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Preliminary Exploration of Enhancing the Technological Innovation Capacity of the Civil Engineering College under the Downturn in the Construction Industry

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ABSTRACT: This research paper is about to control the engine valves of an one cylinder 4-stroke engine with a computer controlled electromagnetic actuator. There are many possibilities in electromagnetic devices. We chose a push solenoid to actuate the engine valve. For controlling the solenoid, we chose a user interface with control options. The user interface communicates serially with a microprocessor. The microprocessor monitors and reports the engine's performance and control the opening/closing of the engine valves. The ultimate goal is improved efficiency, decrease pollutants, and produce maximum power throughout the RPM range with a camless engine.

KEYWORDS: Higher Education Institutions; Civil Engineering; Technological Innovation; Survey; Solutions

I. INTRODUCTION

Universities hold a significant position and possess unique advantages in scientific research in China. As the main executors of the national science and technology innovation system, scientific research is also a crucial pathway for improving the academic level of university teachers, particularly young faculty members, and for promoting the development of teaching and academic disciplines [1][2][3]. Therefore, the research awareness and capability of university faculty members are of paramount importance.

Civil engineering is an ancient discipline and serves as the foundation for various industries, playing a critical role in China's economic development. However, with the reduction in national investment in infrastructure, the field is now facing a developmental bottleneck. Due to external environmental factors and internal factors within the college, several issues currently exist in the college's scientific research and innovation endeavors:

1.The number of significant achievements is limited, with a lack of national-level grant projects, provincial or higher-level scientific and technological awards, and high-quality publications [4], all of which urgently need improvement.

2.Experimental conditions are inadequate, with severely outdated equipment and instruments, which fail to meet the requirements of professional certification and educational evaluation [5][6][7]. Moreover, these conditions make it challenging to satisfy the needs of scientific research, necessitating urgent upgrades.

3.The historical background has led to a relatively weak research foundation within the college, with a shortage of high-level academic teams. It is difficult to cultivate high-caliber research talents from the current faculty within a short period [8][9]. Additionally, the location and compensation offered by the university are also critical factors limiting the recruitment of top-tier talents and teams.

These issues have directly impacted the college's ability to enhance its research and academic team dynamics. How to stimulate and improve young faculty members' research awareness and capability, strengthen research vitality, and build excellent academic teams are the key issues identified during the thematic education on studying and implementing the new era of socialism with Chinese characteristics [10][11]. Addressing these challenges is also part of the college's efforts to foster a strong research culture, enhance problem awareness, cultivate the ability to

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confront and solve problems, and strengthen its overall capacity to tackle challenges. In response, the leadership of the Civil Engineering College has conducted thorough investigations on these matters.

II. ANALYSIS OF THE CURRENT SITUATION OF TECHNOLOGICAL INNOVAION IN COLLEDGES

In recent years, influenced by the broader civil engineering industry environment, many faculty members have been devoting more time and energy to horizontal collaborations with enterprises, beyond fulfilling their basic teaching workload. Due to the nature of the discipline, horizontal projects are well-funded, yield quick results, and are in relatively high demand by companies. In contrast, vertical research projects, constrained by factors such as platform limitations, experimental conditions, and intense competition, often do not yield significant research outcomes in the short term. Over time, faculty members tend to prioritize immediate short-term gains. Additionally, the high demands for promotion, limited promotion pathways, and relatively low income have further diminished the entrepreneurial spirit and motivation among teachers. The phenomena of "lying flat" and a more laid-back attitude have become increasingly common.

Currently, there is a significant imbalance between the research output of young PhD faculty members and their status and expectations. This imbalance is one of the critical factors that severely restricts the internal development of the college and affects the pursuit of high-quality growth.

III. EXISTING PROBLEMS

The investigation revealed several issues, including insufficient initiative, inadequate research conditions, excessive administrative tasks, insufficient mentorship, and the lack of a fully formed research team.

1.Constraints due to Objective Research Conditions (e.g., Equipment): Faculty members believe that inadequate research conditions, particularly the insufficient research and experimental facilities within the college, are the main factors limiting research output. Although the college currently has several provincial or higher-level research platforms, the equipment is outdated, and research equipment makes up a relatively small proportion of the total available resources.

2.Excessive Administrative Work Consuming Research Time: Faculty members are burdened with too much administrative work, which encroaches on their research time. Poor time management is identified as a key factor limiting research vitality. The primary administrative tasks identified in the survey include various data reporting, training, and meetings. Among these, data reporting is particularly troublesome for most faculty members, being repetitive, cumbersome, and time-consuming.

3.Lack of Initiative: Many young faculty members reported facing challenges in transitioning from students to teachers after joining the faculty. They encounter difficulties in grasping research directions, leading teams, and managing relationships with colleagues, all of which require significant time and effort.

4.Insufficient Support for New Faculty Members: Young researchers often face challenges in the early stages of their careers, such as a lack of graduate students and insufficient funding. Without timely research outcomes, they risk ending their research careers prematurely. The margin for error in choosing research topics is narrow, placing significant pressure on young faculty members during their initial stages.

5.Lack of a Fully Formed Research Team: The college's research team is still in its early stages of development, with issues such as scattered research directions within teams, limited influence of team leaders and key academic members, a lack of shared research funding, and insufficient internal communication.

6.Insufficient Information Exchange: There is still inadequate communication between universities and local industries, as well as between governments and enterprises, and among enterprises themselves. This lack of real-time information exchange has prevented the discovery of many potential collaborative opportunities, thus hindering the effective development of cooperative efforts.

7.Lack of Strong Policy Measures and Long-term Mechanisms for Industry Collaboration: The staffing and funding arrangements are not well-suited to the work requirements, and the college lacks dedicated personnel for industry collaboration, making it difficult to advance such initiatives. There is a need to establish strong policy measures and long-term mechanisms to support these efforts.

IV. SOLUTIONS

After analyzing the current issues, we believe that efforts should be focused on improving conditions, building talent teams, enhancing institutional frameworks, refining management and

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services, and strengthening social services. These measures will help stimulate the research vitality of young faculty members, thereby enhancing the college's scientific and technological innovation capabilities.

STRENGTHENING CONDITION CONSTRUCTION:

1.Integration of Existing Laboratory Resources: The college has categorized its existing equipment and laboratory spaces, establishing a Teaching Experimentation Center and a Research Innovation Center. All equipment is managed by designated personnel, and an equipment borrowing and registration system has been put in place. This ensures that all equipment is shared across the entire college, thereby increasing its utilization.

2.Continuous Development of Research Platforms: The construction and development of research platforms are crucial for nurturing and attracting talent. The college will collaborate with partner institutions to jointly build research platforms and establish open funds. In the future, the college will gradually upgrade existing research equipment, phasing out outdated equipment to meet the research needs of faculty members.

STRENGTHEN THE CONSTRUCTION OF THE TALENT TEAM:

1.Strengthening Talent Recruitment: The college aims to recruit multiple PhD holders annually from top universities, specifically targeting those from universities ranked A-class or higher in discipline evaluations. The focus will be on recruiting PhD holders from teams led by academicians, recipients of prestigious grants such as the National Science Fund for Distinguished Young Scholars, or PhD holders with significant achievements (meeting the university's A-class PhD requirements).

2.Focusing on Key Individuals in Discipline Development: This year, the college will prioritize the cultivation and recruitment of discipline leaders, particularly in the geotechnical engineering field. Currently, the academic backbone primarily consists of young PhD holders, with many holding lecturer positions. The college plans to favor young PhD holders in terms of paper publication and award nominations, supporting their promotion in academic ranks.

ENHANCE THE EFFICIENCY OF MANAGEMENT SERVICES:

1.Establishing a Research Output Management System: The college will create a research output management system to continuously collect and organize data on research progress. This system will allow for real-time tracking of the college's research activities and enable the easy export of summarized research data. This will significantly reduce the time faculty members spend on routine data entry tasks.

2.Enhancing Support for Academic Teams: The college will focus on key research areas and discipline specialties to develop a standardized talent recruitment criterion. Additionally, the college will refine and improve the management and evaluation systems for academic teams. To better support researchers, the college will also optimize the allocation of research spaces, ensuring that PhD holders with specific needs are provided with appropriate research facilities.

SOCIAL SERVICE CAPACITY:

Moving forward, the college will be guided by Xi Jinping's Thought on Socialism with Chinese Characteristics for a New Era. It will focus on the major strategic needs of China's economic and social development, encouraging each department to implement the "Five-One Project." This project aims to: focus on one core discipline, build a high-level team, establish a high-level platform, connect with a strong industry chain, and produce a series of high-level research outcomes. The college will concentrate on the direction of discipline development, align with regional industry needs, coordinate the construction of academic disciplines and professional programs, and meet both teaching and research requirements. By integrating existing platform resources, the college aims to develop a highly integrated and widely shared high-level research platform.

V. CONCLUSIONS

1.Issues Identified in the Survey: The survey found that the college primarily faces issues such as insufficient initiative, inadequate research conditions, excessive administrative work, inadequate mentorship, and the lack of a fully formed research team.

2.Key Areas for Improvement: To address these issues and enhance the research vitality of young faculty members, the college should focus on several key areas: improving conditions, building talent teams, enhancing institutional frameworks, refining management and services, and strengthening social services. These efforts will help to boost the college's scientific and technological innovation capabilities.

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