

A Brief Discussion on the Application of Electronic Information in Construction Engineering Management

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Keywords: Electronic Information; Construction Engineering Management; Safety Control; Digitalization

Abstract: Under the background of rapid development of information technology, electronic information technology is widely used in all walks of life. The Application of BIM in Construction Engineering Management can solve the challenges, including information transmission delay, low efficiency of collaboration existing in traditional management and promote the large-scale and detailed development of construction projects. This paper focuses on analyzing the application value of electronic information in construction engineering management, elaborating its main application areas and scientific and rational application strategies. These strategies involve creating an end-to-end digital management platform, leveraging IoT technology to enhance the management of equipment and resources, applying big data and artificial intelligence technologies to improve decision-making processes through these recommendations, enhancing a system integration assurance system, and advancing real-time supervision through the use of internet technology. It is hoped that this can be a reference to the high-quality development of construction industry.

1. Introduction

In the era of technological access, first and foremost information technology is electronic information technology, which has penetrated all walks of life and changed the original operating model and development mode. It is a good tool for construction engineering management, which can timely and accurately transmit information to solve some problems that lead to delayed construction progress and poor project quality; the Internet of Things (IoT), big data and artificial intelligence (AI) technology are used to realize rapid collection and analysis between construction companies. We will promote supply-side structural reform, industrial transformation and upgrading to foster high-quality development in housing. Therefore, deeply analyzing the applied strategy of electronic information in construction engineering management is of an extremely practical significance.

2. Application Value of Electronic Information in Construction Engineering Management

2.1 Enhancing Engineering Management Efficiency

The most significant aspect of enhancing overall management efficiency is to use electronic information. From the perspective of a physical entity, electronic information technology provides chances to break down departmental barriers or share real-time information such as construction advancement or design revision. It also regulates the management of resources—human, material, financial—in construction projects on an accurate basis. Management costs will be effectively reduced through optimal configuration of personnel on demand with project progress, releasing standby and idle time into management cost in this traditional manner, optimizing utility rate and shortening construction speed; this is a fundamental improvement based on just supporting delivery format for project management ^[1].

2.2 Beneficial for Strengthening Cost Control

Construction engineering management by full collection and integration of cost data via

electronic information technology Smart sensors and mobile terminals automatically collect consumption of materials, equipment usage data. This data is instantly uploaded to information management systems and integrated into a complete cost database, providing an objective guarantee for cost control. With initialization of e-information technologies, managers could now dynamically supervise costs and alarming in time if actual expenses deviate from budget to avoid worse consequence being overweighted expense.

2.3 Ensuring Construction Project Quality

Instead, by your information technology Electronic information technology application the further breakdown for construction quality guarantee is important ways of. The process of gathering information during construction is more precise before passing this on. For structural health monitoring that periodically collects (in situ) parameters which represent the structure status e.g. the stress or deformation of a structure deploying several sensors. It allows managers to identify elements that could compromise quality or safety and which are, therefore, most at risk more quickly and act accordingly to eliminate those risks before an accident happens. In addition, most digital management systems driven by electronic information technology provide the basic characteristic of centralised control over all essential documents such as design drawings, construction cadences and material test reports in order to prevent quality deviation resulting from slow flow of information.

3. Main Application Areas of Electronic Information in Construction Engineering Management

3.1 Dynamic Supervision of Engineering Progress and Resources

The depth of application of electronic information technology can effectively improve project management. The integrated supervision platform based on BIM and IoT technology can realize real-time dynamic perception of the construction progress and resource allocation. Its platforms that are treated as digital 3D models, using carriers such as sensor networks and RFID tags. They cooperate with AI algorithms to identify the health condition of construction equipment and provide early detection of faults. In addition, electronic information technology can also use the dynamic resource database construction to realize intelligent matching relationship of material inventory and construction progress. Mobile Apps and cloud collaboration enable on-site managers to upload process data (progress pictures and inspection records) directly into the system for automatic contextualization with links to related locations in the BIM model: this finally creates a visual dynamic map of progress and resources. This lays a foundation for multi-party decision-making based on clear and traceable information. The dynamic supervision model based on electronic information is an incremental/refined-detail-oriented solution of the project management field, and a credible technical support to the digital transformation of construction industry.

3.2 Engineering Safety and Quality Monitoring

Electronic Information Technology is a restructuring of the old model of supervision. With the assistance of wireless communication, it becomes possible for project construction to upload data to cloud platforms, thereby enabling dynamic perception of the physical status of a project. Using the edge computing, these project data can be processed in a more efficient manner. The complementary benefits of digital signature technology and blockchain assure tamper-proof data from source, robustly supporting the quality traceability of key process records, quality inspection reports & other forms of data on chain.

3.3 Engineering Information Collaboration and Decision Support

Electronic information technology is the main carrier for information interaction in construction project management. Using this way to share, again to achieve the cross-region and cross-disciplinary engineering information sharing, dynamic update; Moreover, the collaborative advantages of BIM enable firms to integrate multi-dimensional data to form a single information

model for electrical and mechanical systems, as well as construction schedules. Electronic information technology is capable of solving complex engineering problems at the level of decision support through the construction of intelligent analysis models. For example, Information technology can integrate the heterogeneous data which generated from multiple sources such as geological survey data of various stations information and environmental monitoring along with cost budget parameters in mega infrastructure projects. Randomly distributed probabilities can generate a decision tree model which will assist machine learning algorithms to dynamically assess construction risks. One of the advantages cloud computing presents is the ability to predict what kind of effect will be achieved after implementing this strategy, which in turn helps show decision-makers how parallel simulation and optimization comparison between multiple scenarios can lead those desired results that were predicted by predictive capabilities.

4. Application Strategies of Electronic Information in Construction Engineering Management

4.1 Building a Full-Cycle Digital Management Platform

Digital management platform full cycle construction paper of implementation of electronic information technology. At this stage, companies are still in the planning phase, companies should use GIS (Geographic Information System) technology to collect information on topography and surrounding environment information. Through such data, both strengths and weaknesses of multiple site selection can be evaluated, which will return strong references for rational project ^[2]. In the designs that prepare building, this requires much manpower and apply material resources, in order to solve those problems of design in advance through target-oriented optimization; therefore companies can use the BIM technology to set up a 3D visual model and simulate before construction so that overall building and internal structure and functional layout can be formed theoretically. The rational planning makes sure that everything is optimized before the construction if needed. As a part of the construction, each & every aspect concerning schedule, quality and cost can be matched in an integrated project management information system within the platform. Deployment of various kinds of sensors both on site to comprehensively gather environmental parameters and the status of equipment operations. They can really carry out preventive maintenance by predicting future equipment failures from sensors monitoring devices installed in the operation and maintenance stage. Companies benefit smart utility by using big data cloud computing technologies to analyze the vast amount of operational generated, it can not only provide strong decision support for energy management and space optimization, but also effectively improve overall operational efficiency. The platform should view user feedback as an integral part of its evolve and adapt process, fine-tuning aspects and features each time an issue is detected to keep the quality and relevance high.

4.2 Deepening the Application of IoT Technology in Equipment and Material Management

IoT construction site connected on material and equipment management — This is the key point of how digital transformation must be driven in this field as well. Applying RFID tags and sensors to the materials and equipment enables companies to jointly create the perception network across transportation, warehousing, and procurement. At the same time, during the project management process, it can construct a digital management platform based on IoT technology and build a BIM model to achieve virtual-real scene mapping. Once again the huge companies will have to make a deep mining of existing data in big data and AI so as to establish the standards between the access of these IOT devices, as well as secure material management and equipment information systems Tages. And for the enterprises, it is to realize unity in the industry standards, complete standardization of devices communication protocol and data interface format. A routine system security audit is required to avoid imprudent leakage of information, which weighs on project management.

4.3 Utilizing Big Data and AI Technologies to Optimize Decision-Making Processes

The new application of electronic information technology should take the path of deep integration of big data and AI, reconstruct decision-making power to promote its intelligence. Along with unstructured data like BIM Models or Design Drawings Abstracts; Relations derived from these and high material classes can use Natural Language Processing. In scenarios like concrete pouring, temperature sensors and construction logs assist in pinpointing exactly what risk factors are compromising quality. At an operational level, machine learning algorithms mine features on historical project data and apply appropriate models (e.g., LSTM neural networks) for a dynamic realistic simulation of duration, cost and quality ^[3]. Middle management can leverage knowledge graph technology in the integration of industry standards of operation and process standards — tacit knowledge that is already stored into expert systems — essentially forming an explainable decision rule library. At a higher level you can implement a reinforcement learning framework, where your system learns how to allocate resources optimally through trial and error in simulated environments — starting from classical physics. Through a 3D visual interface, digital twin technology can also be used to develop virtual sites of companies that allow decision-makers to see how certain schemes impact the company ecosystem; through Monte Carlo simulations — with sufficient granularity — ideal time windows for processes like rebar tying. The manual intervention interface will be preserved for the last-level decision-making process, and alongside that, the entire data flow continues collecting correction data to later inject it into the model training set as fast as possible.

4.4 Strengthening the System Integration Guarantee System

Strengthening of system integration support framework for implementation of electronic information technology. In construction engineering management, often various participants and software systems exist which may lead to information silos when different formats or interfaces occur. Therefore it is essential for organizations to develop a standard global data standards which will comprise of format and accuracy metrics so as to ensure accurate transfer of data across different systems. In addition, it needs a stricter interface protocol standard, and the protocols need to unify the type of interface as well as the specification for data transmission between system interfaces so that data can be smoothly shared and deeply interacted with across systems. Finally, projects need to build a layered security protection space, make use of the intrusion detection and package control system, regularly conduct vulnerability scanning and security patch so as to enhance the risk resistance ability of information management system. Advances the use of overall management platform systems that integrate features such as project, scheduling & quality control – aggregating decentralized subsystem. Created central management and analysis of the data — read true, complete information to support decisions. Functions of collaboration can bring together female participants, enabling effective communication and collaboration with other project staff to work efficiently by initial data entry on-site upload the same data to mobile terminals at a given time for managers to track project dynamics no matter when or where. Management information systems are to be properly supported on a continuous basis, so also need to be upgraded from time to time for providing efficiency and effectiveness performance in the long-run. Then instead of project economic loss, in response to system failure, data loss etc., measures must be implemented

4.5 Promoting Real-Time Supervision Using Internet Technology

Utilization of Electronic Information Technology is made by improving the Qualities of Supervision. Enterprises need to take advantage of Internet technology to develop real-time supervision platform items, solving traditional supervision exists lagging and incompleteness of information problems, promote and improve management from extensive mode changing to the refinement, intelligence ^[4]. Meanwhile, the establishment of multi-source data fusion perception network in the field at enterprises need to use technical means to monitor concrete curing environment and wearing state of safety equipment personnel. The obtained data are sent to cloud system through 5G communications, enabling supervisory department learned site dynamic timely. Detect abnormal data and issue alerts automatically so that the information can not be distorted

affecting project decision-making. Companies are also using internet technology to connect the models together with on-site perception devices, enabling a two-way mapping of the virtual and real worlds. The platform will enable supervisors to monitor construction progress and access quality inspection reports and safety inspection records of any nodes, it can also play a role in risk prevention and applied with big-data-analysis ability. And also further confirmed that the Internet of things technology can effectively realize the transparency of information transmission between supervision departments vs construction units, contractors and third-party service agency.

5. Conclusion

Towards the application-oriented transfer of digital processes in construction engineering management: Results from a survey on the use of electronic information. The ever growing importance and speed of changes characterize the. The application of electronic information technology is reasonable, and the transmission and communication between departments can be strengthened to avoid delay or distortion. Accordingly, construction enterprises should focus on building full-cycle digital management platforms, further digging material and equipment management of relevant IoT technologies, maintaining the utilization advantages of big data and AI to effectively support optimization decision making processes in all aspects of construction process with a matching degree of system integration framework for the enabling systems; also constantly explore internet technology empowerment under real-time supervision.

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