Effective Plant Design for Competitive Advantage

How we plan and design our factory can determine how effectively we can meet our customers' requirements in terms of speed, quality and cost effectiveness leading to a significant competitive advantage in the market. In this article, Yusuf Patanwala highlights the importance of Effective plant designing.

A SMART manufacturing facility is a place where multiple forces and factors that come into play are balanced harmoniously. Some of the most important factors that determine the smartness of a manufacturing facility are as follows:

1. Workflow designed to minimise movement of manpower and materials within the plant
2. Flexible design for varied products, processes, production volumes and future growth
3. Safety and protection from hazards that affect health and wellbeing of humans
4. Smart allocation and placement of each area within the plant
5. Design for effective hygiene, cleaning and sanitisation management
6. Environment friendly use of natural resources like light, water, air, fuel and power
7. Worker friendly design to minimise fatigue and health hazards and to maximise productivity
8. Compliance with regulatory laws concerning safety, food contamination, pollution, labour and environment
9. Elaborate systems to handle waste, hazards, noise, smoke, heat and pollution due to use of equipment like ovens, chillers, steam generators, exhaust fans, chimneys and burners
10. Design that minimises costs incurred during operations, running and maintenance of the plant

Various studies by expert panels have concluded that an optimised bakery plant layout can reduce cost of production by as much as 30 percent! A manufacturing facility that harmonises the above factors can produce products of high quality with minimum wastes and less use of energy while achieving maximum productivity from its workers.

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Let's attempt to look at each of the above factors and how they influence operation and running of the factory in more detail.

1. Design for Workflow:

In a bakery, we need to plan areas with conflicting nature. hot area v/s cold area, wet area v/s dry area, area with positive air flow v/s negative air flow and area that store raw materials v/s finished goods. Each of them requires a specific and customised design to enable smooth production and to protect food against cross contamination.

For e.g., we need to design the final packaging area that is cool, dry, clean and with positive air flow. We cannot have heat, moisture, dust or smoke entering this area during movement of men and materials. The above situation can affect shelf life of products adversely.

2. Design for Flexibility:

Different bakery products follow different manufacturing processes, need different set of equipment and have to be produced in varied quantities. Duration of mixing, proofing, storage, baking and cooling processes may vary from product to product. Selection of right equipment and allocation and placement of each area then becomes a factor of prime importance if we want to manage the above factors effectively.

A decision to design a batch wise production with centralised mixing, baking and packaging areas OR to design production lines based on the specific needs of each product family needs to be considered very seriously and needs substantial thought and planning at the design stage itself.

For e.g., if we have a high production volume of a

particular product family (like Tin Bread), then it makes sense to plan a dedicated production line for that product family.

3. Design for Safety and Protection from Hazards:

This is a no-compromise factor in design of any factory. When all precautions are taken care of and all safety provisions made, the long term and smooth operations of the entire facility are almost guaranteed.

For e.g., when power and electrical norms are compromised there is high power consumption, frequent equipment failures and fire hazards that lead to high costs and poor plant efficiency.

4. Design for Smart Space Utilisation:

Different equipment have different requirement for space while operating, for cleaning, for maintenance and for accessories like pipings for fuel, water, steam, etc. Unless and until all factors are properly considered and provided for, there will always be a hindrance in either running of the equipment, cleaning or maintenance of the equipment.

For e.g., ovens need area for dissipation of heat and hence require an area with greater height. Oven area needs to be designed considering the wellbeing of the operator especially during the summer season with proper lighting, air ventilation, emergency exit and safety precautions against fire.

5. Design for Hygiene:

It should be easy to maintain a clean and hygienic factory. All processes and activities that lead to accumulation of dirt, smoke, waste, etc. need to be identified and an effective way to manage them, at the infrastructure design first and then operations stage later, must be planned and executed.

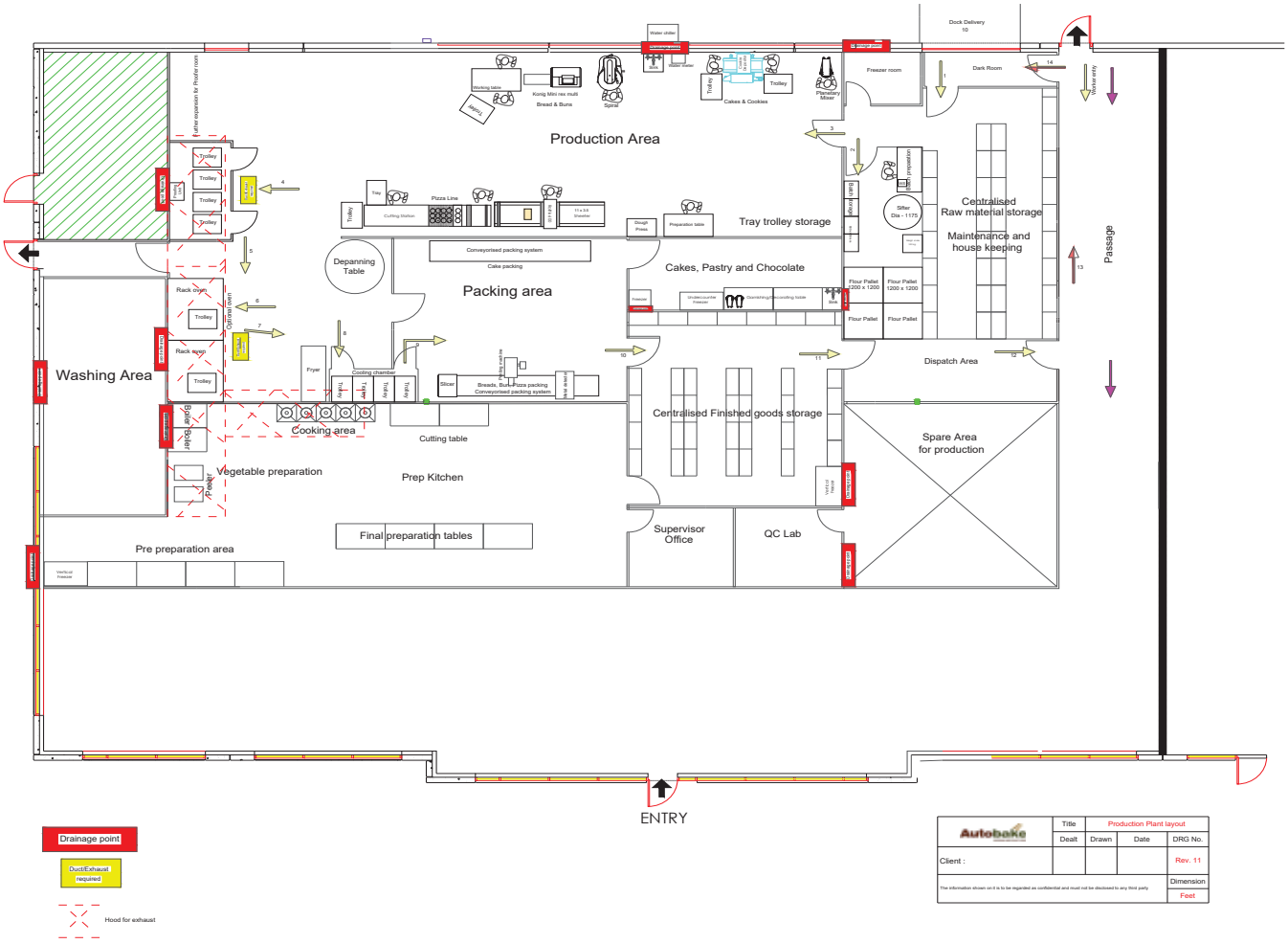
For e.g., the mixing area is most prone to spillage of flour, water and various ingredients. Providing adequate space for storage of flour and other ingredients in bins, pre-portioned batches of raw materials, anti-spillage methods of dispensing flour and other liquids, etc. all help towards maintaining this area clean and free from unhygienic surrounding.

6. Design for an Eco-Friendly Environment:

Proper management of heat generating equipment by provision of exhaust and fresh air systems helps maintain a cool working environment which in turn helps gain maximum efficiency from equipment and from workers. Some examples are:

Use of natural light and ventilation reduces load on chillers, air conditioners and exhaust fans thereby saving fuel and power.

Use of environment-friendly construction materials and lighting devices helps save water and electricity.



Proper means of collecting and segregating wet and dry waste helps in minimising food waste and also in recycling and re-using processes.

7. Design for Worker Safety and Well Being:

As discussed in earlier points, design of workplace with worker safety and wellbeing is paramount and needs no compromise. Workplace design should facilitate effective, smooth and minimal movement of workers within the factory.

For e.g., taking care of flooring in slippery areas where there is moisture (the mixing area) and taking care in oven area where there is continuous heat and smoke by designing good exhaust and fresh air systems helps in worker wellbeing and safety.

8. Design for Compliance:

Every city or district has its own distinct laws and regulations related to safety, pollution, etc. to be followed. It makes sense to incorporate and make provisions for such laws while designing the factory to avoid issues with authorities later.

9. Design for By-Products and Waste:

Carbon mixes with exhaust fumes from the chimney, sticky and dense solids mix with water drainage during cleaning and all primary and secondary packaging material garbage including plastics are generated during the food production processes. They interfere with the environment if not disposed properly and responsibly.

For e.g., use of Effluent Treatment Plant helps in separating the suspended solids from water that can then be used in washrooms and for gardening purposes.

10. Design for Plant Effectiveness:

There are certain costs incurred on continuous basis if the factory is poorly designed and they should be taken care of at design stage itself.

For e.g., breakage of flooring and tiles, overflow of garbage and drainage areas leading to pests, heat buildup in factory leading to frequent equipment failures, manpower health and illness issues due to exposure to smoke and heat, high consumption of power, fuel and electricity, high water wastage, etc.

Taking care of all the above factors may look time consuming and capital intensive in the beginning but they go a long long way in building a high growth oriented, safe, sustainable and profitable manufacturing facility.

There is a saying that a major part of success of any enterprise lies in good planning and thus if you fail to plan, you are definitely planning to fail! ✤