Industrial Efficiency and Value in a Changing Market

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SUMMARY

Logistics activity profiling can be used to enhance the internal and external flow within an existing industrial operation. This can lead to greater efficiency and an extended useful life for an existing single- or multi-facility operation.

Each element of the subject industrial facility should be considered relative to the competitive market and trends in technology. Analysis of the trends in the market for labor, raw materials, transportation networks, industrial technologies and others factors of production will enable a facility and business entity to be more competitive in an ever changing international market.

Prudent planning will decrease the chances and amount of functional obsolescence over time. This will strengthen an industrial facility's ability to retain value within the market and to the exiting business operation.

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1. INTRODUCTION

Industrial facilities are meant to serve business needs; some facilities are new construction; others are renovations of existing facilities. In either case, the business dynamics of the firm (customer demand, product life cycles, brand expansion, etc.) can cause the physical facility's efficiency and usefulness to change over time.

As time passes, the usefulness of a specific industrial location will also change. Changes in the work force, technology, transportation, raw materials, demand for the finished product and other market changes directly affect the utility (usefulness) of specific industrial facility and location.

Industrial facilities are an integral part of the overall mix of components that together enable a firm to function: these include the firm's customers, its products, and its physical plant and equipment.

1.1 Business Mission – Plant & Equipment

Why construct an industrial facility in the first place? We contend that the physical plant, equipment, land, utilities, and all other capital invested in creating a working industrial facility is done to support a business mission. That mission will vary from firm to firm, but all firms that manufacture and distribute goods share common needs as regards their industrial space.

Within "the four walls" of an industrial facility, a typical manufacturing firm requires certain quantities and configurations of space for receiving, storing, and distributing raw materials into manufacturing processes; plant floor space for manufacturing, assembly, packaging, and other operations; space for storing and distributing finished goods; and shipping and receiving docks. In addition, the firm requires space for office and administrative functions.

Beyond the four walls of the facility the firm will require outdoor improvements suitable to its needs, such as a marshalling yard with sufficient capacity to handle inbound and outbound traffic volumes. Beyond the yard, the firm will also have needs to have access to appropriate linkages to its customers and markets; we will address those issues in the second part of our paper.

The mix, quantity, and configuration of space that defines an industrial facility's initial design is driven by the nature of the firm's products and its customer's current and projected demand for those products.

1.2 Business Mission – Customers & Products

A firm's customers and products drive the nature of the industrial space it requires to fulfill its business mission.

Customers have many characteristics that affect their relationship to the firm. As regards their impact on the design and location of industrial facilities, two key aspects are product demand and geographic location. Product demand, aggregated from all the firm's customers, determines how much product the firm will make. Geographic location, i.e., markets, determine how many and in what locations the firm will site its manufacturing and distribution facilities.

Products have several key characteristics that affect the design of the industrial facilities in which they are manufactured and from which they are distributed. These characteristics include physical, population, and demand pattern.

A product's physical characteristics include its weight, dimensions, cubic volume, and material handling requirements. These physical characteristics determine the types of storage and material handling equipment necessary to move and store a specific product.

Product population is an aggregate measure of how many individual products (also known as stock-keeping units, or SKU's) the firm manufactures and ships.

Finally, each product has a demand pattern. A common demand pattern is *consistent*, in which a product is introduced to the market and maintains relatively level demand over time. A *declining* demand pattern is one in which a product's demand falls steadily from its point of introduction until it is discontinued. This pattern is typical in fashion goods. A *seasonal* product's demand pattern has peaks at certain times of the year. School supplies typically have a major peak in the late summer before classes start in the fall. *Inclining* demand indicates a product with increasing demand over time. Finally, some products have an *irregular* demand pattern.

1.3 Putting it all Together

Industrial facilities are designed and constructed to serve a business mission. The firm's customers demand certain quantities of products from the firm. Those products have physical characteristics that determine what type of storage and material handling equipment is required to move the product. The quantities and time frame in which customers demand the product establish the product's demand profile, and establish the quantity of each SKU the firm must produce over time.

A key relationship in the industrial facility's design is the quantity of product that customers demand and the physical characteristics of the products. By aggregating demand for all customers and all products over time, the firm can define the quantity and type of industrial space needed, as well as the types of storage and material handling equipment necessary to store and move the product. Firms typically analyze historical aggregate product demand, and then size the facility based on that historical profile plus a forecast allowance for growth and peak capacity demand.

This approach is both logical and reasonable and typically yields a facility that provides functional utility for the firm. However, customers and markets are *not* always logical and reasonable, and the business dynamics of the firm will certainly change over time. As a result, even the best-designed industrial facility can become inefficient and functionally obsolescent over time.

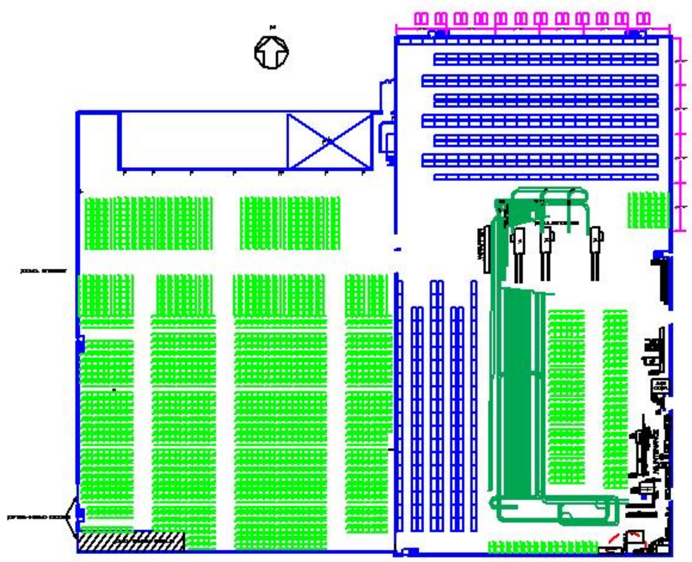
2. CASE STUDY

In our example, we were asked to analyze a business that was rapidly outgrowing its facility. The firm wanted to know whether it could take on a new product line with their current space, or if it had to find third party warehousing to handle the expansion.

Our subject firm was a 100 + year old company that had a bottling and distribution plant located in an urban environment. When the facility was initially constructed, it was not in the city – rather the city grew in around it over time. Over the years the firm grew by acquisition and product expansion to have more than 60 brands.

The firm's total campus covered three city blocks and included two bottling plants, several administrative office buildings, a raw materials warehouse for bottling operations, and a distribution warehouse for finished goods storage and distribution.

The subject of our study was the distribution warehouse. The following diagram shows the layout of the facility. As the diagram shows, the facility was divided into two sections, with access through a wide door in the firewall between the sections.



The product in this facility was 100% cases of bottles, and was moved in stacks with clamp trucks. The westerly side of the facility (left side of this graphic) was configured as block stack storage with 10-position deep lanes.

A 6-door shipping and receiving dock was positioned along the north wall of the west section.

The easterly (right) side of the facility was configured with Very-Narrow-Aisle (VNA) rack storage across the northern third and the southwest quarter. The center portion contained product conveyor and three palletizer/stackers used to create product stacks from the individual cases, which were conveyed from the bottling plant across the street.

The southeast portion contained raw material storage for the palletizing operations, as well as a machine shop for servicing the forklifts and other material handling equipment.

The facility was landlocked by city streets along its west, south, and east walls allowing no room for expansion. The firm owned a parking lot across another city street to the north, which is used for marshalling inbound and outbound traffic.

2.1 The Analysis Process

In order to answer our client's question, we performed a capacity study. This study requires us to look at three key elements: the product; the facility; and material flow.

The *product* portion of the study involves a detailed analysis of the firm's customers (i.e., product demand) and products. We call this portion of the study *Logistics Activity Profiling*. In this activity, we first examine the aggregate demand for every product the firm produces. We next examine the physical characteristics of each product, i.e., its dimensions, cubic volume, and weight.

The *facility* portion of the study gathers information about the physical plant. Necessary data includes physical dimensions of all usable spaces; current layout and inventory of all product storage modes (e.g., block stack lane quantities and depths, VNA rack positions and heights); and inventory of all material handling equipment.

The *material flow* portion of the study looks at how material currently moves through the facility from receipt through storage, picking, packing and shipping. These flows can include both mechanized equipment (e.g., conveyors, sorters) and manual procedures.

Once we understand these key data about the product we apply Pareto analyses (commonly referred to as "the 80-20 rule") to rank the products by movement velocity. Upon completion, we develop a list that categorizes product into four groups: A, B, C, and D. "A" items are the fast movers; "B" items less so; "C" items even less so; and "D" items typically move rarely if ever. We have consistently found that Pareto principles hold: in broad terms, the "A" items will comprise 20% of total items, but will generate 80% of the product movement.

2.2. Understanding and Applying the Results

So how do the three study portions work together? In short, the *facility* and *material flow* portions of the study tells you what facility you *have* and how it works today. *Logistics Activity Profiling* of your product tells you what facility you *need* and provides the basis for deciding how material should flow in the future.

The key objective of this study process is that, once you understand your product in relation to your facility you can increase your facility's efficiency and thereby extend its life.

2.3 Case Study Results

In our client's study we made a number of important observations and recommendations. We will discuss three here. First, all product's storage was handled equally. Therefore, regardless of whether a product was an "A" or a "C," it was transported to the first available storage slot found in the warehouse. Therefore, every SKU's travel path on average was from the pickup point at the palletizer/stacker in the east building to the center point of the west building.

By creating fast flow lanes directly in front of the shipping docks and putting the fastest moving "A" SKUs in them, we reduced overall travel by an average of 300 feet (91 metres) per load for those products. This may seem trivial, however, in this high-volume operation the top 20 SKUs moved more than 100,000 loads per year each – which equates to a savings of 5,682 miles, or 9,144 kilometers of forklift travel!

Our second key observation was in the 10-position-deep lane storage configuration of the west side of the building. The Logistics Activity Profile of the firm's 250+ SKUs showed that only seven SKUs shipped in sufficient volume to justify having a lane that deep. As a result, the floor was full of nearly empty storage lanes – we estimated that at least 50% of potential storage space sat empty due to oversized storage locations. Using the activity profile results across the firm's SKU population, we reconfigured the floor storage area into 2-, 3-, 4-, 5- and 7-position lane depths, plus a very few 10-deep lanes. By simply configuring the facility to match the product profile, we were able to regain 30% of total facility capacity.

Our third observation was that partial pallets of product were being stored in the block stack lanes in the west building. Although most of the product was routinely shipped as full pallet loads, some was shipped as cases, which left partial pallets. In addition, cases from the end of a production run and end-of-life product often created partial pallets. Partial pallets stored with full pallets create two problems. First, these pallets only partially use a space that a full pallet would otherwise completely consume. Second, a forklift operator has to move them out of the way to handle the full pallet that they came to get in the first place.

The facility had a significant number of storage spaces configured as Very-Narrow-Aisle (VNA) rack which was generally under-utilized. We created procedures by which all partial pallets found in the block stack area were immediately moved into VNA storage. In addition, based on the activity profile for slow moving "C" and "D" items, we reconfigured their pallet profiles to hold fewer cartons, thereby creating shorter pallets. As a result, these items could be immediately stored to VNA and never placed in block stack. We estimate that utilization of the VNA area increased by approximately 30%.

2.4 Case Study Conclusion

Our client engaged us to help determine whether their facility and operation could be restructured to gain sufficient space and efficiency to handle a new product line. Unfortunately, even the gains we found were not enough for the expansion. However, the client estimated the changes we recommended that they implemented gave them an additional two years of operation with their current brands at normal growth rates without increasing staff.

Every case is different, but in most cases firms can significantly extend the useful life of their industrial facilities through a capacity and process redesign project.

4. PHYSICAL AND LOCATIONAL ATTRIBUTES

4.1 Physical -The Subject Building

The utility of a specific industrial building can be examined by a focus on its common elements. When these elements are adequate, the facility will operate efficiently and is likely to be more valuable than a facility that does not meet the market norms. Facilities can be classified into three broad categories.

- General Purpose Facilities
- Special Purpose Facilities
- Single Use Facilities

These broad categories of industrial facilities differ in adaptability or ease of conversion to an alternative use. A *general-purpose* facility is the most adaptable with a variety of possible economically feasible alternative uses (such as a warehouse). A *special-purpose* facility is somewhat less adaptable and includes properties that would have somewhat higher conversion costs (such as a shipyard, winery or slaughterhouse). A *single-use* facility is the least adaptable and would incur very extensive conversion costs (such as a waste treatment plant, paper mill, or power plant).

We will focus on general-purpose industrial facilities herein, as they make the best example for our purposes. A more adaptive facility has a greater chance of retaining usefulness as markets and technology change over time. The basic elements of a common industrial facility are as follows.

- Ceiling Height
- Construction Material (steel, wood frame, or masonry)
- Sufficient Quantity and Size of Bay Doors (10x10)
- Truck Wells and Dock Height (3.75 feet for rail; 4.25 feet for truck)
- Location and Quantity of Office Space (< 30% typically)
- Bay Size and Column Spacing (50x50)
- Building Shape (rectangular)

- Ratio of Manufacturing to Warehouse Space

The trend in today’s market is for increasing ceiling heights due to innovations in stacking technology. The proper quantity, size, and location of bay doors will affect the flow of materials within the facility and what trucks can be efficiently loaded and unloaded. Adequate truck wells, appropriate dock heights, and sufficiently spacious shipping and receiving docks can save a great deal of time in the loading and unloading process. Wider column spacing allows for more flexibility in interior design, flow and the placement of machinery. Rectangular buildings tend to provide the greatest utility and flexibility for future adaptation, possible multi-tenancy, and trucking access. Other factors most certainly apply but these are some of the key aspects of comparison between industrial facilities.

Development of the facility within typical market standards for these factors and with an eye toward trends in the industrial market will make a facility have a longer and more efficient economic life. The less adaptive, or below-market-standard a facility is, the lower its likely resale value, utility, and economic life.

4.2 Physical Site Characteristics

A careful analysis of site characteristics prior to construction can extend the useful life of a facility and increase the efficiency of its operation throughout that life. Additionally, proper site utilization of an existing facility’s land, which may entail renovation, expansion, or even partial demolition of dysfunctional components, can also extend the useful life of an older industrial facility. The following elements of the physical site, in relation to the specific industrial facility, directly affect the efficiency that they are capable of achieving.

- Site Shape and Size
- Frontage
- Possibility of Flooding
- Soil Conditions & Topography
- Corner Location
- Environmental Issues
- Legal and Allowable Use Issues

These elements are generally physical in nature. In the following sections we will discuss key issues and a specific facility’s location relative to the market. This factor can be every bit as important as the physical characteristics of the land and building.

Key Site Questions that Could Extend the Useful Life of an Existing Facility

The following questions focus on getting the most utility out of an existing industrial facility and the site it occupies. The internal flow of the facility has to be seen in the context of the flow in the site / yard, as well as its interaction with the greater marketplace surrounding the facility. Each interacts (internal building flow, site efficiency, & greater market factors) and affects the utility of the subject industrial property.

- Can the site / yard accommodate a building expansion?
- Can opening new doors, or expanding existing ones, help product flow?
- Can the addition of truck wells and dock space help product flow?
- Can neighboring parcels be acquired for expansion?
- Does the site have sufficient space for truck turn-around (often 150 feet) and loading?
- Is parking adequate?
- How will an expansion of the facility affect site efficiency?

All of the following questions directly affect current and future business at a specific industrial facility. Proper analysis and planning allows for the greatest utility to be achieved from these assets.

4.3 Linkages within the Market

Up to this point our analysis has focused on the specific subject site and building and what components will affect efficiency and economic life. Those specific subject elements must be considered within the context of the surrounding market, and the linkages (time distance relationships) that exist in the region. In this case "linkages" include time, distance, cost, and risk. This concept should be considered on the basis of current and expected future changes as they relate to the subject facility and specific needs of the user of the industrial facility. Proper understanding of the existing linkages and market changes over time will help determine where a specific facility should be located (in the case of new construction), which facilities should be expanded or closed (in the case of a multi-building operation), where to have excess land or capacity available (for future growth), and often the specific building elements most likely to serve both current and future needs.

Some very important linkages for most industrial facilities are as follows:

- Linkages (time/distance) to raw materials
- Linkages to the worker population
- Linkages to the destination of the finished product

The key objective is to decrease the time / distance, cost, and risk factors involved. This will decrease the cost of the finished product, making the facility and company better able to compete and produce profit (or save money in the case of a public works facility). These concepts should be considered in relation to the following:

- Access to and quality of large roadways
- Access to and quality of local roadways
- Access to sea routes
- Access to and quality of rail facilities
- Access to and quality of airport facilities
- The expected change in the labor market over time
    - Quantity

- Cost
- Competition
- Legal issues

- The expected change in the demand for the finished product over time
  - Quantities
  - Timing
  - Location of the demand sources (customers)
  - Competition
  - Legal implications
- Access to complementary facilities
- Access to educational facilities

Several key questions arise as we consider these concepts as they relate to a specific property.

- Is the transportation network already at capacity?
- How predictable is the transportation network?
- What is the growth pattern in the market for workers?
  - Are worker populations being pushed further away?
  - Is the cost of labor increasing rapidly?
- What is the growth pattern in the demand centers for our finished products?
  - Will the transportation costs increase rapidly over the coming years?
  - Will the required transportation methods change?
- Will raw materials become more costly?
  - Is there a known limit on a key raw material?
  - Will increased demand cause the operation to require more costly sources of raw materials?
- Will there be efficiencies of scale as the operation grows?
- Are there governmental incentives that will be available?

The previous items create a very intricate web of possibilities and constraints that affect each existing facility and business. A careful analysis of these factors, with consideration of future changes, will help keep a specific business and facility more efficient as it reacts to ever changing market pressures. Every industrial operation that accurately plans for the future is more efficient and able to stay economically viable for longer than those that do not.

4.4 A Case Study on Timeline Effects for an Industrial Facility

In our example we will consider a small distribution warehouse facility in Tampa, Florida USA. This facility is located close to the city center, near the Port of Tampa. This location was originally an efficient location for industrial operation.

As the years passed, the roadways around the subject property became more congested. Linkages deteriorated, and it became very difficult for trucks to access the location at peak traffic hours. The facility itself was originally fairly efficient, but newer technology called for much larger facilities with higher ceilings than were needed when it was originally constructed. Standard trucks became larger, and the subject site was not able to accommodate these larger trucks. It was limited to small and medium sized vehicles due to inadequate turn and loading space.

As demand increased for commercial office uses in this general location, most industrial users relocated out of the area. Road networks were expanded in more distant but growing industrial distribution nodes, newly located to the north, south, and east of the subject's central location. Expansion of roads near the subject was not really possible. As such, the efficiency of the subject decreased greatly relative to its newer competition elsewhere, which decreased the building's ability to generate profit.

Population centers moved ever further from the subject location and it became more difficult for workers to access the area due to high traffic volumes, especially during peak hours. This began to increase labor cost for industrial uses in this downtown industrial location.

Increased demand for office, service, and commercial uses in the downtown core caused real estate values to rise, increasing taxes and other expenses of operation. These increased costs further decreased the utility of operating at this location.

In the end, the subject facility and nearly all of the small industrial facilities in that specific market niche, converted to other uses. These conversions required conversion costs. These costs ranged from extensive renovation to total demolition. Many rehabilitated properties retained permanent functional obsolescence after conversion to office use.

Proper long-term planning could have saved a great deal of money for the developer and operator of the facilities in several ways:

- A flexible or generic design could limit the conversion costs at the end of the building's useful life as an industrial facility
- Forecasting the time that this niche industrial market would transition could have allowed for the development of a shorter-life structure that would expire at approximately the same time as the niche market lost its competitive edge for industrial uses
- The development of the "proper" building component in this location could have been both a good investment and filled a useful business function during an interim period

Pitfalls that caused users to potentially lose valuable assets in this location were:

- Investing in costly long-term facilities that would be difficult or impossible to convert to another use when market viability ended
- Operational business losses due to inefficiency

4.5 Industrial Efficiency Conclusion

Efficiency, economic life, and value for industrial facilities can be enhanced with prudent planning. Logistics activity profiling can enhance the internal flow of an existing facility and extend a facility's remaining useful life. Logistics analysis can also be used to examine flow within the site areas and over a multi-building operation. Care should be taken to consider each element of the subject facility relative to the competitive market and trends in technology and demand for similar space. Each industrial facility operates within a changing marketplace. Accurate analysis of the trends in the market for labor, raw materials, transportation networks, and others factors of production will enable a facility and business entity to be more competitive in our ever changing world.

REFERENCES

Appraisal Institute, Appraising Industrial Properties (2005)

Appraisal Institute, The Appraisal of Real Estate Twelfth Edition (2001)

Appraisal Institute, The Dictionary of Real Estate Appraisal Fourth Edition (2002)

Real Estate Principles – A Value Approach, David Ling and Wayne Archer (2004)

BIOGRAPHICAL NOTES

Steven L. Nystrom, MA, MAI is the President of NewStream Companies, based in Tampa, Florida. NewStream Companies is a commercial real estate consulting firm that specializes in commercial real estate valuation. Prior to creating NewStream Companies, Steven was a senior associate at General Motors Acceptance Corporation (GMACCM), where he performed complex valuations on a wide variety of assets. He also performed many reports for mortgage-backed securities via the conduit portfolio market. Steven has more than sixteen years experience in all facets commercial valuation. These assignments include general commercial facilities, special use properties, vacant land, litigation assignments, condemnation or eminent domain appraisals, environmentally sensitive wetlands, lease analysis and many large unique industrial, office and retail facilities.

Steven is an instructor for the Appraisal Institute and has served as a Special Magistrate for the Pinellas and Pasco County valuation adjustment boards over the 2003 to 2006 period. He holds a Masters of Arts Degree from the University of Florida focusing on the valuation of real estate in an Appraisal Institute sponsored program, and a Bachelor of Arts degree in Economics from the University of Florida.

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