

Studies and Application of the Platform for Synergies among Tobacco Enterprises in Tobacco Leaf Threshing and Redrying

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Abstract. Departing from the formulas of cigarette products, synergized business framework is established on the basis of cross-enterprise synergies for tobacco leaf threshing and redrying through the introduction of batch management, remote quality data sharing and consistent processes, among others. Functions of the business framework are achieved and a platform for synergies is erected by applying IOT, cross-enterprise system integration and big data processing technologies, resulting in a new pattern for intensive interaction and synergies between China Tobacco Zhejiang (CTZ) and tobacco redrying plants for more delicate management of the redrying process, more interactive information flows and more stable tobacco strip quality.

1. Introduction

Tobacco leaves are the most crucial strategic resource of cigarette manufacturers and tobacco leaf threshing and redrying is an important part in the supply chain of tobacco leaves and plays a primary role in the production of cigarettes. Currently procurement as well as the redrying of raw tobacco is completed in individual growing regions and tobacco leaf redrying plants which are far away from cigarette manufacturers, leading to insufficient synchronization between logistics and information flow and hence lack of effective real-time monitoring and management of the changes in the logistics of tobacco leaves. Therefore, domestic cigarette manufacturers have engaged in effective studies and practices in improving the management of the raw tobacco procurement and redrying and strengthening the application of information technology in these processes^[1-4]. In the context of facilitating the “Internet+” Action Plan across the industry, China Tobacco Zhejiang Industrial Co., Ltd (CTZ) introduced such measures as batch management, remote quality data sharing and the consistent process, among others, and has set up a synergy platform in tobacco leaf threshing and redrying based on synergies among the enterprises. This article presents the establishment and application of the platform, which may be referred to in efforts for highly-efficient management of tobacco leaf logistics.

2. Business Design Guidelines

2.1. Basic guidelines

Based on the ongoing tobacco leaf threshing and redrying operations across the tobacco industry and from the perspective of lean management and quality control, efficient cross-enterprise synergies shall



be achieved on the basis of batch management by departing from the raw material formulation of cigarette products and aiming to improve quality data sharing and the consistent process in the course of leave threshing and redrying. More specifically, synergies will be fulfilled in three aspects, i.e., quality standards, business processes and data analysis and monitoring. See Figure 1 for corresponding business framework:

2.2. Basic Practice

With a focus on batch management, synergies will be achieved together with the redrying plants in specific courses of tobacco leaf threshing and redrying based on the basic guidelines for the business framework for synergized threshing and redrying with consideration of the requirements for quality management and information sharing. See the following for details:

2.3. Synergies in quality standards.

By departing from the formulas for cigarette products, demand of the industrial enterprises for raw materials is converted to formula standards, which is to be conveyed to the tobacco leaf threshing and redrying plants.

Stipulation of formula standards: Based on the formulas for cigarette products with consideration of product plans for the future, CTZ defines the standards for formulas in tobacco leaf threshing and redrying and develops corresponding criteria for the selection of tobacco leaves, in accordance with which the plants shall make preparations for the selection of tobacco leaves and the redrying process.

Distribution of formulas: Prior to the commencement of the tobacco leaf threshing and redrying work, CTZ pushes master data and formulas of the tobacco strips to be processed to the front end of corresponding redrying plants via the synergy platform as guidance for preparation of raw materials as well as the tobacco leaf threshing and redrying process.

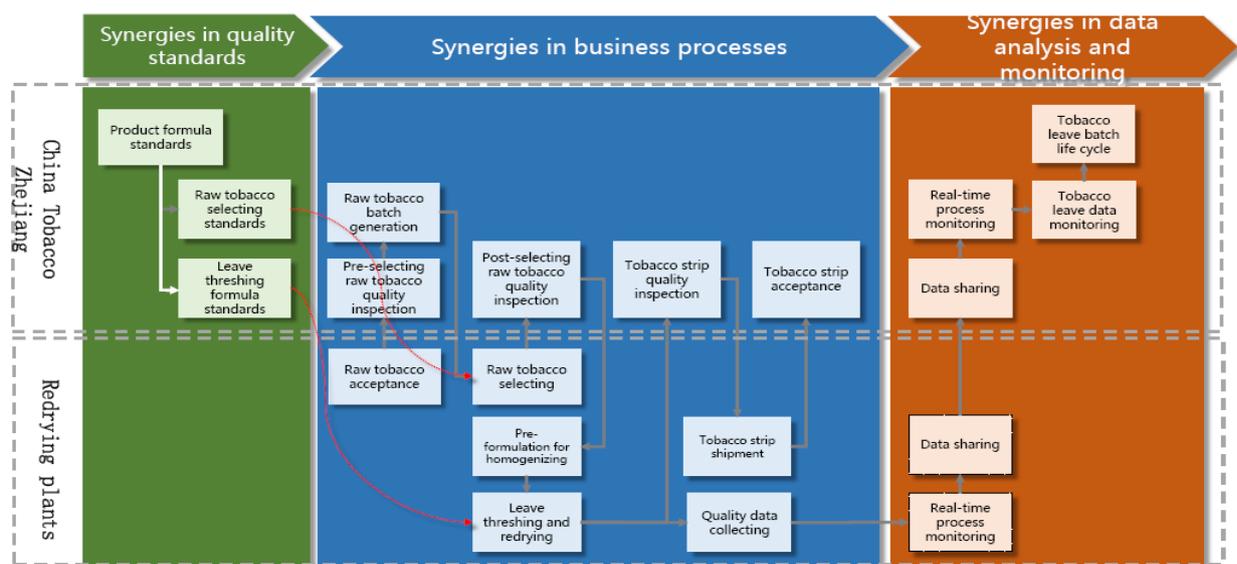


Figure.1. Business Framework for Synergized Tobacco Leaf Threshing and Redrying

2.4. Synergies for business processes:

With a focus on batch management, process-specific synergies will be achieved together with the redrying plants in various courses of tobacco leaf threshing and redrying with consideration of the requirements for quality management and information sharing.

Raw tobacco acceptance and quality inspection: Raw tobacco is accepted at the leaf threshing and redrying plants or central warehouses. On-site personnel from the Department of Material Supply (DMS) creates raw tobacco receipt in “trucks” through the synergy platform and request quality inspection in “trucks” for on-site personnel from the Technical Center (TC) to fulfill physical quality inspection and provide feedbacks according to the inspection requirements provided.

Generation of raw tobacco batches: With approximately 2,000 *dans* (piculs, equal to 50kg) received

as a benchmark, raw tobacco batches are generated by on-site DMS and TC personnel according to place of origin, grade, quality inspection result (truck serial number) and the time of acceptance and must be piled up separately and marked with batch tags on the physical materials.

Raw Tobacco selecting: Tobacco leaves are selected at the redrying plants by batches in accordance with the standards for the selection of tobacco leaves. When selection of a batch of raw tobacco is completed, on-site DMS personnel keep an account of the data on raw tobacco both before and after the selection on the synergy platform and request inspection. Raw tobacco is stacked up by batches upon the quality inspection and marked with batch tags on the physical materials.

Consistent pre-formulation: A chemical indicator testing is conducted for selected raw tobacco by means of the near-infrared testing and control technology. Selected raw tobacco is then pre-formulated on the synergy platform via predetermined algorithm in accordance with the quality requirement for consistent formulas to ensure consistency in the intrinsic chemical indicators of raw tobacco of the same grade.

Feeding for threshing and redrying: Materials are prepared at the redrying plants in accordance with the formula standards for tobacco leaf threshing and the materials must be prepared as per the batches assigned if such batches are provided for in the formula standards. When a given batch is put into the production line for the first time, the grade, batch number, weight and time, etc., of the raw tobacco put into production will be recorded in the synergy platform. Error checking and correction (ECC) will be carried out automatically on the platform during the recording of such information.

Quality data collecting: Based on the redrying processes with consideration of the requirements for consistent processing, CTZ and the redrying plants work together to identify a total of 73 key quality indices, including technical indices for the redrying and processing process, physical and chemical testing indicators, among others, and fulfill automatic collection and display of quality data at the redrying plants through the quality data collection system, which is to be transmitted to the synergy platform in real time.

Completion of tobacco strip processing: Workshop personnel of the threshing and redrying plants print batch barcode labels before the processing of tobacco strips is completed. Such labels shall be stuck to the external package of corresponding tobacco strips upon completion of the processing and the barcode be scanned with a handset device to mark the time when the processing the tobacco strips is completed. Barcode information in the handset device are uploaded to the synergy platform by production shifts and correlated to corresponding Redrying Sheet at the end of each shift of the production.

Tobacco strip shipment: DMS distributes movement of processed tobacco strips according to inventories of the redrying plants and the warehouses in Hangzhou and Ningbo as well as the distribution strategy for brands to be manufactured and creates waybills on the synergy platform based on the movement distribution as instruction for the shipment of tobacco strips.

Delivery picking: Personnel of the redrying plants scan barcodes of the tobacco strips to be transported with a handset device by trucks in accordance with the waybill and upload the batch data of the tobacco strips by trucks, which is to be correlated to the waybills. Meanwhile the synergy platform verifies the grade and amount of the tobacco strips according to the barcode information and the waybills.

2.5. Data analysis and monitoring.

Quality data collected in various stages of business synergies will be made full use of and joint efforts will be made with the tobacco leaf threshing and redrying plants in real-time monitoring and ex post analysis of the business processes.

Real-time monitoring: CTZ conducts real-time monitoring and statistics of the collected quality data so as to acquire information on the quality indices in tobacco strip processing at the tobacco leaf threshing and redrying plants as well as the execution of consistent production on site in a timely manner while the plants are also able to view the same data feedback and display on site and hence collaborate with the on-site personnel in communicating with the workshop floor of the plants in a timely manner to ensure identification of any problem during the course of processing.

Tobacco leaf data analysis: CTZ makes both horizontal and vertical analysis and comparison of

data in each individual processing year at the redrying plants by a variety of analytical dimensions to find out the difference among all the plants in their manufacturing capacity and put forward corresponding instructions for improvement with regard to any drawbacks of the plants in management. The plants generate all sorts of quality statistical statements and statistical analysis reports, e.g., SPC control charts, automatically in response to process requirements, to offer guidance in optimizing the manufacturing processes.

Life cycle of tobacco leaf batches: From the generation of batches upon acceptance of raw tobacco to the sorting of raw tobacco, the consumption of raw tobacco in the course of tobacco leaf threshing and redrying processes, the generation of tobacco strip batches as well as the formation of all quality and process parameters throughout the life cycle of individual batches provide a solid support in full-life cycle traceability and full-life cycle analysis of the batches.

3. Technical Fulfillment of the Synergy Platform

According to the features in the requirements of the synergized operations of tobacco leaf threshing and redrying, it is confirmed that J2EE software system architecture be adopted for system design and development [5]. First of all, a synergy platform is established for tobacco leaf threshing and redrying characterized by a full and complete array of information, strict logics and full scalability. Secondly, this is to be expanded for sharing of data on tobacco leaf threshing and redrying. Lastly, CTZ starts pilot research and facilitates consistent processing in tobacco leaf threshing and redrying through analysis and intensive application of the data from the platform.

3.1. Platform Design

Business demand should be analyzed in great detail during the erection of the platform. Business plans will be designed according to the business demand, which in turn provides the basis for the design of functional architecture. See Figure 2 for the functional architecture.

Functional demand will be met based on the characteristics of the business demand framework. CTZ has made intensive efforts for the research and application of IOT and various information technologies and the design of the technical architecture for the synergy platform of tobacco leaf threshing and redrying. See the following Figure 3 for technical architecture:

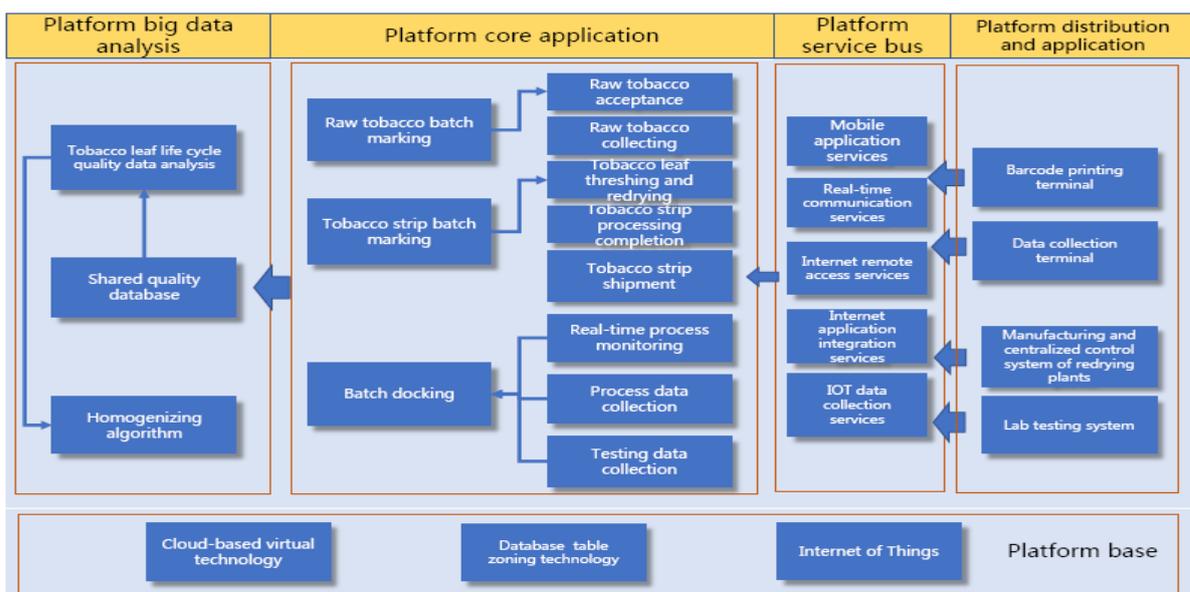


Figure.2. Functional Architecture of Synergy Platform for Tobacco Leaf Threshing and Redrying

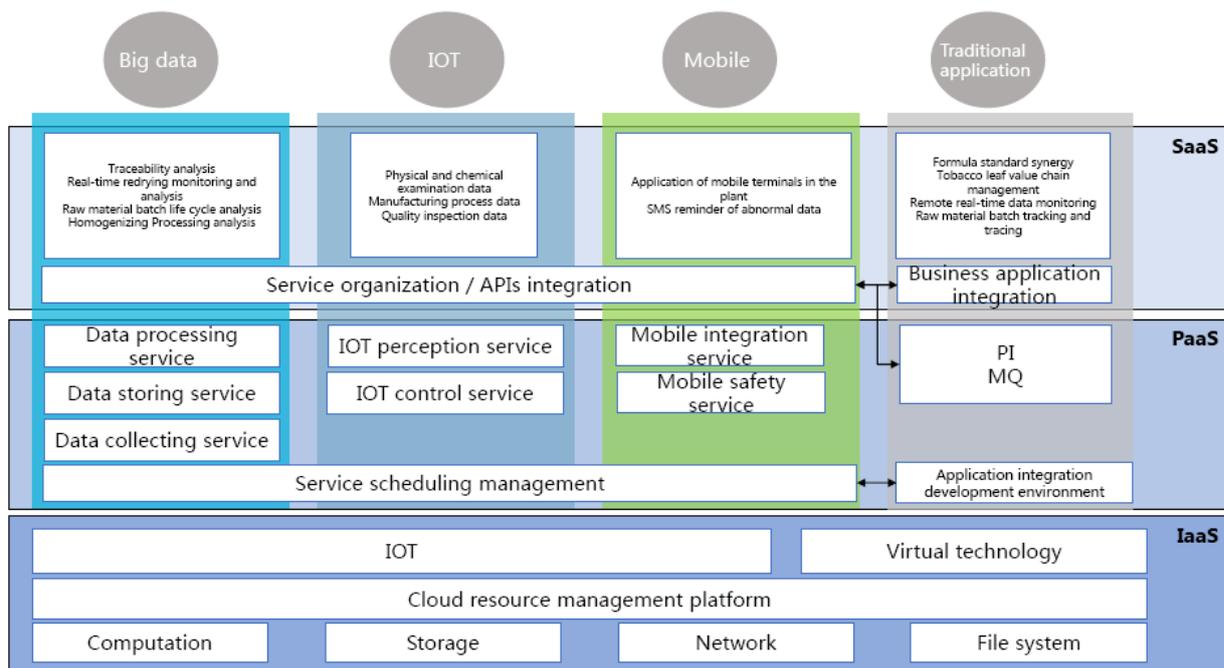


Figure.3. Technical Architecture for Synergy Platform of Tobacco Leaf Threshing and Redrying

3.2. Critical Technologies

Efforts are focused on the research and application of the following critical technologies in the enforcement and promotion of the platform.

IOT technology: On the synergy platform for tobacco leaf threshing and redrying, CTZ uses Code 128 barcode labels as mark of the raw tobacco and tobacco strip batches ^[6] and Honeywell6500 mobile device for data collection. RS232 serial communication technology and TCP/IP communication technology are adopted for instruments and devices in response to physical and chemical testing indices based on characteristics of different equipments. Mobile terminals are used for scanning and identifying the targets, with voice matching the result fed back and identified on the screen. Both online and offline operation models are considered with regard to some functions of the mobile terminals to ensure that business operations are not discontinued due to network failure. The status of the things is perceived when the business takes place and data are uploaded to the server with regard to status control to avoid data lagging, the amount of manual labor as well as poor efficiency due to man-made factors.

Inter-enterprise system integration technology: Mature data exchange software is used as corporate system data bus to build up the data bus channel for the passage of data between systems for less complexity and greater stability of integration. CTZ uses SAP PI as corporate data bus to which CTZ sends the data, whether generated in the course of tobacco strip barcoding, shipment synergy and tobacco leaf threshing and redrying or produced within CTZ's system, before PI distributes the data to corresponding systems. The use of PI as corporate data bus in synergies for tobacco leaf threshing and redrying eliminates P2P interlinks and provides more flexible scalability and stability ^[7].

Big data processing technology: A technology for securing system application functions and performance in case of mass data. In response to the mass data business environment for intensive synergies in tobacco leaf threshing and redrying, MQ is set in the front end of the synergy platform with a data queuing mechanism; quality data in the course of tobacco leaf threshing and redrying are integrated in the database of the synergy platform; mass database is enabled based on the zoning by dates and business scope database for more effective performance in data storage and retrieval; data memory and load-on technology is used on the server-side in case of frequently visited basic information to improve the efficiency of correlated retrieving.

4. Platform Application and Effect

The company has developed an “overall planning, step-by-step promotion and comprehension application” implementation strategy according to the characteristic of the project. In principle, the application will be made available to eligible plants and then to the rest when they are eligible for the application due to the large number of the redrying plants and the considerable difference in business management and information technological standard. The management of raw tobacco batches, sharing of data on tobacco leaf threshing and redrying as well as consistent processing will be enforced successively to result in the tobacco leaf threshing and redrying synergy platform for synergies between the plants and the business. See the following for specific application in various segments:

Raw Tobacco batch management: From 2012, application of raw tobacco batch management, from acceptance of raw tobacco to completion of tobacco strip completion and shipment, is facilitated on site in 25 tobacco leaf threshing and redrying plants, including Xuanwei Plant and Tianchang Plant, which cover the tobacco leaf threshing and redrying business of CTZ.

Tobacco leaf threshing and redrying data sharing: From 2013, sharing of tobacco leaf threshing and redrying data is facilitated and systems have been deployed in nine major redrying plants, including Tianwei Plant and Huidong Plant (covering more than 95% of the output of processed core raw materials for core brands).

Consistent processing: Technical research started in 2014 and application was facilitated comprehensively in five redrying plants, including Xuanwei Plant and Wuyi Plant. Consistent redrying process under near-infrared control in a comprehensive manner in seven processing centers as planned by CTZ, with the processing scale reaching over 2.5 million *dans* (equal to 125,000,000kg).

5. Application Effect

Desirable benefits have been achieved after the effective linkage between CTZ and the redrying enterprises through the platform for synergies among enterprises in tobacco leaf threshing and redrying. The wide use of the platform conforms to the three goals of tobacco leaf threshing and redrying synergies, i.e., “more delicate management, more interactive information and more stable quality” and plays an important role in improving the tobacco leaf threshing and redrying operations.

More delicate management: Correlation of feeding composition of tobacco strips after completion of redrying to quality indices is integrated from grade-based tobacco leaf threshing and redrying management to MPU-based batch full life cycle management and from the discrete management of information on tobacco leaf threshing and redrying to the full-range integrated management of such information.

More interactive information: Information on the entire process from the acceptance of raw tobacco to the shipment of threshed and redried products is obtained in real time by making use of the IOT and Internet technologies to increase the efficiency and accuracy in information interaction and enable further synergies based on highly-efficient interaction of information.

More stable quality: With regard to the quality in tobacco leaf threshing and redrying, traditionally, CTZ provides for standards and requirements and the plants executes and controls the standards and requirements. With support of new technologies, CTZ is more proactive and more deeply involved in the process of tobacco leaf threshing and redrying to ensure stability in the quality of the processing as well as constant optimization and improvement.

6. Conclusion

The platform for synergies in tobacco threshing and redrying, which is based on intensive inter-enterprise synergies, breaks through territorial restrictive factors and establishes a new model for successful intensive interaction between CTZ and the tobacco leaf threshing and redrying plants, leading to manageable, controllable and traceable raw material processing as well as mutual assistance and benefit, which results in better overall profit of the tobacco leaf value chain. This project also conforms to the requirements of the *Protocol to Eliminate Illicit Trade in Tobacco Products* signed by the Chinese Government in 2013 for “tracking and tracing” and is helpful in strengthening the safeguard of consumer rights.

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