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The Direction of Digital Transformation of Nongwei Greens: The Dilemma towards Customer Management or Farm Management¹

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Abstract

Nongwei Greens (hereafter as Nongwei) is the first vegetable and fruit packing plant that get traceability accreditation. Top supermarkets such as Carrefour, Shin Kong Mitsukoshi department store, and City's Super are the major customers of Nongwei. Produces come from 120 hectares of farm, in which a hundred farmers collaborate with Nongwei. With the increase in customer orders, Nongwei suffers from the original documents that process by Excel software. Repeated confirmation of orders takes a lot manpower and time. Inaccurately orders processing lead to loss for produces return and exchange handling. The general manager of Nongwei, Qianyi Huang, begins to think about digital transformation to increase the accuracy and efficiency of the orders processing. On the other hand, Nongwei has been checked by the health units for excessive pesticide residues several times that results from the non-compliance of the pesticide use regulations by the contracted farmers. This results in huge fines and losses. Farm management affects the quantity and quality of vegetable supply. Without digitalization to manage the process of produce planting, and it is difficult to pass verification. Nongwei try to introduce two digital technologies, named "Agrigo" and "Join Farm", to handle the planting and order processing problems simultaneous. However, resources limitation leads to Nongwei unable to introduce these two digital technologies at the same time. Which should be first? Qianyi Huang is in a dilemma.

Keywords: Digital transformation, Intelligent agriculture, Exploitative transformation, Exploratory transformation

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Case

“This season’s bell papers are somewhat plump. They seem to be ripening quite well!” Nongwei Greens Co., Ltd. (hereinafter, Nongwei) General Manager Huang Qian Yi remarked to this effect while in the process of discussing the quality and production of this season’s crops with contract farmers at a greenhouse located 1,000 meters above sea level in Xinyi Township. In order to overcome usual scenario whereby fruits and vegetables need to be continuously harvested, making pesticide management problematic, Nongwei successfully has integrated the Traceability System into its fruit and vegetable assembly plants as well keeping a close eye on the Farm management of farmers in order to avoid excessive pesticide residues contaminating agricultural products; in doing so, the company avoided damaging its business reputation and impacting customer relationships. In 2017, Nongwei was awarded the honor of serving as the Traceability System vegetable supplier for Athletes’ Village, Summer Universiade Taipei, while in 2018, they served as the Traceability System vegetable ingredient supplier for the National Agricultural Conference. However, alongside an ever-increasing production volume, pesticide residues have been detected within this output multiple times, resulting in fines for the company being imposed by health agencies. Accordingly, it is Huang Qian Yi’s responsibility to pay strict attention to the quality of farmers’ crops, so he felt passionately that, in the absence of an adequate information base, passing the various inspections would prove difficult.

Furling his eyebrows, Huang Qian Yi glanced at the message on his Line app which said, “There are problems with the supermarket orders again!” Nongwei is currently the fruit and vegetable supplier for supermarkets such as Carrefour, Shin Kong Mitsukoshi, and City’Super. However, because the orders are processed manually, due to human error, they are often entered incorrectly, resulting in an annual loss from product returns and exchanges of 4 million NT\$. This is an issue that has given Huang Qian Yi massive headaches. In addition, the large supermarkets have even threatened to reconsider their supply relationship with Nongwei. Sighing, Huang Qian Yi thought, “Is the time due to switch from manual processing to digital software?”

Information companies have introduced two systems, “Agrigo” and “Join Farm”, to respectively help process order management at the customer end and Farm management issues at the supply source end. However, because Nongwei is limited both in terms of size and resources, it is unable to carry out the simultaneous implementation of both systems. Therefore, one could ask the following questions: “Should ‘Agrigo’ first be introduced to reduce the error rate for processing of customer orders? Or should ‘Join Farm’ be first introduced to strengthen Farm management? Which should come first?” Huang Qian Yi was at a loss to find an answer.

1. Farm to Table: The Fruits and Vegetables Traceability System Value Chain

The fruit and vegetable value chain from upstream and downstream can be divided into the four major stages: planting, distribution, channel, and consumer. Firstly, there is the planting stage, the foundation of agricultural value activities. For a long time, farmers planted or managed crops on owned or leased land according to their specifics or field suitability in regard to the provision of crops such as rice, grains, vegetables, or fruit to the Taiwanese people. Secondly, there comes the distribution stage for agricultural products, of which the main members are “distributors”, “distribution organizations”, and “traders”, among others. In the past when crops were harvested, farmers had to independently transport them to distribution organizations such as traders, farmer’s associations, or production and sales cooperative societies, who then exported them to fruit and vegetable wholesale markets for sale to consignees. Later, distributors who engaged in long-term collaborations with farmers emerged, with Nongwei playing this role, along with other companies located in Xiluo such as Sun Fresh and Han Kuan Agriculture. These operators send the crops harvested by farmers to the collection freight yard to undergo value activities such as the tallying, precooling, packaging, and inspection of goods. However, in order to ensure the stability of production and quality, a portion of manufacturers introduce Traceability Systems to cooperate with farmers.

The third stage involves channels. The work of channels focuses mainly on the storage, shelving, sale, and servicing of consumer purchases of fruit and vegetable products and can be split into traditional and modern channels. Traditional channels refer to retail markets (for example: general traditional markets), and modern channels refer to supermarkets and mass retail stores (for example, Shin Kong Mitsukoshi, City’Super, Carrefour, and PXMart, and others). Generally speaking, most farmers associations, production and sales collaborative societies, and traders send fruit and vegetables to fruit and vegetable wholesale markets and traditional channels for auction, while distributions mainly focus on modern channels through which fruit and vegetables are sold directly to caterers and restaurants. The final stage involves the consumer, a term which refers to general family consumers, group caterers, and restaurants, among others, and are the main purchasing group for the retail of fruit and vegetables. Because fruit and vegetables are circulated and sold by a wide variety of sources, and the field equipment, management capabilities, and cognition of each region are all different, risks are highly likely to occur in certain areas, such as pesticide residues and broken cold chains impacting agricultural product quality and freshness. However, with the current increase in food safety awareness, the choice for consumers of safe, fresh, and high quality food products has already become the prevailing market trend. Whether it’s a consistent operating procedure spanning from the farm to the dining table, a transparent production and sales process, or tracing and tracking capabilities, the industry’s primary purpose is to allow customers to consume food free of worry.

2. Makeup for Fruit and Vegetables: Becoming the First Fruit and Vegetable Assembly Plant to Obtain Traceability System Verification

Nongwei is a fruit and vegetables supply factory which was established by Huang Qian Yi and his wife Yang Suqin in Xiluo, Yunlin County in 2006, a process which involved Yang Suqin assuming the role of vice general manager, vegetable packaging being the company's main business. Initially, the company specialized in supplying packaged fruit and vegetables to large-scale distributors for sale to the large-scale chain store "Carrefour". Nongwei first purchases fresh vegetables from farmers from the production site, after which, according to the specifications of distributors, the products are assembled, packaged, and sent to distributors for distribution to Carrefour stores across Taiwan. In addition, because it adopts an OEM method, Nongwei must ensure that agricultural products purchased from the field meet specifications and food item and quality standards, and must also have the capability to carry out the assemblage duties given by distributors. As a result, in addition to procuring from the market, Nongwei also contracts farmers so as to control vegetable quality.

Nongwei specializes in the contracting business. Initially, the contract orders received by the company were mostly small-batch orders that large-scale distributors were unwilling to accept. However, as the quality of its agricultural products gradually gained the recognition of consumers, Nongwei's contract orders increased steadily, with the growth proving sufficient to eventually attract supermarket practitioners to reach out to conduct supply negotiations. From 2006 to 2007, the year-to-year (YoY) contract revenue reached 440%. However, there were also drawbacks to running a well-respected contracting business. For example, for several years the contract volume for baby corn alone exceeded 100 tons, a volume sizable enough to justify directly importing baby corn from Thailand. Additionally, a large contracting volume tends to cause distributors to retract the contracting business for that product, resulting in the instability and decline of the business. In response to these transactional uncertainties, Nongwei decided to take advantage of its ability to provide quality products by starting to directly negotiate with supermarkets. Nongwei also announced a brand slogan stating "Shen-Tu-Bu-Er" (In Chinese, this slogan is a phrase that speaks of the intimate connection between the human body and the environment, with the meaning extendable to the support of local production and the love for Taiwanese agricultural products). Nongwei also self-identified as a "fruit and vegetable supplier with Traceability System circulation and assembly verification", and also as a vegetable makeup artist. On that subject, Huang Qian Yi stated,

"From the baskets upon baskets of vegetables plucked from the production site and brought to the factory, our staff are capable of skillfully separating and selecting products. We have established SOPs for the packaging of every type of agricultural products for our packing staff to follow. Using mini bell peppers as an example, we ask the questions, 'How do you pack them so that they look more colorful and have better aesthetic quality, and how do you turn an originally average looking product into a beautiful one?' We are therefore fruit and vegetable makeup artists whose task is to make vegetables shine brightly on display shelves, in turn increasing product value. Although such work processes are likely to lead to an increase in various packaging costs, the products have a voice of their own and good products also help us find more customers. As a result, we have earned the favor of many department stores and supermarkets. We are also the first fruit and vegetable assembly manufacturer in Taiwan to obtain Traceability System circulation and assembly verification, while our products have successfully appeared on the shelves of high-unit-price supermarket channels like Shin Kong Mitsukoshi and City' Super."

The Traceability System vegetables supplied by Nongwei occupy roughly 5% of the total number of labels in Taiwan, and its recipients include large chain stores, supermarkets, school meals, and large group meal caterers. From packaged vegetables weighing tens of kilograms to bulk businesses comprising over ten thousand people, their vegetables are sufficient to satisfy everyone's needs. Currently, the number of cooperative vegetable farmers on the production end is 100, and their contract area is roughly 75 hectares. The Traceability System verification cooperative planting area is over 120 hectares, and is distributed across Yunlin County, Nantou County, Changhua County, and Pingtung County. The crops include mini bell peppers, cucumbers, beefsteak tomatoes, sweet beans, bell peppers, potatoes, carrots, onions, cabbage, broccoli, and romanesco cauliflower, among others. Currently, Nongwei's main products are Traceability System cucumbers and mini bell peppers. The production volume for cucumbers is 10,000 kilograms per week, with the supply amount reaching 5% of the national total in 2017, while the production volume for mini bell peppers is 8,000 kilograms per week. These two products both use greenhouse cultivation and year-round harvesting. Using the experiences he gained over many years as an executive for Carrefour's fruit and vegetable department, Huang Qianyi accumulated production site information, learned about the quality and packaging needs of consumers, and ultimately led 30 employees to enter the agricultural product supply chain, which is differentiated into the following departments: marketing administration, merchandise procurement, factory packaging, and market sales departments, along with others. (please reference Figure 1 for the organizational structure).

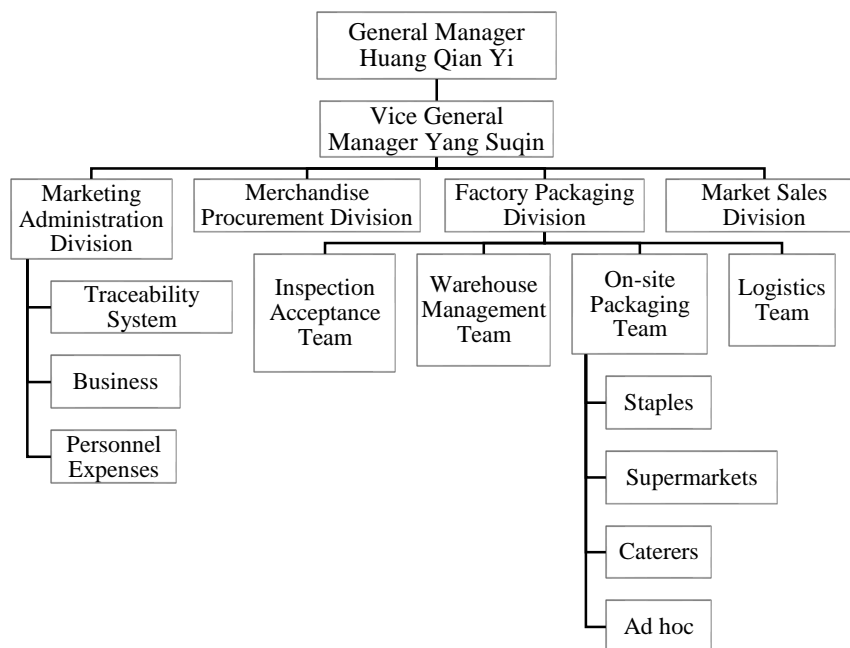


Figure 1 The Organization of Nongwei Greens

3. Pesticide Residues Reflect Farm Management Issues

Fruit and vegetables such as cucumbers and small bell peppers are continuously harvested, while the Farm management of fruit and vegetables is also more complicated compared to ordinary crops. Regarding rice or other single-harvest crops, it is sufficient to determine accurately the safe harvest period. However, because continuously harvested crops requires the use of pesticides during the harvest period, pesticide control is relatively more difficult. Therefore, farmers must strictly abide by the usage regulations for crops during the planting and harvesting periods. In the past, because contract farmers failed to abide by the usage regulations for pesticides, health unit inspections found that pesticide residues exceeded the accepted level by up to a frequency of 3 to 4 repeated violations within a month, causing Nongwei to suffer substantial fines. The business focused on contracting thus underwent a change in 2014. Huang Qianyi said.

“Our gross profit margin as a vegetable contractor for distributors is only 2%. In 2014 Nongwei was fined 180,000 NT\$, which, if used in calculations, a contracted production of 9,000 boxes would be needed to recoup 180,000 NT\$. However, the gross profit margin for distributors ranges from 10% to 15%. Meanwhile, the responsibility and penalties for excessive pesticide levels is borne completely by myself. This is totally unreasonable. Therefore, I have decided to reduce the proportion of contracting and to introduce a Traceability System.”

Contract profits are meager and carry an enormous penalty risk, which indeed is a big blow for Nongwei. In order to keep track of the production process and volume, Yang Suqin, the person responsible for communicating and coordinating with farmers in the field, had already started to contract farmers. At the same time, in order to connect with the upstream production end and establish a stable supply chain that is safe and also focuses on planned production, cooperative farmers had to be asked to join the “agricultural product Traceability System”. However, upon observing the state of the production and operation management of contract farmers in the field, many difficulties (Table 1) were discovered. Yang Suqin commented,

“Nongwei’s adoption of the Traceability System began in 2015, with the area covered gradually increasing every year. At the southernmost, the growing of onions takes place in Checheng, Pingtung, with the main production region being Yunlin, while, Chiayi, Changhua, and Nantou are also counties where significant production is carried out. In order to ensure year-round supply, Nongwei’s contract farms in the Renai and Xinyi townships in Nantou plant bell peppers and beefsteak tomatoes, while Nongwei’s main produce of cucumbers is only grown in Yunlin by adopting greenhouse cultivation and production methods. We believe that the current method for resolving Farm management issues is inadequate. Besides, it consumes manpower, is inefficient and inaccurate, and the exploration of other solutions is required to assist contract

farmers in production. Therefore, our first task is to introduce the Traceability System to all contract farmers.”

Table 1 The Difficulties of Farm Management

Problem	Explanation
Dispersed land and difficulties in production and operation management	Contract farmers are dispersed in different regions. The crops grown are different, and different crops also have different production operating procedures. The production process lacks a SOP and product quality is inconsistent.
Unable to keep track of cultivation conditions and difficulties in production schedule management	Fields are dispersed; field operation conditions are unable to be managed and controlled. Large errors in crop yield estimates; inconsistent supply and demand; prices are subject to fluctuation, resulting in unstable revenue.
Field recordation consumes time and effort; difficulties in the management and control of fertilizer and pesticide use.	The use of pesticides and fertilizers for management and control requires recordation. The awareness of food safety is constantly increasing. Thus, the question of how to strictly control the use of fertilizers and pesticides on agricultural products in order to provide safe and reliable agricultural products is critical.
Farm management is difficult.	Farm management information is unable to be displayed on the same interface and requires manpower to compile and summarize, which is disadvantageous to future Traceability System tracing.

Farm management work mainly involves the recordation of the agricultural product production process, including the recordation and management of crop varieties, times, and fertilizer and pesticide use, field climate and soil changes, and the monitoring and reporting of production volume and quality. The establishment of farm production records during the process of the repeated collection and summarization of related data in turn allows for a complete and accurate understanding of field production resumes. The Traceability System for agricultural products refers to the complete record of an agricultural product’s production, processing, packaging, circulation, and sale: that is to say, it is the construction of a transparent, traceable, and safe and consistent certification system for publicizing all of the production and sales information of agricultural products spanning all processes from Farm to table. After Nongwei adopted the agricultural product Traceability System, contract farmers were required to produce crops in accordance with the Taiwan Good Agricultural Practices, or TGAP, as well as accept third-party verification and upload product information onto the “Taiwan Agricultural Product Safe Traceable Information Network” so as to provide consumers with all production and sales information regarding Traceability System crops. In addition, certification institutions assist farmers in carrying out product certification and obtaining certification badges, as well as in sampling soil and irrigating water resources and agricultural products, and also review whether farmers carry out production processes in compliance with TGAP. Meanwhile, farmers must accurately record the Farm management production process in order to obtain the authorization from certification institutions to print barcode stickers and ultimately affix the “Traceable Agricultural Products Label (TAP Label)” onto products.²

After considering the correlation between pesticide usage and crop pests, Nongwei also collaborated with the Taiwan Agricultural Chemicals and Toxic Substances Research Institute to implement Integrated Pest Management (IPM) on the contract farmer end. From problem diagnosis to prescription and usage to monitoring and prevention, various methods and management models are used to carry out pest prevention and treatment, including cultivation control, biological control, chemical control, and physical control, allowing farmers to learn that there are ways to control pests other than the use of large amounts of pesticides. The application of an improved medication concept is not only environmentally-friendly, but can also create a win-win result for farmers and consumers.³

Nevertheless, the promotion of the new system was not a smooth process. At the beginning, the farmers were unable to adjust their old habits, and also displayed much resistance. Yang Suqin, who is responsible for communicating with farmers on the field end, remarked,

“It’s not that all contract farmers are willing to accept the IPM method. Upon seeing pests, many farmers will still directly use pesticides; this occurs at a frequency of twice a week in serious cases, while they even simultaneously use many types of pesticides. In order to correct these practices, we must irregularly hold

² Chen, Chi-Ruei (2008), “Implementation result of agriculture and food Traceability System in Taiwan,” (accessed March 25, 2022), [available at <https://www.coa.gov.tw/ws.php?id=13700>].

³ Agriculture Science & Technology Decision-Making Information Platform (2021) “Promoting IPM for Agriculture sustainable management to against highly dependent on pesticide in Japan,” (accessed March 25, 2022), [available at <https://agritech-foresight.atri.org.tw/article/contents/3696>].

farm observation and learning activities to allow farmers to observe correct farm methods. For example, we must educate them as to how to avoid the pesticides from neighboring fields from spreading out and polluting their own fields, as well as how to control pesticides during continuous harvests. In the beginning, everybody felt that their techniques were good, and that the revenue was also fair, so they felt that nothing needed to be changed. It wasn't until they saw that other people's pesticide usage is one-half or one-third less than theirs, and that others produce cucumbers that are long and pretty while their cucumbers are short and have pesticide residues on them, were they convinced and willing to consider the use of IPM."

The introduction of the Traceability System not only contributed immensely to Nongwei's revenue, but also attracted large-scale supermarket channels and restaurant practitioners, such as Carrefour mass retail stores, PXMart, Yumaowu, and Wowprime Corporation to actively negotiate with them. The City' Super supermarket introduced by Far Eastern Group took a liking to Nongwei's Traceability System products, allowing the company's products to not only be sold in Taiwan, but also imported to stores in Hong Kong, Singapore, and other regions. In turn, this opportunity allowed Nongwei to introduce the Global Good Agricultural Practice (Global GAP) system to support the export of company products. As the business becomes increasingly large, the number of contract farmers will inevitably increase, after which old software will no longer be able to meet the accuracy needs of production and management in the future. As a result, only through carrying out digital transformation of Farm management can Nongwei continue to use accurate statistics to increase the quality and quantity of agricultural products and extend competitive advantage.

4. The Difficulties of Customers on the Channel End

Most of Taiwan's agricultural businesses are medium or small in scale and generally have a low inclination to use information systems. Due to limited capital, most are hesitant towards the idea of building digital management processes and investing in related maintenance projects.⁴ As with the majority of businesses, in order to save money, Huang Qianyi chose to use Excel, the market's most popular software and also the one he is most familiar with, to carry out order, purchase, and shipment, and other processes. Such work includes recording the number of transactions and contracts with logistics companies and supermarkets; the production plans, records, harvesting periods, and estimated production volumes for contract farmers; and internal company production records, external quotations, and farmer bonuses. On this topic, Huang Qian Yi remarked,

"I am not only a general manager, but also hold the position of an information manager. Initially, I did not think it would be a big problem. If there were issues, I would correct them one at a time. However, once the business expands to a certain stage, Excel is no longer enough to manage the ever-increasing amount of information and files. Searching for information becomes very difficult, and a lot of information cannot be obtained immediately. Sometimes, in order to find a particular statistic, an entire day must be spent on comparison work. It really is very unsatisfactory and wastes too much time."

Noticing that Excel was no longer of sufficient use and that he himself was engaging energetically developing new customers, Huang Qian Yi knew that he could no longer assume the role of information manager within the company. Through a friend's recommendation, Huang Qian Yi became acquainted with an Information Technology (IT) company based in Taipei that could provide package invoicing software to replace Excel. However, contrary to expectations, processing delay issues started to surface after using the new software for just a year. Because the one-year warranty period had already passed, the Information Technology (IT) company was indifferent towards Nongwei's demands for repair of software malfunctions, which proved to be an even more painful experience than when using Excel. Additionally, functions were unable to be modified based on the logic of agriculture businesses thought. At this point, Huang Qianyi realized that the only solution was to find someone who understood the agriculture business to help create a customized information system.

Nongwei's customers are primarily supermarkets and mass retail stores. Due to consideration for information safety, supermarkets do not use their own ERP systems to send electronic bills, so procurement personnel can only use traditional print orders when working with suppliers. Director Liu of Shin Kong Mitsukoshi Taipei Tianmu Store commented,

"We often see suppliers sending the wrong products to the supermarket. Under reasonable conditions, we will help to retrieve the products. However, we couldn't help but feel that they just wanted to load their products on us, which made us feel very perplexed. After inspection, we found that they often misread the purchase orders that we gave to them. They really need to think about how to accurately deliver the products we purchased. If the fines cannot be resolved, then we have no choice but to switch suppliers!"

As it currently stands, Nongwei's business at the customer end is becoming more prosperous by the day. However, due to inaccuracies in the procurement process, mistakes are often being made, resulting in the issue of compensation. To this end, wish the new digital system can reduce the frequency of error, improve real-time warehouse management

⁴ Chen, Mei-Yue (2022), "Design and Application result of Agribusiness Enterprise Resource Planning system," (accessed March 25, 2022), [available at <https://www.coa.gov.tw/ws.php?id=2445500>].

capabilities, accurately keep track of operating costs, and optimize customer usage experiences. Huang Qian Yi said,

“After we send the quotes to supermarkets and department stores, all the items will be printed out, taking up roughly 6 A4 pages. Supermarkets cannot buy all of the products, and usually order about 5-6 items on each page which are photographed and sent to us by Line. However, in the end, this process often results in shipment errors and product exchanges, resulting in an annual loss of roughly 4 million NT\$. Such mistakes not only cost the company, but also impact the mood of our staff in the factory. Once the workers lose confidence, they are likely to resign. Therefore, the connection between the factory and sales ends must be digitized in order to avoid mistakes, having to compensate for losses, and to reduce the manpower consumption for product exchanges.”

5. Entering the Path of Digital Transformation

According to a survey conducted by the Agricultural Technology Research Institute, the degree of digitization of the agricultural industry as a whole fall within the low-to-medium stage. Most agricultural practitioners and enterprises are not even familiar with the concept of digital transformation. Many agricultural enterprises believe that the cost of transformation is too high and that personal budgets are limited, and are unclear as to the benefits of agricultural digital transformation. In addition, they lack suitable collaborative partners and are unable to find both talented information professionals and suitable systems that meet their needs, while the employees also protest against any change. As a result, many agricultural enterprises that attempt digital transformation tend to give up.⁵

During a gathering hosted by the Council of Agriculture, Nongwei came into contact with a company that understands the needs of agricultural enterprises, Ling Cheng Technology. Ling Cheng was informed of Nongwei’s dilemma regarding digital transformation and recommended several products. With Nongwei as the nucleus, downstream extends to the customer-end with “Agrigo” (hereinafter, Agrigo) and upstream to the field end with the “Join Farm” system (hereinafter, Join Farm). The comprehensive framework of Nongwei’s digital system plan is as shown in Figure 2.

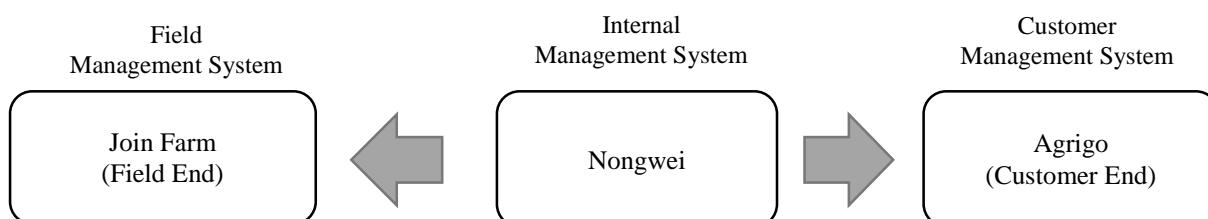


Figure 2 Nongwei’s Digital System Framework

5.1 Agrigo System

The “Agrigo system” can resolve most of the errors caused by traditional order models. In the past, telephone and fax quotations were directly used for customer transactions. After the quote or order was received on Line or through email, it would be manually registered using human labor. However, human processing commonly leads to errors in order placing, which further leads to return costs, an increase in customer complaints, and a reduction in customer satisfaction. After the Agrigo system is set up, the procurement personnel of various supermarkets or other customers are responsible for installation, after which various supermarket branches are able to place orders for the food items they need. Once the orders are received, Nongwei then downloads the sales statistics tables and print labels to provide to the factory for packaging and tallying.

It is estimated that the introduction of the Agrigo system will bring the following benefits: 1. Losses have been incurred from supermarket chain penalties and product exchanges and returns originally amounted to 4 million NT\$. However, after introducing, the system can reduce the order error rate, with the goal being a 15% reduction for the first year and a year-by-year decrease of 300,000 NT\$ starting from the second year; 2. Because orders are automatically connected to ERP, the equivalent of 1 order personnel is saved. Considering a monthly employee salary of 30,000 NT\$ in addition to a year-end bonus, an estimated 390,000 NT\$ in manpower costs can be saved per year. In addition, Ling Cheng provides an after-sales 2 year warranty period for Agrigo. After 2 years, the monthly system maintenance fee becomes 30,000 NT\$, which is then reduced by 5% annually. Based on Nongwei’s total estimated expenses for introducing the 2 million NT\$ Agrigo system, and the total hardware fees, including computer equipment, servers, and

⁵ Cloud Generation-Agriculture Digital Transformation platform, (accessed March 25, 2022), [available at <https://agdigi.atri.org.tw/>].

firewalls, costing 1.19 million NT\$, it is estimated that a positive cash flow can be produced in the second year.

5.2 Join Farm System

The Join Farm system is a smart production solution that is capable of completely replacing the Excel software used previously by the company. It can also be operated by mobile and tablet apps, and thus uses mobile digital management to assist farmers in the establishment of standard operating procedures. In addition to Farm management, system functions include seedling management, resource implementation, warehouse management, production period and volume estimation, cost calculation, and productivity indices analysis; also included are real-time environmental statistic monitoring functions, GPS positioning of land, and hourly weather forecasts, and the ability to collect farm environment statistics at any place and any time. Join Farm's AI integrates statistics and Traceability System of contract farmers to compute strategies for planting management, allowing for a more accurate management of the production of contract farmers and also allowing the company to meet Traceability System and Global GAP requirements. Furthermore, it is estimated that the expenses needed to incorporate Join Farm are an estimated annual software fee of 1 million NT\$ in addition to an estimated field sensor hardware and equipment installation fee of 30,000 NT\$. In addition, it is estimated that 50 farmers will use the system in the first year, with this figure increasing by 10 additional farmers each year, eventually rising to a total of 100 farmers by the sixth year. The estimated unit price for the smart mobile operating software used by farmers is 20,000 NT\$. In regard to the software maintenance fee, the first two years are free of charge, while starting from the third year, the price will be set as 15% of the software price, which will then be decreased by 5% annually starting from the fourth year. On the matter, Huang Qianyi said,

The Join Farm system requires the installation of sensors on fields. We will install them on a couple of fields as a test and collect and analyze data before deciding whether to install them comprehensively. In addition, all expenses are borne by Nongwei as long as they are fields included in the production plan. Cooperative farmers do not need to sign a contract with Nongwei. If their conditions improve in the future, they can leave the team at any time, and farmers who do not comply with the company's policies or meet the targets set by the company can terminate their cooperative agreements. As to the effect on production volume, we estimate that the use of Join Farm can increase the production volume by up to 7%, although production volume is also related to cultivation area.

The introducing of Join Farm not only simplifies the Farm management of Nongwei, but also helps to increase the production volume of vegetables. Using Nongwei's main produce of cucumbers as a reference in calculations, because during the first year data collection and the establishment of parameters are required, it is difficult to increase production volume in a short period. However, it is estimated that during the second year the total production volume will increase by 1%, and then 3%, 5%, 7% and 7% in the period from the third to sixth year. The total estimated production volume for cucumbers is then 520,000 kilograms, and 416,000 kilograms for mini bell peppers. Bearing this in mind, if the year-round unit price for cucumbers of around 60 NT\$ per kilogram and 120 NT\$ per kilogram for mini bell peppers is used in calculations, starting from the fifth year of Join Farm integration, it is estimated that the combined revenue gained for cucumbers and mini bell peppers will increase by 5.67 million NT\$.

In addition, after the introduction of Join Farm, Traceability System information will be directly uploaded by farmers onto the system, following which, management personnel will only need to audit and distribute products. Due to such a function that integrates product receptionists, in-factory inspections, and Traceability System, the manpower for Traceability System management employees is expected to be reduced from 2 persons to 1 person. If a monthly salary of 30,000 NT\$ in addition to a year-end bonus is used in calculations, 390,000 NT\$ in manpower costs could be saved each year and a positive cash flow is expected to be generated by the fourth year. In the future, the Traceability System team in the "Marketing Administration Division" will be moved to the newly established "Farmer Assistance Division" in order to integrate Nongwei's field capabilities from before and after transformation. For instance, in addition to continuing to provide Traceability System guidance to contract farmers, Nongwei Company will use the analysis results of Join Farm to guide new and existing farmers to deepen their field planting techniques and drive more accurate production, with the goal being to expand contract areas and increase production volume.

In addition to the above tangible benefits, the use of big data analysis allows Nongwei to explore field knowledge of fruit and vegetable planting, monitor whether contract farmers are applying fertilizers and pesticides on the field in accordance with instructions, gather data on the changes in field soil, and acquire new knowledge such as the correlation between climate and fruit and vegetable growth. At the same time, understanding knowledge of Farm management and of production parameters allows Nongwei to align itself with the needs of modern channels and customize fruit and vegetables according to special factors such as the regulations of the market and periods for promotion. This, in turn, allows supermarkets and contract farmers to form an ecosystem for the co-creation of value, increases the conversion cost between the supply end and customer ends, and also allows the company to have greater control of the production process from the field to channels and increase the threshold for competition.

6. Should Digital Transformation Be Geared Towards the Customer End or the Field?

After comparing the cost benefit analysis of the two solutions, Huang Qian Yi found it exceedingly difficult to

make a decision. He said,

“The issues at the customer end really are urgent. The distributors seem unable to take it for much longer. If the company wants to grow and evolve, it cannot rely on manpower. Meanwhile, although the introduction of Agrigo will, for the most part, require capital investment during the first year, with funds reaching nearly 3.2 million NT\$ and causing a heavy burden on the company, the error costs saved during the first year amount to 600,000 NT\$ (15% of 4 million NT\$) while the manpower savings amount to 78,000 NT\$. If we do it immediately, we will see benefits within a very short period, and there will then be a positive cash flow during the second year.”

However, Yang Su Qin, the person in charge of Farm management, took exception to this,

“The introducing of Join Farm will allow production volume to increase every year, along with which, revenue will also increase, while it can also save manpower. The climatic conditions are constantly changing and pests are ever present. We have to consider the requirements of Traceability System as well as conditions in the field when providing farmers with suggestions on fertilizer adjustments, which makes life very difficult for our colleagues on the field. To maintain production advantage necessitates a tool; it is insufficient to rely on experience. Therefore, I advocate in favor of the introduction of Join Farm”.

Huang Qian Yi replied to this:

“I understand that we need accurate field analysis data to forecast production volume and make production and marketing adjustments. However, Join Farm requires a capital investment of over 1 million NT\$ per year, and the supposed improvement in production volume right now is only an estimate. This is in addition to the fact that the educational training at the farmers’ end requires considerable effort. Will it really produce the effects that we anticipate? This is hard to know. Why don’t we implement Agrigo first? Wouldn’t this be easier?”

Yang Suqin raised the decibels of her voice with the following comment,

“Farm management is our competitive advantage. Don’t forget that the competition is very fierce. This is especially the case when the smart agriculture business is currently on an upward trend. “If we first implement Agrigo but our competitors beat us to the introducing of Join Farm and steal away our farmers, what would be the point of having Agrigo?”

Huang Qianyi then remarked:

“Dear wife, there isn’t only the problem of field competition. If Join Farm is implemented first to secure farmers, we will gain a competitive advantage, but if we don’t adopt Agrigo, we will continue to be fined by distributors or even be taken off the shelves. What would then be the point in using Join Farm?”

Not willing to admit defeat, Yang Suqin countered,

“Enterprise management cannot be too short-term. Long-term strategic thinking must be used to achieve sustainable management. The prioritization of Join Farm is seriously needed right now. Otherwise we will regret it.”

Huang Qianyi replied,

“I understand everything you have said. If the adoption of Agrigo goes smoothly, it can, in the long run, help Nongwei step into e-commerce, enter the B2C market, and directly sell agricultural products to consumers. However, Nongwei’s resources are currently unable to take on the introducing of two systems. Of course, if I could, I would want to incorporate both at the same time! Is there anyone that can help me?”

7. Student Pre-Class Discussion Questions

- (1) Please describe the value chain for the fruit and vegetable industry as well as the main role and function of distributors.
- (2) What are Traceability Systems? What are its’ main functions and values?
- (3) Why does Nongwei want to incorporate digital technologies? Please carry out analysis from the perspective of internal and external management and explain the benefits that digital technology introducing brings to the company.
- (4) Please explain the contents of the two solutions of Agrigo and Join Farm and analyze the differences between the two solutions in terms of implementation strategy.

- (5) Please attempt to list the costs and benefits for the two solutions of Agrigo and Join Farm over the course of six years according to the information provided in the case.
- (6) Please carry out a comprehensive analysis of the advantages and disadvantages of Agrigo and Join Farm from the perspective of benefit indicators and management strategies and offer a suggestion for Nongwei as to whether to first implement Agrigo or Join Farm. Or could there be another solution? Please provide your reasons.

Teaching Note

1. Case Summary

Nongwei is Taiwan's first fruit and vegetable assembly plant to obtain "Traceability System Circulation Assembly Certification"; as well as a supplier to Carrefour and other large-scale supermarkets; additionally, it was also previously the Traceability System vegetable supplier for Athletes' Village, 2017 Summer Universiade Taipei, and the Traceability System vegetable ingredient supplier for the National Agricultural Conference in 2018. Nongwei is currently actively investing in digital transformation. On the one hand, the demands from channels seem to suggest that the company should first actively focus on the customer end by introducing the "Agrigo" system to reduce the large fines produced by order errors and to optimize customer relationships. On the other hand, issues of pesticide residues and Traceability Systems at the field end are also in urgent need of resolution. To this end, the introduction of the "Join Farm" system could assist in the smart management of contract farmers and increase production volume and product quality; by means of big data analysis, the company could conduct more accurate production and sales planning, thereby improving its competitive advantage. Moreover, considering the trend of the upgrading of the agriculture industry, if competitors take the lead by first incorporating smart agriculture, Nongwei's clients in the field may quickly be snatched away. From the perspective of the cost and benefit analysis of financial investments, as well as medium and long-term business strategy, it is indeed the case that the introducing of the two systems each have their advantages and disadvantages. However, because small-to-medium sized enterprises are extremely limited in terms of resources, it is impossible to implement both solutions at the same time. Thus, this was a difficult decision that greatly troubled Nongwei General Manager Huang Qian Yi. Should he first focus at the customer end with Agrigo, or Farm management with Join Farm?

2. Teaching Objectives

The case study's teaching objective is to use the investment decision of Nongwei's General Manager Huang to discuss the particular paths regarding digital transformation selected by Taiwanese enterprises in circumstances of limited resources. This decision influences the chronological order of digital investments and can further guide student consideration regarding a digital transformation strategy. The estimated discussion time for this case is 100 minutes. In terms of teaching strategy, the three stages including icebreaker activity, question discussion, and ending can be used. The discussion questions and time allocations are described below.

- (1) Icebreaker and warmup: Start with the experience and familiarity with Traceability Systems and discuss the industry chain that deals with processes spanning the stages from the field to the dining table. (15 minutes)
- (2) Why must Nongwei incorporate digital technologies? What problems and challenges did this company face? (15 minutes)
- (3) In regard to Nongwei's digital transformation, what are the differences in the system contents of and implementation strategies of Join Farm and Agrigo? (20 minutes)
- (4) How should the two solutions be evaluated from a financial investment perspective? (20 minutes)
- (5) How should they be evaluated from a comprehensive business strategy perspective? (20 minutes)
- (6) Ending and summary. (10 minutes)

3. Suitable Courses and Objects

If we are to regard digital transformation as a type of strategy for organizational change, this case is suitable for general schools of management or the agricultural enterprise management departments at colleges of agriculture, as well as the strategic management, organizational change, management theory, and small and medium enterprise management-related courses of university or graduate Master's programs and in-service master's programs. In terms of course planning, this case is suitable for use in the "technology integration and organizational change" and "directional choices for transformation (change)" course lessons of strategic management and organizational change courses. In small and medium enterprise and management theory courses, the case contents can be directly discussed in course lessons on organizational change.

Because the students of schools of management lack related agricultural business management knowledge and experience, in terms of teaching strategy, more time is needed for an explanation and discussion of industry background and agricultural supply chain concepts.

4. Theoretical Explanation of Digital Transformation Strategy

Organizational change is driven by change strategy, which is separately categorized as exploitative change and exploratory change. Exploitative change uses exploitation to drive the progression of change, while exploratory change uses exploration as the means to instigate change. Exploitation stresses the activities of the following: continued

refinement, efficiency, selection, and execution; on the other hand, exploitation focuses on search, change, risk assumption, experiment, flexibility, and innovation. Exploitation uses an organization's existing knowledge base or extends existing capabilities to simplify existing transactions and service processes, while exploration requires the experimentation of various alternative solutions in an attempt to find new information. (Huang 2017; Gastaldi et al. 2018) The outcomes of exploitative strategies have a low degree of uncertainty, while the outcomes of explorative strategies have a high degree of uncertainty. The two change strategies also have a relatively high degree of variation, but adopt different logic. In summary, exploitation focuses on an organization's existing knowledge and capabilities in the hope of maximizing the profit produced by an organization's existing decision model, and values a stable cash flow, high control and efficiency, and short-term performance requirements; on the other hand, exploration emphasizes learning new knowledge and the excavation of new capabilities and new business opportunities, and is usually associated with uncertainty of outcome (Cenamor, Parida, and Wincent 2019).

Due to resource limitations or resource crowding, exploitation and exploration are often regarded as mutually conflicting strategic choices (Kim, Song, and Nerkar 2012; Weigelt and Sarkar 2012). Especially in terms of the relationship between organizations, exploitation and exploration appear to have a dual relationship, resulting in the issue of difficulty in implementing approaches both simultaneously. Many organizations are stuck in a strategic conflict between "using a brand new business model to replace an existing business model" and "gradual transition to a new business model" (Khanagha, Volberda, and Oshri 2014; Volberda Khanagha et al. 2021), with these strategic conflicts and tensions in turn damaging the efforts an enterprise makes towards digital transformation. As a result, the change process for digital transformation must balance the tensions formed between exploitation and exploration. In terms of transformation paths and plans, because the focus of the majority of organizations is the improvement of efficiency, exploitation tends to be adopted as the main driving force to increase efficiency, especially in regards to cost benefits. After reaping the initial benefits of digitalization investment, organizations are likely to then begin the exploration of how to enact fundamental change. At this time, exploration becomes the main driving force (Gastaldi et al. 2018).

Nongwei is a small-to-medium sized agricultural enterprise. After the company increased its scale of operation, the use of a spreadsheet (Excel) as an information management tool was no longer sufficient. Therefore, the company introduced a customer-end purchasing system (Agrigo) and the Farm management of contract farmers (Join Farm). However, the resource limitations faced by the company produced a strategic crowding out effect. Because the achievement of one strategy may have been at the cost of the other, it is difficult to strive for the simultaneous implementation of two types of digital transformation strategies (Benner and Tushman 2003). As a result, exploitative change and exploratory change produce a decision dilemma caused by the difficulty of simultaneous execution.

Digital transformation strategy need a firm to reconfigure its resources to satisfy the need for organizational change. (Wang and Habibulla 2021). However, a one-size-fits-all solution that meets the needs of both strategies is unrealistic and difficult to conceive. To this end, punctuated equilibrium may be a method for attending simultaneously to the two (Gupta, Smith, and Shalley 2006; Mavroudi, Kesidou, and Pandza 2020; Uotila 2018). The so-called Punctuated equilibrium originates in Ambidexterity's balanced perspective, and is defined as the swing back and forth between exploitative and explorative strategies; the pursuit of a single strategy based on a specific point in time; and then using the oscillation, or swing back and forth, between the exploitation and exploration strategies to balance the tension between an organization's pursuit of exploitation and exploration (Gupta et al. 2006; Uotila 2018). However, such constant back-and-forth is highly likely to also produce a negative impact on business performance (Mavroudi, Kesidou, and Pandza 2020).

5. Discussion Questions and Teaching Recommendations

This discussion for the case is split into five parts. Teachers are asked to carry out discussion based on the following order.

5.1 Icebreaker and Warm-up

For the opening question, please ask, "Has anyone scanned a Traceability System barcode before? If so, what information was included on it?" At this point, some students may have related experiences (especially the students of in-service programs), who may then be asked to share their experiences of purchasing Traceability System fruits and vegetables. Next, teachers can continue to ask students the following questions: "When purchasing food or dining out, do you or family members look for Traceability Systems (yes/no)? When you and family members purchase food or are dining out, are you worried about the issue of pesticide residues (yes/no)?" (Table 2)

Next, to conclude the icebreaker activity, please ask the students individually for each of the four selections to propose solutions for Nongwei's digital transformation. At this point, teachers may ask others students about their views with reference to the 8 different grid squares. After the discussion of Traceability Systems, teachers can next ask students, "Does everyone know the process by which peppers travel from Farm to Table?" and further discuss the industry value chain for fruits and vegetables.

Table 2 Blackboard Writing 1: Icebreaker Activity Record Chart

Whether or not Traceability Systems are referenced		Do you reference Traceability Systems when dining out?	
Worries about pesticide residues		Yes	No
Are you worried about pesticide residues when ordering food or dining out	Worried	Agrigo Join Farm	Agrigo Join Farm
	Not worried	Agrigo Join Farm	Agrigo Join Farm

5.2 Why Must Nongwei Company Incorporate Digital Technologies? What Problems and Challenges Did the Company Face?

In regard to industry value chains, students can be further asked the following questions: “Where is Nongwei located in the supply chain? What are the key issues that Nongwei has regarding upstream contract farmers and downstream modern channels?” (Table 3)

Nongwei’s location in the supply chain sits between the field and customers, so the pressures it faces come from both directions. On the one hand, farmers in the field hope to maximize production volume. As a consequence, they are motivated to carry out speculative behaviors and not comply with regulations such as pesticide management, leading to issues involving food safety and which may lead to agricultural enterprises facing disciplinary action from the channel-end and regulatory units. On the other hand, channel and markets require the accurate delivery of goods; in such circumstances, repeated mistakes are not permitted. Currently, whether it be for the customer end or field end, Nongwei Company uses either a computation software (Excel) or human labor to perform recordation, making mistakes or omissions difficult to avoid and causing damage and loss to Nongwei Company’s work efficiency and business reputation. Thus, the issue of how to use digital tool introducing to promote change is unavoidable.

Blackboard Writing 3: Farm management Difficulties (Source Pages 172-174)

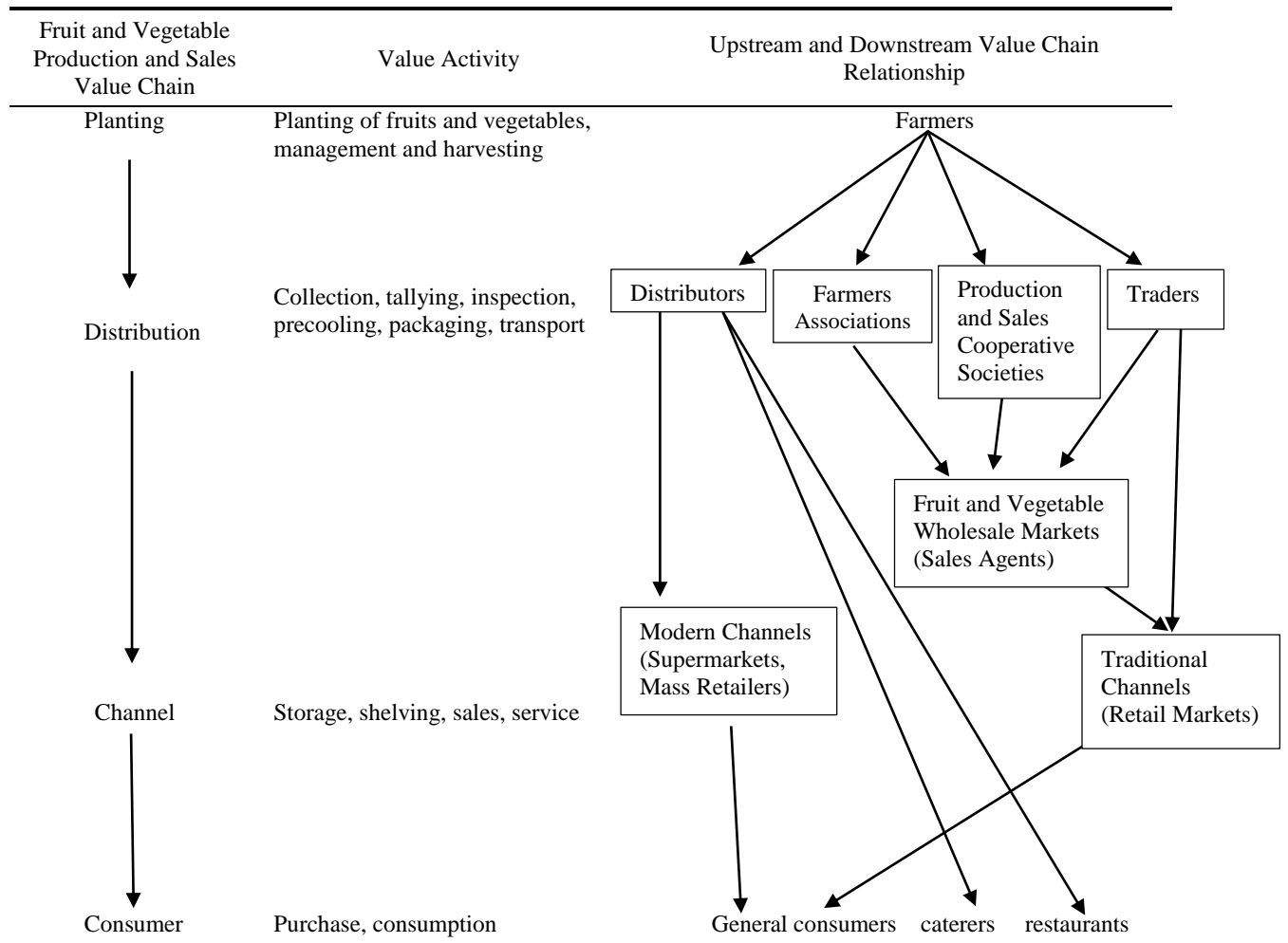
1. Dispersed land and difficulties in production and operation management
2. Unable to keep track of cultivation conditions and difficulties in production schedule management
3. Field recordation consumes time and effort; difficulties in the management and control of fertilizer and pesticide use.
4. Field management is difficult.

Blackboard Writing 4: Customer End Problems (Source Pages 174-175)

1. Traditional order processing methods are complicated, consume time, and waste manpower
2. Prone to errors, resulting in fines by retailers
3. Subject to the revoking of supply rights by retailers

By means of discussion of the challenges faced by Nongwei Company, teachers can next introduce the two directions for digital transformation by asking, “Do these issues require the introducing of digital technology systems?” After confirming the need and direction for digital transformation, teachers can then proceed with the next topic of discussion.

Table 3 Blackboard Writing 2: The Fruit and Vegetable Production and Sales Value Chain (Source Page 171)



5.3 In Regard to Nongwei’s Digital Transformation, What Are the Differences in the System Contents of and Implementation Strategies for Join Farm and Agrigo?

The teaching objective for this question lies in deriving the two strategy orientations for digital transformation: exploitation (Agrigo) and exploration (Join Farm). In order to allow students to obtain these two theoretical points, the following teaching suggestions are provided to teachers (Table 4).

- Teachers can ask the following questions, “Are there any students that can describe how Nongwei Company carried out transactions before the introducing of Agrigo? After the introducing of Agrigo, how will the transaction process change?”
- Teachers can follow up by asking the following questions, “Before the introducing of Join Farm, how did Nongwei Company carry out transactions and manage farmers? After the introducing of Join Farm, how will the transaction process change?”

Table 4 Blackboard Writing 5: Differences in the Transaction Process After Digital Technology Introducing (Source Pages 175-176)

Incorporated system	Before introducing	After introducing
Agrigo	<ul style="list-style-type: none"> ● After the orders of supermarkets are prepared, they are sent to Nongwei Company through fax or photograph. ● After orders are received by Nongwei Company, they are entered into the company's system. The transaction record is then recorded in the spreadsheet. 	<ul style="list-style-type: none"> ● The transaction process does not change much. Supermarket orders only need to be registered on the system and check-marked to complete the ordering process. ● After Nongwei Company receives the orders sent by the supermarket system (mobile phone), they are directly inputted into the system and outputted as a command for the use of on-site packaging and shipping.
Join Farm	<ul style="list-style-type: none"> ● Field cultivation and management is completely reliant on empirical judgment. ● The field cultivation and production process is prone to omissions due to the use of paper-based record keeping. ● Production schedules are manually adjusted, making work processes exhausting. 	<ul style="list-style-type: none"> ● The related records for contract fields are automatically linked to the system. ● Gives assistance for the judgment of field cultivation processes and environment statistics. ● Production schedules are adjusted with the help of big data, making work processes easier.

Next, teachers can ask the question, “What difficulties exist in the implementation of the two systems?” and “What are the advantages of each system?” (Table 5)

Table 5 Blackboard Writing 6: Comparison of the Agrigo and Join Farm (Source Pages 175-176)

Difference Dimensions	Join Farm	Agrigo
Degree of difficulty	Dispersion of production sites; separation of production seasons; requires continued experimentation, the accumulation of big data for fields, and analysis for conversion into Farm management capabilities	Low level of difficulty. The only requirement is that channels and procurement personnel place orders online. The system will convert the procurement orders into work orders, reducing the error rate.
Performance output	Can resolve issues such as production site dispersion for fruits and vegetables and the separation of production seasons to ensure the quality of fruits and vegetables. Thus, results can only be seen in the long-term. At the same time, performance outputs will contain a certain degree of uncertainty, but will have a large impact on competitive advantage.	The order reception process is smoother. Finance systems are easy to compare, and results can be seen in the short-term. However, the impact on competitive advantage is relatively small.

- The teacher can follow up by asking the question, “What is the purpose of introducing Agrigo?”

At this time, students should be able to deliver the following response: “The introduction of Agrigo simplifies existing transactions and service processes.” When this keyword appears in a student response, teachers can then give the following brief summary: “The introduction of Agrigo serves to simplify existing transactions or service processes. Thus, its digital transformation strategy is that of exploitation.” If students are unfamiliar with the strategy of exploitation, teachers can reference the digital transformation strategy theory chapter in the fourth chapter of the teaching manual and write out the definition on the blackboard.

- Teachers can also follow up with a further question: “What is the purpose of introducing Join Farm?”

Students should be able to give the response, “The introduction of Join Farm can be used to accurately determine new planting management strategies through the use of data collection, big data analysis, and the smart management of contract farmer production resumes.” Once this keyword appears in a student response, teachers can provide a summary of the strategy of exploration and write out the definition on the blackboard (Table 6).

Table 6 Blackboard Writing 7: Comparison of the Implementation Strategies for Agrigo and Join Farm (Source Pages 175-176)

Agrigo		Join Farm
Exploitation		Exploration
<ul style="list-style-type: none"> • Exploitation use an organization’s existing knowledge bases or extends upon existing capabilities in order to simplify existing transactions and service processes • Low uncertainty • Emphasizes continued refinement, efficiency 	<ul style="list-style-type: none"> • Focuses on information searching, experimentation and the use of big data analysis in an attempt to find new management behaviors. • High uncertainty • Emphasizes flexibility and innovation 	

5.4 How Should the Two Solutions Be Evaluated from a Financial Investment Perspective?

Next, teachers can ask, “How much funding is required for each of the two systems, and what benefits do they bring?” Then, students should be asked to write their answers to the pre-class discussion questions on the blackboard. Teachers can first focus on the discussion of investment funds, and then discuss benefits and the cash flow produced as a result of the two (Table 7 and Table 8).

After conducting the two investment benefit analyses, students can be asked to compare them: “Which solution should be prioritized?” Students may have a variety of opinions. But teachers can follow up by asking, “Should the evaluation of investment solutions only consider a financial perspective?” and then move on to the next discussion point.

Table 7 Blackboard Writing 8: Cost Benefit Table for Agrigo (Source Page 176, Unit: NT\$)

Year	Investment amounts			Benefit indicators		Cash flow
	Software	Hardware	System maintenance fee	Order error costs saved	Personnel costs saved	
Year one	2,000,000	1,190,000	Free	600,000	780,000	-1,810,000
Year two			Free	900,000	780,000	1,680,000
Year three			360,000	1,200,000	780,000	1,620,000
Year four			342,000	1,500,000	780,000	1,938,000
Year five			324,900	1,800,000	780,000	2,255,100
Year six			308,655	2,100,000	780,000	2,571,345
Total	2,000,000	1,190,000	1,335,555	8,100,000	4,680,000	8,255,445

Table 8 Blackboard Writing 9: Cost Benefit Table for Join Farm (Source Pages 175-176)

Year	Investment amounts				Benefit indicators							Cash flow (NT\$)
	Software (NT\$)	Hardware (sensors) (NT\$)	Mobile (NT\$)	System maintenance fee (NT\$)	Estimated production volume (%)	Annual increase in production volume for cucumbers (kilograms)	Annual increase in revenue for cucumbers (NT\$)	Annual increase in production volume for bell peppers (kilograms)	Annual increase in revenue for bell peppers (NT\$)	Total increase in annual revenue (NT\$)	Personnel costs saved (NT\$)	
Year one	1,000,000	1,500,000	1,000,000		0	0	0	0	0	0	390,000	-3,110,000
Year two	1,000,000	300,000	200,000		1	5,200	312,000	4,160	499,200	811,200	390,000	-298,800
Year three	1,000,000	300,000	200,000	150,000	3	15,600	936,000	12,480	1,497,600	2,433,600	390,000	1,173,600
Year four	1,000,000	300,000	200,000	142,500	5	26,000	1,560,000	20,800	2,496,000	4,056,000	390,000	2,803,500
Year five	1,000,000	300,000	200,000	135,375	7	36,400	2,184,000	29,120	3,494,400	5,678,400	390,000	4,433,025
Year six	1,000,000	300,000	200,000	128,606	7	36,400	2,184,000	29,120	3,494,400	5,678,400	390,000	4,439,794
Total	6,000,000	3,000,000	2,000,000	556,481			7,176,000		11,481,600	18,657,600	2,340,000	9,441,119

5.5 Please Carry Out a Comprehensive Analysis of the Advantages and Disadvantages of Agrigo and Join Farm from the Perspective of Financial Indicator and Management Strategy and Give a Suggestion to Nongwei as to Whether to First Implement Agrigo or Join Farm. You Can also Consider Other Solutions. Please Provide Your Reasons.

Here, we arrive at the key point of this case by asking students, “What are the advantages and disadvantages of the two solutions from a financial perspective?”, and “What are the advantages and disadvantages from a non-financial perspective”. Remind students that a non-financial perspective may include the perspectives of competition and customer relationships, as well as a correlation between the two solutions. Afterwards, conduct another class poll.

In terms of teaching strategy, teachers must emphasize the decision dilemma involving a choice between the two strategies. For example, for students who elect to first implement Agrigo, teachers can ask, “If Agrigo is implemented first, but competitors elect to first incorporate Join Farm and steal the company’s farmers, what would then be the point of having Agrigo?”, and, “Is the customer-end the key to Nongwei’s competitive advantage? If not, why must it be prioritized? Are there strategic implications in the decision which justify prioritizing it?”

For students who support the implementation of Join Farm, teachers can pose the following question: “If Join Farm is incorporated first to secure farmers, the company will gain a competitive advantage, but because Agrigo was not implemented, the company will continue to be fined and may even be taken off the shelves by distributors. What would then be the point in incorporating Join Farm?” The scenario may be explored further: “It will take several years for the results of incorporating Join Farm to be seen and whether or not it will be successful remains unknown. With this in mind, why should Agrigo not be implemented first, since the objectives would be easier to achieve?”

Returning to the blackboard, write “1” and conduct another poll to check if there are any changes in voting. For students who change their votes, ask them what caused them to alter their views (Table 9).

Table 9 Blackboard Writing 10: The Advantages and Disadvantages of Two Solutions (Financial Indicators and Strategic Thinking) (Source Pages 175-177)

Evaluation Indicator	Advantages	Disadvantages
Agrigo-financial indicators	<ol style="list-style-type: none"> 15% in order error costs will be saved in the first year. Reduction of 300 thousand NT\$ starting from the second year. Manpower of two personnel saved, amounting to 780 thousand NT\$. A positive cash flow starting from the second year. 	<ol style="list-style-type: none"> The initial software cost investment is as high as 3.2 million. In addition, 300 thousand per year is required for software maintenance, causing great financial pressure to agriculture enterprises.
Agrigo-strategic thinking	<ol style="list-style-type: none"> Digitalization of the procurement process; high order reception efficiency. Saves customer procurement time. Increases stickiness with customers. Can cross-over to the B2C business. 	<ol style="list-style-type: none"> Has the resource crowding effect. Join Farm is unable to be implemented first, resulting in the falling behind in Farm management and loss of competitive advantage.
Join Farm -financial indicators	<ol style="list-style-type: none"> Two years of use can increase the production revenue by about 800 thousand NT\$. 	<ol style="list-style-type: none"> Capital expenses must be recorded every year. Product volume must be actually increased in order to increase revenue. Cash flow is relatively poor. Still subject to fines or unshelving on the channel-end.

Evaluation Indicator	Advantages	Disadvantages
Join Farm -strategic thinking	<ol style="list-style-type: none"> 1. The collection of field statistics, analysis, improvement of production environments and crop types, and making of precise production plans can ensure that Nongwei keeps its competitive advantage. 2. Ensures Farm management to gain an early mover advantage in smart agriculture and increases competitiveness. 3. Allows farmers to rely on Nongwei's digital resources; the conversion cost for farmers is high. 	<ol style="list-style-type: none"> 1. The analysis of digital statistics needs to be performed by capable talents. 2. Digital technology requires the spending of resources to educate farmers. 3. The performance of smart agriculture is not guaranteed.

6. Conclusion

Teachers can again ask students, “Do you believe that Nongwei is a special case, or is it the case that all small-to-medium sized enterprises will most probably encounter this issue when selecting digital transformation strategies?” They can follow up by asking, “If so, what decision criteria would you adopt?” After students respond, teachers can use the take away below to review the differences between the exploitation and exploration strategies and of the comprehensive analysis of financial perspective and strategy perspective outlined in blackboard writing 10, allowing students to learn the application of “punctuated equilibrium” for decision-making dilemmas.

The so-called punctuated equilibrium originates in Ambidexterity’s balanced perspective, which states that “binary opposite ends both have their merits”, and is defined as the oscillation, or swing back and forth, between exploitative and explorative strategies, or, in other words, the pursuit of a single strategy based on a specific point in time, which then uses the oscillation between the exploitation and exploration strategies to balance the tension between an organization’s pursuit of exploitation and exploration. According to punctuated equilibrium, Nongwei’s digital transformation can start with the introduction of Agrigo to digitize existing assets (relationships with channel partners, in-factory operating processes) and convert original paper orders into online orders, in which the changes in the operating process are relatively small and the benefits can be immediately seen (reduced order errors). This stage can be characterized as an exploitative digital transformation change. On the other hand, the introducing of Join Farm would require the accumulation and combination of knowledge of diverse aspects such as the weather, seeds, seasonal adjustments, and pesticide usage. To instruct contract farmers how to carry out planting, Nongwei Company must depart from a focus on the channel-end and collect relevant data to carry out experiments; moreover, a relatively long period of time is needed to see results. In summary, the introduction of Agrigo helps to increase efficiency, but due to a stagnant supply, it is unable to increase revenue—only with the introducing of Join Farm can it increase its supply capacity and sources of revenue. Thus, punctuated equilibrium may serve as a feasible solution for simultaneously attending to the two strategies.

Lastly, for the take away, teachers can present the following table as a slideshow or print out paper copies to give to students (Table 10).

Table 10 Organizational Digital Transformation Strategies

Exploitation	Exploration
<ul style="list-style-type: none"> ● Emphasizes continued refinement, efficiency, selection, and execution. ● Uses an organization's existing knowledge base or extends upon existing capabilities to simplify existing transactions and service processes ● Produces outcomes with relatively low uncertainty. ● Focuses on an organization’s existing knowledge and capabilities in hopes of maximizing the profit produced by an organization’s existing decision model, and values a stable cash flow, high control and efficiency, and short-term performance requirements. 	<ul style="list-style-type: none"> ● Focuses on search, change, risk assumption, experiment, flexibility, and innovation. ● Requires the experimentation of different alternative solutions in an attempt to find new information ● Produces outcomes with relatively high uncertainty and has a relatively high degree of variation. ● Emphasizes learning new knowledge and the excavation of new capabilities and new business opportunities, and is usually associated with uncertainty of outcome.

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