

Lesson 5

Classification of Dairy Plants

5.1 Introduction:

The design and layout of the dairy plant depend much on the quantity of milk handled and the type of the product made. Some may need refrigerated condition for the distribution of the product, while others may not need such requirement. Some of the products may not need a daily delivery and need to be transported once a week or so. There is a wide variation in the size and type of dairy plants. Fig. 5.1 and Fig 5.2 shows broad classification of milk plants.

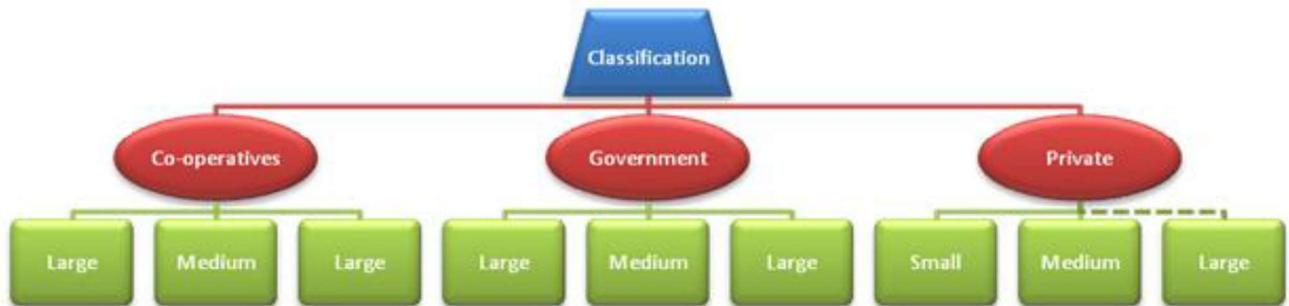


Fig. 5.1 Classification of dairy plants as per type of organization and capacities

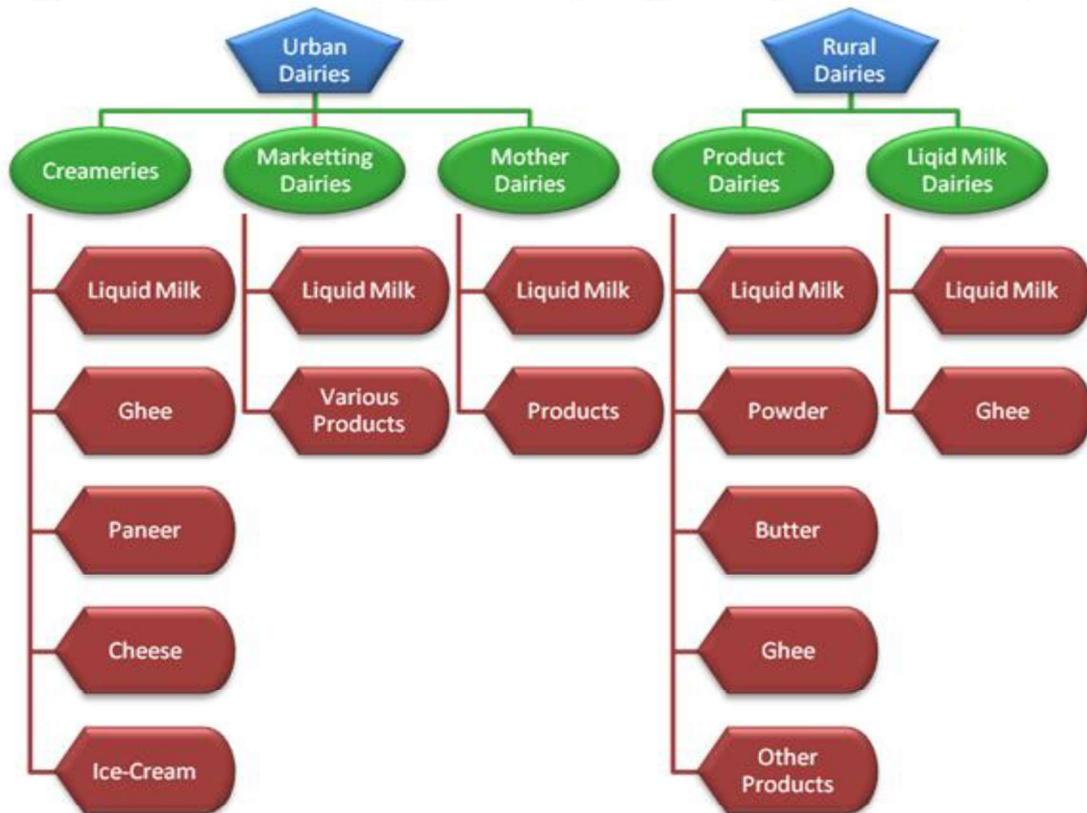


Fig 5.2 Classification of the dairy plants as per the location and type of products

The milk plants can be classified broadly into two groups –

· **Liquid Milk Plant**

This type of plant should be situated/located as close as possible to the consumer area i.e., generally in or on the outskirts of a large city or town. It supplies market milk in chilled condition in small retail packs.

· **Product Milk Plant**

Here, there is the production of products like cheese, butter, ice-creams, etc. which do not require daily distribution to the consumers. So the plant should be located near the producing areas. The difference in the location areas of both plants results in the minimized transportation cost.

Milk plants can be classified based on its capacity also :

· **Small Capacity Milk Plants**

These are usually below 10,000 LPD and may need to load milk in road tankers and send to larger dairies. Very limited local sales of liquid milk could be possible, as these are essentially located in small towns.

· **Medium Capacity Milk Plants**

The capacity of the medium sized dairy plant ranges from 20,000 lit to 1,00,000 litres of milk handling per day. Layout for products like market milk, butter & ghee and cheeses can be designed. Each room should be planned separately and arranged with forward flow of product as per requirement.

· **Large Capacity Milk Plants**

Here, the plant building may have few floors having multi-product manufacture, where the reception is done at the ground floor and should have both milk treatment and tank storage on the first floor. If products like milk powder are to be manufactured, then the powder plant should placed in different building.

The classification in general may be subject to change in the capacities and there can be a certain overlap in the type and products handled. Some dairies could be handling both liquid milk as well as products, to maximize their market reach and profitability. Though there were certain restrictions in the area of operation of dairies, the same is not strictly enforced or adhered to at present.



MODULE 2 - LOCATION AND SITE SELECTION FOR DAIRY PLANTS

Lesson 6

Location of Dairy Plant and Types of Locations

6.1 Introduction:

Location and site selection for dairy plants forms the important first step in plant design and layout. It has a bearing on the profitability of the dairy and initial quality of the milk. The step is further an important one as any mistake here cannot be corrected easily. The size and operation of the plant also gets restricted if the decision is not made properly at this stage.

6.2 Selection of Location:

The problem of selecting a location for a dairy plant has been given considerable thought by many authorities. Selecting a location involves large commitments of capital, as a result it must be done with the utmost care. The problem involves selecting a region as well as specific site within that region. The most difficult part of a plant location analysis is determining the criteria by which various location alternatives can be evaluated.

As the dairy plant construction involves a very large initial capital investment, numerous considerations must be evaluated at the very beginning in the planning of a new plant. Out of these, the location and site selection requires utmost care as it forms a large single capital investment. It involves selecting a region as well as a specific site within the region, of which the most difficult part is determining the criteria by which various location alternatives can be evaluated.

Location is a strategic issue, and the decision where to locate cannot be taken lightly. It is the first decision in the implementation of a project. Upon the decision to proceed, an investment is made which is irreversible. That investment in bricks and mortar cannot physically be transferred to another location if the decision turns out to be wrong. The most favorable location is one, which attains the lowest unit cost in producing and distributing the product or service to consumers.

Traditionally, a location was selected for reasons of economic geography like,

1. Proximity to raw material source
2. Proximity to relatively cheap and abundant energy
3. Availability of relatively inexpensive manpower or specialist skills
4. Proximity or good transport links with materials suppliers and markets.

But nowadays, the location decision has become more complex with newer intervening factors like more sophisticated markets, increased competition, short supply of skills, technological change that soon outdate newly installed processes, shooting costs of land and materials, government influences, legal requirements, corporate matters and peoples' influences. In general, in selecting an area to locate a plant, following consideration should be given to the following factors

1. Availability of spacious land for immediate requirements of all buildings, roads, service facilities, garden, tree plantation for wind break etc., with provision of land for expansion at a future date
2. Accessibility and availability of raw materials
3. Accessibility of market
4. Adequacy & availability of labor
5. Adequacy of transportation facilities
6. Volume of power and fuel
7. Water supply and its quality
8. Soil conditions for heavy loading
9. Site cost
10. Elevation in location to facilitate removal of dairy effluent, suitable treatment and disposal
11. Climatic conditions, including direction of prevailing wind and probable increase in dust and smoke nuisance from the surroundings, and
12. Government laws
13. Market Potential
14. Clean environment

The two terms location and site are often confused with each other. It must be clearly understood that, the term 'location' implies to Area, Region or Territory, while 'site' is the place, within a selected location, where building is to be constructed.

6.3 Plant location

Location is primarily influenced by the nature of the product manufactured. The general location and the specific site should be selected with the aim of attaining as nearly as possible the ideal over-all economic situation for the particular enterprise, may it be a fluid milk plant or milk product dairy. The most favorable location is one that attains the lowest unit cost in producing and distributing the product or service to consumers.

6.3.1 Differences between location and site

The two terms location and site are often confused with each other. It must be clearly understood, that, the term 'Location' implies to Area Region or Territory, while site is the place, where building is to be constructed.

6.3.2 Location problem

Location problem has to be solved at two levels, first Territory or Region level and second site level. Some location factors may be applicable to both the levels. Still region level and site level are to be given specific consideration.

6.3.3 Types of Location

Three types of locations are possible for dairy plants viz. i) city location ii) suburban location and iii) country location.

6.3.3.1 City location:

When a city is planned by a town planner, all areas are marked for future buildings. The industries likely to come up are marked in area called 'Industrial area' and usually dairy plants are allotted a plot in that area only. Dairy plant in the neighborhood of other industry or factories emitting smoke, dust, offensive smell, gases, carries great risk. It is therefore essential, that the location marked for milk plant should be free from all pollution.

6.3.3.2 Suburban location:

Suburban location means suburban town or outer skirts of large city. The dairy plant located in this situation has advantages of being close to consumption area with possibility of availing all facilities such as electricity, water, waste disposal and labor etc.

6.3.3.3 Country location:

Country location means sitting dairy plant in country or milk producing area. There will be little competition from other industries and land will be cheap. The plant will not create a noise problem and it is unlikely that atmospheric pollution will cause any difficulty. There will be no traffic congestion. Milk supply routes will be short. But it will be away from the city consumption area.

For all the dairy plants in whatever region they are, there are some important points which are common and essential to be considered in determining the location. Moreover there are some problem factors applicable to both region level and site level. The former is covered in the subsequent chapters while latter is given in the Table. 6.1.

Table. 6.1 Problems related to regional location/plant site factors

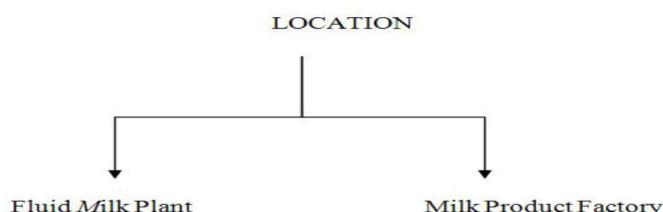
Problem	Regional location Factor	Plant site factor	Comments
Water supply	Limited surface water supplied forcing dependence on uncertain underground supply or costly city water. Water is contaminated by city sewage.	Plant site lacks its own water, forces use of city water, nearby industries contaminate water supply making it necessary to install costly purification equipment	Importance of supply and cost of water depends on the process. Ample supply of low cost water will be increasingly important. Having own water supply i.e. tube wells and setting up of water treatment plant will combat the problem
Fuel costs	High freight charges on coal, fuel oil supplies	Inadequate storage space on plant site for coal, oil to insure against emergencies	With labour and raw material costs high, one cost reducing path is to reduce service bills. Locate the plant where fuel is available at reasonable cost
Electricity	State Electricity Board's electricity is available, but not adequate to meet peak load requirements		If state electricity supply is available at reasonable cost, use it and set up own generating plant to meet rest of the requirements
Sewage and waste disposal	Municipal regulations limit low cost disposal of waste	City sewage facilities are limited, require costly additions. Local ordinances restrict waste disposal. Limited space forces expensive methods to eliminate waste.	Not a major item for many plants, but does affect costs, community relations on the right plant site, disposal of solid wastes can be turned into an asset used to fill land
High maintenance cost	Severe climate attacks paint, building materials and equipment. Shortage of trained labour means abuse of machinery, need for frequent repair	Poor soil forces continued rebuilding of foundations. Nearness to plants emitting dirt, smoke add to paint, cleaning bill	Most of companies with clean operations end up near a plant that belches smoke and dust. Make most out of plant appearances a sales and workers' morale tool by picking a clean location and cut maintenance costs while doing it
Cost of supervision	Shortage of trained supervisory personnel due to competition. Area does not appeal as a place to live	As in case of workers, plant is hard to reach, nearly living conditions are not satisfactory	Supervisors are more flexible in their views, more ambitious than plant labour and will accept inconveniences. But they expect higher pay to work in unpleasant surroundings.
Expansion	Too far from market or from suppliers or from both, to add to productions, sales and still meet competition. Labour supply limited to present operating needs	No room for convenient expansion of production on the plant site	If the company is planning to expand its operations, it is a 'must' a stop and re-examine your plant location and plant site. More money invested in present site only makes it more costly to move later, if that is desirable

Lesson 7

Location of Fluid Milk Plant and Milk Product Plant

7.1 Introduction:

The location of the fluid milk and product plant differ in more ways than one. The fluid milk plant has the requirement of disposing the milk in retail containers or packets, at refrigerated condition to consumer on day to day basis. On the contrast, milk powder factory has to dispose product at room temperature itself, and not on daily basis. The wide variation in the scale and method of disposal of the products does have a bearing on the location. For example cheese manufacturing needs cow milk. Hence the location of cheese factory should preferably be in cow milk producing area.



A market milk plant that handles only fluid milk should preferably be located in a city or its outskirts due to the following reasons:

1. Nowadays good transport facilities are available, that connect the country milk shed areas to the cities
2. Even after pasteurization, milk has got a lower shelf life when compared to other products, hence it should be disposed as soon as possible
3. Bulk transport of pasteurized milk can increase the chances of contamination
4. If glass bottles are used which are to be returned for re-use, location near the market will reduce the costs
5. Increased advertising value of the plant, when it is near the market

Usually space is allotted for dairy plants in the industrial areas; hence environmental aspects are to be considered as Industrial areas tend to be highly polluted. Preferably the plant should be located on a side road to a major road, because

1. Easy access to the major road
2. Pollution, noise and dust of major road avoided
3. Traffic blocks won't create a problem at the gate for incoming and outgoing vehicles

7.2 Location and site selection for dairy plants.

The problem of selecting a location for a dairy plant has been given considerable thought by many authorities. Selecting a location involves large commitments of capital, as a result it must be done with the utmost care. The

problem involves selecting a region as well as specific site within that region. The most difficult part of a plant location analysis is determining the criteria by which various location alternatives can be evaluated.

7.3 Location of Milk Products plant:

The location of milk product plant is decided based on milk product consumption, availability of milk, and other services required. It is advantageous to locate manufacturing plant close to areas where surplus milk is available after meeting the daily requirement of liquid milk. The activities of milk product manufacturing should be centralized to get advantage of economic handling of fluid milk, seasonal surplus milk and milk products with a better management control.

A few points mentioned below will help in determining the location **milk product** of plant:

(i) The plant should be located at a place where transportation facilities are available, such as railway siding or near highway. It should be noted that, suitable site would always provide easy transport of raw material to the plant and disposal of finished products.

(ii) To avoid contamination, the bulk transport of pasteurized milk should be discouraged. If pasteurized milk is to be distributed in glass bottles or small containers which are to be returned for reuse, the dairy should be situated close to consumption area. For any reason, if dairy is situated far away from consumption area, it is necessary to transport bottled milk in large quantity to local depots equipped with cold storage facilities.

(iii) Advertising value also affects the location of the plant. For instance a plant installed by the side of a heavily traveled highway naturally commands good sales.

(iv) Location of building should be such, that, all necessary services e.g. electricity, water, waste disposal are available at reasonable cost.

(v) The site must be large enough and of suitable shape to give freedom in planning the building and to allow space for future expansion.

(vi) The area should be free from atmospheric pollution.

(vii) Adequate labor must be available at site and it may be necessary to provide housing facilities to workers.

(viii) Traffic congestion around the plant should always be avoided. Larger plant will require more land for smooth control of traffic pattern.

For any entrepreneur desirous of setting up a dairy industry, it is advisable to go through the following check list on 'Location' to assess its suitability. A milk product plant can be located preferably in a village location due to the following reasons;

1. Proximity to the milk shed, reduced transportation cost for raw material
2. Increased shelf life of the product when compared to the raw material
3. Availability of cheap land and labor
4. Reduced noise and pollution

5. In many cases the volume of the final product is less than the milk used, hence reduction in transport and handling cost eg: Cheese, Butter

6. Solid products can be transported in trucks

7. Some products doesn't even require cold-storage.



Lesson 8

Site Selection

8.1 Introduction:

Once the broad location for the dairy plant is decided, within that limited area of location, a site is to be chosen depending on some factors that maximize the operational flexibility and minimize the operational cost as well as contamination. The site should also be selected keeping in view the future expansion of the plant.

Before any work can be done on the building's design, a site for the plant must be chosen, which requires careful thinking. If the site is wrongly chosen, it may lead to a costly venture and difficult to correct situations such as:

1. Heavy transportation rates for incoming and outgoing materials from the plant
2. Heavy cost for labor and difficulty in having services like water, electricity and waste disposal
3. Reduced profits due to competition for getting raw materials as well as sale of products.
4. Legal complications if the local community objects to have the plant in the area
5. Restricted future expansion due to site conditions

8.2 Selection Criteria for dairy building site

After selecting the general location for the plant, one needs then to select the actual site on which the building can be constructed. In order to make this decision one needs to consider the following:

- (i) Whether a sloping or level site is required?
- (ii) Access to the location - are roads suitable and is a rail link required?
- (iii) Has the land or site been contaminated and what is the underlying geology?
- (iv) Will planning permission be granted?
- (v) At what level is the water table and what is drainage like?
- (vi) What utilities are available - water, gas, electricity, etc.
- (vii) Security, in particular access and boundaries.

Since dairy plant and products manufactured in it have direct public reaction, it is therefore important, that, the site should have a good landscape. Advertising value plays a great part in site selection as well as in external plant appearance. To have a good business and sales, it is suggested to have a thorough check up on the topography of the place and the other factors.

Topography of the site means detail description or representation of natural and artificial features on the map of the place where dairy building is to be constructed. The topography will immediately point out to local services available, location of the sewer line, municipal water lines, zoning and planning of area, restrictions, conditions obtaining in the area and nearby surrounding etc. After studying topography of place, necessary corrective measures may be taken to ensure the suitability of the site

Some typical factors for site selection include size of area available, layout and orientation, drainage, freedom from flooding, any utilities already in place, subsoil, excavation and foundation considerations. Further, Gullies, streams etc. have to be bridged. Any abnormal grading or landscaping problems, any pipelines or other utilities to be relocated. approach to main road and highway. Certain commercial services near the site selected, which are to be considered include facilities for major repair shops, electric motor maintenance, product distributors, lubricants, sanitary materials, engineering department supplies, stationary, local trucking, railway, postal service, air conditioning service and professional service.

The site selected for dairy plant should be suitable for space requirements as well as for the needs of future expansion. The cost of site should be considered together with the development cost, including such items as the provision of rail road or dock if waterfront site is selected. The availability of drainage facilities and the costs of sewage disposal should be checked. Level and firm bottom land is desirable for all sites. The character of the underlying strata and their suitability to support structures at low cost should be considered. Soft underlying formations increase costs because expensive piling is required. Although top-rock formation raises the cost of constructing sewage disposal system, pipelines undergoing tanks and deep foundations required for equipment, it reduces cost of building construction. The cost of plant, therefore, is to some extent determined by the site. The shape and size of the land plot on the site may have an important influence on the layout. It must allow for possible future expansion requirements. The plot plan of the site should be developed in such a way that there is no wastage of areas.

It is important, that the nature of ground at the site conforms to certain requirements. The upper layers of the soil must allow easy drainage as is the case with gravel, sand and the like, so that, water quickly disappears from the surface. At the same time, the ground should provide a firm foundation for roadways and surfaced areas. The subsoil should be firm at the depth for the foundations of the building. Sites with loose clay, shifting sand or high water table should be avoided, as the foundation work on such ground will be both expensive and time consuming. Before making a final choice of site, trial holes should be dug where the building is to be erected. At the same time the subsoil water level in the wet season should be checked to make sure that it is at an appropriate depth.

It is also necessary that the site selected should have transportation facilities, so that, raw material can be easily transported to the milk processing plant and disposal of dairy products to local depots, milk booths or milk parlours does not pose any problem. Delivery trucks, insulated milk tankers, and other vehicles directly or indirectly related to dairy factory should have ample parking space at site along with garage facilities for washing and lubrication. There should be wide roads, and traffic pattern has to be planned in such a manner at site so that, incoming vehicles do not block the passage of outgoing vehicles. Site should have convenient approach from main road or highway. If the site selected is near railway station, it will be beneficial to have railway siding touching the dock at dairy plant.

In addition to the dairy company deciding if a site is suitable to meet its requirements, the impact of the factory on the surrounding area needs to be assessed. The normal method of assessing the impact of a factory on the surroundings is to carry out an environmental impact assessment. In addition one may also wish to carry out lifecycle analysis. The assessment should include the following key issues:

(i) Waste disposal

(ii) Potential hazards to local community

- (iii) Pollution - gas, liquid and solid
- (iv) Noise levels - day and night
- (v) Effect of the facility on the use of local raw materials
- (vi) Transportation infrastructure

8.3 Planning the dairy building on site:

1. Locate the building about 45 m back from highway. This will allow some space surrounding the building even after a highway-widening project.
2. Traffic should be planned to ensure safe movement of all vehicles and pedestrians. Places where pedestrians need to cross roads should be avoided. Truck and automobile driveways should be segregated close to the entrance with clear distinction for visitors. Soiled vehicles that could pose a sanitation risk to the product should be routed in a different way to avoid contamination. Roads should be kept in good condition to avoid damage to products in transit.
3. Provide driving access to all sides of the buildings, if possible. This allows for one-way circulation and will allow fire-fighting vehicles to have access where needed.
4. Rail sidings, parking lots for trucks and automobiles, trash collection areas, and “surplus” equipment dumps can become a source of contamination and a breeding place for vermin. These areas should be kept groomed and drained to prevent contamination to food products by seepage.
5. Locate loading bays at the rear of the building. A gentle slope from the front to the rear will cause the floor of the building to be about 1 m above grade without cutting or filling.
6. Grade the site for natural drainage to ditches. In some areas, grading must be done so that all surface water will be channeled into a storm drain system. Surface water must never be allowed to enter the waste drain system, because water treatment costs are also based on volume.
7. Provide access to the truck building and weigh scale.
8. Locate employee and visitor parking at convenient entry points to the building.
9. Truck parking should be separate from the other parking areas and could be fenced.
10. Raising outside equipment about 20 cm above the pavement will prevent it from being used by rodents as a breeding place.
11. Landscaping and gardens contribute to the company image. Good planning will ensure low initial costs and low maintenance costs. Small recreation areas outside of the plant improve employee morale. Employees should eat in the space provided for them and should not take food outside. Dropped food attracts birds, rodents, and insects, and feeding stray cats or birds on site should be prohibited.
12. Around the base of the buildings, a 1 m grass-free strip covered with gravel or stones are advisable. This controls weeds and is a good area for placing traps and bait.

13. The perimeter should be fenced for security reasons and to prevent children from entering the grounds. This is important if bait-accessible bait boxes are placed outside the plant. Chain-link fences, more than 2 m high, are normally sufficient. The fences will catch pieces of paper, and cleaning them must be part of the overall housekeeping on the site.

14. Orient the building so that its best features and sign face the busiest street.



Lesson 9 Location of Milk Product Plant

9.1 Introduction

The location of milk product plant is decided based on milk product consumption, availability of milk, and other services required. It is advantageous to locate manufacturing plant close to areas where surplus milk is available after meeting the daily requirement of liquid milk. The activities of milk product manufacturing should be centralized to get advantage of economic handling of both fluid milk, seasonal surplus milk and milk products with a better management control. The location of the plant is as per the requirement of dairy machinery and its installation requirements, which decides the building should be of single storey or multi-storey and accordingly site is selected looking to the topological requirements considering water level and application of super structure concept for the building.

9.2 Classification of Dairy plants

· Product Milk Plant

Here, there is the production of products like cheese, butter, ice-creams, etc. which do not require daily distribution to the consumers. So the plant should be located near the producing areas. The difference in the location areas of both plants results in the minimized transportation cost.

Milk plants can be classified based on its capacity:

· Small Capacity Milk Plants

These are usually on ground floor i.e., one level like for liquid milk plant. The milk storage tanks can be easily be placed in the processing rooms. Also the laboratory is connected to the milk reception room. The despatch should be placed next to the storage. The arrangement should be such that keeps the flow in view and all pipes should be kept as short as possible. A wall should be made in such manner that allows a provision for future expansion.

· Medium Capacity Milk Plants

The capacity of the medium sized dairy plant ranges from 20,000 lit to 1, 00,000 liters of milk handling per day. Layout for products like market milk, butter & ghee and cheeses can be designed. Each room should be planned separately and arranged with forward flow of product as per requirement.

· Large Capacity Milk Plants

Here, the plant building may have few floors having multi-product manufacture, where the reception is done at the ground floor and should have both milk treatment and tank storage on the first floor. If products like milk powder are to be manufactured, then the powder plant should placed in different building.

A few points mentioned below will help in determining the location of milk product plant:

(i) The plant should be located at a place where transportation facilities are available, such as railway siding or near highway. It should be noted that, suitable site would always provide easy transport of raw material to the plant and disposal of finished products.

(ii) To avoid contamination, the bulk transport of pasteurized milk should be discouraged. If pasteurized milk is to be distributed in glass bottles or small containers which are to be returned for reuse, the dairy should be situated close to consumption area. For any reason, if dairy is situated far away from consumption area, it is necessary to transport bottled milk in large quantity to local depots equipped with cold storage facilities.

(iii) Advertising value also affects the location of the plant. For instance a plant installed by the side of a heavily traveled highway naturally commands good sales.

(iv) Location of building should be such, that, all necessary services e.g. electricity, water, waste disposal are available at reasonable cost.

(v) The site must be large enough and of suitable shape to give freedom in planning the building and to allow space for future expansion.

(vi) The area should be free from atmospheric pollution.

(vii) Adequate labor must be available at site and it may be necessary to provide housing facilities to workers.

(viii) Traffic congestion around the plant should always be avoided. Larger plant will require more land for smooth control of traffic pattern.

For any entrepreneur desirous of setting up a dairy industry, it is advisable to go through the following check list on 'Location' to assess its suitability. A milk product plant can be located preferably in a village location due to the following reasons;

1. Proximity to the milk shed, reduced transportation cost for raw material
2. Increased shelf life of the product when compared to the raw material
3. Availability of cheap land and labor
4. Reduced noise and pollution
5. In many cases the volume of the final product is less than the milk used, hence reduction in transport and handling cost eg: Cheese, Butter
6. Solid products can be transported in trucks
7. Some products doesn't even require cold-storage

