

Risk Management in Agricultural Supply Chain: A Tool to Foresee Possible Risks in the Value Chain.

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Abstract - This paper deals with an empirical approach to analyze the various risks involved in the whole value chain of Agriculture. An overview of Agriculture supply chain's contribution to a country's economy and how potential risks if handled with right can help its economy has been displayed. Surveys and interviews have been conducted with various sets of people and companies linked with the Agri-Supply Chain and a detailed analysis has been carried out with the feedback obtained. An overview of the agricultural supply chain and its various flow processes has been discussed in detail. Compiling all the key risk factors, a model Rubric, PAAR (Problem Analysis for Action Rubric) has been developed. This rubric helps in for a better evaluation of potential risks involved in the supply chain. The PAAR is scored for the data collected from sample sets to emphasize the significance of the tool.

Key Words: Agri-Supply Chain, Supply Chain Risk Management, Problem Analysis for Action Rubric.

1. INTRODUCTION:

Agriculture has been the backbone of India even before Independence.

The foodgrain production rate in India has surged from 51 million tonnes in 1950-51 to 250 million tonnes during 2011-12 which is the highest ever since independence [9]. Countries like India deal with excessive pressure due to its population and labour surplus economy, it demands a rapid increase in food production. Unless the Indian agriculture Market is able to continuously increase its production of food grains, a crisis is likely to emerge in the near future [10]. Not only limiting food production, but other agro-based processing industries like sugar, cotton, jute, beauty products are also heavily dependent on agriculture for their supplies.

Hence these industries' development is directly linked with agricultural developments of the country. Indian agriculture also plays an important role in the import and export trades of the country. These trade activities help in establishing global connections and helps in expanding the service sector of the country. Indian government earns huge revenue from the agriculture sector as well. The means of revenue generation is from freight travel, i.e, Indian railways, and other state transportations play a vital role in the logistics of agricultural products for internal trades. Compared to other business organizations,

the agricultural sector and farmers are more prone to face risks in the business aspect. It is mainly because of the fact that most agricultural products and services are directly exposed to natural processes, biological assets, and plant and animal diseases [12].

The research sector in Supply Chain Risk Management has become crucial over the past few years. Risk management is even more important for agricultural supply chains due to various challenges associated with it. Globalization and Lean Management are the main factors behind this development. Agriculture plays a vital role in the world's economy. [1] Mainly in India, it contributes about 14% of the GDP and also provides employment to over 60% of the population in India [2]. Seasonality, Seed Quality, Culture methods, Perishability are the main characters associated with agricultural products which in turn are the main reasons for Risks in the Agricultural Supply Chain. Farmers have to have prior knowledge of the risks involved in the whole process. This paper importantly puts up a Problem Analysis for Action Rubric to help the farmers and the stakeholder to score their risks out of 10 and get to know their stance in the risk management.

Literature review:

The modern definition of a successful Industry is the one that has a concrete supply chain linked to each and every functionality the industry operates in. "Supply Chain Management", an important value determining factor, has many intricacies and risks when deployed in the field of Agriculture. These intricacies affect the supply chain processes that might bring huge losses for people involved in. The reforms of 1991 have introduced Indian agriculture to globalization which has a very significant impact on agriculture and the supply chain. The cause of the 2007- 2008 "World Food Price Crisis" was due to production risk related to severe droughts. This risk magnified into a crisis when the government introduced export bans and restrictions throughout [8]. During this crisis, farmers faced production risk, market risk, and Governmental policy risk all in a short span of time. Apart from these human-generated risks, there are other external and natural factors that pose risks to agriculture and its supply chain. Thus, we could infer that risk outcomes can have a cascading effect where one type links up to another [7].

In India, there are many measures taken to help farmers and supply chain work better, one of such measures is Jeevika FPC(Farmers Producer Company)

practiced in the locals of Bihar. Apart from providing 15–20% higher prices to farmers, the producer company has made profits to the tune of INR 6.3 million in its first 2 years of active operation[14].

Poor technological adoption and the presence of intermediaries along all the channels of the supply chain are major factors that affect the transportation and distribution channel of the supply chain [11]. In addition, while considering distribution channels the market information is highly dispersed because the physical location of agricultural production and its consumption is very scattered [13].

2. Agri-Supply Chain Management (ASCM):

One of the major contributors to a Country’s GDP is agriculture. A lot of developments have been consistent in the field of agriculture since the Green Revolution in the 1960s in India. A country is set to be agriculturally strong only if the sector’s network is well linked to every part of the country.

Though a lot of positive changes took place in the field, supply chain management’s role was never looked into deeply. The first research in ASCM started in the year 1980 with a study on inventory management. A general ASCM follows a “Farm to Fork Approach ” which starts from the process of purchasing seeds to reaching consumers for day to day needs [4]. As per Supply Chain is considered its basic components consist of three parts and they are Supplier, Processor or Manufacturer, and Customer. The operations in this chain get supportive services from logistical, financial, and technical services which are basically controlled by the three flows in supply chain management; information, financial, and material flows to effectively perform in an enabling environment [2].

The major players in the chain are the Supplier, Processor and Consumer. The whole chain revolves around them.

The supplier is the one who supplies the products as per the order placed by the processor or the manufacturer. In agriculture, the suppliers are usually the farmers who sow and harvest the crops. Depending upon the demand the processors place the order. In some cases, the farmers act as the customers also. As farmers don’t have advanced machinery to process their raw materials they tend to move out to processors to get help. They later buy back their finished products and sell them to the market directly. While considering the whole value chain, there could be multiple suppliers for a single processor. When these multiple suppliers act as a single entity and supply goods in a timely manner it could enhance the overall productivity of the entire chain [5]. Usually, the form of supply in ASCM could be of two major types. Perishable products like Crops, Fruits and vegetables, eggs, Milk, Meat which has a limited shelf life, and Durable products like Dry fruits, dried millets, eggshells have an extended shelf life [3].

The processor’s role is to make the raw material into the final consumable product once the supplier delivers the goods. The role of the processor is very much critical as the raw materials get its final shape here. This is an extensive process involving labor intensive work. Also, this area has got a lot of scope for optimization with the involvement of technology. In Agri-Supply Chain (ASC) the processors are the factories and mills that help in furnishing and packing the goods according to customer requirements. There are many management strategies involved in this stage. Just in Time manufacturing, Total Quality Management, Lean Manufacturing, Inventory Management are the various strategies put up for the further enhancement of this sector.

Finally, after the product reaches its desired form the customer picks it up from the processor. The customer can be a retailer or a wholesaler, and sometimes consumers also get the product from the processors directly. In every supply chain Customer is the most important person who decides the value of the entire chain. The products are made according to the customer’s requirements. Usually, reverse logistics is also done when the customer’s demands are not satisfied.

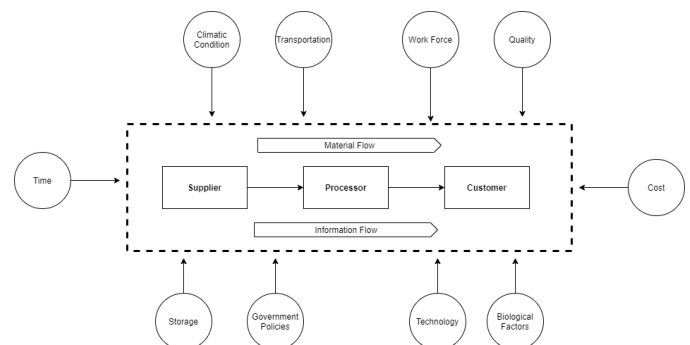


Fig -1: Risks in Flow of Agri-SCM

2.1 Logistics:

Logistics is the transportation of materials and goods in and around the Supply Chain. There are two types of logistics, inbound and outbound. Inbound logistics is the flow of goods coming into the processor from the suppliers and Outbound logistics is the flow of goods leaving the processor to the customer. Without a proper or a well-connected logistics system the whole supply chain will not function properly.

2.2 Material and Information Flow:

Material and Information flow are persistent throughout the process. Material flow is termed as the flow of products in each and every stage. Sharing of knowledge or information with co-workers and partners to effectively serve the downstream customers. The information shared is usually regarding production status and the planning process, but this is subjective and varies for one business environment to another [6]. Importantly

sharing of information happens at different levels. Information flow in the supply chain is basically controlled by the ICT domain or through word of mouth.

2.3 Possible Risks:

When a supply chain is formed it always comes with a set of risks that must be identified and one should find ways to mitigate them. This paper discusses the possible risks that could occur in the Agri-Supply Chain. During the course of this supply chain, there are multiple risks involved that could turn into a potential problem and lead to heavy loss of crops, time, or money.

When these risks are not considered as a threat or dealt with, the problem will affect one entity in the above show diagram i.e., for example, a climatic risk could become a potential problem for a crop's goodness. If a crop is affected the seller or buyer has to face losses. Here in the example, the 'Processor' phase is affected where storage is involved and the storage time is vulnerable to climatic conditions.

Climatic risk is one major risk involved in Agriculture SCM. Periodic rainfall, temperature change, hail storms, strong winds often affect the agriculture supply chain as most of the agricultural products are temperature sensitive. Strict monitoring and maintenance of optimum temperature and moisture are necessary for the storage phase of agricultural goods too.

The availability of labour is a major risk especially in the processing phase of agricultural goods. Since most of the crops are seasonal especially like paddy, wheat, maize, and some grains, the processing mill could not run throughout the year. Shelf life and perishability are the main key factors involved in Time bounded risk. ASCM mainly deals with food products thus each one has specific perishability. In storage, it is necessary to maintain the product with optimum temperature and moisture to assure their shelf life which comes under known risk. While there are also unknown risks like pests infestation that can damage the food products. Strict monitoring is essential in the inventory phase for quality assurance.

Transportation risk is mainly due to the following reasons. 1. Road accidents might occur during transportation which leads to a major loss. 2. Often delay in delivery of products which may break the trust circle of the supplier. 3. Theft possibilities are high in long transportation.

Biological risk can be classified into two types. One is due to the spread of disease to the crops in the field and the second is the possibility of bacterial/fungal infection in the storage phase due to poor inventory maintenance.

It may be difficult to assure the expected quality to the customer due to poor maintenance and improper processing. For instance, in paddy processing, it is necessary to dry the paddy to reach optimum moisture before dehulling. Improper drying will affect the quality and the husk might not get removed completely from the rice after dehulling. Sometimes end products received by customers might also get adulterated by intermediate agencies.

Research and development in agriculture have introduced many technologies to support and improve farming. But the problem lies in the implementation.

For example, many small and medium scale processing mills face difficulties in the implementation of new technologies due to factors like cost, land, and other resources. Various risks occur due to the import and export of agricultural products across countries. These risks are majorly attributed to changes made in government policies.

3. Kharif crops supply chain scenario:

The primary focus of this paper is on the possible risks on the Kharif Crop supply chain. Kharif crops are nothing but monsoon crops or rice crops. This variety of crops is taken as our main focus as it is grown all over the country and the process involved in the supply chain is moreover common in all the parts of the country. Rice is the primary food consumed by the South Indians. We particularly chose supply chain networks connected with Thanjavur and Perambalur districts respectively as these districts are the backbone of Tamil Nadu's Agricultural sector.

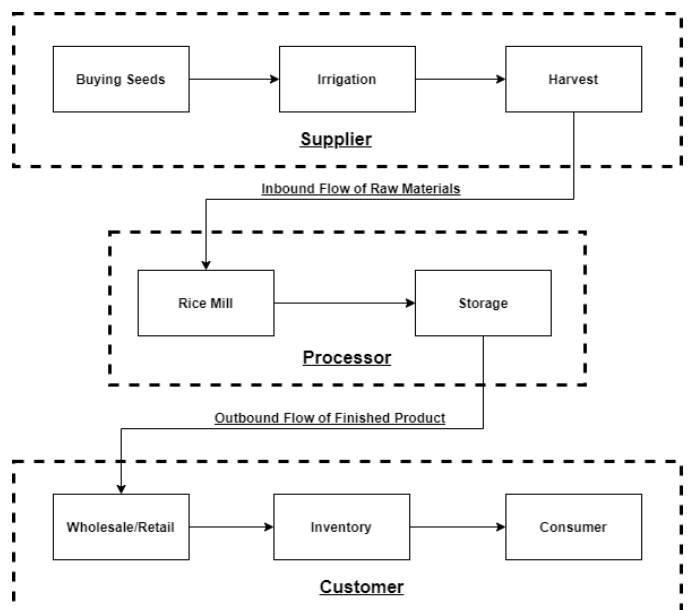


Fig -2: Process flow diagram of Agri Supply Chain

3.1 Aim:

The goal of this paper is to identify the list of adoption barriers or risks involved in Kharif Crop supply chains and to preach the stakeholders to be resilient enough to tackle the adverse scenarios in advance.

3.2 Source:

All the data used in this paper has been put in an empirical approach. The paper mainly focuses on Farmers, Rice mill owners, Retailers, and wholesalers in and around Thanjavur and Perambalur District. We collected the data through one to one interviews and through telephonic conversations. To check whether the got back data was highly reliable we did a lot of interviews with the specific target groups until we found the data to be reliable.

4. Methodologies and Approaches:

A well-defined model is prepared for the determination of the adoption barrier involved in executing a supply chain. From the data collected a PAAR (Problem Analysis for Action Rubric for Agricultural crops) is created for the evaluation of the whole process. With the data acquired from various companies through interviews, we scored the PAAR for each sector out of 10. It was astonishing to note that each sector namely Supplier, Processor and the customer had the same score in their respective domain irrespective of different companies. The main findings of this research work are the construction of the PAAR which could be a handy evaluation tool for the investors as well as the stakeholders. The finally evaluated score is analyzed for supply chain improvements or to identify the core problem.

4.1 Model:

The PAAR consists of the sources of most common and possible risks in the Agri-Supply Chain in the left column and the matching rows represent the score relating to the risks in rubrics. The suitable box is read, interpreted, and selected according to the scenario an entity is facing. The rubrics mentioned in the PAAR is self-explanatory. The factors considered for assessing each problem are the frequency of occurrence, significance/impact level of the problem, and if those problems can be controllable by any means.

The majorly occurring and influencing factors are selected based on the feedback received from the interview and are listed.

1. Climate Influence
2. Pests/Weeds
3. Resource Availability
4. Harvest Storage
5. Demand and Supply

The score from the selected box is added to a total of 50. The lower the score higher the risk for the investor in the Agri-supply chain.

4.2 Supplier PAAR:

Agricultural crops Problem Analysis for Action Rubric (PAAR) - Supplier					
Climatic influences	The process is affected by climate very frequently, causing heavy losses and seems unavoidable 4	The process is affected by climate few times a year, causing heavy losses and seems unavoidable 6	The process is affected by climate very frequently, causing small losses and seems rectifiable 8	The process is affected by climate seldom, causing very small losses and seems rectifiable 10	
Pests/ Weeds	The crops are affected by pests very frequently, causing heavy losses and seems unavoidable 2	The crops are affected by pests sometimes, causing heavy losses and seems unavoidable 4	The crops are affected by pests frequently, causing heavy losses and seems partially controllable 6	The crops are affected by pests very frequently, but causes small losses that can be controlled 8	The crops are affected by pests seldom, causing very small losses and seems negligible 10
Resource Availability	There is often problem for availability of resources like water, fertilizer which highly affects the process 4	There are problems sometimes for availability of resources like water, fertilizer which highly affects the process 6	There are problems sometimes for availability of resources like water, fertilizer which has low impact on the process 8	There are no problems for availability of resources but can be easily handled in case 10	
Harvest storage	Very frequent problems occur in storage, which causes significant losses and cannot be handled 2	Problems in storage are frequent but has high influence when encountered. It is partially controllable 4	Problems in storage are frequent but has high influence when encountered. It is controllable 6	Problems in storage are rare but has high influence when encountered. It is easily controllable 8	There are no problems in storage and if encountered it can be easily handled 10
Demand and Supply	There is more supply(crops) than the required market demand and it cannot be sold 4	There is just enough supply(crops) for the market but can't be sold due to factors like competition 6	With current capacity the demand for crops cannot be met and is hard to predict 8	Crop demand is predictable before investment and the supply is not surplus 10	

Fig -3: PAAR for Supplier(From collected data)

Suppliers are the initiators in this supply chain. The suppliers can be small to large scale farmers who gain their outputs from agriculture. We conversed and interviewed over 16 South Indian local small and large-scale farmers. From the information and insights gathered we converged to the below results. The scores given are based on the replies collected from the farmers.

Climatic Influences:

Among the common problems faced, the climate had a major influence. From the interviews, we came to know that there are heavy losses due to extreme climates during some time of the year. Rain batters Kharif crop on 45,000 hectares in August 2020- according to the Times of India. It's not only rain in India, but around 68% of the country is also prone to drought to varying degrees as recorded in 2017. Climate also plays a vital role in facilitating insect and pest growth which could damage crops. And these wethers are a natural phenomenon that cannot be controlled, but some precocious measures could be taken.

For this reason, a score of 6 is given for climatic influence on farming.

Pests/Weeds:

Few other vicious threats to agriculture are pests, insects, and weeds. Based on the feedback from the farmers, Insects are unpredictable. They originate out of nowhere, start conquering and consuming the fields so fast. "India combats swarm of locust attacks amid Covid-19 pandemic"- in May 2020, according to BBC. Weeds are nutrient snatchers, they consume the water and nutrients that are supposed for crops. They again cost time, money and labour to be cleared. Insect attack is also common these days, they cause heavy damages in unpredictable times. This is also the reason for the high usage of harmful

pesticides. Though they cause heavy damage there are eco-friendly and healthy remedies to prevent pests and weeds. Hence a score of 6 for the pest and weeds interference.

Resource availability:

Most farmers faced difficulty in finding resources like water and labour. There is always uncertainty about water availability for irrigation. There is a shortfall of 49% labourers to work in agricultural fields, in 2020 over the decade. According to the feedback from farmers, the workforce is low so handling seems difficult. This has a high influence on getting the required output from farms. From this, the user could infer that resource management should be handled or addressed better. Hence we have given a score 4 for resource availability.

Inventory:

From the interviews, it was found that during the short period storage/inventory time, farmers face similar challenges to that of a processor and wholesaler. Their storage is not on a regular basis but ignorance can cost more than expected, the storage area should be kept clean to avoid pests and climatic interruptions. If the inventory faces a problem it is hard to clear and control the problem. Hence we have given a score 2 for the storage/inventory.

Demand and Supply:

From interactions with the farmers, it was clear that demands affect farmers in the early-stage and it becomes critical on rare occasions. Farmer’s supply and demand risks are decided when they select to invest or buy seeds for farming. They have sometimes encountered losses due to wrong predictions based on previous year’s yields. These encounters can be avoided with reliable prediction systems. Hence we have given a score 8 for the demand and supply.

Summary:

The overall score for the Supplier section in the PAAR score sheet is 28 out of 50.

4.3 Processor PAAR:

Agricultural crops Problem Analysis for Action Rubric(PAAR) - Processor					
Climatic influences	The process is affected by climate very frequently, causing heavy losses and seems unavoidable 4	The process is affected by climate few times a year, causing heavy losses and seems unavoidable 6	The process is affected by climate very frequently, causing small losses and seems rectifiable 8	The process is affected by climate seldom, causing very small losses and seems rectifiable 10	
Pests/ Weeds	The harvests are affected by pests very frequently, causing heavy losses and seems unavoidable 2	The harvests are affected by pests sometimes, causing heavy losses and seems unavoidable 4	The harvest are affected by pests frequently, causing heavy losses and seems partially controllable 6	The harvests are affected by pests very frequently, but causes small losses that can be controlled 8	The harvests are affected by pests seldom, causing very small losses and seems negligible 10
Resource Availability	There is often problem for availability of resources like labour, equipments which highly affects the process 4	There are problems sometimes for availability of resources like labour, equipments which highly affects the process 6	There are problems sometimes for availability of resources like labour, equipments which has low impact on the process 8	There are no problems for availability of resources but can be easily handled in case 10	
Inventory	Very frequent problems occur in inventory, which causes significant losses and cannot be handled 2	Problems in inventory are frequent but has high influence when encountered. It is uncontrollable 4	Problems in inventory are frequent but has high influence when encountered. It is easily controllable 6	Problems in inventory are rare but has high influence when encountered. It is easily controllable 8	There are no problems in inventory and if encountered it can be easily handled 10
Demand and Supply	There is more supply(crops) than the required market demand and it cannot be sold 4	There is just enough supply(crops) for the market but can't be sold due to factors like competition 6	With current capacity the demand for crops cannot be met and is hard to predict 8	Crop demand is predictable before investment and the supply is not surplus 10	

Fig -4: PAAR for Processor(From collected data)

The processor includes both small and large scale processing mills. The PAAR rubric has been scored after proper validation with rice mills across Trichy, Thanjavur, and Kanyakumari districts. We have interviewed over 20 mills through phone calls and direct visits. From the data validated from the rice mills, we concluded the following results.

Climatic Influences:

From the interviews, we came to know that there will be a great loss in production due to climatic influences. But it can be prevented if the mills are equipped with proper resources. For example, if a mill does not have proper storage or inventory management systems in place on rainy days, the paddy will start to germinate inside the sack itself. This will cause a great loss for the mills as they wouldn't be able to return the product with promising quality for the customers. Drying is one of the main processes in mills. Drying paddy during rainy seasons is seen as a strenuous job for mills using manual drying instead of machine dryers.

From this analysis, we scored 6 for climatic Influences in the PAAR.

Pests/Weeds:

The feedback obtained suggests that the rice mill has a very minor risk due to pest incursion. It can completely be prevented if proper management and routine checking is done at the storage facility. As it is a manageable task it is scored 8 in the PAAR.

Resource availability:

From the data validation, we came to an understanding that the resource needed for rice mills differs from one another based on their physical location. The Rice mills in rural areas could easily afford labour resources but they

face difficulties in getting machines/spare parts if there is any fault or defects. Anyway, labour maintenance is a difficult task for every mill irrespective of its location. Since most of the mills run seasonally, hiring labours for work in that particular season is quite tough to find. So, this part scores a 6 on the PAAR sheet.

Inventory:

The interview says that about 95% of the mills are equipped with a storage system. The problem arises in the maintenance, it is necessary to clean the storage rooms for every season because improper cleaning directly affects quality and brand. The next important thing is the storage room, which should be properly sheltered and covered to increase the shelf life and to protect it from rainy days without germination. As these many considerations should be taken care of, the probability of risk arousal is also quite high. For this is the reason the Inventory has scored 6 in the PAAR.

Demand and Supply:

Since rice is one of the major consumable food products in India there is always a high demand for it. But while considering the mills, the growth and profit are in the hands of the supplier. The suppliers are the ones deciding where the paddy to be processed. It depends on the quality of their deliverables. So it has been scored 8 in the PAAR rubric.

Summary:

The overall score for the processor section in the PAAR score sheet is 34 out of 50.

4.4 Customer PAAR:

Agricultural crops Problem Analysis for Action Rubric(PAAR) - Customer					
Climatic influences	The process is affected by climate very frequently, causing heavy losses and seems unavoidable 4	The process is affected by climate few times a year, causing heavy losses and seems unavoidable 6	The process is affected by climate very frequently, causing small losses and seems rectifiable 8	The process is affected by climate seldom, causing very small losses and seems rectifiable 10	
Pests/Weeds	The harvests are affected by pests very frequently, causing heavy losses and seems unavoidable 2	The harvests are affected by pests sometimes, causing heavy losses and seems unavoidable 4	The harvests are affected by pests frequently, causing heavy losses and seems partially controllable 6	The harvests are affected by pests very frequently, but causes small losses that can be controlled 8	The harvests are affected by pests seldom, causing very small losses and seems negligible 10
Resource Availability	There is often problem for availability of resources like goods which highly affects the process 4	There are problems sometimes for availability of resources like goods which highly affects the process 6	There are problems sometimes for availability of resources like labour which has low impact on the process 8	There are no problems for availability of resources but can be easily handled in case 10	
Inventory	Very frequent problems occur in inventory, which causes significant losses and cannot be handled 2	Problems in inventory are frequent but has high influence when encountered. It is uncontrollable 4	Problems in inventory are frequent but has high influence when encountered. It is easily controllable 6	Problems in inventory are rare but has high influence when encountered. It is easily controllable 8	There are no problems in inventory and if encountered it can be easily handled 10
Demand and Supply	There is more supply(crops) than the required market demand and it cannot be sold 4	There is just enough supply(crops) for the market but can't be sold due to factors like competition 6	With current capacity the demand for crops cannot be met and is hard to predict 8	Crop demand is predictable before investment and the supply is not surplus 10	

Fig -5: PAAR for Customer(From collected data)

The customers are the retail and wholesale Rice shop owners. The PAAR is scored according to the feedback that we receive from selected customers through interviews. The interview was conducted with 20 retail shops and 10

wholesale shop owners in and around Thanjavur and Trichy districts. The mode of the interview was through phone considering the COVID situation.

From the information and insights gathered we converged to the below results:

Climatic Influences:

From the interview, we got to know that climatic conditions have been influencing the sales constantly, but the loss due to it was bearable. They say mostly the sales don't get affected until the climatic situation worsens which happens very rarely due to some unpredicted cyclones or other environmental calamities. Although climate has a huge influence in the other sectors, here from the consumer's point of view it is not much significant. This is the reason behind it getting a score of 8 in the PAAR.

Pests/Weeds:

The infestation of pests in the consumer godowns was reported in the interview. They stated that the problem is persistent and they find it very difficult to manage. Though they use some pest trapping equipment the severity of the losses is unavoidable. Because of the high significance, it possesses it is given a score of 4 out of 10 in the PAAR.

Resource availability:

The problem the customers face due to the lack of resources available in the market is merely significant. The loss they mainly report is due to the lack of availability of labourers. They find it difficult to hire trusted labourers to their shop for maintenance and other pity works. Since this problem is manageable, it is given 8 in the PAAR.

Inventory:

Inventory is not seen as much as trouble in the retail sector although some wholesalers report it to be a problem. Wholesalers usually find it difficult to store their crop sacks in inventory as they are difficult to maintain and incurs high costs. Retailers on the other hand store stocks sometimes in third-party warehouses or have connections with them so that whenever they have issues with the stocks they can easily get updated by the connected warehouses. As the risk is not much impactful it is given a score 8 out of 10.

Demand and Supply:

This is the best-controlled area. As per the feedback, customers say that they never get a complete stock-out scenario. They always have their supplies according to the current market demands. As rice is an essential and a fast-

moving product they ensure to have safety stocks well in advance every time. This is the reason this part is scored the highest in the entire PAAR.

Summary:

The overall score for the customer section in the PAAR is 38 out of 50.

5. Application:

This Problem Analysis for Action Rubric (PAAR) can be used as a risk mitigation tool for Agri-Supply Chain Management irrespective of the choice of crop. This tool helps in prior identification of possible risks and prepares the company to be resilient enough to tackle the upcoming coming risks. The PAAR also serves as a diagnostic tool for continuously assessing the inherent risks.

The PAAR can eventually track down the significance and the frequency of a risk that is occurring. It is tailored for each block in the supply chain namely Supplier, Processor, and Customer.

6. CONCLUSIONS

Agriculture field research in recent years has been focused a lot. Though many research works' primary focus was with supply chains in agriculture or risk management, this paper concisely termed the possible risks that could occur in every part of the Agri-Supply Chain and also provided a useful preparatory tool cased The Problem Analysis for Action Rubric (PAAR) for the participants in the entire value chain.

In general, the possible risks that could occur in Agri-SCM are:

1. Climatic Risks
2. Time-Bound Risks
3. Quality Assurance Risk
4. Cost
5. Transportation Risks
6. Pests and Diseases
7. Government policies
8. Technological Influence
9. Resource Availability

Each of the risks has been mentioned in the paper and the main risks which have a major influence have been put up in the PAAR.

The scores of the respective phases based on the data collected are as follows:

1. Supplier score - 28
2. Processor score - 34
3. Customer score - 38

A farmer or an agricultural investor can plot their score to avoid any risk related to the agricultural supply chain before beginning the process. PAAR score will give an insight on what risks should be tackled and what risks can be avoided. Further losses and failures can be avoided with this model.

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