

BACKWARD INTEGRATION OF SHORT SHELF LIFE PERIOD PERISHABLES AT SUPERMARKETS: A CASE STUDY

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ABSTRACT

Supermarkets are the one stop solution for urban consumers these days. Similar products having different brands, colours, flavours etc are being available under a single roof. Supermarkets are specifically bulk purchasers. They try to purchase the non perishables as well as perishables in a large quantity with a high discount; so that they can easily sell it to the consumers at less price as compared to the local market. But, in case of short shelf life period perishables, this strategy can't be implemented. Especially in the case of fruits, and ready to cook vegetables, supermarkets are not that much really competent. In case supermarkets which purchase vegetables, and fruits in a bulk manner to get high discount, it has to invest upon proper refrigeration, results in a huge electricity bill. High amount of food waste is done by supermarkets. For eg. Tesco, London & Sainsbury, London; had faced lots of food waste as per BBC news. In India, Reliance Fresh[13] had also faced loss for the last 7 years and was forced to shut down some of its centres because of great loss. ASO (Automatic Store Ordering) software especially helps in case of non perishables and semi-perishables but it fails in case of perishables having short term shelf life period. The major problem is the supply chain pattern of fruits and vegetables. Supermarkets get very less time to market those vegetables, fruits, flowers, bread etc.

This report comprises of proper backward integration for vegetables and fruits that can be grown locally. It also deals with effective disposal of these perishables.

Keywords: Backward Integration, Perishables, Bulk Purchase, Refrigeration Cost, Food Waste, Bio-gas Plant.

INTRODUCTION

BBC news [2] on 21st October, 2013; revealed that, Tesco, London had generated a food waste of 28000 tonnes in the first six months of 2013. Out of which, 21% was fruits and vegetables & 41% was bakery items. In India, Reliance Fresh faced continuous loss for 7 years. It dealt especially with perishable products especially. As per the financial report of Reliance Fresh 2011-12, it posted a loss of 283.8 Cr INR. Reliance Fresh shut down all of its stores which were resulting in loss, in order to make a gross profit. These are the live examples of improper inventory planning and control of perishables. Improper supply chain pattern is also responsible. Proper refrigeration is also needed for fruits and vegetables and dairy products etc. which will result in cost high electricity bills. Another fact is that supermarkets get very less time to market those

products. Even some of the supermarket retailers fear to sell these type of perishables having less shelf life period. Supermarkets are currently using ASO (Advanced System Optimizer) software for effective inventory control, but it is not that much beneficial for vegetables, fruits, bread etc. Fluctuation is very high in demand and sales for these perishables. That's why it becomes risky to sell these type of perishables.

Scope

As there is high fluctuation between demand and supply of perishables having less shelf life period, automatic store ordering software fails to predict the future demand with a high accuracy. This report deals with minimisation of fluctuation and use of alternate resources in an effective manner. As per this report, supermarkets can use ASO for perishables; they will get more time to market those

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perishables; supply chain or transportation cost will reduce etc. All these happen only if a proper backward integration of these perishables will get set up.

1. Classification of Perishables, Semi-perishables, Non-perishables : A Literature Review

In this literature, the authors have categorized the perishable items, in order to get the proper control over all the perishable products, which are discussed in a group wise manner.

Donselaar (2006) [8] has divided all the perishables into two groups i.e. daily fresh product & weekly fresh product. The products whose validity are 9 days is daily fresh product and above 9 days are stated as weekly fresh products. But in this report, the perishable products are categorized in branded and non branded items. The non branded items such as fruits, ready to cook vegetables are to be cultivated in nearby lands and the branded items are to be purchased from authorized wholesalers. Because in case of branded items, IPR is also an issue.

In this paper, it is stated that super markets are losing their maximum sales from perishable products because of their improper timing. In the paper of Mahajan and Ryzin (2001) [9], a single algorithm is defined which can meet different customer choice models.

These are the items which remain fresh up to 10-12 days without refrigeration and around 20 days with refrigeration. Since it is a short span of time, marketing becomes highly risky. Here, in this paper, self cultivation is proposed which will result in high profit, high remaining shelf life and less cost of refrigeration. People most possibly go to super markets in weekends and they try to get the perishable items for a week. Hence the vegetables, dairy products, fruits are to be fresh and have at least 5-6 days of RSL. The demand of the items should be taken into account regularly in order to predict the future sales. Most of the literature focus upon the perishability instead of the demand substitution. Parlar (1985)[11] has described this phenomenon. He has taken both the perishability and demand substitution into account. Nahmias(1982)[10], Raafat(1991)[12], Goyal & Giri(2001)[4] has also focused upon the perishability of the

items.

Donselaar(2006)[8] has defined the weekly fresh products whose RSL is more than 21 days. Here also the demand substitution as well as perishability should be taken into account. Some of the researchers have suggested for direct delivery of the perishable items. Raman has described it in his journal. He has assumed constant demand in case of perishables. Kok and Fisher(2003)[7] have also added an extra point to this. They have suggested simulation based optimization.

The ASO system could be improved for the perishable items. It should depend upon market demand, occasions, weather, local area etc. The weekly food waste should be recorded and year wise, as well as weekly sales pattern sales data should also be taken into consideration in order to minimize the waste.

Especially, the products are being categorized between perishables and non perishables as per their shelf life. Shelf life decides the time duration within which the product will yield its best quality, for e.g., - we must have seen a statement "best before 6 months of manufacture" upon the soft drink bottles. That indicates that 6 months is the shelf life period. In this case, the stated storing conditions are to be strictly followed, i.e. the soft drink is to be preserved at low temperature.

The dictionary meaning of "perishable" indicate things which will perish rapidly if not refrigerated. As per Donselaar (2006) [8], an item can be considered as a perishable product only if it satisfies one of the following two conditions,

Condition 1: The rate of deterioration must be quite high at normal condition. Ambient storage conditions are required for slow deterioration rate.

Condition 2: "The obsolescence date of the product is such that reordering for the products with the same date is impractical." Donselaar (2006) [8].

In overall, a product can be classified as,

- Perishable product
- Semi-perishable product
- Non-perishable product

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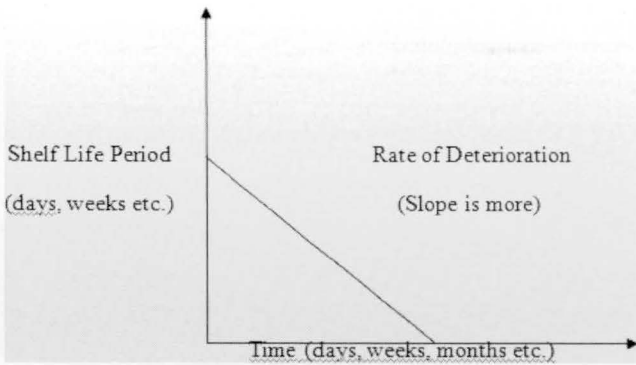


Figure 1. Rate of Deterioration of Perishables like Fruits, Vegetables etc.

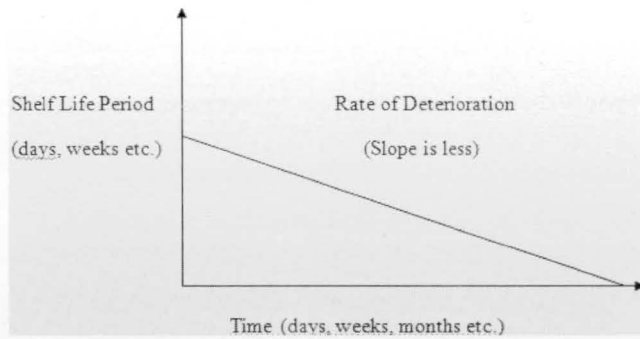


Figure 3. Rate of Deterioration of Semi-Perishables like Potato, Ginger etc

The major factor which distinguishes the products in these 3 categories is the rate of deterioration.

1.1 Perishable Products

The rate of deterioration of perishables like fruits, vegetables etc is shown in Figure 1. For such products like fruits, ready to cook vegetables, milk, dairy products, beer, medicine etc., the rate of deterioration is high and conditioned environment is required to reduce the rate of deterioration.

Figure 2 shows the rate of deterioration of perishables like periodicals, newspaper, weekly/monthly magazines etc. These types of products have a short shelf life period. After that specific period of life, it becomes a piece of paper only.

1.2 Semi-Perishable Products

The rate of deterioration of semi-perishables like potato, ginger etc is shown in Figure 3. The rate of deterioration is a bit less than that of perishable products; conditioned environment is specifically not required.

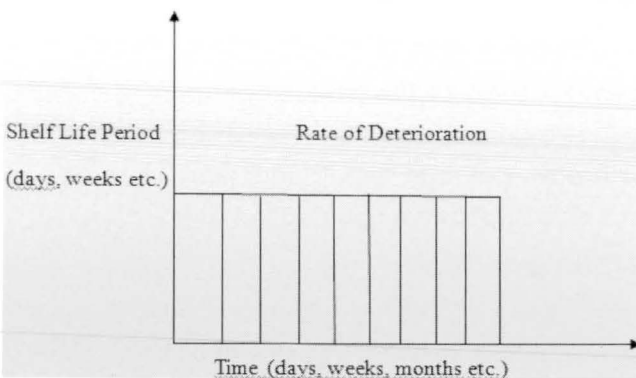


Figure 2. Rate of Deterioration of Perishables like Newspapers, Weekly Magazines etc

1.3 Non-Perishable Products

Figure 4 shows the rate of deterioration of non-perishables. For non-perishables, the rate of deterioration is quite less, and conditioned environment is not required at all. Few examples of non-perishables are soap, plastic products, rice etc.

2. Logistics Model

2.1 Current Logistics Model

Currently, as shown in Figure 5, supermarkets deal with lots of brands, lots of varieties etc. So, it never purchases products from each and every individual manufacturing unit. It always prefers to purchase from wholesaler/distributors. Products come from manufacturing unit or production farm to wholesaler, and from wholesaler to supermarkets.

2.1.1 Pros

- Supermarkets don't have to deal with lots of manufacturing units. It gets all the varieties from local wholesaler. It's a time saving process.
- Supermarkets purchase items from wholesaler in a bulk manner. So, they get more discount.

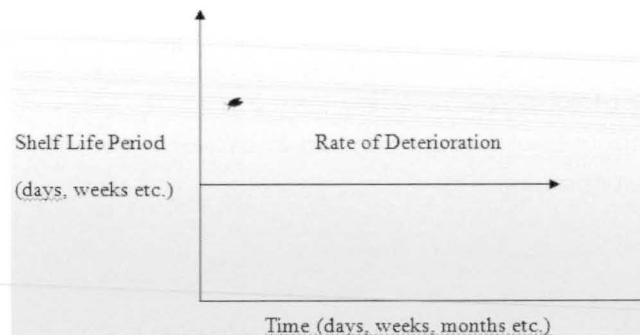


Figure 4. Rate of Deterioration of Non-Perishables

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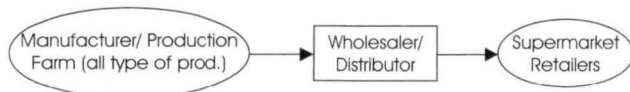


Figure 5. Current Logistics Model of Perishables at Supermarkets

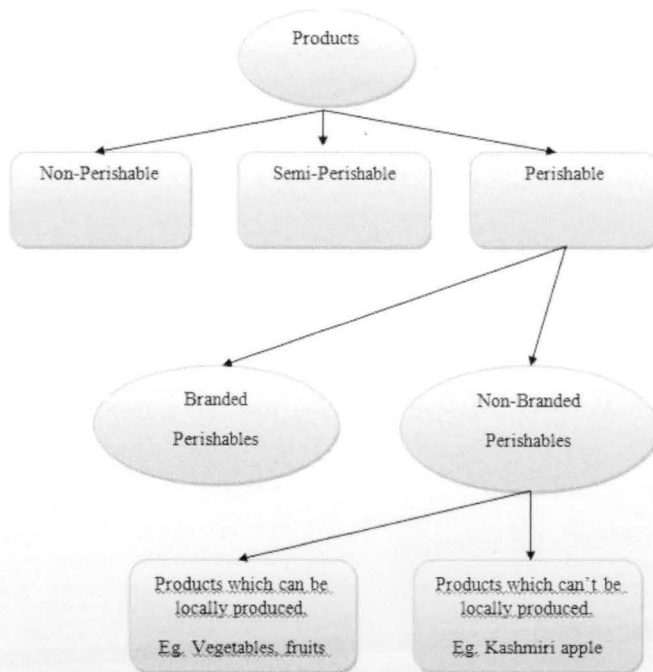


Figure 6. Proposed Classification of Products at Supermarkets

2.1.2 Cons

- For short shelf life period perishable products (i.e. Fruits, vegetables, milk etc.) this type of process is non-beneficial. The process consumes a bit of that shelf life period and supermarkets get less time to market those products.

2.2 Proposed Logistics Model

Figure 6 shows the classification of products at supermarkets. The proposed logistics model for Non-Perishables, Semi-Perishables, Branded Perishables and those perishables which can be locally produced are shown in Figure 7 and Figure 8 respectively.

In the case of perishable products, short shelf life period is the major problem. At the farm (Figure -9), when the product is got cut from the plant, it has a RSL(X) (remaining shelf life period of X):

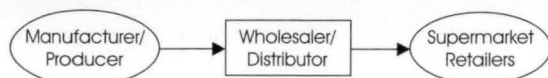


Figure 7. Proposed Logistics Model for Non/Semi/Branded Perishables

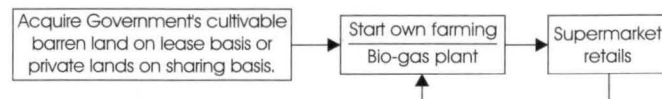


Figure 8. Proposed Logistics Model for Locally produced Perishables

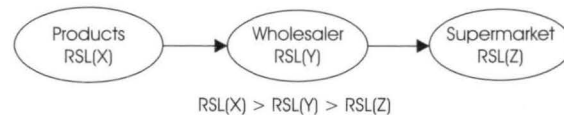


Figure 9. RSL analysis as per the Current Logistics Pattern of Perishables

When it comes to the wholesaler, its remaining shelf life period get reduced and it becomes 'y' (RSL(Y)).

Now, supermarkets purchase it from wholesalers. When these products go to the supermarkets, its RSL again gets reduced. Hence, supermarkets get very less time to market them. Sometimes, it results in loss.

This report proposes that, supermarkets should go for backward integration specifically for these type of products. Supermarkets will get the products with RSL(X) and can get more time to market them. The products will be more fresh when it come to the retailers.

2.2.1 Pros

- Products will be more fresh.
- Food waste or loss will be less.
- Electricity bill upon refrigeration will be less.
- Transportation cost will get reduced.
- Country's production will get enhanced.
- Supermarkets can apply more discount on fresh products in order to attract more consumers.
- Lower class families can also access supermarkets.

3. Disposal of Perishables

3.1 Current Scenario

When RSL=0, perishable products get rotten. Before that, the supermarket workers either consume it or it goes to the municipality garbage yard. It leads them to a complete loss. It is clearly shown in Figure 10.

3.2 Proposed Scenario

As per Figure 11, Supermarkets can cut fruits, vegetables as per the proper inventory planning and control. ASO can also be used in this case. Now if the products won't get sold within the due date, it should not be sent to the

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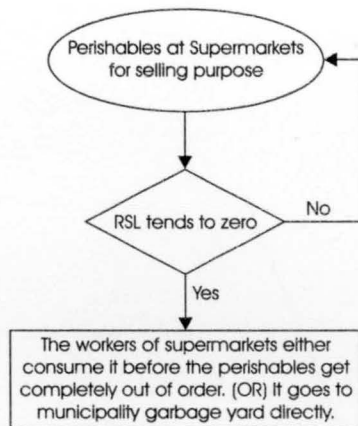


Figure 10. Current Disposal Process of Perishables at Supermarkets

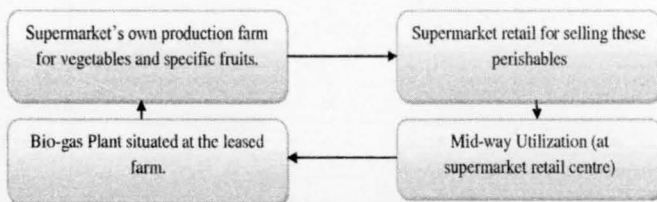


Figure 11. Proposed Disposal Model of Perishables at Supermarkets

garbage yard; it should be sent to the supermarket's own restaurants. It may be termed as midway utilizations. In case, it's not utilized, then it should be sent to the biogas plant which must be situated at supermarket retail's own farm. The workers who will be working over there at farm, can use the biogas in cooking as well as illuminating bulbs and the rest can be utilized as fertilizer in the farming. In this way, it can be a waste free system for these type of perishable products. Sainsbury, London; a giant supermarket is also using the bio-gas phenomenon.

3.3 Mid-way Utilizations

If supermarkets opt for backward integration, then it will get some more time to sell these short shelf life period perishable products. Here, as per Figure 12, when shelf life period of the product comes down to 60% of its initial shelf life, it is unable to attract consumers. But as per the quality, it's quite good. These things occur as a loss in current situation. But in order to prevent that, midway utilizations can be implemented. Now-a-days supermarkets have started their own "ticket restaurants". These ready to cook vegetables, fruits etc are advised to be used in those restaurants within 60-80% of initial shelf life period. It can be used in various recipes, fruit salad, juice etc. In that

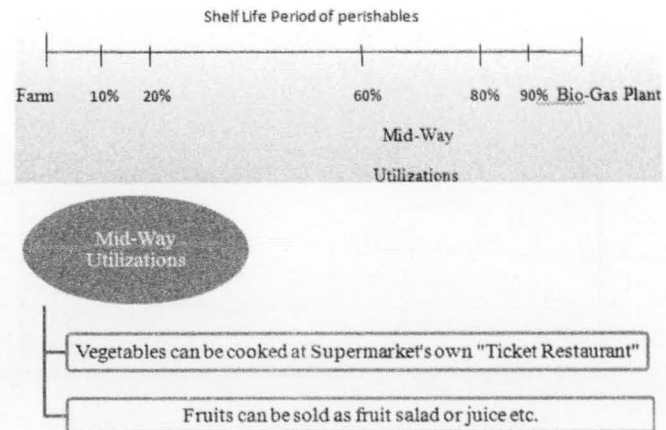


Figure 12. Details about Midway Utilization Process

case, its marketing can be enhanced which will lead to a loss reduction.

4. A Case Study : Big Bazaar, Saraidhela, Dhanbad

4.1 About the Organization

Big Bazaar is one of the largest hypermarket chain in India having a total revenue of US\$ 1.7 Billion. It started its operation in the year 2001 having head quarter at Mumbai, Maharashtra, India. At Big Bazaar, Saraidhela, Dhanbad; the perishable items are being stored at ground floor. According to the warehouse manager, they were initially storing short shelf life period perishable items like ready to cook vegetables, fruits, bread etc. But they were unable to sell those products within due period. Finally, the workers of Big Bazaar either consumed them or it went to municipality garbage yard. As per the company's point of view, its a complete loss. At some of the other Big Bazaar retail centres, it was seen that the vegetables were unable to attract customers either as per the quality or selling price. The perishables over there were having a minimum expiry period of 45 days. It clearly showed their failure in case of short term period perishables i.e. ready to cook vegetables, fruits, bread, milk(not dairy products) etc.

4.2 About Dhanbad, Jharkhand, India

4.2.1 Geographical Location

As shown in Figure 13, Dhanbad is situated in between 23°37'30"N - 24°56'N latitude and 86°8'23"E - 86°50'18"E longitude of Jharkhand state in Eastern India. As per the map, there are 2 rivers near the boundary of Dhanbad i.e.

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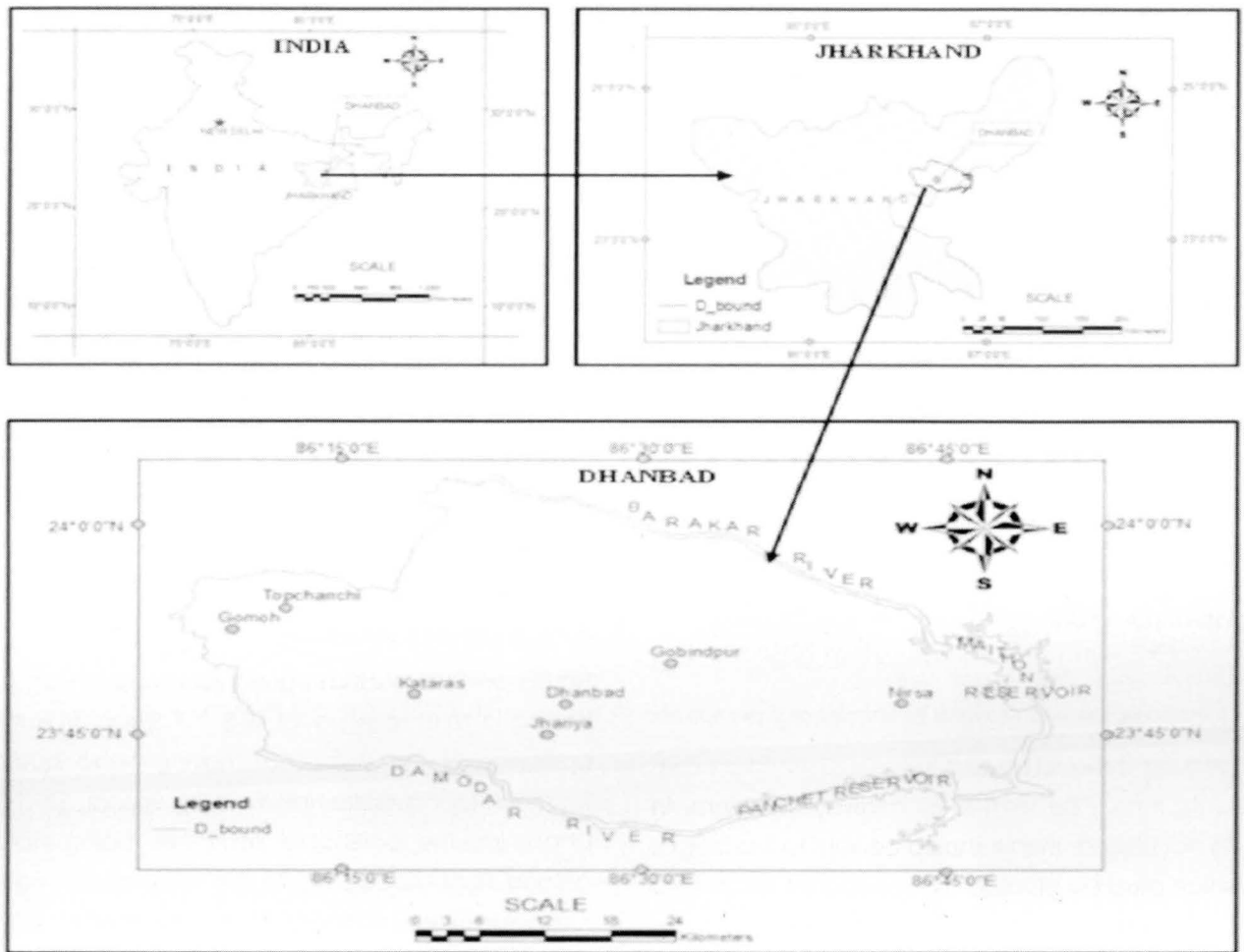


Figure 13. Geographical Location of Dhanbad, Jharkhand

Barakar river in the north and Damodar river in the south. Two major reservoirs are there i.e. Maithon and Panchet. Specifically, Dhanbad lies on the eastern part of Chhotanagpur plateau. So, it's quite suitable for cultivation. It is also known as the coal capital of India. Dhanbad is surrounded by Giridih & Jamtara (Jharkhand) in the north, Purulia (West Bengal) in south, Burdwan (West Bengal) in east & Bokaro (Jharkhand) in west. The total geographical area is 2996 Sq. Km. It is at a height of 232 mt. from sea level. Annual rainfall varies from 110 cm to 148 cm, and the temperature varies from 46° to 22° in summer and 22° to 8° centigrade in winter.

4.2.2 Land Availability for Farming

As per the 'Brief Industrial Report [3] of Dhanbad 2010-11' by MSME, Ranchi; the land details are as given in Table 1. As per the data shown in Table 1, 57542.21 Hectares of

Agriculture: Land details	Year	Unit	Area
Total Area	2010-11	Hectares	201801.45
Agricultural Land	2010-11	Hectares	89200.25
Non-Agriculture Land	2010-11	Hectares	55058.96
Cultivable Barren Land	2010-11	Hectares	57542.21

Table 1. Cultivable Barren Land Details of Dhanbad, Jharkhand

barren land is available at Dhanbad alone, which is suitable for agriculture.

4.2.3 Rainfall & Underground Water Availability for Proper Irrigation

Figure 14 shows the ground water level of Dhanbad. As per the map, water availability is more than 95%(approx.) in Dhanbad. Quite small places are marked as red in the picture. As per the MSME 2010-11 report, the annual rainfall ranges from 110cm to 148cm. Figures 15 and 16 gives a brief idea regarding availability of underground water for irrigation purpose.

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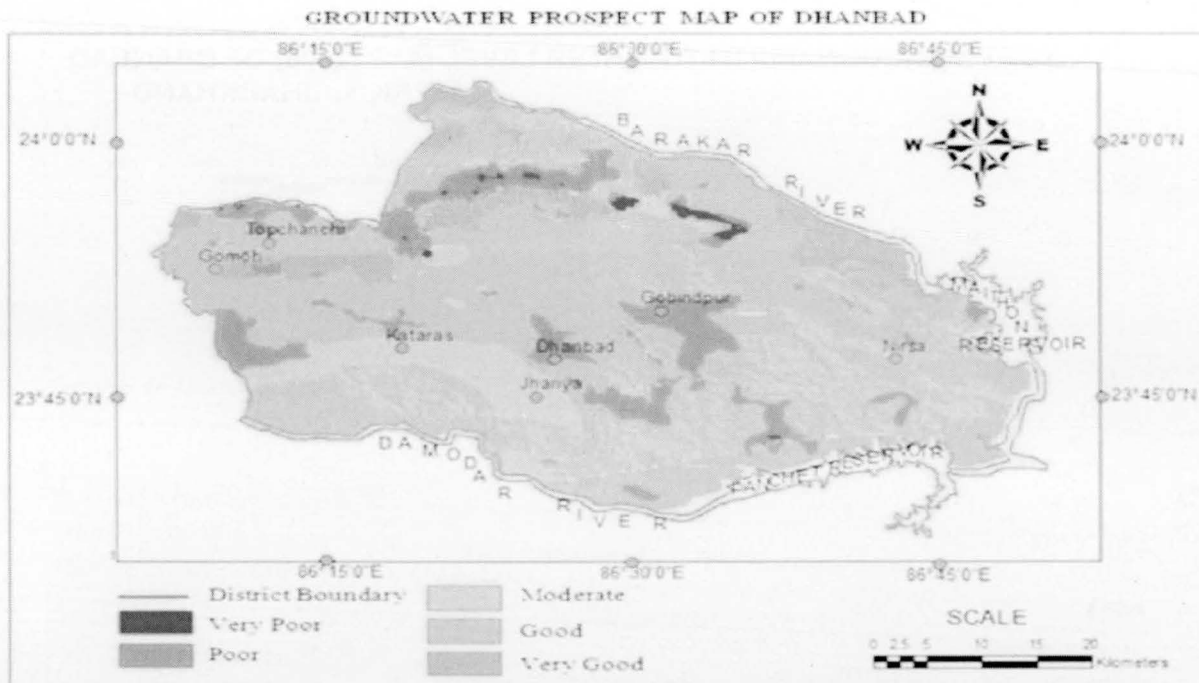


Figure 14. Underground Water Map of Dhanbad, Jharkhand (Srivastava (2012) [14])

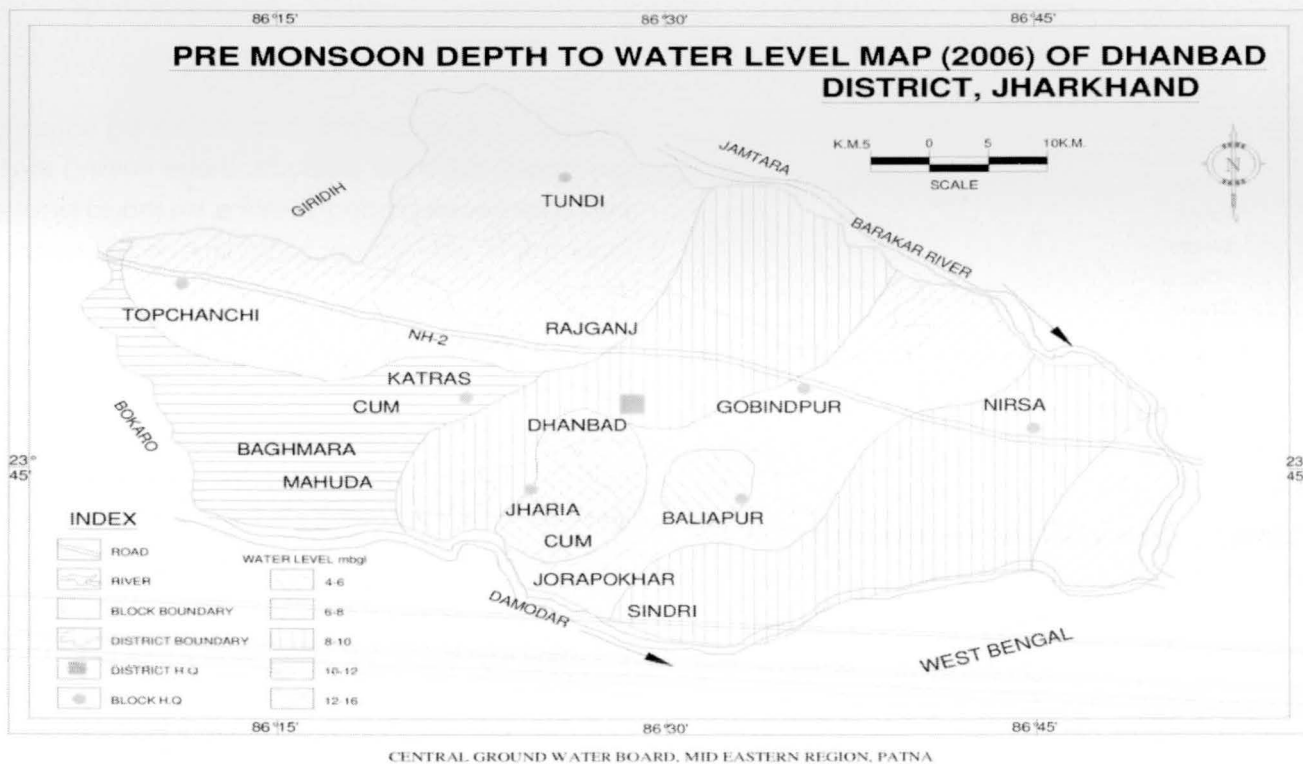


Figure 15. Pre-Monsoon Water Level Map of Dhanbad, Jharkhand (Srivastava (2012) [14])

4.2.4 Predicted Annual Production of Dhanbad district

As per the Agriculture Contingency Plan[1] for the district Dhanbad, the productivity information is as given in Table

2. As per the information given in Table 2, if we take the case of cabbage only, Cabbages produced from 1 hectare is 16 kg. Cabbages can be produced from

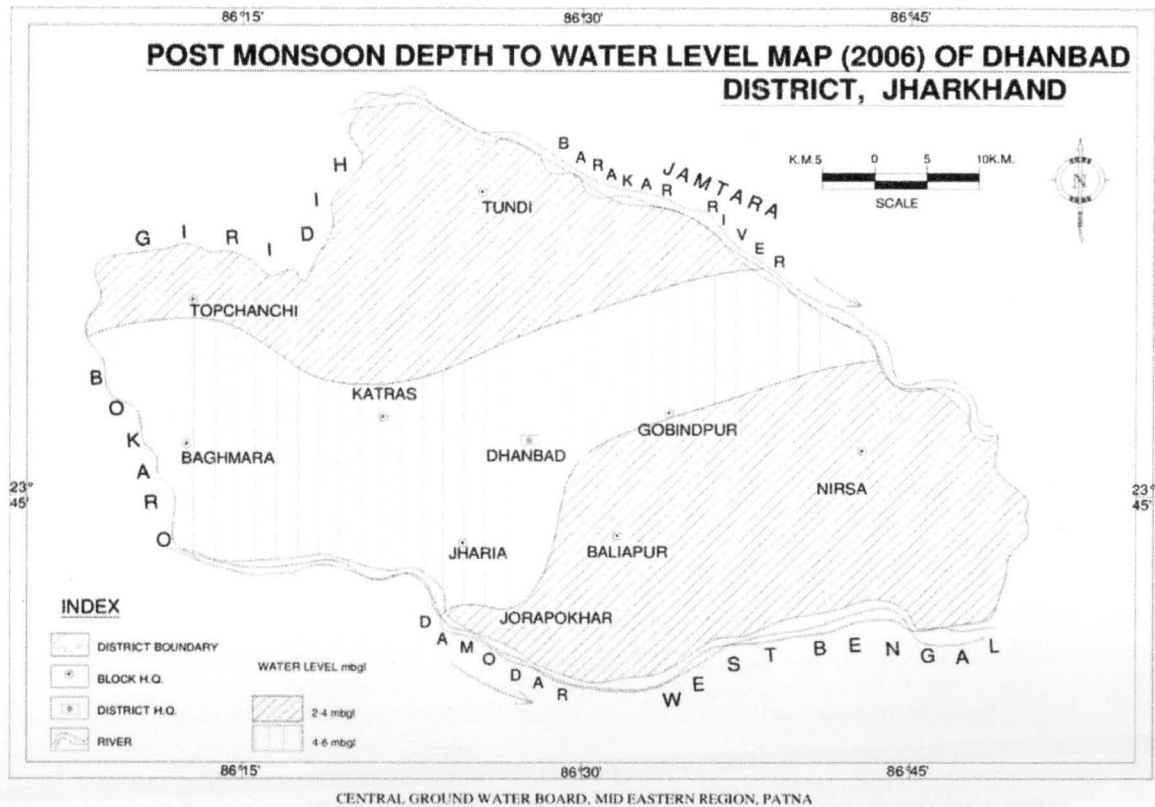


Figure 16. Post-Monsoon Water Level Map of Dhanbad, Jharkhand (Srivastava (2012) [14])

Major Horticulture Crops	Productivity (kg/hectare)
Cabbage	16
Potato	9.8
Onion	20
Tomato	20
Okra	14
Chillies	18

Table 2. Minimum Production per Hectare Details

57542.21 hectares of cultivable barren land, is equivalent to $(57542.21 \times 16 = 920675.36)$ i.e. 920675 kg approximately.

4.3 Current Logistics Pattern for Perishables at Big Bazaar, Dhanbad

As shown in Figure 17, the local distributors collect the perishables like vegetables, fruits etc from the respective farms, and sell it to Big Bazaar and other retailers. Big Bazaar never purchases items from farms directly. This is because, it has to deal with variety of products and it easily gets all the products from the wholesaler directly. But in case of perishable items, the shelf life period matters a lot especially in case of short shelf life period perishables

i.e. bread, vegetable, milk, fruits etc. So, Big Bazaar gets less time to sell those products. The remaining shelf life period decreases gradually. Hence, we should try for level reduction in order to get more time to sell perishable items.

4.3.1 RSL Analysis

$$RSL(P) > RSL(Q) > RSL(R) > RSL(S) > RSL(T) \quad (1)$$

As per Figure 17, Big Bazaar gets the short term perishables when the products have RSL(R). The more we reduce the levels on the current supply chain, we will get more time to market those products.

4.3.2 Profit analysis

In current logistics pattern, the wholesaler's profit margin, inter-district transportation tax etc make a negative term upon Big Bazaar's net profit. These things can also be minimized or even eliminated.

4.4 Proposed Logistics Pattern for Short Term Perishables at Big Bazaar, Dhanbad

As shown in Figure 18, Big Bazaar should have its own local

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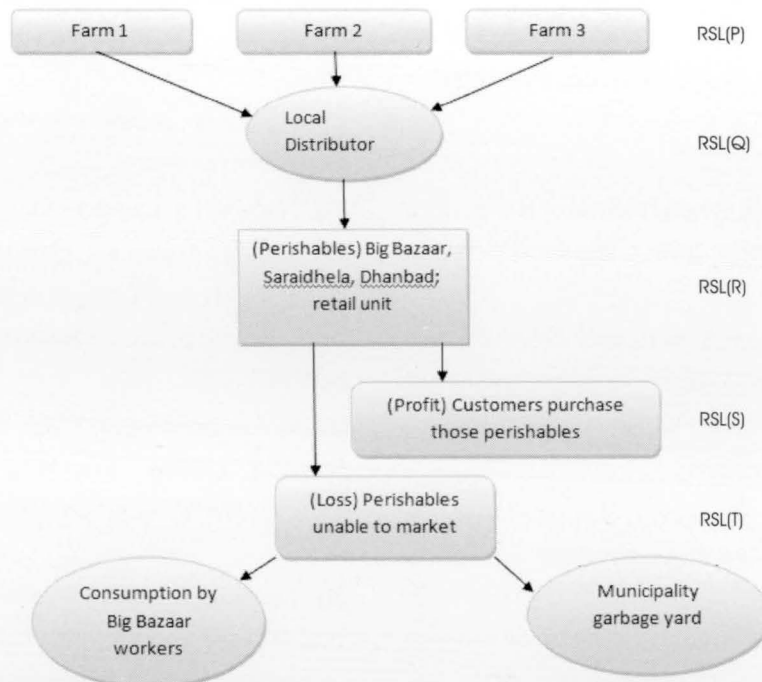


Figure 17. Current Logistics Pattern of Perishables at Big Bazaar, Dhanbad

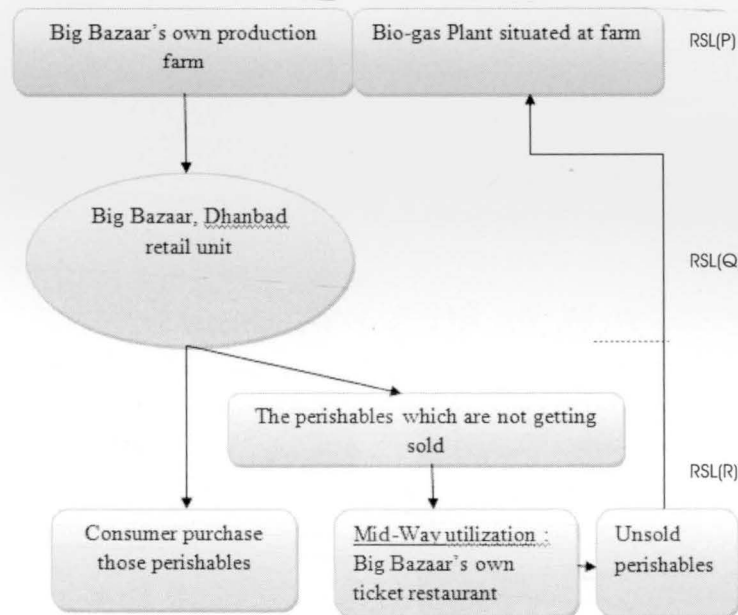


Figure 18. Proposed Logistics Pattern for Short Term Perishables at Big Bazaar, Dhanbad

production farm on lease or sharing basis. It can use Government's cultivable barren lands for this purpose. A bio-gas plant must be set up at the farm. Now, Big Bazaar can use ASO for procuring perishables from its own local lands. Usage of cold storage will get less. It will cut that much the volume of vegetables which is required as per daily demand basis. Products will be more fresh as

compared to the current scene. Big Bazaar can apply more discount as compared to the local market in order to attract more customers.

4.4.1 RSL Analysis

$$RSL(P) > RSL(Q) > RSL(R) \quad (2)$$

Big Bazaar will get the perishable items at RSL(Q). As compared to the current scenario, Big Bazaar was getting

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the perishables at RSL(R). But in proposed method, it will get the products at RSL(Q). As $RSL(Q) > RSL(R)$, it is more beneficial for supermarkets.

4.4.2 Profit Analysis

As compared to the current scene, the local distributor's profit margin as well as inter district transportation tax become positive factors.

Big Bazaar's proposed profit = current profit + local distributor's profit margin + reduction in transportation cost + inter district transportation tax.

Conclusion & Future Implications

Backward integration of supermarkets is quite beneficial for country's production as well as supermarkets can get a growing market in this field. Consumers can also get fresh products at nominal price. Implementation of bio-gas plant will make the whole system a waste less system. The products whose remaining shelf life period becomes completely zero i.e. it gets rotten, it can be used as an input material in the bio-gas system. The output can be used as a fertilizer in the farm and cooking gas and current etc., may be saved. Sainsbury, London is using this bio-gas phenomenon method in order to make it waste free. On the overall, this proposal is quite beneficial for everyone.

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