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THE DEVELOPMENT OF SAFE VEGETABLES IN SUSTAINABLE FOOD SYSTEMS: A CASE STUDY IN THAI NGUYEN PROVINCE

Nguyen Thi Minh Hue[1], Nguyen Thi Hien Thuong[1], Vu Thi Hai Anh[1], Kieu Thi Thu Huong[2], Nguyen Hoai Nam[3]*
[1]Tan Trao University, Viet Nam
[2]Thai Nguyen University of Agriculture and Forestry, Viet Nam
[3]Thai Nguyen University Learning Resource Center, Viet Nam
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Abstract:

Food system (FS) and food safety remain important issues in Vietnam. In which, producing and market accesing safe vegetables plays an important role. The production of safe vegetables has not been developed currently,, although the economic efficiency analysis shows that safe vegetable production uses less material input and commands higher prices, resulting in increased income for farmers. However, the production of safe vegetables requires more labor. The quality of safe vegetables is much better than that of conventional vegetables, but it needs to follow many criteria and standards. The network of safe vegetables in Thai Nguyen has not been developed (accounting for about 10% of total output), mainly safe vegetable consumption at supermarkets and some points of sale of safe vegetables, safe vegetable consumption is difficult. Point-of-sale are not convenient for buyers, and consumer satisfication remains low. More powerful and oriented policies and sets, especially in the planning of safe vegetable production and trading areas, communication on safe vegetable products, including traceability, and state support for products is required.

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PHÁT TRIỂN RAU AN TOÀN TRONG HỆ THỐNG THỰC PHẨM BỀN VỮNG: MỘT NGHIÊN CỨU ĐIỂN HÌNH TẠI THÁI NGUYÊN

Nguyễn Thị Minh Huệ[1], Kiều Thị Thu Hương[2], Nguyễn Thị Hiền Thương[2], Vũ Hải Anh[2], Nguyễn Hoài Nam[3]
[1]Đại học Tân Trào, Việt Nam
[2]Đại học Nông Lâm - Đại học Thái Nguyên, Việt Nam
[3]Trung tâm học liệu Trường Đại học Thái Nguyên, Việt Nam
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Tóm tắt

Hệ thống thực phẩm (FS) và an toàn thực phẩm vẫn là những vấn đề quan trọng ở Việt Nam. Trong đó, sản xuất và tiếp cận thị trường rau an toàn đóng vai trò quan trọng. Việc sản xuất rau an toàn hiện nay chưa được phát triển, mặc dù phân tích hiệu quả kinh tế cho thấy sản xuất rau an toàn sử dụng ít nguyên liệu đầu vào hơn và giá bán cao hơn, giúp tăng thu nhập cho người nông dân. Tuy nhiên, việc sản xuất rau an toàn đòi hỏi nhiều lao động hơn. Chất lượng rau an toàn tốt hơn nhiều so với rau thông thường nhưng cần tuân theo nhiều tiêu chí, tiêu chuẩn. Mạng lưới rau an toàn ở Thái Nguyên chưa phát triển (chiếm khoảng 10% tổng sản lượng), chủ yếu tiêu thụ rau an toàn tại các siêu thị và một số điểm bán rau an toàn, việc tiêu thụ rau an toàn gặp nhiều khó khăn. Điểm bán hàng không thuận tiện cho người mua và mức độ hài lòng của người tiêu dùng vẫn ở mức thấp. Cần có nhiều chính sách và định hướng mạnh mẽ hơn, đặc biệt là trong quy hoạch vùng sản xuất và kinh doanh rau an toàn, truyền thông về sản phẩm rau an toàn, bao gồm cả truy xuất nguồn gốc và hỗ trợ của nhà nước đối với sản phẩm là cần thiết.

Introduction

Food system (FS) and food safety remain important areas of concern in Vietnam. The production and access to markets of safe vegetables offers considerable potential in mitigating these issues. According to the FAO (2018) "*Food systems (FS) encompass the entire range of actors and their interlinked value-adding activities involved in the production, aggregation, processing, distribution, consumption and disposal of food products that originate from agriculture, forestry or fisheries, and parts of the broader economic, societal and natural environments in which they are embedded.*"

A sustainable food system (SFS) is a food system that delivers food security and nutrition for all in such a way that the economic, social and environmental base to generate food security and the nutrition of future generations is not compromised. This means that it is profitable (i.e., economic sustainability), has benefits for society (i.e., social sustainability), and has a positive or neutral impact on the natural environment (i.e., environmental sustainability). Within this framework, this study tries to investigate the way of improving safe vegetable production in the holistic context.

Vegetables play an important role in the food of every Vietnamese family. They are an important source of nutrients for the body such as vitamins, fiber, mineral salts, and organic acids. The average consumption demand for vegetables and fruits per household in Vietnam is about 71 kg, of

which vegetables account for a quarter of the total consumption of vegetables and fruits of the household. However, in recent years, the poisoning phenomenon caused by eating vegetables has been increasing. The main reason is due to excessive residues of plant protection chemicals on vegetable products and the habits of use to much chemical input on vegetables (VFA, 2017)

In order to meet or exceed the curren safety standards for food in the world, standards for safe vegetable (SV) production such as JGAP, GlobalGAP are issued. The Vietnamese government of Vietnam has also issued the VietGAP standards that define the criteria for safe agricultural production, including regulations on safe vegetable production.

VietGAP standards have been applied by many localities to build safe vegetable production areas, including the province of Thai Nguyen. However, the production and consumption of vegetables is affected by various factors. That directly affects the safety of products and the sales process of manufacturers. According to the Center of Consumer Research, in 2016 there were 74% of safe vegetables produced under the safe process to be sold in free markets and small markets, only 26% sold in shops and supermarkets. Thai Nguyen, there are still many difficulties in agricultural production, especially for SV production. This study presents the current state of safe vegetable production and consumption in the locality, trying to find solutions to promote SV production to meet the needs of consumers.

Methodology

Research site and sampling techniques

- *Research site:* The study was conducted in Dai Tu District and Phu Binh District, Thai Nguyen Province.

- *Sampling techniques:*

120 households producing vegetables in the 2 districts were selected for interviews. Of these, 60 households produce safe vegetables and 60 households produce standard vegetables. 60 consumers were also selected according to the stratified random method to analyze their needs and expectations of the vegetable supply chain. In order to complete the value chain of vegetables, the role of traders is also significant. Therefore, in-depth interviews with 30 trading households about the distribution and consumption of vegetables in the study area was conducted.

Collecting and analyzing data

The study used a number of evaluation tools including in-depth interviews, participant observation, and questionnaires in field investigations and information collection.

Survey implementation was conducted using previously prepared survey questionnaires. The data collected during the survey are synthesized, processed, and calculated using Microsoft Excel. The quantitative data were analyzed by using descriptive statistics and Qualitative data were anylyzed with the support of Maxqda10.

Results and discussion

Safe vegetable production situation in Thai Nguyen

Before 2015, Thai Nguyen had no households producing SV. Since then, state intervention compiled with consumer pressure has resulted in the acreage of SV increasing annualy. In 2017, Thai Nguyen started to develop an area of SV with an area of 11.3 ha. This was the first year of SV production but the yield of SV is higher than that of vegetables producing SV is 4.3 tons / ha. In 2019, the planting of SV in Thai Nguyen doubled compared when compared to 2017. In addition, productivity also tends to increase. However, the percentage of SV area compared with the total area of vegetable cultivation in the locality still accounts for a low percentage.

Table 1: Area grow vegetable and safe vegetable in Thai Nguyen from 2017 to 2019 Unit: ha

Year	2017			2018			2019			Annual Grow Rate (%)
Vegetable		13.679			13.658			14.037		2,61
Safe vegetable		11.3			10			27		138,93

(Source: DARD Thai Nguyen, 2019)

Current situation of vegetable production in researched areas in 2019

The producer is the first and arguably most important actor in the value chain of the vegetable sector. Producers product vegetables to supply to the market and to consumers. They are the ones that determine the quality of the product and it is clear that their benefits are tied to the quality and type of the product. Products with guaranteed quality and safety will be easily accepted by consumers. Therefore, we study the current situation of vegetable producers and their needs to determine the ability to expand production scale to meet the needs of consumers.

Households characteristics:

Thai located in the Northern Mountain Region (MNR) with many difficult socio-economic natural conditions. This directly affects the life of the people in general and for the people growing vegetables in particular.

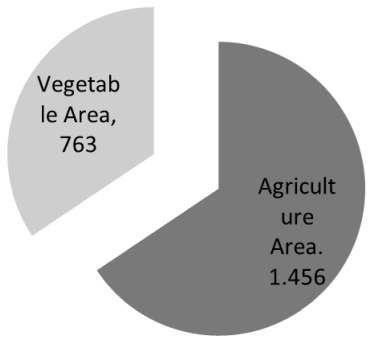

Fig 1. Land areas of household in research areas in 2019

(Source: Field survey, 2019)

The results from survey show that the households growing vegetables in Thai Nguyen mainly belong to the medium group, accounting for about 72%, the remaining 19.5% of the households are in the rich, and 8.5% in the poor. The average area of agricultural production land is 1,456 m^2. In which, the area for growing vegetables accounts for nearly 50%. Average income in 2019 of average households reach 60,000,000 VND / year. Most households have the main source of income from agricultural, accounting for about 72% of the total income. Income from vegetable accounts for 64% of total income and 89% of income from agriculture. The study shows that income from vegetables is an important source of livelihood for the households in the study area.

Safe vegetable production and consumption

Types of vegetables produced in the areas are very diverse and seasonal, including: cabbage, tomato, corn, peas, cauliflower are the main vegetables grown in winter-spring season, summer-autumn season includes water spinach, spinach, amaranth, etc.

The average production value per 1 ha of vegetables differs between vegetables per unit area and between the same vegetables but according to different production cultivations. Added value of tomatoes reached 116,892,000 VND/ha, slightly higher than Cruciferous vegetables (110,262,000 VND/ha), and cabbage (92,996,000 VND/ha). Therefore, the factor of regional (indigenous) products can also be one of the criteria to consider of vegetable producers when deciding on the model of the product they will cultivate in accordance with household capabilities and efficiency of the model.

Traders have to import vegetables from collectors because they can provide a more stable source of vegetables than importing vegetables directly from producers or other sources. Even types of vegetables supplied by collectors are also more plentiful than other sources, but the cost of importing vegetables is also higher than directly imported from producers. This is also the reason why the profits of trader decrease and vegetable costs also increase.

Comparing the economic efficiency of Safe vegetables (SV) and Normal vegetables (NV)

Comparing the economic efficiency of SV production with NV, the total cost of SV production is lower. The reason is that SV production uses less fertilizer and pesticides. However, there are more labor in SV growing. The production cost of SV for cabbage is 42,000,000 VND/ha and for Cruciferous vegetables is 42.500.000 VND/ha; The production costs of SV and SV for vegetables of all types are respectively 36.040.000 VND/ha, 38.040 000 VND/ha. Tomato is 43.500.000 VND/ha and 45.200.000 VND/ha. Thus, the cost difference between planting SV and NV is quite high

Table 2. Production efficiency of some vegetables in Thai Nguyen

No.	Criterial	Types of Vegetables							
		Cabbage		Cruciferous vegetables		Tomato			
		SV	NV	SV	NV	SV	NV		
1. GO	Area (ha)	1	1	1	1	1	1	1	
Productivity (kg/ha)		14.506	14.307	16.732	16.215	14.465	13.752		
Quantity (kg)		14.506	14.307	16.732	16.215	14.465	13.752		
Price (thous. VND)		7.000	6.500	7.500	6.800	10.000	8.500		
Total revenue (Mil. VND)		**101.542**	**92.996**	**125.490**	**110.262**	**144.650**	**116.892**		
2. IC	Varieties (Mil. VND)	4.800	4.800	3.540	3.540	6.500	6.500		
3. CL									
4. TC		10.800	12.500	10.000	13.000	14.000	16.500		
Fertilizer (Mil. VND)		3.400	4.200	2.000	3.500	3.000	4.700		
Pesticides (Mil. VND)		21.000	19.500	18.500	16.500	18.000	16.000		
Labor (Mil. VND)		2.000	1.500	2.000	1.500	2.000	1.500		
Others (Mil. VND)		**42.000**	**42.500**	**36.040**	**38.040**	**43.500**	**45.200**		
Total cost (Mil. VND)									
5. Pr (Mil. VND)			**59.540**	**50.496**	**87.950**	**72.222**	**101.150**		**71.692**

(Source: Field survey, 2019)

The study shows that, although the production of SV is not significantly higher than NV, the selling price of SV is higher due to its higher quality, so the production efficiency of SV is much higher than that of NV.

Cost of vegetable production

The production cost of SV is lower than that of SV production, the cultivation process and technique have a clear difference between the two production cultivations. For NV production, technical requirements are not high or difficult, for production SV equire stricter requirements from the cultivation and use of plant protection. It is necessary to be precise about the amount of fertilizer used for each stage as well as the dosage of the pesticide, especially the quarantine period. Among the costs for vegetable production, most of the costs are the costs of fertilizers and labor. Other costs include costs for purchasing production equipment such as covering materials, pumping water for irrigation, etc.

Vegetable consumption

The study also shows that most of the vegetables are sold by producers to collectors with a consumption rate of up to 61%. After that, vegetables are consumed directly in markets near the city (29.7%). A portion of vegetables are sold to supermarkets and vegetable shops in Thai Nguyen city and the canteen of schools in the area accounts for about 10%. The remaining vegetables are sold at farm gate to retail and some other forms. This shows that vegetables are consumed directly from the producers to the consumers, vegetable shops is very low, but have to go through intermediaries before going to the vegetable shops and then sold to consumers. This leads to higher costs of vegetable price and lower profits for producers. Therefore, this will be an issue to consider when expanding the market for vegetable production, especially safe vegetables need to be paid more attention so that producers can distribute directly to consumers, vegetable shops. In the case of selling to traders, there is a need for supporting labels, preserve products, and ensure price stability, ensure product quality for consumers, this is also an option that is being encouraged.

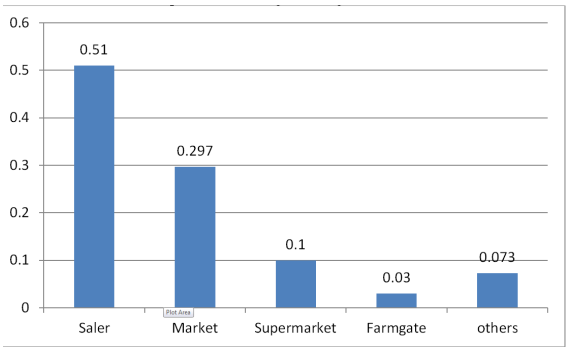

Fig 2. Vegetables distribution to different channels of SV

(Source: Field survey, 2019)

The current situation of distribution and consumption of vegetables by traders

Traders are mainly from the rich, and medium households and there are no poor households. This

is also the difference between groups of households producing for SV and sale and groups of households only producing vegetables in the study area. While most of the producing households are in the middle group, the group of households producing and sale has better economic conditions. Among traders, the proportion of better-off households accounts for 63.6%, the medium households is 30%, the rest are rich households. Most of trader households have experience in vegetable business for more than 5 years, accounting for 50.5%, households have had time to do businessfrom 3-5 years experience, accounting for 30.6%, they have stable stalls in the markets. Other groups of households with lesser experience of saling often do not have stable locations and they sell at different points / markets, some of them open small shops in their homes. Income sources of traders households are also very diversified, from many different sources such as service activities, wages, agriculture... but the main source of income is from business services

Types of vegetables in trader households

Types of vegetables produced and traded by households are diverse, and often change according to seasons. They divided into 4 product groups, including leafy vegetables such as water spinach, spinach, cabbage..., group of tubes such as potatoes, carrots, radishes..., group of fruits such as tomatoes, cucumbers, and finally spicy vegetables like onions, dill, and chili…. In which the most profitable group is spicy vegetables (100% Traders believe that the profit per unit volume of spicy vegetables is the highest). But the biggest consumption is still leaf vegetables which accounts for 45-50% of the total, then cube vegetables fluctuate about 20-27%, the rest about 2 -3% are spicy vegetables.

According traders, the current SV output is still low and not diversity in types of vegetables. In the study area, only a few types of SV are high-value vegetables such as cucumber, beans, and tomatoes. And vegetables with lower economic value are limited and almost nonexistent. Besides, the supply of SV is also limited and unstable.

Table 3. Percentage of consumption of each type of vegetables

Unit: %

Leafy vegetables	Root vege-tables	Tomato and other	Spice veg-etables
45-50	20-23	25-27	2-3

(Source: field survey, 2019)

Supply of vegetables

Traders in the study area import vegetables from many different sources such as collectors, directly from producers, self-growing, and a number of other sources, but mainly through collectors. This accounts for 61.2% of total vegetables consumed by traders. This is followed by buying directly from producers (27%). In addition, some households have their own source of home-produced vegetables, but the proportion is not significant.

Traders have to import vegetables from collectors because they can provide a more stable source of vegetables than importing them directly from producers or other sources. Even types of vegetables supplied by collectors are also more plentiful than other sources, but the cost of importing vegetables is also higher than directly imported from producers. This causes the cost of vegetables to increase, which is the reason why the profits of traders have decreased.

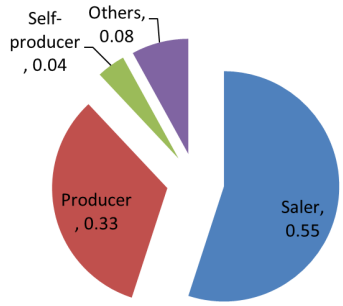

Fig. 3. Sources of vegetables

(Source: Field survey, 2019)

Safe vegetables consumption by traders

Research shows that the percentage of households running safe vegetable business is only 29.2%. The main source of safe vegetables is from local producers accounting for 63.5% and purchased from the market 29.3%, the rest 7.2% from self-producing. Especially, there is no safe vegetable that imports from collectors. The reason is that they do not really believe in the quality provided by collectors, they trust the origin and quality of locally produced SV. This is also one of the factors that need to be considered in order to develop SV production and business in Thai Nguyen.

Customers who buy safe vegetables include three main groups: high income (37.4%); middle income (29.4%) and people running small businesses (23.5%) and the rest 9.7% with lower incomes (poor households). Ratio of SV buyers between these This group of households does not differ much. The main reason is that psychology of these groups of households is very concerned about health and food hygiene and safety. Poor households are less interested in and using SV because the price of SV is often higher.

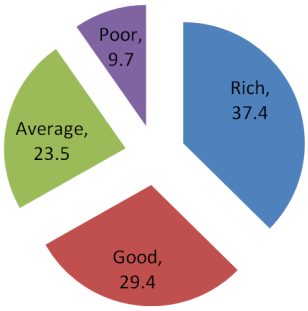

Fig 4. *Groups of customers*

(Source: Field survey, 2019)

Demand and consumers for SV

The daily amount of vegetables consumed by Thai Nguyen households is about 1.1 kg/ household/ day on average. And the average expenditure for vegetables buying by households is about 315,000 VND/ household/month. For consumers, vegetables are indispensable dishes for each family in their daily meals. It also shows that the demand for and the vegetable market is huge and stable.

Consumers often choose to buy vegetables at the markets, this rate accounts for 52.9%. Then in vegetable stores, accounting for 27.7%, only 7% of consumers choose to buy vegetables at a safe vegetable store because of 3 reasons: (1) the price of vegetables is often higher; (2) the place to buy safe vegetables is not convenient; ans (3) it is difficult for consumers to control the origin and evaluate the quality. So people choose to buy vegetables in familiar shop with 12.4%.

Demand for SV

Currently the number of people buying vegetables at SV stores and in supermarkets is very low. And when asked why they did not buy safe vegetables, up to 47% of consumers said they did not have sufficient information about safe vegetables and 31.67% did not believe in the quality and origin of safe vegetables. Only 10% of consumers do not buy SV because the price is higher.

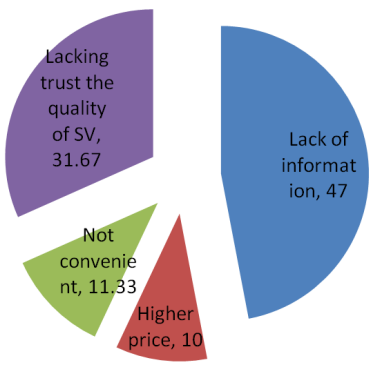

Fig. 5. *Reasons not to buy SV*

(Source: field survey, 2019)

When asked again about the demand for SV, 100% of the households have the need of SV and they all want to have access to SV products.

Ability to recognize/distinguish SV from NV

Most consumers said that they could not distinguish SV from safe vegetables (80%), and they thought that SV and unsafe vegetables were the same without any difference. About 20% of the rest of the people differentiate SV based on their belief in sellers and shops. This shows that the knowledge of safe vegetables of consumers is very limited and it is necessary to equip consumers with knowledge about safe vegetables to ensure their health and increase the output of SV consumption, and expand production scale. Vegetable buyers are also very limited in knowledge of SV-related. Up to 79% of consumers do not know information related to safe vegetables. Even people who regularly buy vegetables at supermarkets do not know the source of the vegetables they bought. The information they know is also very limited, of which 9% know the manufacturer's name, 12% know the production location and other information do not know.

Access to information about SV

The research results on the information channels that consumers can access to know about safe vegetables show that: 25% through TV channels; Internet 57%; and friends 15% and 3% are from other sources. The information consumers receive from these channels is also very general and nonspecific, so it is difficult for them to distinguish safe vegetables from safe vegetables.

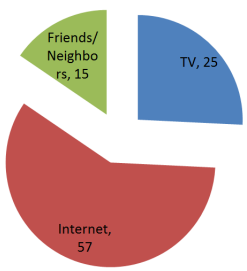

Fig 6. *Information channels on SV*

(Source: Field survey, 2019)

The development of SV in Thai Nguyen

The efficiency of SV production in Thai Nguyen is expected to develop effectively in sustainable ways.

- *In terms of economic efficiency*: The value brought by the vegetable industry is increasing, contributing more to the province's SV production and trading. Income of SV production and consumption agencies increases due to high economic efficiency of production and business management, vegetable export contributes to foreign currency income for the

province, develops SV production and consumption. contribute to shifting the economic structure of vegetable production in the province from self-sufficiency to the direction of market orientation.

- In terms of social efficiency: SV will contribute to the development of social infrastructure (transportation system, communication, markets, supermarkets, trade centers, etc.), create more jobs, improve income of SV production and business establishments, contribute to poverty reduction, reduce negative in rural areas. Increasing production of safe vegetables, high-grade vegetables and processed vegetables will contribute to improving the quality of SV products, diversifying SV products, serving the daily needs of people, contributing to increasing the health of citizen. To receive new and advanced science and technology in the world due to investment cooperation with foreign countries, contributing to limit backwardness.

- Environmental efficiency: Promote SV and vegetable production according to GAP standards, develop sustainable agriculture, contribute to protecting the environment, reduce environmental pollution, create ecological balance, ensure sustainable development, limit toxicity to producers, and reduce food poisoning.

Conclusion

The current situation of SV production and consumption in Thai Nguyen remains scattered and on a small scale; infrastructure for safe vegetables is limited; and the industrial technical level is still weak. Production of safe vegetables is still underdeveloped. The SV consumption in the value chain is not yet developed, mainly SV consumption in the form of spontaneous supply. In which, the state plays an important role in assisting and encouraging the SV sector to develop through undertakings and policies. Policies and guidelines of the State management agencies of Thai Nguyen and development of SV production and consumption are not consistent and not really strong. Planning for SV production areas has not been done well.

Recommendation:

To organize the planning of SV production such as planning the concentrated SV growing areas according to the district area to form commodity vegetable production zones. The planning work should be implemented quickly with specific plans to plan production areas, on the principle of synchronous concentration, with adequate infrastructure for the development of SV production.

To prioritize investment in the construction of infrastructure for SV production regions, and increase investment in infrastructure in service of specialized concentrated SV production regions. To step up technical assistance in the development of SV production and consumption in the context of integration, this is a very important content in the development strategy of the SV sector. Strengthen agricultural extension.

Continue to build and complete a close relationship between the production and consumption of safe vegetables in order to create the synergy of vegetables of the SV industry through developing the value chain. To develop SV production and consumption through the implementation of decisive macroeconomic management policies such as investment policies, science and technology, finance - credit, and agricultural extension; strengthen inspection and control of safe vegetables market, check quality of SV products... The state plays a key role in investing in building infrastructure for the SV industry, scientific research and development of new technology, and SV market information.

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