Vegetable quality and safety supervision technology Integration solutions and evaluation

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Abstract. Based on carding the technology integration theory of vegetable quality and safety，this article proposed Vegetables quality and safety monitoring technology integration solutions, and selected the evaluation method to evaluate the vegetable quality and safety supervision information technology in Beijing six gold rings NongYeYuan.

Introduction

Meaning of technology integration."Integration" is essentially an idea and methodas the guidance of system science theory.Lansiti (1995) first proposed a “TechnologyIntegration”concept; he believes technology integration is a more effective innovation management methods and procedures,because it combines each tiny elements of new and old technology as an organic wholein reasonable structure. Technology integration is essentially a process of innovative and existing technologiescross-integration. In the integration process, a variety of optional technology need for evaluation, selection and matchingto achieve organic integration of multiple functions.

Theoretical overview of Vegetable quality and safety supervision integration ideas. The internal logic of the study can be summarized in four dimensions;The first dimension:Around the "value target", clearly the main demand, including the main choice needs, integration requirements and optimize demand for technology;The second dimension: Focus on "technical sources", clear technical classification, including key technologies and supporting technologies based on key and critical control points;The third dimension: Focus on "technical evaluation", deepening technology integration, including high-level integration, intermediate-levelintegration and low-level integration; The fourth dimension: Focus on "technology systematic", conduct equipment (facilities) configuration, including high-level configuration, intermediate-level configuration and low-level configuration.

Integrated solutions of Vegetable quality and safety supervision technology

Integrated solutions of Vegetable quality and safety supervision technology is shown in Table 1.

Table 1.Integrated solutions of Vegetable quality and safety supervision technology

Name	Content	Conditions	Applicable area	Function and effect
1.High-end integration	1.The highly integrated and joint monitoring of information technology equipment and key technologies; 2. The application of	Suitable the group company and organization，which has very high demand for quality and safety of agricultural products,	Applicable to the technical level of Vegetable quality and safety	High technology costs and equipment costs, accuracy and

	information technology equipment runs through all aspects of the whole industry chain.	with strong economic strength and large, business coverage from agricultural production to sales of the whole industry chain enterprises and organizations Group	supervision in the mature stage of farmers and regions.	good controllability.
2. Mid Integration	1.Senior integrated and joint monitoring of information technology equipment and key technologies; 2.In industry chain, choose the impact on some of the larger quality and safety of agricultural products link for application of information technology equipment.	It is suitable for larger enterprises and organizations which require a higher quality and safety of agricultural products, and involve only a few aspects of agricultural production, processing, distribution or sale of enterprises and organizations.	Applicable to the technical level of Vegetable quality and safety supervision in the mature stage of farmers and regions.	Technology costs and equipment costs are high-end, better accuracy and controllability
3.Mid-low integration	1. Middle integrated and joint monitoring of information technology equipment and key technologies; 2. In industry chain, choose the impact on some of the larger quality and safety of agricultural products link for application of information technology equipment.	Suitable for small and medium-sized enterprises and organizations which require the general quality and safety of agricultural products. And their business only involves in one or a few aspects of agricultural production, processing, distribution or sale.	Applicable to the technical level of Vegetable quality and safety supervision in the development stage of farmers and regions	Technology costs and equipment costs are low-end, accuracy and controllability in general.
4.Low-end integration	1.Low integrated and joint monitoring of information technology equipment and key technologies； 2.In the industry chain, there is no application of information technology equipment.	Suitable for poor Economic strength enterprises and organizations which require the lower quality and safety of agricultural products. And their business only involves in one aspects of agricultural production, processing, distribution or sale.	Applicable to the technical level of Vegetable quality and safety supervision in the early stage of farmers and regions	Technology costs and equipment costs are low-end, poor accuracy and controllability.

Integration solutions evaluation of Vegetable quality and safety supervision technology

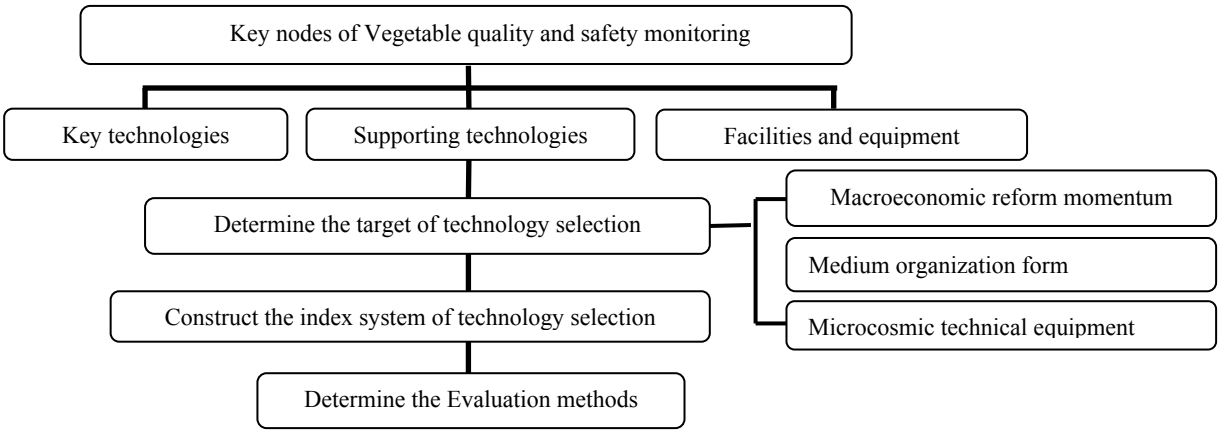

Fig. 1. Research Framework

Overview of evaluation methods. Vegetable product quality and safety supervision technology integration involves different aspects and control points,and every link and control points are composed of different technologies, which exist between crisscross complex interactions. Therefore, in this study, The idea of technical evaluation is to in-depth the technical system itself,to start from thekey link and key control points in the system, through combing the relevant technologyand equipment,to determine the technical optionsgoal, and according to the key to determine the corresponding index system of technology selection (It is shown in Fig.1) . This study mainly uses the scoring method.

Construction of Evaluation Index System. Technology selection index system through the quantitative evaluation of each critical control point, adopt the method of grade analysis to analyzefeatures and flexibility of each level. We have got the preliminary technology selection index system.

The index system includes 5 level indicators and 17 level two indexes. Level indicators include environmental and investment monitoring, production process control, storage management, distribution management and technical equipment adaptability, and each first level index are divided into a plurality of secondary indicators.

Table 2.Technology selection index system of Vegetable quality and safety supervision information

Level indicators	Secondary indicators	Interpretation	Scoring criteria
Monitoring of the environment and the inputs	Air	Monitoring of major air pollutant	The monitoring level and ability for air pollutants indicator：High-level：5；General level：3；Can't monitor：1
	Soil	Monitoring of heavy metals in soil	The monitoring level and ability for indicators of heavy metals in soil：High-level：5；General level：3；Can't monitor：1
	Surface water	Monitoring of surface water quality	The monitoring level and ability for surface water quality：High-level：5；General level：3；Can't monitor：1
	Inputs	Quality monitoring of	The monitoring level and

		seeds, pesticides, fertilizers, agricultural film	ability for Inputs: High-level：5；General level：3；Can't monitor：1
Manufacturing process control	Environmental Control	Control of temperature and humidity, CO_2, etc. in the process of production	The control ability and level for environmental: High-level：5；General level：3；Can't monitor：1
	Fertilizer	Control of chemical fertilizer and application time in the process of production	The control ability and level for fertilizer: High-level：5；General level：3；Can't monitor：1
	Pesticide	Control of the amount of pesticide spraying and spraying time in the process of production	The control ability and level for application of pesticides: High-level：5；General level：3；Can't monitor：1
	Irrigation water	Control of irrigation water usage and application time in the process of production	The control ability and level for irrigation water use: High-level：5；General level：3；Can't monitor：1
Storage and Processing Management	Fresh control	Control of agricultural storage temperature, humidity and time	The control ability and level for storage and preservation of agricultural products: High-level：5；General level：3；Can't monitor：1
	Inspection	Test of pesticide residues and microbial after agricultural products harvest	Detection of information openness and transparency: High-level：5；General level：3；Can't monitor：1
Circulation Distribution Management	Identification and traceability	Information identification device such as RFID, the two-dimensional code, etc.	Identification and traceability:1；No logo or can’t be retroactive：0
	Environmental control in the circulation distribution vehicle	To control the temperature and humidity inside the vehicle	The ability to control temperature and humidity inside the vehicle: Very strong: 5; General: 3; does not control: 1
	Vehicle Location	GPRS positioning system in the vehicle	Positioning system: 1; No positioning system: 0
	Electronic Trading	Order online, electronic trading	Electronic trading system：1；No electronic trading system：0

Technical equipment adaptability	Maturity of the technology and equipment	Different successional stages of technical equipment from research to industrial process	Industry: 5; Pilot: 3; R & D: 1
	User acceptance	Degree of user acceptance	Very recognized: 5; Average: 3; Not recognized: 1
	Degree of quality and safety protection	The ability to protect the safety of the quality with this set of technical equipment	Quality safety guarantees ability: Very high: 5; average: 3; can't guarantee: 1

Evaluation method. Vegetable quality and safety regulatory mode evaluation index system is established. In order to accurately measure the pros and cons of the vegetable quality and safety regulatory model, the index weight and integrated measurement is also needed to determine. Determination of the Indicators weights: the scoring method.

Comprehensive index score is calculated as:

$$\prod = \sum_{i=1}^{n} Wi \left(\sum_{j=1}^{m} Wij \quad Pij \right)$$

The II represents information technology index composite scores, n is composed various index element number, M means the index number of the I element, Pij I is the elements of the j standards value, Wij is the elements of j index weight.

Determining the weights of the index system. Weights of the index system of vegetable quality and safety supervision information technology are shown in Table 3.

Table 3. Weights of the index system of vegetable quality and safety supervision information technology

Level indicators	Weights	Secondary indicators	Weights	Interpretation
Monitoring of the environment and the inputs	0.2353	Air	0.0235	Monitoring of major air pollutant
		Soil	0.0471	Monitoring of heavy metals in soil
		Surface water	0.0706	Monitoring of surface water quality
		Inputs	0.0941	Quality monitoring of seeds, pesticides, fertilizers, agricultural film
Manufacturing process control	0.2353	Environmental Control	0.0941	Control of temperature and humidity, CO_2, etc. in the process of production
		Fertilizer	0.0471	Control of chemical fertilizer and application time in the process of production
		Pesticide	0.0471	Control of the amount of pesticide spraying and spraying time in the process of production
		Irrigation water	0.0471	Control of irrigation water usage and application time in the process of production
Storage and Processing Management	0.1765	Fresh control	0.0588	Control of agricultural storage temperature, humidity and time
		Inspection	0.1175	Test of pesticide residues and microbial after agricultural products harvest
Circulation Distribution Management	0.2059	Identification and traceability	0.0824	Information identification device such as RFID, the two-dimensional code, etc.

		Environmental control in the circulation distribution vehicle	0.0618	To control the temperature and humidity inside the vehicle
		Vehicle Location	0.0206	GPRS positioning system in the vehicle
		Electronic Trading	0.0412	Order online, electronic trading
Technical equipment adaptability	0.1470	Maturity of the technology and equipment	0.0490	Different successional stages of technical equipment from research to industrial process
		User acceptance	0.0245	Degree of user acceptance
		Degree of quality andsafety protection	0.0735	The ability to protect the safety of the quality with this set of technical equipment

Scoring criteria and classification.

(1)High-end integration (Scoring criteria: 5)

Appropriate objects: It is suitable for group businesses and organizations which has the high requirements for agricultural products quality and safety, and cover the whole industry chain from agricultural production to the sales.

(2)Mid Integration (Scoring criteria: 3-5)

Appropriate objects: It is suitable for larger enterprises and organizations which require a higher quality and safety of agricultural products, and involve only a few aspects of agricultural production, processing, distribution or sale of enterprises and organizations.

(3)Mid-low integration (Scoring criteria: 0.8558-3)

Appropriate objects: Suitable for small and medium-sized enterprises and organizations which require the general quality and safety of agricultural products. And their business only involves in one or a few aspects of agricultural production, processing, distribution or sale.

(4)Low-end integration (Scoring criteria: 0.8558)

Appropriate objects: Suitable for poor Economic strength enterprises and organizations which require the lower quality and safety of agricultural products. And their business only involves in one aspects of agricultural production, processing, distribution or sale.

Conclusion

We choose Beijing six gold rings NongYeYuan as a base for the application.After the weighted calculation, the vegetable quality and safety supervision informationization level value is 3.5 points, in the high-end level.The conclusion shows that the rapid development and vigorous application of wireless sensor network, 3G,mobile Internet and other information technologies, promote the leap forward development of the agriculturepark. The information equipment, such as mobile wireless sensor network system etc., makes the Beijing six gold rings NongYeYuan be in the leading position in the application of agricultural information technology, and have distinctive exemplary role.

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