



Comprehensive Conceptual Framework for Strategically Transforming the Geological Survey Industry in the Context of Ecological Civilization Construction

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Abstract. Within the framework of ecological civilization construction, the strategic transformation of the geological survey industry is essential to prioritize environmental protection. This necessitates the timely reinforcement of the industry's holistic environmental consciousness, the elevation of its scientific and technological innovation capabilities, the strengthening of geological survey data management, the expansion of services into green development domains, the fostering of collaborations with relevant sectors, the establishment of a robust legal and regulatory framework, and the enhancement of the scientific validity, impartiality, and sustainability of geological surveys. By implementing these strategic transformation measures, the geological survey industry can effectively contribute to the advancement of ecological civilization construction, facilitating a synergistic interplay between ecological preservation and economic development.

Keywords: Ecological civilization construction; Geological survey; Strategic transformation; Industry development; Comprehensive conceptual framework

1 Introduction

In the context of ecological civilization construction, the geological survey industry is undergoing strategic transformations aimed at prioritizing environmental protection. This involves implementing measures such as employee training, the development of environmental protection standards [1-2], environmental impact assessment and management, research and application of environmental protection technologies, and the establishment of assessment mechanisms to reinforce the industry's environmental awareness [3-5]. Additionally, collaborative efforts with relevant departments are being strengthened to facilitate resource sharing, technological innovation, and knowledge exchange, while establishing a comprehensive legal and regulatory framework to govern industry practices [6-10]. Concurrently, there is a focus on enhancing technological innovation capabilities, improving data management and sharing, expanding services in the green sector, and fostering cross-industry collaborations. These initiatives are intended to facilitate the strategic transformation of the geological

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survey industry and contribute to the harmonious coexistence of ecological preservation and economic development [11-16].

2 Industry's Overall Environmental Awareness

Enhancing the environmental awareness of professionals within the geological survey sector is of paramount importance. This can be accomplished through the implementation of pertinent training programs aimed at cultivating a profound comprehension of the principles underlying ecological civilization. The training curriculum should emphasize the significance of environmental protection, encompassing aspects such as environmental legislation and regulations, environmental conservation techniques, ecosystem preservation, and land spatial ecological restoration. By doing so, it will elevate the environmental consciousness of industry professionals and foster a deeper understanding of ecological restoration concepts [17-18].

The formulation of stringent environmental protection standards is imperative to delineate the requisites and regulatory measures pertaining to environmental considerations during the course of survey processes. These standards ought to be grounded in scientific research and practical experience, and undergo meticulous professional assessment and endorsement, thereby ensuring their scientific validity and practicability. The standards should primarily encompass geological exploration, sampling, and monitoring phases, with the overarching objective of minimizing the environmental impact associated with survey activities [18-23].

Conducting thorough environmental impact assessments for survey projects assumes critical importance as it enables the identification of potential environmental risks and impacts, facilitating the implementation of appropriate management measures. This encompasses the assessment of survey activities' effects on vital aspects such as water resources, soil quality, and biodiversity. Consequently, comprehensive protection and restoration plans can be devised to mitigate adverse environmental consequences [23-28].

To enhance the accuracy and reliability of environmental data during survey processes, the adoption of advanced geological environmental monitoring and sampling analysis techniques is warranted. Simultaneously, there is a pressing need to explore and embrace environmentally conscious technologies, including low-impact exploration techniques, clean energy alternatives, and eco-friendly materials. These initiatives are instrumental in curtailing the ecological footprint associated with survey activities, thereby fostering sustainable environmental practices.

3 Technological Innovation Capabilities

Increasing investment in technological innovation represents a fundamental strategy to be pursued. By allocating substantial financial resources and optimizing human capital, the establishment of specialized research teams or collaborative mechanisms can be facilitated, thereby driving continuous breakthroughs and fostering technological innovation. Investing in research and development projects and supporting collabora-

tions between research institutions and enterprises will provide the necessary financial and resource support, thereby establishing a solid foundation for technological innovation.

The adoption of cutting-edge technological approaches serves as a pivotal pathway to enhance technological innovation capabilities within the geological survey industry. It is imperative to actively introduce advanced exploration techniques, remote sensing technology, unmanned aerial vehicles (UAVs), and artificial intelligence (AI) tools to enhance exploration efficiency and precision. For instance, leveraging state-of-the-art surveying instruments, sensors, and advanced data processing and analysis techniques enables the achievement of precise and efficient exploration of subterranean resources. The utilization of remote sensing technology facilitates the acquisition of high-resolution, wide-coverage surface information, thereby expediting the acquisition of geological information and environmental monitoring data. Furthermore, leveraging UAVs and AI empowers the execution of efficient and safe survey operations in challenging or hazardous terrains.

Exploring novel survey methods and technologies represents a crucial endeavor to enhance technological innovation capabilities. The geological survey industry should actively explore and develop innovative survey methods and technologies to meet the demands of ecological environmental protection. Notably, research on green survey technologies should be pursued to identify low-impact, high-efficiency survey methodologies, effectively minimizing disturbances to the ecological environment. Moreover, the integration of geological information and environmental data should be pursued, along with the development of intelligent survey methods and models, thereby enhancing the accuracy of predictions and assessments and providing robust scientific support for the construction of ecological civilization.

4 Geological Survey Data Management

The establishment of a comprehensive data management system represents a pivotal undertaking. It entails the utilization of efficient data collection tools and technologies to ensure the accuracy and timeliness of data. Robust data security protection mechanisms, encompassing data backup, encryption, and access control, are imperative to safeguard data integrity and confidentiality.

Standardizing data sharing constitutes a crucial measure to propel industry advancement. The geological survey industry should actively foster data sharing and establish collaborative mechanisms with pertinent governmental bodies, research institutions, and universities. This can be accomplished through the creation of data sharing platforms or entities that facilitate the interoperability and exchange of data. The formulation of pertinent policies and regulations to incentivize data sharing among enterprises and institutions, coupled with the provision of reward systems and intellectual property protection, can further expedite the implementation of data sharing initiatives.

Facilitating the application and dissemination of research findings constitutes a pivotal step. Collaboration between the geological survey industry and research insti-

tutions, universities, and other pertinent stakeholders should be intensified to enhance the practical application and dissemination of research outcomes within survey activities. Through the sharing of data resources and the execution of collaborative research projects, the translation and application of research outcomes can be facilitated. The establishment of mechanisms for evaluating and promoting research outcomes, as well as the integration of exceptional research achievements into industry standards and specifications, can stimulate support for and enhancement of geological survey work through technological innovation.

5 Green Development Service Sector

The geological survey industry has the potential to broaden its scope and contribute to the green development service sector through various initiatives. One such initiative is providing comprehensive environmental monitoring and assessment services that encompass the collection, analysis, and interpretation of environmental data to evaluate the impact of human activities on the natural environment. This entails employing advanced techniques and methodologies, including environmental impact assessment, environmental monitoring and data analysis, and environmental modeling and forecasting. By conducting scientifically rigorous assessments, the industry can furnish valuable scientific evidence for informed environmental decision-making, thereby facilitating environmental protection and sustainable development endeavors.

Additionally, the geological survey industry can actively engage in ecological restoration and protection efforts by undertaking research initiatives and offering technical expertise to formulate and implement ecosystem restoration plans and measures. This encompasses a wide range of activities such as ecosystem assessment, restoration and reconstruction of ecosystem functions, biodiversity conservation and restoration, among others. By employing scientifically guided ecological restoration and protection measures, the industry can contribute to enhancing the stability and functional recovery of ecosystems, thereby promoting the overall health and resilience of the ecological environment.

Furthermore, the geological survey industry can contribute to comprehensive resource utilization by exploring innovative and environmentally conscious approaches to resource extraction and utilization. This involves providing scientific support for resource exploration, evaluation, and development, as well as engaging in research and practical applications related to resource recycling, reuse, and the adoption of circular economy principles. By emphasizing technological innovation and research and development endeavors, the industry can drive the transition towards sustainable resource utilization practices, optimizing resource efficiency, and fostering environmentally friendly economic development.

6 Collaboration with Associated Industries

The geological survey industry should proactively engage in cross-industry collaboration and communication with relevant sectors. This necessitates the establishment of

collaborative mechanisms and platforms to facilitate the exchange of information, technology cooperation, and resource integration. By forging collaborative partnerships with industries such as environmental conservation, energy, and construction, the geological survey industry can gain access to invaluable industry insights and technical support, thereby fostering innovation and advancement within the sector.

Cross-industry collaboration serves to promote the sharing and integration of resources. Through partnerships with related industries, the geological survey industry can exchange geological information, exploration data, and other valuable resources. For instance, collaborating with the energy sector enables the sharing of geological information for energy exploration and development, thereby providing support for the rational utilization of energy resources. Similarly, collaborations with the construction industry facilitate the sharing of geological survey and assessment data, thereby supporting site selection and geological risk assessment for construction projects. This resource sharing contributes to enhanced efficiency and accuracy in resource utilization.

Collaboration with associated industries propels technological innovation and research and development (R&D). The geological survey industry can engage in joint R&D initiatives with industries such as environmental conservation and energy, focusing on innovative technologies for environmental monitoring and resource exploration. Through the exchange and collaboration of technologies, diverse expertise and technological advantages can be consolidated, thereby driving technological progress and innovation within the industry.

Cross-industry collaboration and communication also facilitate the dissemination of experiences and best practices. The geological survey industry can share its own experiences and successful cases in environmental protection, resource utilization, and other pertinent areas with other industries. Concurrently, it can learn from advanced practices in other sectors, drawing inspiration from successful management models and sustainable development approaches.

7 Legal and Regulatory Governance Framework

The geological survey industry should proactively strive to establish a robust regulatory governance framework encompassing mechanisms for supervision, evaluation, and enforcement. Collaborative efforts with relevant governmental departments are of paramount importance to jointly formulate appropriate regulatory provisions and establish effective mechanisms for supervision, inspection, and penalties to address non-compliance. Additionally, industry associations and self-regulatory organizations play a crucial role in strengthening industry self-discipline, regulating professional conduct, and raising overall industry standards.

To ensure the scientific rigor and impartiality of survey work, the geological survey industry should establish a scientific and impartial mechanism for conducting surveys, guaranteeing the accuracy and reliability of survey data. This necessitates the development of standardized survey methodologies and standards, the establishment of quality management systems, and the enhancement of practitioner training and quali-

fication certification. Furthermore, it is imperative to establish scientific mechanisms for data analysis and interpretation, ensuring the scientific validity and credibility of survey findings.

The geological survey industry should prioritize sustainable development and embed sustainable principles throughout the entire industry development process. This entails promoting sustainable resource utilization, placing emphasis on environmental protection and ecological restoration, and fostering harmonized development of the economy, society, and environment. To attain sustainable development objectives, the industry can establish a system of sustainable development indicators and evaluation mechanisms, regularly assessing and improving its own level of sustainable development.

8 Conclusion

Within the context of ecological civilization construction, the geological survey industry requires strategic transformation. On one hand, the industry should implement a range of measures, such as employee training, the establishment of environmental protection standards, environmental impact assessment and management, research and application of environmental protection technologies, and the implementation of assessment mechanisms, to reinforce environmental awareness. On the other hand, it is crucial to strengthen collaboration with relevant departments, promote resource sharing, technological innovation, and experience sharing, and establish a robust legal and regulatory framework to standardize industry practices and ensure the scientific validity, impartiality, and sustainability of survey work. Additionally, the geological survey industry should enhance its capacity for technological innovation, expand into green service sectors, strengthen data management and sharing, and foster collaboration with related industries. Through these endeavors, the strategic transformation of the geological survey industry can contribute to ecological civilization construction, facilitate efficient resource utilization, and safeguard and restore the ecological environment.

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