Digital Transformation Application of Precision Industrial Quotation System

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Abstract. The digital era is coming. In recent years, due to the continuous improvement of information technology, Artificial Intelligence, Big Data, Cloud Computing and IoT related technology has flourished. For traditional industries, demand is gradually changing from less diverse product to more diverse product. And most of them are customized orders, so the change of production mode has also become an opportunity for the digital transformation of enterprises. In addition, under the impact of the epidemic at the end of 2019, enterprises pay more attention to digital transformation.

This study cooperates with a precision industrial company in Taichung. The company used to record all the data in the quotation process in paper. In addition to the difficulty of data backtracking, quotation data such as cost, delivery period, production process, outsourced manufacturers and prices are also difficult to compare with the actual order data. Also, departments often affect the quotation time due to the cumbersome communication process. In order to solve the above problems and improve the quotation process, this study is discussed in a faster, more accurate, more effective and profitable way.

By building a digital quotation system, digitally optimize the difficulties encountered by quotations, and finally solve the problem to make the quotation system successfully digitally transformed.

Keywords: Digital Transformation · Quotation · Data Mining

1 Introduction

1.1 Background and Motivation

In the process of enterprise operation, it is absolutely related to production operation management, marketing management, human resources management, research and development management, and financial management.

There is a large amount of data that can be used in each management. If the data is not recorded in detail and used properly, it is really a loss to the enterprise. When traditional industries carry out digital transformation, they will always rely on information technology. Such as Industrial Internet of Things ERP system etc. Access to data through cloud

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computing technology and execute data through multiple ways like data cleaning, data integration, data conversion and other data pre-processing steps to make the data more accurate with the original data. It will not lead to misjudgment due to outlier values or wrong data, and focus on the dimensions of value to enterprises. Finally, through big data analysis, we can understand the competitive edge of enterprises.

In order to achieve the purpose of digital transformation, enterprises must continuously improve and optimize internal working processes. Only when we able to produce diverse customized products and quantitative commodities, we can move forward for the purpose of flexible manufacturing system as to improve our own value. Create a high-tech and high entry barrier, help enterprise to improve the competitive advantages and plays an important role in the manufacturing industry.

1.2 Research Purpose

This study cooperates with a precision industrial company in Taichung. The company used to record all the data in the quotation process in paper. In addition to the difficulty of data backtracking, quotation data such as cost, delivery period, production process, outsourced manufacturers and prices are also difficult to compare with the actual order data. Also, departments often affect the quotation time due to the cumbersome communication process.

In order to solve the above problems and improve the quotation process, this study is discussed in a faster, more accurate, more effective and profitable way. By building a digital quotation system, digitally optimize the difficulties encountered by quotations, and finally solve the problem to make the quotation system successfully digitally transformed.

2 Literature Review

2.1 Digital Transformation

This study integrates the interpretation and definition, application scope and use methods of various experts and scholars for digital transformation. [1] It is mentioned that digital transformation can not only measure the extent to which an organization benefits when applying information technology tools, but also as an evolutionary process. [2] This study builds an integrated model of digital transformation and establishes measurement tools for educational institutions, and evaluates the results in general to determine that this model is suitable for universities. [3] Use the code development platform to provide and promote the technical mechanism of automated software application process development, develop the emerging low-code field on the basis of computer-aided software engineering, and serve as a tool for digital transformation. In the case of digital transformation in European countries, it is mentioned that digital transformation plays an important role in technology and industrial policies, and digitalization is understood as the process of using digital technology and tools to develop business. Through two-stage analysis, this study first evaluates the cluster analysis method (clustering and K-Means) of differences and similarities among EU countries. Then use TOPSIS to rank countries

according to the evaluation criteria. The research results found that if EU countries have a similar level of development, they can effectively carry out technical evaluation through social, economic and corporate dimensions. [4] Research on the pharmaceutical industry and complete the digital transformation through the planning and development of the Nerve Live platform. Nerve Live platform has a total of eight models applied to different fields. Since the development of the system launched, the organization has been able to have direct experience, create intelligence, and create value throughout the value chain. Each model combines decades of operating data of multiple internal systems, generates new intelligence pattern through machine learning and advanced analysis, and creates application process modules. Through action and insight planning, tracking, prediction, comparison and monitoring activities, keep the cost down and maximizes both quality and efficiency. For example, a faster, better and cheaper, and eventually create smarter and data-driven decisions throughout the drug development process. And increase information transparency, and all departments can see the same data, so that new strategies can be generated from a complete, comprehensive and common perspective.

2.2 Quotation System

[7] Through research of the value stream mapping (VSM), we provide relevant decision-making bases such as resource utilization rate, delivery time, current products in progress, non-value-added time and number of operators in the quotation process, and achieves concise management to reduce imperfect losses considered by the company in the quotation [8] . Build a quotation model for urgent customers, record all changes and information in the previous quotation process, and be able to propose a more accurate quotation numbers and restore a precise calculation of quotation. In line with the purpose of this study, we hope to speed up the efficiency of quotation and reduce the waiting time of customers through the quotation model.

2.3 Data Mining

When the data warehousing construction is completed, the valuable information that needs to be mined from a large amount of data can be mined through data exploration. [5] This study sorts out the application of data mining in various fields. Because the data generated by the health care exchange is too large to be processed and analyzed through traditional methods, it is necessary to convert the data into useful information through data exploration. From this, it can be seen that data mining technology can extract effective information for a large amount of data. This study analyzed diabetic patients. In 1,778 non-diabetic cases, the decision-making successfully judged 1,728 cases as non-diabetic, with an accuracy of 96.64%. [6] Apply data mining technology to the field of crime analysis, develop a reproducing reporting system based on message extraction technology, and combine natural language processing and cognitive interview methods. Get more information from the testimony of witnesses and victims, and ask questions according to the principle of cognitive interviews through the system to extract answers related to crime, and the overall report exceeds 80% of the accuracy and recall rate. Originally, the police should send manpower to be responsible for the investigation.

Through data exploration-related technology, we can quickly find a response method in various criminal records so far.

3 Method

3.1 Digital Transformation and Data Mining

This study combines Digital Transformation with Data Mining technology (see Fig. 1).

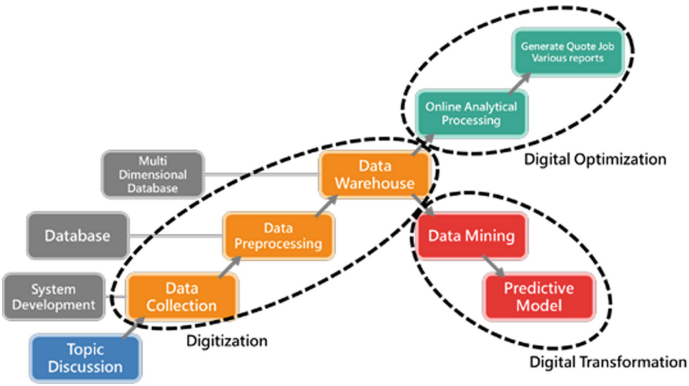

Fig. 1. Concept map of Digital Transformation and Data Mining

3.2 Digitalization

This study will enable the company to move forward in the direction of digital transformation by building a quotation operating system. First of all, change the quotation process from the original paper work to the quotation system to record all the data in the quotation process in detail, plus the principle of feasibility assessment to record the possibilities of the quotation. And the processing of parallel operations to reduce the time spent on the quotation, and then record all the time in the quotation process in detail. Including the time spent by each department in each quotation process or the average length of the total quotation, etc. It also records in detail the reasons why the quotation content has changed during the quotation process. Finally, a variety of charts are generated to explain the quotation status. After completing the quotation operation, the data generated by the process will be constructed as a customer relationship management analysis model. In the future, customer classification will be carried out, so that the company can provide customized services and marketing for each customer.

Data Collection

From the time the business receives the customer's inquiry to the completion of the whole quotation process, the quotation operation system records are adopted. Whether it is customer data, inquiry data, process data, manufacturer data, data generated by the

evaluation process, time generated by the evaluation process, etc., in order to establish subsequent data warehousing. The quotation operation system has added parallel operation technology, which shortens the time of quotation, and increases the function of switching operations, and records the communication of various departments. All changes due to the design changes and the adjustment of the process to communicate with customers will be followed up; the above functions cannot be achieved in the previous quotation process. Through feasibility assessment, parallel operations and change operations, the quotation process is more perfect and flexible.

Data Preprocessing
In the process of data input, it is inevitable that errors such as input error messages, empty data, and irregular data will inevitably occur. Therefore, it is necessary to adopt data pre-processing actions such as data cleaning, data integration and data conversion. Ensure the correctness, integrity and usability of data, and avoid presenting wrong data leading to wrong decisions.

Data Warehouse
Establish a multi-dimensional database through data warehouse to facilitate the subsequent analysis and use of large data. For data analysis in data warehouse, data is generally presented in a multi-dimensional way. Through online analysis and processing, query, data comparison, data extraction and multi-dimensional data processing, users can query, analyze and browse data conveniently and quickly in different dimensions and data levels according to specific or professional needs.

3.3 Digital Optimization

Due to the large number of relevant departments involved in the quotation operation, how to shorten the waiting time of customers or business, it is necessary to optimize the quotation operation process. After the digitalization process is stable and the database of each dimension of quotation is built and improved, it can cooperate with the company's customer relationship management. As a reference basis for the urgent order sorting process, it can also be used through the function of quotation grouping and components. Through similar quotation content, the efficiency of quotation is greatly improved to achieve the effect of time optimization, and the previous feasibility assessment is analyzed to increase the success rate of the quotation to avoid the waste of quotation costs.

OLAP
OLAP has six characteristics: 1. Able to provide integrated decision-making information immediately and quickly. 2. The main purpose is to support the analysis of decision-making information rather than OLTP. 3. It is often necessary to extract a large amount of historical data for trend analysis. 4. It is often necessary to carry out complex analysis of multi-dimensional and aggregate information. 5. It is often necessary to present data

in different time dimensions. 6. The data required by the user has been defined and calculated in advance, so the query speed is relatively fast.

Generate Various Forms of Quotation Operation
Provide the company's customer relationship management reference basis through OLAP, and then use the quotation group and assembly function. So that the quotation operating system can meet the needs of customers to quote at the same time, improve parallel operations to achieve optimization, and provide urgent authorizations through analysis to achieve the purpose of time optimization. Finally, for the problem of excessive quotation time, the relevant statements are provided for the purpose of improving the accuracy of quotation.

3.4 Digital Transformation

Through quotation data warehouse, using various dimension analysis to learn useful information for the development of the company. For example, through the historical results of the feasibility assessment, we know why the company often evaluates the reasons it cannot process, and finally analyzes the important information that the company has never found in the previous quotation through Data mining.

Data Mining
This study is expected to compare whether the data of the customer's actual order is consistent with the data at the time of quotation through the data exploration tool. For example, estimate the completion time of the quotation, the manufacture procedure and processing order used, the cost and time of the outsourced manufacturer, whether it can be successfully produced, etc. to prove the accuracy of the quotation, analyze the reasons for the closure of the case, and corresponding countermeasures.

Prediction Model
In the future, we hope that when the business receives customer inquiries, it can automatically enter the key attributes of the quotation. Through the data mining results, the success rate of the quotation is counted. It is convenient for the business to judge whether to undertake this quotation, and can provide customers with more accurate quotation time to improve the success rate of the quotation.

4 Results

4.1 Digitalization - Current Situation Results and Discussion

At present, the quotation operation system has been planned. The participating departments have a total of seven departments: business departments, R&D departments, production management departments, production departments, processing departments, procurement departments and quality control departments. By recording all the data in the quotation process, to construct a perfect and rich data table of each dimension, the functions of the system are as follows: (1) Fill in the quotation information in the business. (2) Fill in the graphic data in R&D. (3) R&D feasibility assessment. (4) Internal

and external production and manufacturers of production management evaluation. (5) The production management filled in the internal system and work center. (6) External production and manufacturers of production management. (7) Feasibility assessment of filling in the production management. (8) Production Filling in Planning Evaluation. (9) Working hours and working days in the production form. (10) Processing and filling in planning and evaluation. (11) Processing Filling Forms include Working hours and working days. (12) Management Filling in Forms include Working hours and working days. (13) Purchasing forms fill in the working day and amount. (14) Purchasing forms fill in Planning and Evaluation. (15) The quality control filling form only measured the time and the number of working days required for batches. (16) Quality control forms filled in the planning and evaluation. (17) Cartographic upload sheet. (18) Amount filled in in the production management. (19) Business forms fill in the management and sales % and exchange rate. (20) Fill in the working day and order number for business.

Differences before digitalization and after digitization.

Table 1 will list the differences before and after digitalization, and explain in detail the differences before and after improvement for each department:

Table 1. The differences before and after digitalization

project	department	before	after
1	business department	If the quotation is made in paper, if the customer asks about the status of the quotation, the business cannot track the quotation progress and respond to customer questions immediately because it does not know which stage the quotation is on	Through the quotation operation system, you can see the progress of all quotations from the inquiry list and screen all the customers. The total number of quotations of customer and the status of individual quotations will be listed
2	business department	Impossible to know how many quotations have not been closed so far, and it is difficult to track and control	The business can screen the undone quotation documents in order to track the progress, and confirm whether it is necessary to ask departments to speed up the quotation

(*continued*)

Table 1. (*continued*)

project	department	before	after
3	business department	If there is a change in the previous quotation process, it is difficult to trace back to the reason why the change was caused, and the evaluation	At present, when the change needs to be made, it is necessary to record the reasons why it is not feasible, as well as the personnel who record the evaluation. If there is any problems in the follow-up, you can also find the reason for the change and understand the situation at that time
4	production department	Because production is divided into three departments, in the past, it was necessary to manually judge which processes each department was responsible for	The system determines which production department should make this process to avoid manual judgment errors, and can also record which processes and evaluation personnel evaluated by each department at that time
5	procurement departments	The previous quotation process has not recorded material data	Building material data in the system can not only record the amount of materials to provide cost calculation, but also build a database of materials
6	quality control department	The previous quotation process has not recorded the quality data	At present, the quality data can be recorded in the system to record the measurement method at that time
7	All departments	The previous quotation process completed one item and then carried out another, resulting in an extended quotation time	Through the concept of parallel operation, projects that do not affect each other are evaluated at the same time to speed up the quotation

(*continued*)

Table 1. (*continued*)

project	department	before	after
8	All departments	It is difficult to record the time and completion in paper work when each department receives the quotation	Because the system can record the time of state change, it can record the time spent by each department in each state to achieve the purpose of time control

4.2 Digital Optimization - Problem Discussion

When the quotation process is changed to use digital recording and the data warehousing, it can then be able to carry out some analysis and discussion through data.

For example, how to speed up the quotation efficiency, improve the success rate of customers to place orders, or how to improve the accuracy of quotation, so as to accurately grasp all the time and cost spent in the quotation process, use it as a follow-up production management order, and how to ensure that the quotation is profitable. For an enterprise, making profits is the most basic and important thing. Therefore, whether the management and marketing expenses incurred in the quotation process are reasonable or not, and whether the subsequent pricing can enable the company to obtain profits after the formal order, it must be understood through analysis. These contents are information that could not be known during previous paperwork (see Table 2).

Table 2. The differences before and after Digital Optimization

project	department	before	after
1	business department	It is impossible to provide corresponding services for the customer's quotation model	After analysis, you can know the customer's quotation model and provide a quotation process that is more in line with this customer. For example, customers who often place orders immediately after the quotation should pay attention to the quotation time and delivery date
2	procurement departments	Only the materials used are recorded in the digitalization of quotation operations	Through analysis, the materials that often appear in the quotation process can be used to provide procurement reference to ensure sufficient inventory

(*continued*)

Table 2. (*continued*)

project	department	before	after
3	All departments	Previous data are only recorded in their respective databases, so it is difficult to compare	Improve the accuracy of quotation by comparing quotation data with order data

4.3 Digital Transformation - Problem Discussion

After the digital optimization step, the quotation efficiency and quotation accuracy will be improved. Then this study will explore how to save work time through the surface. Data warehouse has been built when the quotation operation is digitalize. Through key information, it can provide departments with data adjustments without enter data (see Tables 3 and 2). And when the business personnel receive the inquiry request, they can judge whether there has been a similar quotation before through the previous quotation information, and provide the information at that time for reference to the decision makers, or the success rate of the quotation to determine whether this quotation needs to be undertaken.

Table 3. The differences before and after Digital transformation

project	department	before	after
1	business department	Can't know which quotations are interrelated	Through the document association function, you can know what similar or related quotations are
2	All departments	Previously, because all the reasons for the closure of the case had not been recorded, it was difficult to find out the bottleneck of the company's quotation	Through the feasibility assessment, we can understand the company's current bottlenecks and transformation direction, such as purchasing machinery and equipment or adjusting materials, processes, etc
3	All departments	When each department previously filled in the quotation content, the information that may be filled in will not change much, but it needs to be filled in again every time	The quotation process can tend to be automated, and suggested data can be made through historical data

5 Conclusion and Future Research

This study has now completed the digitalization of the quotation operation. In-depth research will continue in the direction of digital optimization and digital transformation in the future. Provide a corresponding reference basis for the three-oriented roles of the company. For the decision-making side, because the quotation operation system is an open system, the data presented is absolutely true. Through the two aspects of time and cost, decision makers can understand the current quotation status of the company in order to make correct decisions; For the management side, it can understand which bottlenecks and problems in the current operation have not been found before, and put forward improvement policies in time to improve departmental problems. For the user side, in addition to being able to record all the time points of the quotation and remind the current quotation progress, the efficiency of quotation will be greatly improved after the system function is more stable. Digitalize the existing quotation operation, optimize the quotation process by collecting a large amount of information, and finally make the quotation direction towards business intelligence through data mining.

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