

A Grounded Theory Study on Developing Competency Models for Technical Managers in Transformation of Medical R&D Findings

Qiufan Sun
 School of Health Policy and Management
 Peking Union Medical College
 Beijing, China
 email: sunqiufan@student.pumc.edu.cn

Zhimin Hu
 School of Health Policy and Management
 Peking Union Medical College
 Beijing, China
 email: huzhimin@pumc.edu.cn

Abstract—Despite its critical importance, the transformation (aim to industrialization) rate of medical Research and experimental Development (R&D) findings is significantly lower than in other fields, mainly due to the scarcity of skilled professionals. This study employs grounded theory and semi-structured interviews with key stakeholders from both the supply and demand sides to develop a competency model tailored for medical technical managers. By aligning the model with specific challenges and requirements of transformation of medical R&D findings, this research aims to significantly enhance these professionals' capacity. In addition, the competency model will provide a foundational tool for enhancing the quality and quantity of such professionals and facilitate the public's ability to benefit from scientific research findings more quickly and effectively.

Keywords—Transformation of medical R&D findings; technology transfer; technical managers; competency models; grounded theory.

I. INTRODUCTION

The experiences trying to combat the COVID-19 pandemic have highlighted the importance of transforming biological and clinical discoveries. In China, the concept of "transforming R&D (research and development) findings" aligns with the international notion of "technology transfer." Unlike the general definition of technology transfer, which involves the process from its owners or holders to another entity, the "transformation of R&D findings" emphasizes the complete process from experimentation, development, application, and promotion of valuable scientific results to the creation of new products, processes, materials, and industries. Thus, the transformation of R&D findings in the medical field not only improves health but also enhances the dynamism of the health industry, boosts employment, and yields substantial social value.

The pathway for transforming research and development findings in the medical field is particularly challenging. Its human-centric focus, prolonged processes, and substantial investment requirements characterize it. Additionally, medical professionals, such as doctors and nurses, often lack crucial business and legal knowledge. Coupled with the immense pressures of their work, these factors contribute to a significantly lower transformation rate in this field in China, as depicted in Figure 1 [1].

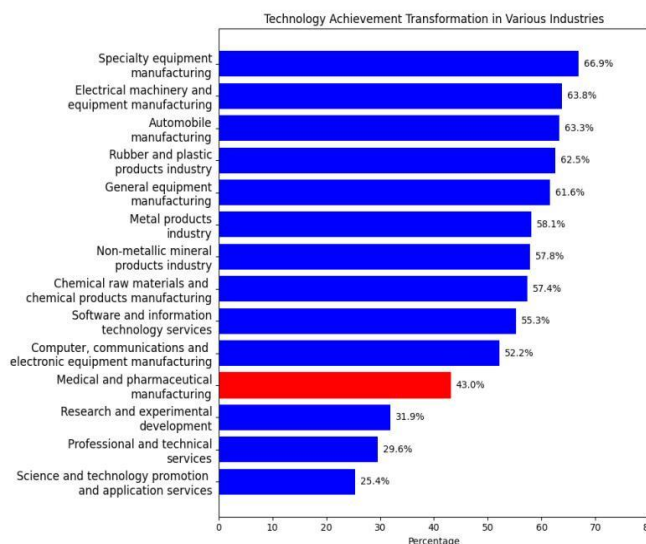


Figure 1. Industrialization rate of invention patents of Chinese enterprises in different industries, 2023 [1].

In July 2022, the revised "Occupational Classification Code of the People's Republic of China" was published, introducing the position of "technical managers" [2]. These professionals are engaged in the excavation, cultivation, incubation, maturation, evaluation, promotion, and trading of R&D findings and provide related financial, legal, and intellectual property services. Despite its recent development, research on technology managers remains in its infancy due to a lack of historical data and experience.

Since the 1970s, the cooperation between enterprises, universities and research institutes has become increasingly close [3]. As a result, some famous universities and research institutes, like Stanford University, began to set up technology transfer offices and hired technical managers. In 1974, the Association of University Technology Managers (AUTM) [4] in the USA was founded, aiming to promote the exchange and cooperation opportunities for technical managers. In 2010, AUTM, together with other national and regional associations, established the Alliance of Technology Transfer Professionals (ATTP) [5], which provide international standards and professional qualifications for practitioners in the field of technology transfer.

As medical technical managers are a kind of special and complex profession that relies heavily on experience, the training content of medical technical managers is difficult to

quantify. Also, there are large differences in the regulatory policies of medicine and health in countries, so there are currently no standardized courses for medical technical managers that take into account the specificities of medicine. Above all, previous studies have addressed the positioning, skills, and expectations of technical managers [6]-[10], but some limitations and deficiencies remain yet:

- **Singular Perspective:** Previous studies primarily focused on the supply side of technology transfer personnel [8][10], ignoring demand transformation of medical R&D findings.
- **Not Specific Enough:** Existing competency models for technical managers have been developed across a wide range of scientific and technological fields, but no comprehensive competency model has been developed explicitly for medical technical managers.
- **Incomplete Analysis:** Transformation of medical R&D findings is a sequential and prolonged process. However, current research rarely delves into the specific skill requirements at different stages of the transformation process.

This study utilizes the Grounded Theory methodology [11], high-quality project samples, and interviews with stakeholders from both supply and demand sides to assess competency needs in medical R&D transformation. It aims to create a comprehensive competency model for medical and technical managers that could greatly enhance their effectiveness and increase the success rate of medical R&D transformation once implemented.

II. METHODOLOGY

A. Semi-structured Interview Methodology

Semi-structured interview methodology is a common way to acquire perceptions and experiences of a broad range of stakeholders [11]. This study uses semi-structured interviews to engage critical stakeholders in transforming medical R&D findings, focusing on both supply and demand. The supply side includes at least 12 employed technical managers and the demand side includes at least 36 researchers, clinicians and government officials. All participants are affiliated with Peking Union Medical College and its hospitals, which are actively engaged in transformation projects, ensuring a comprehensive insight into the challenges and needs of transformation of R&D findings.

- **Supply side (to technical managers):** Interview content was mainly included the match between their previous majors and current job, learning gains from the technical manager training courses, professional competencies that have been developed and need to be developed, and channels for acquiring new competencies.
- **Demand side (to researchers, clinicians and government officials):** Interview content mainly based on their work experience, which include questions about their level of need for technical managers, the specific transfer tasks/steps

they expect to be assisted with, the major and minor competencies that the technical managers should have, and ideal cooperation model they expected with.

B. Grounded Theory

Grounded Theory, introduced by Anselm Strauss and Barney G. Glaser in 1967 [12], is a methodology primarily used for qualitative research [13]. In this study, extensive interviews with stakeholders involved in the transformation of medical R&D findings are conducted, employing a three-level coding process of Grounded Theory (open coding, axial coding, and selective coding) to develop a comprehensive competency model for medical technical managers.

C. Data Analysis Tools

The study uses NVivo and Microsoft Excel for source analysis. NVivo facilitates the deep reading, coding, and analysis of textual data, while Excel supports additional statistical analysis. Python scripts will also be utilized to create visualizations, enhancing the ability to analyze and interpret data trends effectively.

III. EXPECTED RESULTS

A. Developing Competency Models for Medical technical managers

The competency model for medical technical managers developed in this study is structured around two interdependent aspects, with plans for future expansion and refinement:

- **Individual Competency Perspective:**

1) **Ethical Foundation:** At the core, technical managers must possess strong moral and ethical standards, including integrity and a commitment to ethical practices.

2) **Basic Competence:** Essential professional knowledge spanning medical, legal, financial, and technological domains is required.

3) **Soft Skills:** Effective communication and collaboration skills are crucial.

4) **Advanced Competencies:** Experience-based skills such as leadership and strategic foresight.

- **Transformational Stage Perspective:** First, technical managers should be able to evaluate the market potential of findings and determine the finding's current stage of development and future development path. In the middle stage, technical managers need intellectual property protection and business negotiation skills. Finally, their ability to navigate the challenges of clinical trials and ultimately bring a product to market is critical, particularly during the rigorous phases of trial and commercialization.

B. Training Model for Medical Technical Managers

Based on the developed competency model, this research proposes a comprehensive training model for medical and technical managers, which incorporates several key components:

- **Course Content:** The curriculum spans from foundational medical knowledge to advanced topics in technology transfer strategies and regulatory compliance.
- **Educational Methods:** The educational framework includes degree programs for newcomers and continuing education for existing professionals.
- **Project Participation:** Engaging actively in projects from the initial research phase to market promotion provides technical managers with practical skills and capabilities.
- **Assessment Requirements:** This system will measure their technical knowledge, operational competencies, and strategic thinking and problem-solving skills.

Through this integrated training approach, medical technical managers will be comprehensively equipped to meet the diverse challenges and demands of the technology transfer process. This model aims to cultivate high-quality professionals capable of leading and driving the transition of medical and scientific achievements from the laboratory to the market.

IV. CONCLUSION

This study addresses the challenge of medical technical managers' insufficient quantity and capabilities in transforming medical R&D findings due to unclear competency requirements. Utilizing Grounded Theory methodology, it aims to construct a competency model from both supply and demand perspectives, detailing the essential qualities, knowledge, and skills required for this role. This model will enhance the capabilities of existing medical technical managers and facilitate the training of new professionals, thereby improving the success rate of medical technology translation. Ultimately, this will enable research findings to benefit public health more swiftly, safely, and effectively.

REFERENCES

- [1] China National Intellectual Property Administration, China Patent Survey Report 2023, pp. 9, 2023, [Online]. Available: <http://www.chinatag.org.cn/uploads/soft/240417/1-24041GIA1.pdf>.
- [2] Occupational Classification Code of the People's Republic of China, pp. 124, 2022, [Online]. Available: <https://rsj.ganzhou.gov.cn/c100232/202406/550e6b9cecc524c30b1e25f2263cfc6f/files/1885fe525a9e4f22ac64fe500a613fd9.pdf>.
- [3] D. W. Hsu, Y. C. Shen, B. J. Yuan and C. J. Chou, "Toward successful commercialization of university technology: Performance drivers of university technology transfer in Taiwan", in *Technological Forecasting and Social Change*, 92, pp. 25-39, 2015. DOI: [org/10.1016/j.techfore.2014.11.002](https://doi.org/10.1016/j.techfore.2014.11.002)
- [4] AUTM's history and missions, [online]. Available: <https://autm.net/about-autm/mission-history>.
- [5] ATTP's structure and governance, [online]. Available: <https://attp.global/about/attp-structure-and-governance/>.
- [6] Z. Fan, "Practicing quality and functional positioning of technology managers", in *Cooperative Economy and Technology*, 15, pp. 90-91, 2023. DOI: [10.13665/j.cnki.hzjyjkj.2023.15.026](https://doi.org/10.13665/j.cnki.hzjyjkj.2023.15.026).
- [7] J. Yang, and F. Dong, "Research on the Role Positioning of Technical Managers in Colleges and Universities and Their Enhancement Strategies", in *Inner Mongolia Science Technology & Economy*, 13, pp. 32-34, 2022.
- [8] P. Su and S. Liang, "On the construction and application of a competency model for technical managers", in *Journal of Chongqing University of Technology (Social Science)*, 37(7), pp. 80-92, 2023.
- [9] X. Zhu and K. Hu, "Core competencies and vocational education mode of technology transfer profession—Based on the experience of alliance of technology transfer professionals", in *Studies in Science of Science*, 36(6), pp. 1018-1026+1047, 2018. DOI: [10.16192/j.cnki.1003-2053.2018.06.008](https://doi.org/10.16192/j.cnki.1003-2053.2018.06.008).
- [10] L. Jiang, Y. Song, Y. Zhang and X. Li, "Construction of Competency Model for Technical Managers of Colleges and Universities". in *Science and Technology Management Research*, 43(19), pp. 64-70, 2023.
- [11] C. Toale, M. Morris and D. O Kavanagh, "772 Perspectives on Simulation as an Assessment Tool in Surgical Training: A Qualitative Study of Key Stakeholders", in *British Journal of Surgery*, 109 (Supplement_6), znac269-391, pp. 269-391, 2022. DOI: [org/10.1093/bjs/znac269.391](https://doi.org/10.1093/bjs/znac269.391).
- [12] B. G. Glaser and A. L. Strauss. "The discovery of grounded theory: strategies for qualitative research". in *London New York: Routledge*, 2017.
- [13] Y. Chen. "Grounded Theory: Its Misuse and Clarification". in *Journal of Guangxi Normal University (Philosophy and Social Science Edition)*, 58(6), pp. 79-93, 2022. DOI: [10.16088/j.issn.1001-6597.2022.06.007](https://doi.org/10.16088/j.issn.1001-6597.2022.06.007).