



# Measure of input/output efficiency of agricultural supply and marketing cooperative implementing service innovation strategy

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## Abstract

Recently, governmental reformation is all the rage worldwide. One after another, any nations execute entrepreneurial government reformation of new public strategy. The innovation of government department is to enhance nationals' well-being and national competitiveness. Agricultural supply and marketing cooperative has been working on enhancing farmers' well-being and promoting agricultural development for a long time. It plays an important part in being the entry level organization for farmers and has been doing a great job. Therefore, in order to strengthen market competitiveness, the cooperative should be service innovation oriented and look for all kinds of business strategies and then discuss how to execute the service plan more precisely.

This research use supply and marketing cooperative in Shanghai as research objects, and furthermore pick out more representative ones to run data empirical analysis through Delphi Method and Data Envelopment Analysis. There're 15 DMU in all. The research results are shown as following: 1. One DMU presents strong-form efficiency, revealing that supply marketing cooperative implementing service innovation strategy is strongly efficient; Five DMUs show efficiency value between 0.9 and 1, which means marginal inefficiency; Nine DMUs appear efficiency value below 0.9, which means obvious inefficiency. 2. Slack variable analysis brings up the way to improve the excess and shortage input problem in supply and marketing cooperative. Lastly, according to the results, the author proposed some suggestions, hoping they could help the cooperative earning profit, increasing customer confidence and loyalty. After that, they could take it one step further and increase the competitiveness of agricultural supply and marketing cooperative.

**Keywords:** agricultural supply and marketing cooperative, service innovation, innovation strategy, performance appraisal

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## INTRODUCTION

Agricultural supply and marketing cooperative has been working on enhancing farmers' well-being and promoting agricultural development for a long time. It plays an important part in being the entry level organization for farmers and has been doing a great job. With the coming internalization, globalization, and economic restructure, the whole agricultural business environment suffers from lots of impacts, which lead to continuously operation crisis. However, innovation for agriculture and society are both undoubtedly necessary. Before the era knowledge-based economy has come, a company can rely on cost, time, and quality to maintain competitiveness. Now it depends on whether entrepreneurs can strengthen corporate development and innovation effectively. Then again, who holds the key success factors of innovation creates sustainable competitive advantage.

Recently, governmental reformation is all the rage worldwide. One after another, any nations execute entrepreneurial government reformation of new public strategy. The innovation of government department is to enhance nationals' well-being and national competitiveness. For the past few years, government has programmed multiple service projects and systems to enhance internal and external benefits, as well as service innovation effectively. This way, it'd not only simplify administrative process, reduce manpower and cost, but also indeed solve people's problems, fulfill their needs, enhance the overall service quality. Despite the importance of innovation to the government agencies, in retrospect, the research status of innovation issues in our public sectors are increasing gradually, but problems

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like relative research insufficiency and field of research way too narrow are still relatively common. Although all branches from national agricultural supply and marketing cooperative have formed into a strategic alliance, each one of them is individual and their working capital are from the income of their own various business. Therefore, in order to strengthen market competitiveness, the cooperative should be service innovation oriented and look for all kinds of business strategies and then discuss how to execute the service plan more precisely. This research evaluated the performance of supply marketing cooperative implementing service innovation strategy, hoping they could help the cooperative earning profit, increasing customer confidence and loyalty. After that, they could take it one step further and increase the competitiveness of agricultural supply and marketing cooperative.

## LITERATURE REVIEW

### Service Innovation

Wang et al. (2016) believed that innovation can be defined as the creation, acceptance, and execution of a new concept, process, product, or service. The goal of innovation is to create added economic value or social value. Therefore, except being creative, the acceptance and operation model of the new concept have become key successful factors. Venkateswarlu et al. (2015) considered service product included product description and product characteristic, namely related advantage, risk of reliability and perception, product image, and background story of the brand and product. All of these factors are closely related. Barrett et al. (2015) pointed out that merchandising nowadays usually form in a set, including product and service. With that being said, the boundary between product and service is getting vague. At some point, products are just vehicles delivering service and meanwhile service system could be thought as a value net, which includes product and service. There're gonna be some different important parts involved, such as customers, service providers, and the main and subsidiary promoters. Wang (2015) considered innovation as a process of an organization updating its knowledge. It represents the output and structure of individuals and teamwork. According to AMA(American Marketing Association), service is a kind of sales attached to products, and it also provides activity, profit, and satisfaction. Chuang & Huang (2015) believed new service means the service that used to be unable to provide. Because of added service items, technological progress, and the development of service delivering process, it is able to provide customers brand-new experience now. Liu et al. (2015) made a point that besides successful development of new service and product, service innovation includes all kinds of innovative activities like correcting and improving current product, service, and delivering system. Service

innovation is about corporations enhancing their service and product value to improve service and respond to customers' diversified demands. (Hsieh & Hsieh, 2015)

### Innovation Strategy

Chen et al. (2016) mentioned invention is a notion of forming creative product and process while innovation is about introducing new product, process, or service to market. Kilinc & Bennett Milburn (2016) indicated innovation strategy is like scientific research proposal after programming, strategy by objectives, environmental coordination and integration, schedule control to reach the expected goal. Lussier & Hartmann (2017) mentioned innovation is about correcting or inventing a new concept and makes it meet with the current or potential demand. At the same time, improvement and development could make the current function more commercialization oriented. Guo & Bouwman (2016) has stated, during the process of product innovation activity, the related environments corporation surrounded could be changed frequently. External environments like customer behavior, supplier capability, competitor strategy, market economy activity, government policy, and technological progress, all things above could affect corporations doing innovation activity. On the other hand, internal environments such as personal innovative outlook, creative learning ability in group, cross-functional coordination and integration mechanism, also influence the whole innovation activity. Kunttu & Torkkeli (2015) considered corporate innovation ability taking experimentation as a core, which means corporates conceive systematic experiments to create and improve products. This kind of enlightened experimentation has a significant impact on corporations with high product development cost. Four ground rules of enlightened experimentation are as follow: 1) It develops experimental organizational structure rapidly. 2) It'd rather fail a lot at initial stage than make mistakes. 3) It anticipates and uses initial information properly. 4) It combines modern and ancient technology to obtain faster, lower cost experimental benefit. Hill et al. (2016) indicated innovation strategy is a management activity about innovative individuals, teams, organizations, and external environments. On top of that, what innovation strategy focuses on is personal level, team level, and up to organizational level strategy. They're also key successful factors of innovation strategy.

### Performance Appraisal

Gao and Bai (2014) divided organizational performance into two, namely financial performance and operational performance. Pantano & Viassone (2015) mentioned financial performance is financial indicators like sales growth, ROI, EPS, on the basis of output. It measures corporate achieving rate on economic end. Operational performance, as known as non-financial performance, is an assessment index, which works on

efficiency measurement technologically, such as market share, product paunch, product quality, and added value creation. Ting & Nam (2016) evaluated, as for the assessment of financial indicators could also be multiple standards. Due to different objects and range, it applies single construct, namely ROA, ROS, ROE, and sales growth rate. Cheng et al. (2015) divided financial indicators into ROI, ROS, gross profit, cash flow, EPS, ROE, revenue, and sales growth. Liu & Guo (2015) mentioned financial indicators including net profit margin, ROA, ROI, overall competitive position, and general profit margin.

### Data Envelopment Analysis

Data Envelopment Analysis first appeared in an article Charnes, Cooper, and Rhodes published in 1978 (Jain & Natarajan, 2015). Data Envelopment Analysis is a non-parametric method, which means without any default production function, it develops multiple inputs and outputs of decision making unit through mathematical model of linear programming into points on production frontier. Points on production frontier have an economic significance as the most optimal input-output combination of decision making unit, as known as relatively efficient unit. Combining those efficient units becomes efficiency frontier, which is the supposed envelope. After that, comparing observation of input-output ratio with efficiency frontier can measure relative efficiency of every decision making unit and the way to improve it to meet the efficiency (Guo et al., 2017).

## RESEARCH INDICATOR AND OBJECT

### Establishment of research indicator

By summing up the evaluation indicators of agricultural supply and marketing cooperative implementing service innovation strategy above, Delphi Method is utilized as drawing up the evaluation indicators in this study. Delphi Method is also known as expert judgement, which is a group decision-making approach presenting both qualitative and quantitative characteristics. It's also interdisciplinary and future oriented. During the research process, when there's a certain issue with data shortage or unknown situation, an anonymous questionnaire could be run several times till the differentiation between experts reducing to minimum and meet an answer every expert agrees with.

The so-called expert, according to literature, should present the following qualifications (Delbari et al., 2016). 1) Who have shown interests in participating Delphi Method survey. 2) Who possess abundant information and willing to share them with one another. 3) The knowledge and technology in a special field are public approved. 4) Who have a specialty in the subjected-related field, including practical experience and theoretical research. 5) Who agree on the research results containing some special self-own information. Mishra & Chatterjee (2018) also indicated that experts

should possess knowledge standard, reliability, and accuracy. They ought to dig deeper in the industry so that their judgement tend to be closer to the truth than amateurs. Delphi Method is based on such answers.

### Establishment of evaluation indicator

The evaluation indicators in this study are in accordance with Delphi Method. The variables are defined as below.

#### Input variable

- a) Finance: the cost of implementing service innovation.
- b) Production: the manpower involved to implement service innovation strategy

#### Output variable

- a) Customer: including business growth rate of agricultural supply and marketing cooperative
- b) Profitability: the gross revenue is considered as performance output variable.

### Research method and object

This research use supply and marketing cooperative in Shanghai as research objects, and furthermore pick out more representative ones to run data empirical analysis through Delphi Method and Data Envelopment Analysis. There're 15 DMU in all.

## EMPIRICAL ANALYSIS OF AGRICULTURAL SUPPLY AND MARKETING COOPERATIVE IMPLEMENTING SERVICE INNOVATION STRATEGY

### Analysis of agricultural supply and marketing cooperative implementing service innovation strategy

After assuring all input-output data are calculated and reserved, those information have been imported in DEA-Solver at Excel to get every efficiency value and virtual multiplier. The analysis result of DEA has been compacted in **Table 1**. The following will explain relative efficiency, returns to scale, and relative inefficiency respectively.

1) Relative efficiency: According to **Table 1**, there's only one DMU with relative value 1, which is Xuhui District, representing relative efficiency in supply and marketing cooperative implementing service innovation strategy. Out of 12 DMUs, this DMU is relative efficient. Under the concept of DEA, it's on efficient frontier, which means supply and marketing cooperative in Xuhui District should be taken as reference as strong-efficient unit. The more it's been referenced, the more stable and efficient DMU it is. Unless otherwise changed, its efficient value will remain the same.

2) Returns to scale: **Table 1** is shown that except for Xuhui District, in which the relative efficiency comes from constant returns, the input units increase in the rest 14 inefficient DMUs will also cause output units increasing.

**Table 1.** Efficiency analysis result

DMU	Total efficiency	Technical efficiency	Scale efficiency	Returns to scale	Efficiency ranking
Huangpu supply and marketing cooperatives	0.98	0.98	0.99	IRS	2
Xuhui supply and marketing cooperatives	1.00	1.00	1.00	CRS	1
Changning supply and marketing cooperatives	0.96	0.96	0.96	IRS	3
Putuo supply and marketing cooperatives	0.90	0.90	0.90	IRS	5
Yangpu supply and marketing cooperatives	0.85	0.85	0.85	IRS	6
Minhang supply and marketing cooperatives	0.80	0.80	0.80	IRS	9
Baoshan supply and marketing cooperatives	0.83	0.83	0.84	IRS	8
Pudong New supply and marketing cooperatives	0.91	0.91	0.91	IRS	4
Jinshan supply and marketing cooperatives	0.78	0.78	0.78	IRS	10
Songjiang supply and marketing cooperatives	0.84	0.84	0.85	IRS	7
Qingpu supply and marketing cooperatives	0.73	0.74	0.73	IRS	12
Fengxian supply and marketing cooperatives	0.77	0.77	0.77	IRS	11

**Table 2.** Efficiency value of relative efficiency in every supply and marketing cooperative

Decision making unit (DMU)	Improved input		Improved output	
	Finance	Production	Customer	Profitability
Huangpu supply and marketing cooperatives	0	0	1	0
Xuhui supply and marketing cooperatives	0	0	0	0
Changning supply and marketing cooperatives	0	0	1	1
Putuo supply and marketing cooperatives	1	1	1	0
Yangpu supply and marketing cooperatives	1	2	2	0
Minhang supply and marketing cooperatives	3	3	2	1
Baoshan supply and marketing cooperatives	2	2	2	0
Pudong New supply and marketing cooperatives	1	0	2	1
Jinshan supply and marketing cooperatives	3	1	1	0
Songjiang supply and marketing cooperatives	3	2	1	1
Qingpu supply and marketing cooperatives	4	5	2	1
Fengxian supply and marketing cooperatives	3	3	2	0

Data source: this study

3) Relative inefficiency: The reason why the rest DMUs are not up to standard has everything to do with both technical efficiency and scale efficiency. Both input-output ratio and industrial scale need to be adjusted and improved at the same time.

#### Slack variable analysis

About slack variable analysis, the ways to improve input excess or shortage are shown in **Table 2**. With reducing input at excess units and increasing input at those shortage ones, that supply and marketing cooperative will achieve optimal efficiency.

## CONCLUSION

DMU is classified into strong-form efficiency, margin efficiency, margin inefficiency, and obvious inefficiency. Strong-form efficiency represents efficiency value 1 and slack variable 0, implying unless a major change in input and output factors, its efficiency value remains the same and with much more strength than inefficient DMUs. Margin efficiency reveals efficiency value 1 but at least one slack variable not 0, which means its efficiency value, will turn below 1 once increasing input factors or decreasing output factors. Margin inefficiency shows efficiency value between 0.9 to 1 and it could rise up to 1 easily. Those with efficiency value below 0.9 are regarded as obvious inefficiency, and those won't become efficient easily in the near future. With that being said, if there's an efficiency value below 0.75, unless a major change in input and output factors, it shall remain inefficient.

The efficiency value and variable message acquired from DEA are categorized and compacted in **Table 1**. It's shown that 1 DMU shows strong-form efficiency with efficiency value 1 and accounts for 8% of all DMUs, revealing better supply and marketing cooperative implementing service innovation strategy. 4 DMUs represent margin inefficiency with efficiency value 0.9 to 1, accounting for 33% of all DMUs. 7 DMUs reveal obvious inefficiency with efficiency value below 0.9, taking up 58% of all DMUs. Among all that, supply and marketing cooperative in Qingpu District with efficiency 0.73 ranked as lowest.

## SUGGESTION

According to the research results in this study, the following suggestions have been made:

1) Supervisors need to possess good communication skills to reduce obstacles during service innovation strategy. They shall participate in decision making, prioritize service innovation, and fully master teams with multi-major backgrounds. Meanwhile, they must enhance team members' professional quality so that members could introspect and learn from each other. Only when members are willing to change and be innovative, they could think thoroughly and solve problems.

2) The aim of service innovation is to serve customers and that's why customers' feedback and customer interaction become considerably important. As a result, ways to give feedback are necessary. Currently, service could be imitated by competitors easily.

Therefore, a strict confidentiality mechanism is created to prevent plagiarism and keep competitive advantage steady.

3) For the current customers of supply and marketing cooperative, they'd rather have fast service than nice

service. That doesn't mean good service is unnecessary. Instead, for customers, when they walk in, they need their problems solved as fast as possible and suit their needs. Advertising activity is also an important part to approach new customers.

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