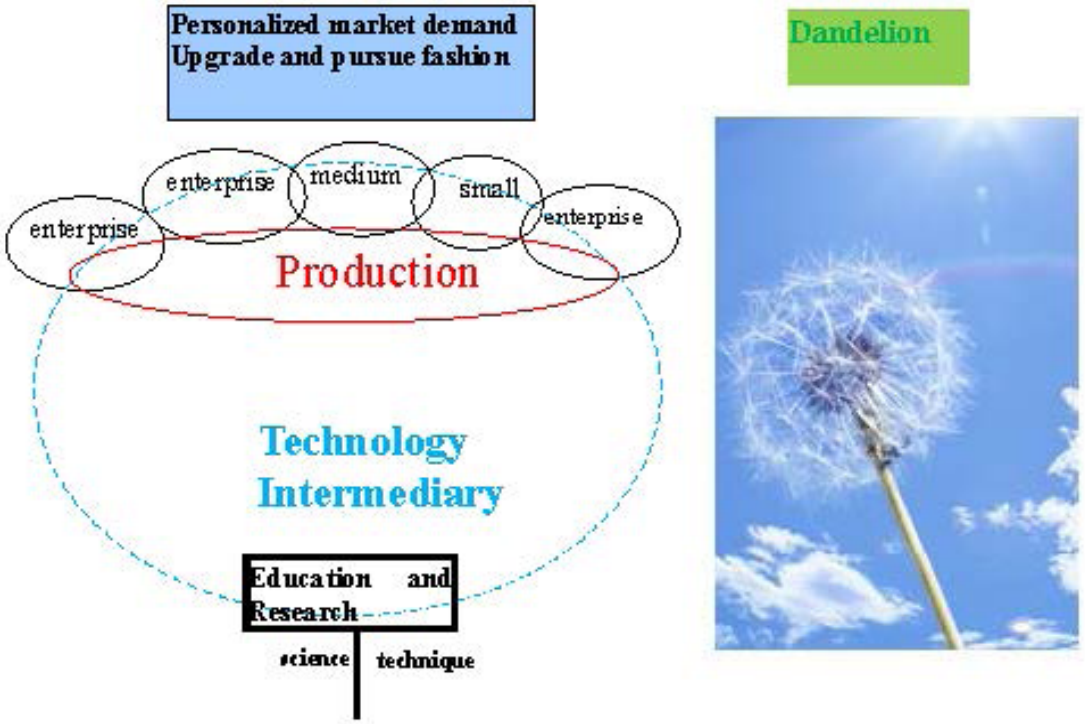

Figure 2
The "Dandelion" Model of Technology Intermediaries

Zhejiang University Taizhou Research Institute actively conducts project pre research, raises funds to conduct project pre research on "digital generator rectifier inverter controller" and "networked entertainment and fitness system research and typical product development" for specific regions with universal needs, and carefully plans and strictly controls the pre research projects with the goal of realizing productization. This kind of "pre research" refers to the search for potential collaborators in small and medium-sized enterprises through technology intermediaries by academic research institutions on the last mile. If we say that in the "cloud model", technology intermediaries are like a cloud that encompasses both academia, research, and production, it is ambiguous; So, in the "dandelion model", technology intermediaries become one of them, inseparable, until the seeds of those dandelions mature.

Zhejiang University Taizhou Research Institute, as the leading unit, undertakes the construction of the Zhejiang Taizhou Sewing Equipment Industry Technology Innovation Service Platform, and as the core co construction unit, specifically undertakes the construction of the Zhejiang Taizhou Agricultural Machinery Technology Innovation Service Platform. The sewing platform has made substantial progress in the research of specialized multi axis linkage control systems for sewing equipment based on common industry technologies, intelligent simulation of key mechanisms for industrial high-speed sewing equipment, and analysis platform for sewing performance. It closely focuses on the urgent needs of the transformation and upgrading of the sewing equipment industry, innovates the industry university research joint mechanism, and establishes an innovative strategic alliance composed of 13 industry representative enterprises and research institutes. We have solved 2 major common technical problems in the sewing equipment industry, introduced, digested and absorbed 1 major high-tech, completed 1 science and technology inspection project of the State Administration of Quality Supervision, and undertaken 6 horizontal scientific research projects; Apply for 5 invention patents. The agricultural machinery platform has also carried out the research and development of corn combine harvester project, electrostatic spray development, air suction rice seedling precision seeding assembly line development and other projects.

The Taizhou Center of the Zhejiang University Industry Research Alliance strives to promote the connection between key laboratories, key majors, and regional enterprise groups in universities, and strengthen the cooperation between the scientific research capabilities of key laboratories in universities and regional enterprise groups. From this, it can be seen that when connecting with numerous small and micro enterprises, universities and research institutions also have a more detailed, thorough, and timely understanding of market demand, and improve and enhance their scientific research achievements.

The previous text analyzed the cloud model and dandelion model of reverse guidance by technology

intermediaries. The commonality between these two models is to enhance the status of "production" among the three parties of industry, academia, and research. For many years, although "industry university research" has been the top priority among the three, it seems that the importance of "production" is highly valued; However, in reality, "production", especially small and medium-sized enterprises, are generally passively waiting and accepting the transformation of academic and research achievements, without fully exerting their subjective initiative. In the face of a bilateral market, technology intermediaries are not actually "neutral", but rather one-way and one-sided. Moreover, due to information asymmetry, the risks borne by relevant entities in the process of transferring scientific and technological achievements from academia and research to production, and from knowledge to entities, show an increasing trend. Generally speaking, learning and research are in a relatively strong position with low uncertainty, focusing on whether the results can be sold and how much money they can be sold for; The next company is in a relatively weak position with high uncertainty, not knowing whether the technology is effective, whether the results can be smoothly transformed, whether they can enter the market to recover costs and make profits, all of which are not within the scope of consideration for learning and research. The so-called "no wrong selling, only wrong buying" refers to the information asymmetry between buyers and sellers in the market. In the process of the flow of scientific and technological achievements from learning and research to production, it is not only the transmission of knowledge and capital, but also includes the "transmission" of uncertainty. Beating the drum to convey flowers not only conveys "flowers", but also leverage, which increases the risk and uncertainty. So, in the chain of industry university research, and in the function of technology intermediaries, the strong in learning and research remain strong, while the weak in the industry may have grown, but they are still relatively weak compared to learning and research. They can only passively wait for the "next bite" from learning and research and technology intermediaries.

It is precisely in reverse guidance that small and medium-sized enterprises have a deep understanding of market demand, and follow the personalized needs of consumers and changes in consumer fashion. In one sentence, they can grasp relevant information. So the situation turned around, with small and medium-sized enterprises occupying a dominant position, enhancing their confidence as market entities, elevating their economic status in the market, and placing them on an equal footing with academic research, resulting in balanced and perfect development of the bilateral market. Undoubtedly, the development of small and medium-sized enterprises will drive domestic demand, increase employment, and contribute to the overall adjustment of the economic structure.

With the improvement of reverse guidance, technology intermediaries have transformed from being biased to truly "intermediaries".

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