Analysis of Science and Technology Figure Reports from the Perspective of Research Evaluation

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Abstract

Purpose/Significance: Reports on scientific and technological figures constitute an important form for media to promote industry exemplars and establish professional benchmarks. The orientation of public opinion to some extent influences researchers' perceptions of and attitudes toward research evaluation, as well as the cultivation of a sound academic environment. By analyzing how mainstream media portray researchers' scientific activities and achievements, this study aims to promote the improvement of China' s research evaluation methodology system.

Methodology/Process: Taking researcher profiles in *Science and Technology Daily* as the research object, this study employs word frequency analysis to examine researchers' primary scientific activities and achievements; extracts key evaluation sentences to analyze researchers'signature contributions; and extracts achievements from the reports to summarize the dimensions of achievement portrayal from both qualitative and quantitative perspectives.

Results/Conclusions: *Science and Technology Daily* provides focused coverage of the diverse scientific activities and achievements of researchers, highlighting the contributions of researchers from different disciplines. The newspaper characterizes the quality and impact of various types of achievements through multiple qualitative and quantitative indicators, with certain differences observed in achievement types and portrayal dimensions across disciplines. Talent evaluation should incorporate more types of achievements into the evaluation system with emphasis according to disciplinary characteristics; for technology application-oriented achievements, consideration should be given to adding more targeted quantitative indicators to evaluate their quality and impact.

Full Text

Preamble

Analysis of Science and Technology Figure Reporting from the Perspective of Research Evaluation

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[**Purpose/Significance**] Science and technology figure reporting represents an important form through which media publicizes professional models and establishes industry benchmarks. Its public opinion guidance influences researchers' understanding of and attitudes toward research evaluation, as well as the cultivation of a healthy academic environment. This study analyzes how mainstream media portray the research activities and achievements of scientists and technologists, thereby contributing to the improvement of China' s research evaluation methodology system.

[**Method/Process**] This study examines science and technology figure reports in *Science and Technology Daily*. Word frequency analysis identifies researchers' main activities and achievements; key evaluation sentences are extracted to analyze landmark contributions; and achievements mentioned in the reports are categorized with their descriptive dimensions summarized from both qualitative and quantitative perspectives.

[**Result/Conclusion**] *Science and Technology Daily* provides focused coverage of researchers' diverse activities and achievements, highlighting contributions across different disciplines. The quality and impact of various achievement types are described through multiple qualitative and quantitative indicators, with notable disciplinary differences in both achievement types and descriptive dimensions. Talent evaluation should incorporate more achievement types with discipline-specific emphasis. For technology application achievements, targeted quantitative indicators should be considered to assess quality and impact.

Keywords: science and technology figure reports; research evaluation; research achievements; evaluation indicators

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1 Introduction

Scientific and technological progress drives national and social development, with researchers serving as the core force of technological innovation. They conduct basic research, applied research, and development across various disciplines, contributing to national innovation and international competitiveness. Media constitutes an important channel through which the public understands scientific research and recognizes the nature of science, and the image of scientists shaped by media influences public identification with science overall [2]. The social trust enjoyed by Chinese researchers—and the social skepticism they

face—are largely associated with media portrayals of scientists. Excellent science and technology figure reporting holds significant value for promoting scientific spirit, cultivating public scientific literacy, and fostering a positive scientific atmosphere throughout society, helping guide public understanding and support for national scientific endeavors.

Previous scholars have studied the portrayal of scientists in domestic media, using content analysis and semantic network analysis to examine how outlets such as *People' s Daily*, *China Science Daily*, and the "Study Strong Nation" platform comprehensively shape scientist images across multiple dimensions including work, life, and spiritual qualities, offering recommendations on how media can better serve as an intermediary between science and the public to advance science communication and enhance scientific credibility [1][2][3][4]. Other scholars have noted the phenomenon of scientists being sensationalized by some emerging news media, pointing out that such practices can lead to declining media credibility and reduced public attention to serious news [5].

Beyond enhancing public identification with science and influencing the development of science and technology at the societal level, science and technology figure reporting also impacts research evaluation work in China. Since 2002, China has undertaken profound reforms in research evaluation policies, issuing a series of normative documents. The 2018 Notice on Launching a Special Campaign to Clean Up the "Five Only-isms" (paper, titles, professional rank, educational credentials, and awards) marked a new climax, as relevant departments sought to establish a diversified, innovation-focused classification evaluation system aligned with international standards to address problems such as excessive reliance on quantitative indicators and external evaluation metrics [6]. News reporting can externalize practice and provide real-world evidence for science policy formulation and revision [2]. The angles from which media report on researchers' activities and achievements, along with the public response such coverage generates, offer valuable reference points for policymakers seeking to improve China' s research evaluation system in terms of methodology and indicators. Additionally, as an important audience for science and technology figure reporting, researchers pay closer attention than the general public to content related to scientific activities and achievements, learning about scientific progress while sensing the public opinion orientation conveyed in reports. Reporting content aligned with national science policy can effectively publicize these policies, deepen researchers' understanding of the "break the Five Only-isms" initiative, guide researchers to refocus on research itself, clarify research missions, emphasize actual impact, and foster a healthy academic environment.

This study analyzes science and technology figure reporting from the perspective of research evaluation. China' s mainstream media typically selects representative researchers with outstanding achievements or significant contributions to national development and social progress for publicity, producing high-quality coverage with strong public opinion guidance and influence. Therefore, this study examines science and technology figure reports in *Science and Technology*

Daily to analyze how national mainstream media portray researchers' activities and achievements, providing insights for improving China' s research evaluation methodology system.

2.1 Data Sources

Mainstream media possesses significant influence and authority, capable of representing or shaping public opinion [7]. Central mainstream media such as *People' s Daily* and *Guangming Daily* undertake propaganda tasks for the Party and state, with science and technology figure reporting being an important topic in their science coverage. Managed by the Ministry of Science and Technology, *Science and Technology Daily* serves as the primary publicity position of the Party Central Committee and State Council in the science and technology domain. Compared with other central mainstream media, it publishes science and technology figure reports more frequently and regularly. Therefore, this study selects science and technology figure reports from *Science and Technology Daily* as its research object.

Using the China Important Newspapers Full-Text Database (CNKI), we screened reports on researchers from *Science and Technology Daily* over the past decade (2012–2022) across columns including "Science and Technology Figures," "Frontier Figures," "Figures," "Anti-Epidemic · Figures," and "Epidemic Response · Figures." Screening criteria included: (1) excluding reports on nurses, technical workers, and other non-research personnel; and (2) selecting only feature stories providing detailed coverage of individual researchers or teams' thoughts and deeds. A total of 635 qualified reports were obtained, dated from July 11, 2012, to July 4, 2022.

The National Standard for Discipline Classification and Codes of the People' s Republic of China [8] divides all disciplines into five categories: natural sciences, agricultural sciences, medical sciences, engineering and technical sciences, and humanities and social sciences. This classification system serves science policy, planning, and statistics management of research projects and achievements. This study uses this standard to annotate the disciplinary fields of researchers or teams mentioned in the reports to facilitate subsequent analysis. The distribution of reports across disciplines is shown in .

2.2 Research Framework

The core purpose of this study is to provide a basis for improving the research evaluation methodology system by analyzing how mainstream media portray researchers' activities and achievements in science and technology figure reports, thereby advancing research evaluation in China. The framework comprises two main aspects:

1. **Researcher Evaluation:** By analyzing report content, we extract researchers' research activities, research achievements, and main contributions, comparing disciplinary differences to inform which indicators should be incorporated into researcher evaluation systems and how emphasis should vary by discipline.
2. **Research Achievement Evaluation:** By analyzing report content, we identify specific qualitative and quantitative dimensions that highlight achievement value for different achievement types and disciplines, providing reference for developing targeted research achievement evaluation indicators.

[Figure 1: see original paper] illustrates the research framework. Science and technology figure reports from *Science and Technology Daily* were obtained from the China Important Newspapers Full-Text Database and annotated by discipline. Paragraphs containing research-related descriptions were extracted as the study dataset. The dataset was analyzed across three dimensions, each examining overall patterns followed by disciplinary comparisons: (1) Using Jieba for word segmentation and stop word removal, supplemented with a custom dictionary to improve accuracy, followed by part-of-speech tagging and word frequency statistics to analyze main research activities and achievements based on verb and noun frequencies, comparing commonalities and differences across disciplines; (2) Developing a list of marker words indicating pioneering or leading contributions (e.g., "first," "first time," "earliest") and using Python to automatically extract key evaluation sentences containing these markers as researchers' landmark contributions, summarizing contribution types and conducting quantitative analysis to compare type distribution across disciplines; (3) Manually identifying and annotating achievements mentioned in reports, categorizing achievement types, extracting achievement description dimensions, and analyzing disciplinary differences in mention frequency and descriptive dimensions for different achievement types.

3.1 Analysis of Researchers' Main Research Activities and Achievements

Verbs and nouns represent two major categories in human cognition of the world and are both crucial in verbal expression [9]. Verbs determine basic sentence structure as the core of sentences, describing actions, situations, and changes of people or things, reflecting researchers' research-related actions and how achievements generate impact. Nouns denote names of people or things, reflecting objects related to research activities in science and technology figure reports, such as subjects participating in research activities and outputs of research activities. Therefore, analyzing high-frequency verbs and nouns can fundamentally reveal the main research activities and achievements covered in these reports.

Overall Patterns: Analysis of the top 100 verbs and nouns by frequency re-

veals that report content primarily addresses what research activities researchers participated in, what achievements they produced, and what effects or impacts resulted. Verbs mainly reflect how researchers participated in research activities and the impact or effects of these activities or achievements, while nouns mainly reflect the types of research activities or achievements and the scope of their impact, with some nouns related to disciplines or disciplinary research content. Example words are shown in .

Disciplinary Commonalities and Differences: Different disciplines have distinct natures, research objects, and tasks, leading researchers to conduct research activities and produce main achievement types differently. Consequently, coverage emphasis varies across disciplines to highlight disciplinary characteristics and primary contribution methods. This study identified the top 10 verbs and nouns (minimum two characters) by frequency in reports on engineering and technical sciences, natural sciences, agricultural sciences, and medical sciences, visualizing them in Sankey diagrams where line thickness represents word frequency to compare commonalities and differences across disciplines. Humanities and social sciences reports were too few for analysis.

[Figure 2: see original paper] presents the Sankey diagram of high-frequency verbs across disciplines. Among verbs reflecting how researchers participate in research activities, several appear frequently across multiple disciplines. The high-frequency word "publish" (发表) appears in all four disciplinary categories, typically collocating with papers, monographs, and other textual achievements or viewpoints, indicating that reports across disciplines commonly address researchers' academic publication records or academic viewpoints. "Lead" (带领) also appears as a high-frequency word across all four categories, reflecting researchers' roles as team leaders or project directors driving research forward.

Some high-frequency verbs are discipline-specific or appear far more frequently in certain disciplines than others, reflecting disciplinary characteristics in research activities. Engineering and technical sciences reports uniquely feature high-frequency verbs "independent" (自主) and "develop" (开发), emphasizing researchers' independent development of practical application achievements, including tools, equipment, and products not reliant on foreign technology. Natural sciences reports show "publish" and "discover" (发现) with much higher frequencies than other words, where "discover" typically introduces new phenomena, patterns, or conclusions found through investigation and experimentation, indicating that natural sciences coverage emphasizes researchers' academic publications and basic theoretical achievements. Agricultural sciences reports feature "plant," "breed" (选育), and "cultivate" (育种), directly reflecting agricultural scientists' main research focus on new variety development. Medical sciences reports feature "treat" (治疗) and "diagnose" (诊断), reflecting researchers' primary work as physicians fulfilling life-saving responsibilities.

Additionally, agricultural and medical sciences reports include high-frequency verbs reflecting achievement impact or effects. In agricultural sciences, "promote" (推广) and "increase yield" (增产) describe how new varieties or agricultural

technologies increase crop or livestock production, while "improve" (提高) encompasses improvements in crop/livestock yield and quality as well as farmers' income. In medical sciences, "reduce" (降低) primarily refers to reductions in medical costs, treatment expenses, mortality rates, recurrence rates, incidence rates, and infection rates.

[Figure 3: see original paper] presents the Sankey diagram of high-frequency nouns across disciplines. These nouns primarily reflect frequently mentioned research activities or achievements in different disciplinary reports, such as "materials" (材料) and "engineering" (工程) in engineering and technical sciences, "variety" (品种) and "rice" (水稻) in agricultural sciences, "surgery" (手术) and "drugs" (药物) in medical sciences, and "technology" (技术) appearing across all four disciplines, plus "system" (系统) and "project" (项目) shared by engineering and technical sciences and natural sciences.

Furthermore, "field" (领域), "international" (国际), and "national" (国家) appear as high-frequency nouns across multiple disciplines, reflecting the scope of achievement impact to some extent. Some nouns indicate impact targets, such as "farmers" (农民) in agricultural sciences and "patients" (患者) in medical sciences. "Team" (团队) appears across all four categories, primarily reflecting researchers' roles as team leaders and their teams' achievements.

Based on this analysis, science and technology figure reports across these four disciplines narrate how researchers participate in research activities and produce achievements from multiple perspectives, with discipline-specific emphasis. Engineering and technical sciences, agricultural sciences, and medical sciences focus on practical and applied research activities and achievements, while natural sciences emphasize basic research achievements. Agricultural and medical sciences reports also specifically highlight main beneficiary groups of disciplinary research, demonstrating the social impact of research activities and achievements.

3.2 Landmark Contributions of Researchers

The 2018 Opinion on Deepening Reform of Project Review, Talent Evaluation, and Institutional Assessment [10] pointed out the need to establish scientific talent evaluation indicators, implement a representative work evaluation system, emphasize quality, contribution, and impact of landmark achievements, and add important evaluation indicators such as disciplinary activity and influence. Which achievements can serve as landmark contributions, and what other indicators can evaluate researchers? By extracting key evaluation sentences from reports as researchers' landmark contributions, this study provides reference for addressing these questions.

Professor Feng Changgen [11] proposed using academic evaluation sentences to assess research achievements. Academic evaluation sentences are sentences

in papers where scholars evaluate predecessors' work, containing marker words such as "first," "first time," "earliest," "traceable to," "for the first time," which can extract the essence from numerous achievements and represent academic recognition of these contributions [12]. This study adapts this approach to define key evaluation sentences in news reports as statements containing marker words that record researchers' outstanding contributions. Marker words highlight the pioneering or leading nature of contributions domestically or internationally, typically representing highly influential contributions treated as landmark achievements. Referencing high-frequency marker words summarized in relevant literature [12] and randomly sampling data to expand the marker word list, we extracted key evaluation sentences and manually removed sentences unrelated to contributions. Based on these sentences, we summarized types of researchers' landmark contributions and analyzed type distribution characteristics across disciplines.

Types and Quantities of Landmark Contributions: Based on 436 key evaluation sentences, researchers' landmark contributions were categorized into four types: basic theoretical, field pioneering, applied technological, and design/leadership, with detailed descriptions and quantities shown in .

Basic theoretical contributions involve obtaining or proposing new discoveries, theories, concepts, viewpoints, schools of thought, or principles. Field pioneering contributions involve establishing new disciplinary fields or research directions, being the first to conduct research in a field domestically, or first publishing domestic achievements in a field internationally. Applied technological contributions involve developing new technologies, processes, products, materials, methods, equipment, varieties, drugs, standards, software, and systems applicable to scientific research or daily life. Design/leadership contributions involve proposing overall design schemes for projects or engineering, leading projects or engineering efforts, or establishing laboratories, demonstration bases, or research centers.

Researchers' landmark contributions primarily consist of research achievements, namely basic theoretical and applied technological contributions, which together account for 85.3% of the total, with applied technological contributions being more numerous at 59%. Field pioneering and design/leadership contributions, which involve promoting disciplinary development or research platform construction, are less common.

In terms of impact, basic theoretical and field pioneering contributions emphasize academic influence—that is, the domestic or international pioneering nature of contributions within their disciplines. Applied technological and design/leadership contributions emphasize the pioneering, leading, or advanced nature of contributions at the practical application level.

Researchers' landmark contributions take diverse forms, including papers in top-tier journals, new processes for production, new products launched on a large scale, standards guiding industry development, and computer software and sys-

tems supporting research or social management. Beyond research achievements, contributions also manifest in other areas, such as promoting disciplinary development domestically and internationally, and participating in various research-related activities including leading major national engineering projects and establishing research platforms. Therefore, activities that positively impact disciplinary development and national/social progress can be incorporated into researcher evaluation.

Disciplinary Distribution of Landmark Contributions: Statistics on the proportion of each contribution type across disciplines are presented in [Figure 4: see original paper]. Humanities and social sciences reports were too few (only three key evaluation sentences: one design/leadership and two basic theoretical), so they are not shown. Disciplines show distinct distribution patterns. Applied technological contributions account for approximately 50% in medical and agricultural sciences, with basic theoretical contributions second. Engineering and technical sciences show applied technological contributions as dominant at nearly 80%. These three disciplines emphasize researchers' landmark achievements at the practical application level, such as new technologies, methods, processes, and products. Natural sciences reports show basic theoretical contributions exceeding half the total, followed by applied technological contributions at 32.0%, emphasizing researchers'landmark achievements in basic research regarding theories, concepts, and principles.

Since basic research achievements typically use papers or monographs as carriers while technological achievements demonstrate value more through application, and given disciplinary differences in main landmark achievement types, "representative works" should have richer connotations in talent evaluation across disciplines, not limited to publishable achievements but also including technologies, processes, products, systems, and software applied in practice. Beyond achievements, researchers' status in disciplinary fields and participation in research activities, such as leading major engineering projects, can also serve as landmark contributions for researcher evaluation.

3.3 Achievement Types and Descriptive Dimensions

The 2021 Guiding Opinions on Improving the Evaluation Mechanism for Scientific and Technological Achievements [13] pointed out the need to comprehensively correct undesirable tendencies in achievement evaluation that overemphasize quantitative indicators while neglecting quality contributions, not using paper count, representative work count, or impact factor as sole quantitative evaluation metrics, and increasing the weight of high-quality achievements in evaluation. This raises questions for policymakers and evaluators: what achievement types beyond papers can be included in evaluation, what quantitative indicators beyond count and impact factor can be used, and how can qualitative and quantitative indicators be comprehensively employed to evaluate quality

contributions?

China's laws and regulations mostly define or classify scientific and technological achievements narrowly from an R&D perspective, but scientific and technological activities also involve transformation, application, and service. Broadly speaking, achievements also include outputs from these activities [14]. Therefore, this study adopts a broad perspective to manually identify and extract achievements mentioned in science and technology figure reports, summarize their types, and analyze the dimensions used to describe different achievement types from qualitative and quantitative perspectives, providing inspiration for developing a classified evaluation indicator system for research achievements.

Achievement Types and Descriptive Dimensions: presents the researcher achievement types and descriptive dimensions summarized from the dataset. Humanities and social sciences reports numbered only eight, all in archaeology, with limited achievement types and dimensions, so they are not included in the table but briefly discussed in the next subsection.

The table includes: journal and conference papers (dimensions: count, citations, impact factor; journal, scientific value, technical value, economic value, social value; pioneering nature; disciplinary development and talent cultivation guidance); monographs (dimensions: pioneering nature; disciplinary development guidance); patents (invention, utility model, design); technical achievements (new technologies, processes, tools, equipment, software, systems for research, production, or engineering; dimensions: innovation, independence, performance, technical value, economic value, social value); theoretical achievements (discoveries, theories, viewpoints, schools of thought, models, principles; dimensions: scientific value, technical/practical guidance, economic value, social value); standards (national/industry standards; dimensions: pioneering nature; disciplinary/industry development guidance); reports and plans (submitted to government or companies; dimensions: decision support); research projects (hosted or participated in; dimensions: count, efficiency, cost/income/profit); products (mass-produced and marketed; dimensions: innovation, independence, performance, economic value, social value, count, efficiency, sales/market share, cost/income/profit).

Some dimensions require explanation: (1) Efficiency, cost/income/profit, and sales/market share appear as absolute values (e.g., "average income per mu reached 3,679.6 yuan") or as changes/rates (e.g., "increased forage utilization rate by 29%"). (2) For technological achievements and products, "efficiency" and "performance" both indicate quality or functionality, but "efficiency" is quantitative (e.g., "Cao Huajun' s technology enables remanufactured machine tools to meet national standards with over 20% energy efficiency improvement") while "performance" is qualitative (e.g., "the team developed efficient, low-risk, high-precision marine measurement technology"). (3) Scientific value refers to theoretical contributions. (4) Technical value includes solving technical problems in research or overcoming key industrial technological challenges. (5) Economic value includes promotion prospects and economic benefits. (6) Social

value broadly encompasses positive impacts in public health, national defense, public safety, ecological environment, and other areas.

Science and technology figure reports involve diverse achievement types, with mainstream media tending to provide comprehensive coverage of researchers' achievements beyond common evaluation types like papers, monographs, and patents. They also include software and systems developed by researchers, standards they led or participated in formulating, reports and plans submitted to relevant departments or companies, and new products they developed or cultivated—all of which can be included in achievement evaluation.

Different achievement types have different descriptive dimensions, but overall they mainly cover three levels: quantity, quality, and impact. Beyond quantity as a quantitative dimension, quality and impact are addressed from both qualitative and quantitative perspectives. Efficiency, performance, and innovation reflect achievement quality; sales/market share, cost/income/profit, economic value, and social value reflect achievement impact.

Quantity is the most common quantitative dimension, mentioned for virtually all achievement types. Paper count, citations, and impact factor are currently the most commonly used quantitative indicators in research evaluation, yet news reports rarely use citations and impact factor to describe papers, focusing instead on qualitative descriptions of content value. Only five reports mentioned citation counts and three mentioned impact factors. Beyond quantity, efficiency, cost/income/profit, and sales/market share are relatively common quantitative dimensions for describing technological achievements and products.

Qualitative description constitutes the primary approach in science and technology figure reporting. For papers and theoretical achievements, scientific value is emphasized, focusing on international pioneering nature and disciplinary status or role. For technological achievements, products, and other outputs closely related to practice or public life, dimensions such as performance, independence, economic value, and social value receive greater attention, with performance emphasizing domestic or international leadership and independence emphasizing breaking international monopolies through independent R&D.

Disciplinary Differences in Achievement Type Distribution and Descriptive Dimensions: Achievement types and descriptive dimensions show disciplinary differences. [Figure 5: see original paper] displays the proportion of reports mentioning each achievement type relative to total reports per discipline.

Overall, except for natural sciences, the other three disciplines show the highest mention rates for technological achievements, consistent with findings from the landmark contribution analysis. Patents, monographs, standards, and reports/plans have relatively low overall mention rates. Due to different disciplinary research output characteristics, some disciplines show substantially different mention rates for certain achievement types: agricultural sciences, whose main achievements are new varieties, show prominent product mention rates;

natural sciences, focused on basic research, show higher mention rates for papers and theoretical achievements.

Different disciplines feature discipline-specific achievements and corresponding descriptive dimensions valuable for constructing discipline-specific evaluation systems, showing which achievements can serve as primary evaluation objects and how different achievement types can be evaluated targeted.

Engineering and technical sciences reports emphasize achievements breaking foreign monopolies when describing technological achievements and products. Since products are typically mass-produced and marketed through researcher-established enterprises or commissioned companies, coverage emphasizes benefits and market share, describing them mainly through sales/market share, cost/income/profit, and economic value.

Natural sciences reports emphasize papers and theoretical achievements as main achievement types, describing papers through count, publication journals, and scientific value, and theoretical achievements through scientific value and potential guidance for technology and practice. Since natural sciences study various substances and phenomena in nature with numerous basic research achievements, reports rarely describe social and economic impacts.

Agricultural sciences reports mention technological achievements mainly as cultivation, breeding, and disease prevention/control technologies, and products mainly as new varieties, quantitatively describing them through promotion scope (e.g., technology application area, new variety coverage rate), crop/livestock yield and quality (e.g., premium rate, fruit size, sugar content, survival rate), and income/profit generated for farmers.

Medical sciences reports mention technological achievements mainly as disease prevention, diagnosis, and treatment technologies and methods, qualitatively describing their pioneering nature and which difficult technical problems they solved, and quantitatively introducing efficiency through success rates, cure numbers, and mortality rates. Products mainly include drugs (including vaccines) and disease treatment/diagnostic products (e.g., vision correction products, artificial blood vessels, virus detection products), qualitatively described for pioneering nature and performance, with cost and fee reductions benefiting patients and generating social and economic impacts.

Humanities and social sciences reports numbered only eight, with achievements including papers, archaeological methods, discoveries, and reports, qualitatively described mainly for their value to historical research.

Other Contributions of Researchers: During achievement extraction, we identified content that, while not classifiable as specific achievement types, represents contributions to disciplinary development or national/social stability through research-related activities, offering reference for improving researcher evaluation systems. Analysis revealed five main activity types: academic exchange participation, field scientific expedition participation, major national en-

gineering project participation, research platform establishment leadership, and science popularization or technical training. Major project participation and platform establishment were already covered in landmark contribution analysis. Academic exchange participation includes presenting at conferences and discussing major issues with international experts, positively impacting disciplinary progress—medical sciences reports frequently mention Chinese researchers sharing difficult disease treatment plans at international conferences, contributing significantly to global medical development and human health. Natural sciences reports cover researchers' participation in field scientific expeditions such as deep-sea diving, polar research, and ecological studies in forests and deserts —activities with high scientific value and roles in ecological and environmental protection. Major national engineering project participation appears mainly in engineering and technical sciences reports, describing researchers as hosts, directors, or designers making important contributions to overall project design, evaluation, organization, and implementation, including military projects (nuclear weapons, satellites) and infrastructure projects (bridges, high-rises) that maintain national defense security and long-term economic/social stability. Researchers leading the establishment of disciplinary laboratories and research centers promote in-depth development of specific fields. Agricultural sciences reports mention researchers conducting science popularization or technical training for farmers and establishing cultivation or breeding demonstration bases, which have important social value in helping farmers achieve prosperity.

Different disciplines have different research missions, and researchers make important contributions in academic and non-academic fields through various research activities. Therefore, when evaluating researchers from different disciplines, evaluation systems should fully incorporate discipline characteristics, include contributions beyond achievements, and emphasize them accordingly.

4 Conclusion

Based on this analysis, *Science and Technology Daily* provides comprehensive coverage of researchers' research activities and achievements, with diverse types described across multiple levels—quantity, quality, and impact—using various qualitative and quantitative dimensions to highlight contributions. Science and technology figure reports across different disciplines emphasize different research activities and achievements: natural sciences reports focus on pioneering basic theoretical achievements and paper publication, while other reports emphasize practical application contributions such as developing new technologies, processes, equipment, and products. Descriptive dimensions also differ markedly according to the nature and characteristics of disciplinary outputs.

Through science and technology figure reporting, mainstream media publicizes professional models and establishes industry benchmarks. Its public opinion orientation influences researchers' understanding of and attitudes toward research

evaluation, fosters a healthy academic atmosphere, and promotes implementation of China' s new research evaluation system. Over the years, China has developed an "overly impatient" research atmosphere focused on producing more achievements and quickly reaching international frontiers, with easily measured indicators like paper count and impact factor gradually becoming mainstream. Therefore, to reform the research evaluation system, we must first cultivate a "patient, unhurried" scientific cultural atmosphere that enables researchers to adjust their mindset, spend time solving major problems, and produce diverse, high-quality achievements with multiple impacts [15]. Science and technology figure reporting, by emphasizing research processes and content, highlighting achievement diversity and quality, and clarifying researcher contributions according to disciplinary missions and output characteristics, can play a positive role in guiding researchers back to the essence of scientific research.

In recent years, China has issued multiple policy documents to provide macro-level guidance for research evaluation reform, but how to operationalize these policies remains an urgent challenge for policymakers and evaluation bodies. This study' s analysis of science and technology figure reporting offers insights for improving research evaluation methodology.

First, evaluation of researchers should be discipline-specific, particularly for problem-solving, demand-oriented disciplines that should emphasize evaluation of practical application achievements, while expanding the scope of valuable achievements and research activity participation included in evaluation systems.

The 2018 Opinion on Deepening Reform of Project Review, Talent Evaluation, and Institutional Assessment [10] called for establishing classified evaluation indicator systems and procedures according to characteristics of different disciplines including natural sciences, philosophy and social sciences, and military sciences. Different disciplines undertake different research tasks and missions, resulting in different main achievement forms and impact methods. However, evaluation system convergence remains problematic. For instance, numerous Chinese medical papers have been retracted by international journals due to fraudulent peer review and academic misconduct, partly because paper publication remains a core indicator for physician promotion despite physicians' main contributions not being reflected in papers. In medical sciences reports, innovative and leading medical technologies and drugs constitute physicians' landmark achievements. While over 40% of medical sciences reports mention researchers' papers, they are not described as core content; instead, detailed descriptions of medical technologies and methods emphasize clinical contributions and patient benefits. Therefore, physician promotion should moderately reduce paper requirements and emphasize clinical achievement evaluation based on cure rates, effectiveness for difficult diseases, and treatment costs—factors directly related to patient welfare. Similar evaluation approaches should apply to agricultural sciences, determining evaluation emphasis from the perspective of main beneficiaries. Reports repeatedly emphasize researchers "writing papers on the earth," noting some researchers have few or no SCI papers yet persist

in demand-oriented new variety cultivation and cultivation technology development while organizing agricultural training to help farmers prosper. Therefore, evaluating agricultural researchers should focus on achievements and activities that directly increase farmers' income.

Researcher evaluation can expand achievement categories to include all types, such as standards, software and systems, and reports/plans submitted to relevant departments or companies—all significant for guiding disciplinary, industry, and social development. Moreover, talent evaluation should not be limited to achievements; researchers' domestic and international influence in their fields and participation in discipline-related and science popularization activities can also serve as evaluation indicators.

Second, research achievement evaluation should emphasize quality and impact, developing targeted evaluation methodologies by achievement type, and for technology application achievements, consider adding quantitative indicators to objectively measure value.

Research achievement evaluation must first correct the tendency to neglect quality. Using papers as an example: while papers are the most important carriers of basic research achievements, reports emphasize content value when describing them. Research evaluation should not focus solely on citations and impact factor but should evaluate influence, contribution, and innovation based on content [16], examining whether topics address important field questions and whether results solve field problems [17]. Additionally, different evaluation methodologies should apply to different achievement types. Applied and development research achievements, while also appearing as papers, demonstrate value more through application prospects, problem-solving capacity, and effective integration with products and markets [17]. Therefore, evaluating such achievements based on papers alone is inadequate. Descriptive dimensions from reports—including efficiency and performance, pioneering and leading nature, independence, sales/market share, and social value—can be used to evaluate applied and development achievements. Science and technology figure reporting frequently uses numerical values to indicate quality and impact of technology application achievements, offering guidance for expanding quantitative indicators in evaluation. Targeted quantitative indicators can be developed according to disciplinary achievement characteristics, such as equipment efficiency, new agricultural variety yield and premium rates, and medical technology success rates.

This study has limitations: the humanities and social sciences category had too few reports (all in archaeology) for some conclusions to represent the discipline. Humanities and social sciences aim to reveal the nature and development laws of human society, playing important roles in guiding human life and social practice, promoting social enlightenment, and ideological/cultural construction. Therefore, researchers' activities, achievements, contribution methods, and impact differ substantially from other disciplines and cannot be generalized. Future research should supplement science and technology figure reports from humani-

ties and social sciences to provide reference for improving evaluation systems in these disciplines.

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Author Contributions

Liu Xiaojuan: Conceived research ideas, designed research framework, revised final manuscript.
Li Xinran: Designed research framework, collected and analyzed data, drafted and revised manuscript.

Note: Figure translations are in progress. See original paper for figures.