"An Integrated Business and Environmental Assessment of the Soybean Value Chain in Sangli District"

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INTRODUCTION:

The "Brilliant Bean" of the twentieth century is the Soybean (Glycine max). It thrives in tropical, subtropical, and temperate climates and is the world's largest cultivated oilseed. Soybeans are a primary source of protein, providing a range of essential amino acids and oil. While categorized as a vegetable crop, they are widely grown as an oilseed. Currently, soybeans are India's second-largest oilseed crop, after groundnuts.

Internationally, soybeans are imported to meet the domestic demand for human consumption and livestock feed due to their popularity. The crop is primarily used for animal feed and edible oil. Crushing soybeans yields approximately 18% oil, while the remaining oil cake or meal serves as the primary protein source in animal feed. Grown during the Kharif season, soybean production in India reaches about 12 million tons, making it one of the country's fastest-growing crops. The top three soybean-producing states are Madhya Pradesh, Maharashtra, and Rajasthan, with Madhya Pradesh and Maharashtra contributing 45% and 40% of the production, respectively.

Recently, soybeans have been transformed into a variety of high-value products, including tofu nuggets, edible soya meal, soya milk, flour, and extracted proteins. However, pre- and postharvest losses occur at various stages, including harvesting, threshing, winnowing, storage, packaging, and transportation. Hand harvesting is commonly employed for soybeans, and during storage, spoilage and losses may arise from mishandling, the use of outdated or damaged gunny bags, and rodent infestations. Threshing accounts for 1-2% of postharvest losses after harvesting, while cleaning and winnowing contribute 3.5-5%. Overall, losses during harvesting and storage at the farm level are estimated to be about 1-2%.

This indicates that local farmers often lack knowledge about soybean production technologies. The adoption of recommended production practices is not particularly encouraging, despite the availability of improved crop production technologies. Compared to its potential yield, the soybean productivity in the state is relatively low, likely because many technologies have not yet reached farmers' fields.

Therefore, there is an opportunity to implement a frontline demonstration project aimed at disseminating scientific knowledge among soybean growers and facilitating direct interaction with farmers. The primary objective of this project is to assess the productivity potential and profitability of the latest soybean production technologies under real-world farm conditions, including their supply chain and food processing, ultimately benefiting the farmers. The "Brilliant Bean" of the twentieth century is the Soybean (Glycine max). It thrives in tropical, subtropical, and temperate climates and is the world's largest cultivated oilseed. Soybeans are a primary source of protein, providing a range of essential amino acids and oil. While categorized as a vegetable crop, they are widely grown as an oilseed. Currently, soybeans are India's second-largest oilseed crop, after groundnuts.

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Therefore, there is an opportunity to implement a frontline demonstration project aimed at disseminating scientific knowledge among soybean growers and facilitating direct interaction with farmers. The primary objective of this project is to assess the productivity potential and profitability of the latest soybean production technologies under real-world farm conditions, including their supply chain and food processing, ultimately benefiting the farmers.

OBJECTIVES OF THE STUDY:

1. To recognize the various constraints faced by stakeholders with respect to fruit and vegetable crops in Sangli District.
2. To analyze the various services received by farmers through the distribution channels support system.
3. To understand the hygiene level and the effect of the environment on soybeans during cultivation and transportation.
4. To investigate the various factors that contribute to fruit and vegetable postharvest loss.

SCOPE AND IMPORTANCE OF THE STUDY:

The purpose of this study is first and foremost to determine why farmers choose a particular supply chain to market their produce. The geographical scope of this study is limited to the selected villages in Sangli District. The study also analyzed farmers' expectations towards the supply chain and the government. The present study not only analyzed the problems and difficulties faced by farmers in terms of production, processing, profitability, and supply chain management for soybeans but also suggested remedies to benefit both farmers and ultimate consumers. Farmers need effective delivery systems and supply chain management tools to meet their requirements. The Indian government can take several conceptual initiatives to solve the problems existing in the Indian food supply chain.

RESEARCH METHODOLOGY:

a. Data Collection: The following sources will be used to collect the data necessary for this study's various aspects: i) Original sources: Feedback from soybean farmers and consumers who purchase soybeans in a variety of forms from cart vendors, retail outlets, and mandis in shopping malls. Interview farmers and middlemen (sellers, wholesalers, retailers, traders, commission agents, and warehousing operators) to learn how long crops are stored across all aspects of agriculture. ii) Secondary sources: Secondary sources will be used to collect data. • The newspapers • The magazines • Research Books

• Reports and Publications of National and International Institutes.
• Government documents. • Various Research Journals, Periodicals.

b. Sampling Technique:

Sampling Unit:

Consumers, who are buying soybean from various sources like shopping mall cart vendors, retail outlet and mandis In SangliDistrict . Farmers and middleman (like shopping mall, cart vendors, retail outlet and sellers in mandis, commission agents etc) In Sangli district

Sampling Method: The cluster and convenience random sampling methods will be used to select the samples.

Sample frame, Size:

SR . No	Tahasil	No of villages	Percentage of village	SamplingSize ofVillages	
01	Walwa	96	15%	15	
02	Shirala	97	15 %	15 03 Palus 35	15%	06
04	Miraj	65	15%	10	
05	Tasgaon	68	15%	11	
06	Khanapur	56	15%	08	
07	Kadegaon	67	15%	10	
Total number of village sample		**484**	**15%**	**75**	

5% of farmers, customers and commission agents will be selected from each village. c. Research Instrument:

The data collection will do by using structured Questionnaires and Observation

DATA ANALYSIS AND INTERPRETATION:

Table 1: Area, Production and Yield of India

Market Year	Area (1000 Ha)	Production (1000 Tons)	Yield (T/Ha)
2011/2012	10,109	11,940	1.2
2012/2013	10,841	12,186	1.1
2013/2014	11,716	9,477	0.8
2014/2015	10,911	8,711	0.8
2015/2016	11,605	6,929	0.6
2016/2017	11,183	10,992	1.0
2017/2018	10,329	8,350	0.8
2018/2019	11,131	10,930	1.0
2019/2020	12,193	9,300	0.8
2020/2021	12,918	10,450	0.8
2021/2022	12,500	11,900	1.0

Source: United State Department of Agriculture

The area, production and yield of soybean is an important part in the agricultural economy. The above table shows the area, production, and yield of India. The area is measure in 1000 Ha, production is measure in 1000 tons whereas, the yield of soybean product measures tons per ha. Area of soybean product in India is increases year after year. The highest production of soybean is in the year of 2012-13. The production of soybean product is not that much increases as per area is increases. Also, the yield of the soybean is remains same. In India, there is need to increases new varieties of seeds and pesticides due to this the production is also increases as area of soybean is increases.

Table 2: State-wise Area of Soyabean Product

| State	2020-21			2021-22		
	Area (lakh ha)	Area (lakh acres)	% to total area	Area (lakh ha)	Area (lakh acres)	% to total area
Madhya Pradesh	58.54	144.66	48.30	55.84	137.98	45.86
Maharashtra	43.21	106.77	35.65	46.01	113.69	37.79
Rajasthan	11.00	27.18	9.08	10.62	26.24	8.72
Karnataka	3.32	8.20	2.74	3.82	9.44	3.14
Gujarat	1.49	3.68	1.23	2.24	5.54	1.84
Telangana	1.60	3.95	1.32	1.51	3.74	1.24
Others	2.04	5.04	1.68	1.72	4.25	1.41
All India	121.20	299.49	100.00	121.76	300.88	100.00

Source: www.agricoop.gov.in

The above table shows the area of soybean product in main states. The area measures in lakh ha. The time period consider only for 2 years. India's acreage planted with soybean product for the 2021–22 growing season was 121.76 lakh hectares, up from 121.20 lakh hectares in the 2020–21 growing season. With 55.84 lakh ha, Madhya Pradesh was the largest state, followed by Maharashtra (46.01 lakh ha). There are 48.30 per cent area of soybean product is under the Madhya Pradesh state followed by Maharashtra (35.65 per cent). Gujarat has less soybean area i.e., 1.23 per cent of overall area of India. The remaining other states has only 1.68 per cent area from overall area of Soybean product in India

1. **Gender of Respondents Under Study**

Table 3: Gender of Respondents					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	203	88.3	88.3	88.3
	Female	27	11.7	11.7	100.0
	Total	230	100.0	100.0	

Source: SPSS 24
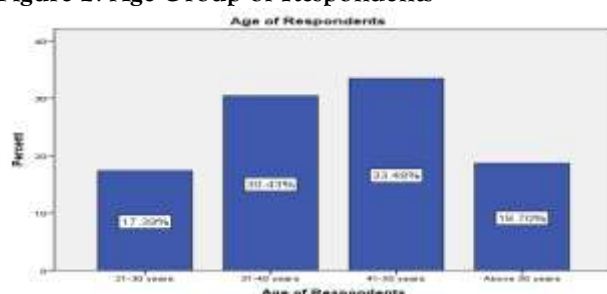
Figure 1: Gender of Respondents
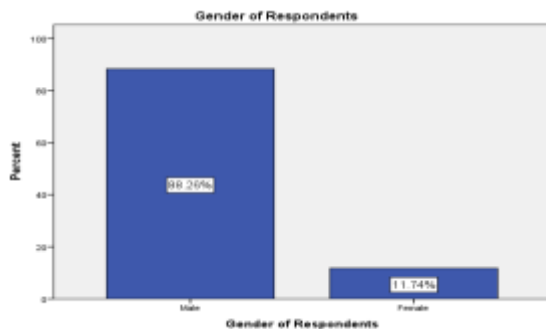
Source: SPSS 24

The above figure represents gender of the respondents under the study. The researcher observed that the male respondents are more responses that is88.26 per cent. Whereas, the female respondents are less responses than the male that is around 11.74 per cent.

2. **Age Group of the Respondents Under Study**

| Table 4: Age of Respondents					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	21-30 years	40	17.4	17.4	17.4
	31-40 years	70	30.4	30.4	47.8
	41-50 years	77	33.5	33.5	81.3
	Above 50 years	43	18.7	18.7	100.0
	Total	230	100.0	100.0	

Figure 2: Age Group of Respondents

Source: SPSS 24

The above figure represents the age group of the respondents under study. The researcher observed that, the more responses are given by the age group of 41-50years that is around 33.48 per cent followed by the age group of31 to 40 years (30.43per cent). The least respondent's responses under the study are in between 21 to 30 years of age (17.39 per cent).

3. Qualification Completed by the Respondents

| Table 5: Qualification of Respondent					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below 12th standard	86	37.4	37.4	37.4
	Bachelor Degree	66	28.7	28.7	66.1
	Master Degree	22	9.6	9.6	75.7
	Professional Degree	27	11.7	11.7	87.4
	Other	29	12.6	12.6	100.0
	Total	230	100.0	100.0	

Figure 3: Qualification of Respondents
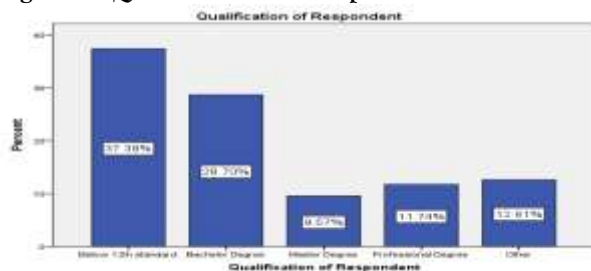
Source: SPSS 24

The data studies the educational qualification of the respondents under study. Most of the respondents are completed below 12th standard of education (37.39 per cent) followed by the bachelor degrees (28.70 per cent). Around 9.57 per cent respondents are completed their master degree. Last but not the least, from overall respondents, around 11.74 per cent respondents are completed professional degree.

Yearly Income of the Respondents under Study

Table 6: Yearly Income of Respondents					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below 1 lakh rupees	90	39.1	39.1	39.1
	1 lakh to 3 lakhs rupees	58	25.2	25.2	64.3
	3 lakhs to 5 lakhs rupees	49	21.3	21.3	85.7
	Above 5 lakhs rupees	33	14.3	14.3	100.0
	Total	230	100.0	100.0	

**Figure 4: Yearly Income of Respondents**
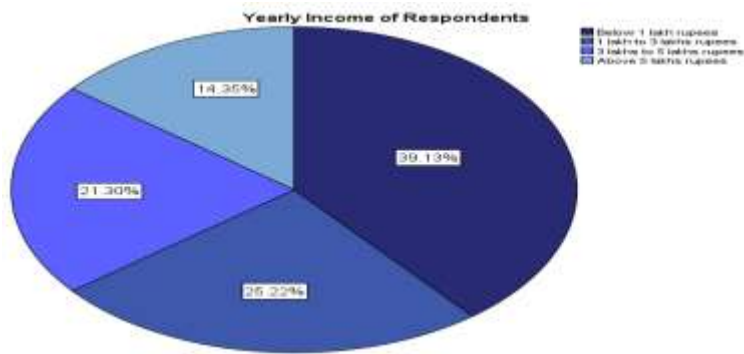
Source: SPSS 24

The data under study analyzes they early income of the respondents. The more respondents have below 1 lakh rupees yearly income (39.13 per cent). While, the respondent's responses which are1 to 3 lakhs rupees of yearly income are 25.22 per cent. The 14.35 per cent of respondents have more than 5 lakhs on yearly income.

Years of Production of Soybean of the Respondent's Farm

Table 7: Years of Production of Soybean in farm					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 3 years	39	17.0	17.0	17.0
	3 to 6 years	41	17.8	17.8	34.8
	6 to 9 years	44	19.1	19.1	53.9
	9 to 12 years	37	16.1	16.1	70.0
	12 to 15 years	36	15.7	15.7	85.7
	More than 15 years	33	14.3	14.3	100.0
	Total	230	100.0	100.0	

**Figure 5: Years of production of soybean in farm**
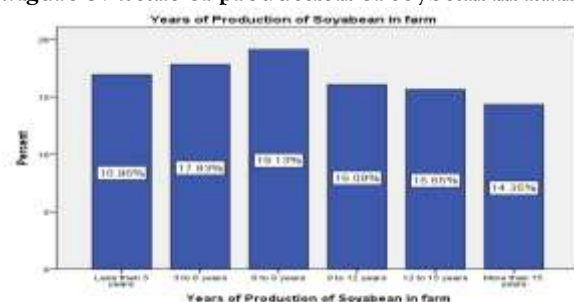
Source: SPSS 24

The above figure shows the years of production of soybean in the respondent's farm. Around 19.13 per cent respondents are taking soybean production in their farm since 6 to 9 years followed by 3 to 6 years (17.83 per cent). The least i.e.,14.35 per cent respondents are taking production since more than 15 years.

4. Land of Farmers (in acres) of the Respondent Under Study

| Table 8: Land of Farmers (in acres)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 3 acres	63	27.4	27.4	27.4
	3 to 5 acres	57	24.8	24.8	52.2
	5 to 10 acres	61	26.5	26.5	78.7
	More than 10 acres	49	21.3	21.3	100.0
	Total	230	100.0	100.0	

Figure 6:Land of farmers (in acres)
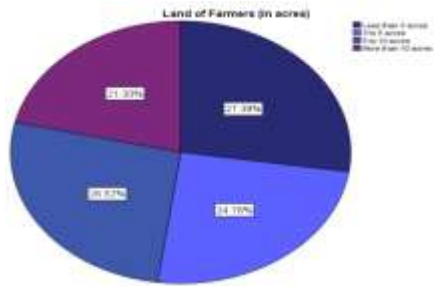
Source: SPSS 24

The above figure shows the land of farmer's uses for soybean product in acres. Around 27.39 per cent of the respondents are uses their less than 3 acres land for the soybean product followed by the 26.52 per cent of the respondents are uses land which is in between 5 to 10 acres.

Gender of Respondents under Study

| Table 9: Gender of Respondents					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	135	87.7	87.7	87.7
	Female	19	12.3	12.3	100.0
	Total	154	100.0	100.0	

Figure 7: Gender of Respondents
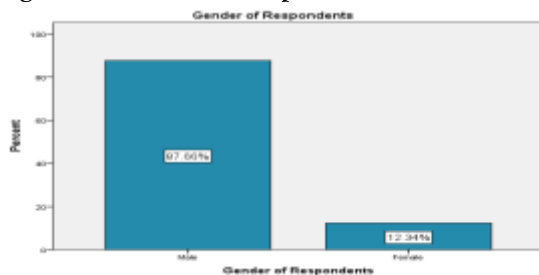
Source: SPSS 24

The above graph depicts the gender of respondents under study. The 87.66 per cent male respondents are responses and around 12.34 per cent female respondents are responses. Hence, the male respondents are more than the female responses.

5. Age Group of the Respondents Under Study

Table 10: Age of Respondents					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	21-30 years	45	29.2	29.2	29.2
	31-40 years	51	33.1	33.1	62.3
	41-50 years	43	27.9	27.9	90.3
	Above 50 years	15	9.7	9.7	100.0
	Total	154	100.0	100.0	

**Figure 8: Age Group of Respondents**
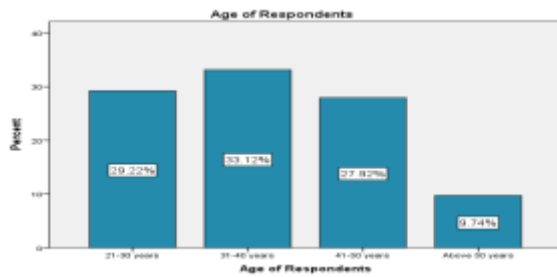
Source: SPSS 24

The above figure represents the age group of the respondents under study. The researcher observed that, the more responses are given by the age group of 31-40 years that is around 33.12 per cent followed by the age group of 21 to 30 years (29.22 per cent). The least respondent's responses under the study are above 50 years of age and percentage of these responses are 9.74 per cent from overall responses.

Qualification Completed by the Respondents

Table 11: Qualification of Respondent					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bachelor Degree	44	28.6	28.6	28.6
	Master Degree	54	35.1	35.1	63.6
	Professional Degree	43	27.9	27.9	91.6
	Other	13	8.4	8.4	100.0
	Total	154	100.0	100.0	

**Figure 9: Qualification of Respondents**
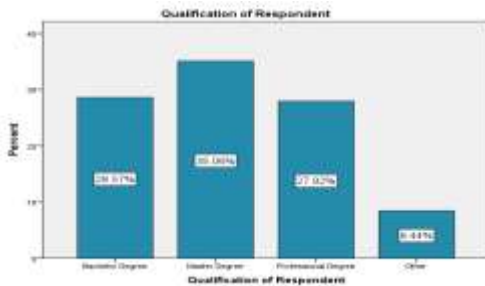
Source: SPSS 24

The data studies the educational qualification of the respondents under study. Most of the respondents are completed master degrees of education (35.06 per cent) followed by the bachelor degrees (28.57 per cent). Around 27.92 per cent respondents are completed their professional degree. Last but not the least, from overall respondents, around 8.44 per cent respondents are completed other degree.

6. Size of Organization

Table 12: Size of Organization					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Small [10-50 employees]	80	51.9	51.9	51.9
	Medium [51-250 employees]	65	42.2	42.2	94.2
	Large [>250 employees]	9	5.8	5.8	100.0
	Total	154	100.0	100.0	

**Figure 10: Size of Organization of Respondent Under Study**
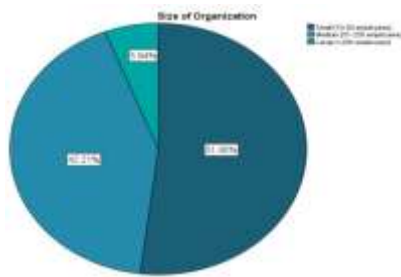
Source: SPSS 24

The above figure depicts that the size of organization under study. Around 51.95 per cent respondents are running the small organizations. The small organization has only 10 to 50 employees are working in the organization. The medium size organization has 51 to 250 employees working in the organization. 42.21 per cent respondents have medium organizations.

7. Traders Under Study

Table 13: Traders under study					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Dealer	26	16.9	16.9	16.9
	Producer	43	27.9	27.9	44.8
	Retailor	34	22.1	22.1	66.9
	Wholesaler	46	29.9	29.9	96.8
	Other	5	3.2	3.2	100.0
	Total	154	100.0	100.0	

Figure 11: Type of Trader
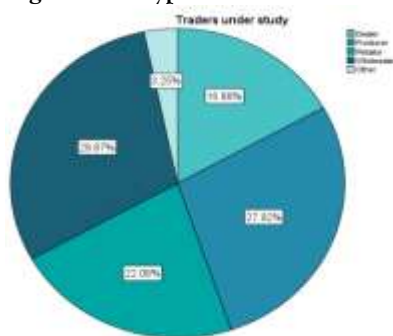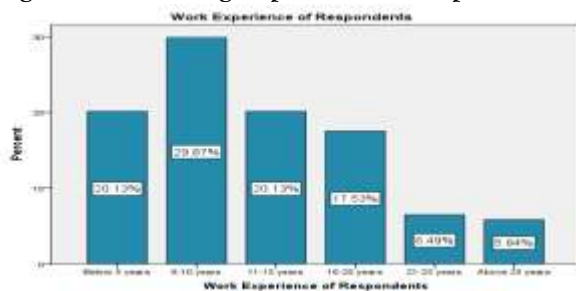

Source: SPSS 24

The figure shows that the types of traders under study. The traders under study are wholesaler, dealer, producer, retailer and other. The 29.87 per cent respondents are belongs to wholesaler trader. 27.92 per cent respondents are producers under study. Around 22.08 per cent respondents are retailer. The other traders are around 3.25 per cent under study

8. Work Experience of the Respondent Under Study

Table 14: Work Experience of Respondents					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below 5 years	31	20.1	20.1	20.1
	6-10 years	46	29.9	29.9	50.0
	11-15 years	31	20.1	20.1	70.1
	16-20 years	27	17.5	17.5	87.7
	21-25 years	10	6.5	6.5	94.2
	Above 25 years	9	5.8	5.8	100.0
	Total	154	100.0	100.0	

Figure 12: Working Experience of Respondent as a Trader
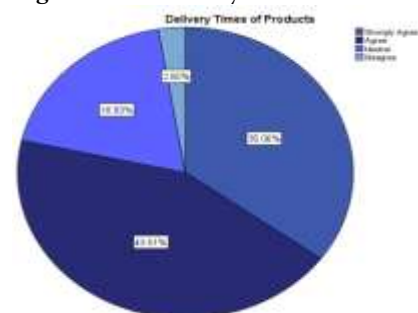

Source: SPSS 24

The above figure depicts that the work experience of the traders under study. Around 29.87 per cent respondents are working since 6 to 10 years in this field. The 20.13 per cent respondents are working in the organization from 11 to 15 years and below 5 years respectively. The least respondents are 5.84 per cent under study.

Support Activities of Soybean Value Chain in Sangli District

Table 15: Delivery Times of Products					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	54	35.1	35.1	35.1
	Agree	67	43.5	43.5	78.6
	Neutral	29	18.8	18.8	97.4
	Disagree	4	2.6	2.6	100.0
	Total	154	100.0	100.0	

**Figure 13: Delivery Times of Products**

Source: SPSS 24

Support activities of soybean value chain is an important factor in the soybean product. The delivery times of product is a necessary factor. Around 43.51 per cent respondents are agree that the delivery times of product is a support activity of soybean value chain. Whereas, 35.06 per cent respondents are strongly

agree that this factor is important for soybean value chain. The least i.e., 2.60 per cent respondents are not agree with this statement.

Table 16: Procurement Costs					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	29	18.8	18.8	18.8
	Agree	90	58.4	58.4	77.3
	Neutral	32	20.8	20.8	98.1
	Disagree	3	1.9	1.9	100.0
	Total	154	100.0	100.0	

Figure 14: Procurement Costs
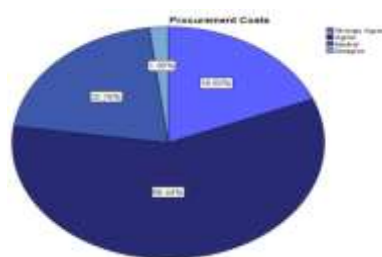
Source: SPSS 24

Another support activity in soybean value chain is procurement cost. Around 58.44 per cent respondents are agreeing that the procurement costs are important in support value chain

Table 17: Information Technology (ICT) Development					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	37	24.0	24.0	24.0
	Agree	90	58.4	58.4	82.5
	Neutral	24	15.6	15.6	98.1
	Disagree	3	1.9	1.9	100.0
	Total	154	100.0	100.0	

Figure 15: ICT Development

Source: SPSS 24

Another support activity in soybean value chain is Information Technology development. Around 58.44 per cent respondents are agreeing that the information technology developments important in support activity of soybean value chain.

Table 18: Human Resource Activities					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	31	20.1	20.1	20.1
	Agree	91	59.1	59.1	79.2
	Neutral	27	17.5	17.5	96.8
	Disagree	5	3.2	3.2	100.0
	Total	154	100.0	100.0	

Figure 16: Human Resource Activities

Source: SPSS 24

The human resource activities are another support activity of soybean value chain in Sangli district. Around 59.09 per cent respondents are agree with the statement that the human resource activity is important for soybean product. While, 20.13 per cent respondents are strongly agree with the same.

Table 19: Firm Infrastructure					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	45	29.2	29.2	29.2
	Agree	70	45.5	45.5	74.7
	Neutral	31	20.1	20.1	94.8
	Disagree	7	4.5	4.5	99.4
	Strongly Disagree	1	.6	.6	100.0
	Total	154	100.0	100.0	

**Figure 17: Firm Infrastructure**

Source: SPSS 24

The firm infrastructure is one of the support activities in soybean value chain of Sangli district. 45.45 per cent respondents are agreeing that the firm infrastructure is important in soybean value chain support activity.

Measurement of Marketing Performance of Soybean/Soybean Products Traders

| Table 20: Brand					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	72	46.8	46.8	46.8
	Agree	66	42.9	42.9	89.6
	Neutral	12	7.8	7.8	97.4
	Disagree	4	2.6	2.6	100.0
	Total	154	100.0	100.0	

Figure 18: Brand
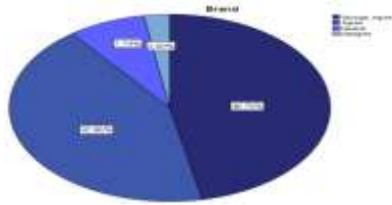
Source: SPSS 24

The above figure depicts that the measurement of marketing performance ofSoybean/Soybean products traders. Around 46.75 per cent respondents are strongly agree that the brand is a measure of marketing performance of soybean product.

| Table 21: Direct Marketing					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	62	40.3	40.3	40.3
	Agree	70	45.5	45.5	85.7
	Neutral	17	11.0	11.0	96.8
	Disagree	5	3.2	3.2	100.0
	Total	154	100.0	100.0	

Figure 19: Direct Marketing
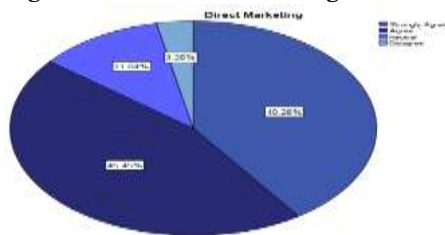
Source: SPSS 24

The above figure represents the direct marketing as a measurement of marketing performance of soyabean product. The 40.26 per cent respondents are strongly agree that the direct marketing is a important measure of marketing performance of soybean product in Sangli district.

Table 22: Public Relationship					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	71	46.1	46.1	46.1
	Agree	71	46.1	46.1	92.2
	Neutral	11	7.1	7.1	99.4
	Disagree	1	.6	.6	100.0
	Total	154	100.0	100.0	

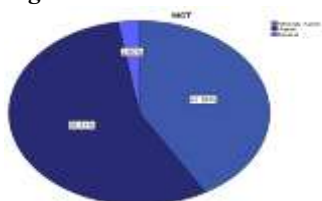**Figure 20: Public Relationship**
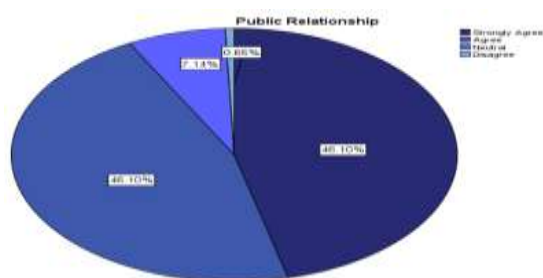
Source: SPSS 24

The above figure depicts that the measurement of marketing performance of Soybean/Soybean products traders. Around 46.10 per cent respondents are strongly agree and agree that the public relationship is a measure of marketing performance of soybean product respectively.

Table 23: MGT					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	64	41.6	41.6	41.6
	Agree	86	55.8	55.8	97.4
	Neutral	4	2.6	2.6	100.0
	Total	154	100.0	100.0	

Figure 21: MGT

Source: SPSS 24

The above figure represents the MGT as a measurement of marketing performance of soybean product. The 55.84 per cent respondents are agreeing that the MGT is an important measure of marketing performance of soybean product in Sangli district. Around 41.56 per cent respondents are strongly agree with the same statement followed by 2.60 per cent respondents are neutral.

FINDINGS
1. The difficulties farmers face is influenced by farm size.
2. The difficulties such as storage facilities and accessibilities issues are addressed in cooperative channels.
3. Bumper season demand management become fragile.
4. Small farmers feel regarding apathy of banks for financing due to their status in the society
5. The Improper Demand from agency, Inadequate Selling Price Negotiation Process are key factors, farmers face a lot of difficulties among all various factors in bumper season.
6. Technical assistance and storage facilities are among the least frequently used. Services imparted to farmers. So, it should be prioritized by the stakeholders. Particularly government for making such system to overcome all these grave problems.
7. The size of the crop has an effect on a number of service factors, like credit service.
8. 70% of respondents stated that more than 10% of losses are the result of an inefficient distribution chain. Non-proper handling of products during transportation results in losses in relation to fruits and vegetables. There is less loss before harvesting.
9. Most of the times loss occurs due to disasters extreme climate, pests, etc.
10. Throughout the distribution chain, it is found that there is missing of proper organized setup. Each player work as isolation for their benefit without consulting with immediate distribution chain players.

SUGGESTIONS
1. Farmers can take help from government, experts and NGOs to overcome the difficulties.
2. Farmers can use group farming to overcome the issues brought on by small farm sizes.

3. The State and Central government have to intensively execute the storage facility scheme. Farmers have to get aware about these scheme which are already exist with government financing support and subsidy

4. To avoid the post-harvest loss, the cold chain mechanism should be Established by the distributers. Companies in the private sector such as Reliance and Godrej can invest in cold chains with support from the government.

5. The product distribution standard must be framed and established by the government.

6. Improper packaging is the main reason for Postharvest loss the Distributers and government can arrange trading to farmers about proper packaging system

7. Government has to promote Industries at rural areas near to its major production zone.

CONCLUSION

In this study, male respondents are more than the female respondents in both the farmers and trader's profile. After that study, it was found that small size of organizations is more in this study. The existence of work experience of the respondents is in between 6 to 9 years. Also, the wholesaler followed by producer is more responded in this study.

The researcher analyzes the support activities of soybean value chain in Sangli district. Product delivery times, procurement costs, information technology (ICT) development, human resource activities, and firm infrastructure were identified as the primary support activities incorporating soybean value chain analysis, according to the findings. Further, the analysis was done related to measurement of marketing performance of soybean products. The main marketing results of the soybean products are the brand, direct marketing, public relations, and MGT. There is a need of more investment; the soybean marketing activities are more profitable. Also, it is a better source of employment in rural area. The overall the researcher found that the soybean cultivation practices are best practices for growth of the product. The integrated pest management is a better option to increase the production of the soybean. Also, the soybean marketing activities are beneficial to the farmers.

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