evolver™

A Practitioner's Guide
To Lean Manufacturing
Full Edition

Sample Presentation

Vincent A. Amaro, Jr.

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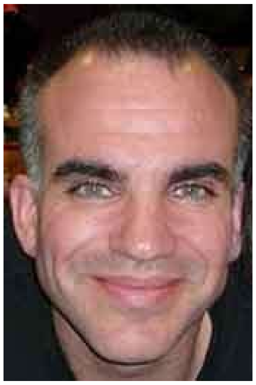

Vincent A. Amaro, Jr. is the founder and President of Lean Manufacturing Consulting, Inc. Mr. Amaro has dedicated his career to the development of world class manufacturing operations using Evolver™ lean manufacturing techniques, which have provided numerous firms a competitive advantage in today's global marketplace. Mr. Amaro has over 25 years of experience in manufacturing, including extensive experience as a machinist.

Mr. Amaro began his career in manufacturing while serving a tool and die apprenticeship during the early 1980's. During his career, he has worked for a variety of firms ranging from aerospace to medical devices and has held several positions including experimental machinist, tool and die maker, mold maker, tool designer, manufacturing engineer, process engineer, Plant Manager, and Vice President of Operations.

Mr. Amaro also has extensive international and multi-plant managment experience having worked at the executive level in Japan, Indonesia, China and Hong Kong.

Having worked his way up from the shop floor, Mr. Amaro has the ability to quickly recognize and solve problems, as well as the ability to earn the respect of the rank and file employees. The combination of in-depth manufacturing knowledge and real "hands-on" experience differentiates him from other executives at his level.

During his career, Mr. Amaro has successfully completed hundreds of lean projects of various sizes and complexities. He is a dynamic leader who is an expert in the implementation of lean manufacturing and the turn around of failing product lines resulting in millions of dollars in savings. Mr. Amaro holds a Bachelor's degree in Business Management and an MBA in Global Business Management.

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Preface

Over the last 15 years, firms attempting to remain competitive in a global economy have turned to lean manufacturing. The recent popularity of lean manufacturing has led to the publication of countless books and articles on the topic. For the most part, these publications provide a general overview of lean manufacturing rather than a practical application.

In addition to the countless books and articles, new lean approaches and methodologies have also appeared, each promising consumers amazing results. Yet, none of these so called lean approaches are even remotely applicable in all manufacturing applications, especially for firms with low volume/high mix applications or those working in job shop environments.

Some lean programs, such as Six Sigma, place too much emphasis on statistical analysis and on the creation of an internal corporate hierarchy. The statistical analysis in and of itself does nothing to improve the bottom line, nor does it provide any foundation for a cultural change. At some point, those using a statistical approach must return to basic lean manufacturing principles if they wish to address their findings. Meanwhile, the creation of an internal class system only serves to further widen the gap within the corporate hierarchy.

Furthermore, most of these lean programs fail to address the importance of self-directed work teams and effective interpersonal skills that are required for a full lean manufacturing deployment, that is until now, meet Evolver™.

What Is Evolver™?

The purpose of Evolver™ is to provide users with highly effective lean tools that work for everyone, from executive management to the rank and file, in any type of manufacturing environment. Evolver™ is a common sense, real world approach that was written by a manufacturing professional specifically for manufacturing firms.

Many of the original lean concepts that were established by those involved in the original Toyota Production System are written in a very rigid manner making them highly effective in select environments and difficult or impossible to apply in others. However, many lean practitioners will lead you to believe that the original concepts are applicable in all manufacturing environments. This is unfortunate because many firms beginning their lean transition waste too much time attempting to make the original concepts "work" in their environments. When the original lean concepts can not be applied, this causes frustration, failure, and the loss of time and money. The reality is that many of the original concepts must be slightly "tweaked" or accompanied by complementary concepts to make them applicable in a greater number of manufacturing environments.

Evolver™ provides the necessary changes to the original concepts and introduces new complementary lean concepts and approaches that can work in any environment. When applicable, both the original lean concepts and the Evolver™ exclusive concepts are presented in this guide to provide firms the opportunity to select the right tool for their individual applications. Evolver™ also demonstrates how, when and where to apply both the original concepts, as well as the Evolver™ exclusive approaches. This is a practitioner's guide to lean manufacturing, not a lean overview. With Evolver™, there is something for everyone.

The "Getting Started" section of this guide covers many important topics and offers suggestions not mentioned in traditional books and seminars that are intended to be lean overviews. The "Getting Started" section contains information and tips that can only be taught by an actual practitioner of lean manufacturing. These tips can make the difference between experiencing a smooth lean transition or failing miserably.

At the end of the day, lean manufacturing in any form is nothing more than the application of common sense combined with a new "tool" or a new way of "looking" at a manufacturing process. With this in mind, a lean implementation should not cost firms tens of thousands of dollars to implement. Evolver™ offers a highly effective low-tech approach that allows firms to make a difference in the workplace immediately, without requiring a large expenditure.

Purpose Of This Guide

This guide is intended to serve two main purposes: 1) to provide valuable information and additional insight on each of the lean tools contained in the Evolver™ program beyond offering mere definitions, which can be found in any number of sources, and 2) to act as a study guide/train-the-trainer program for those interested in becoming lean trainers using the Evolver™ program. There are numerous lean trainers who are well-rehearsed in the classroom, but lack real hands on practical lean experience. If this describes you, this book will not only serve to make you a more informed trainer, but it will also help to shorten the learning curve between being well-rehearsed to becoming a seasoned lean practitioner. Those designated by their organizations to provide lean training should familiarize themselves with the entire contents of this guide.

Who Should Read This Guide?

This book should be read by CEO's, presidents, cost accountants, operations managers, materials managers, quality managers, production planners, lean trainers and anyone interested in learning more about the lean concepts presented by Evolver™.

The Evolver™ Slide Presentation

The Evolver™ presentation consists of over 200 slides, each containing valuable and practical information. The purpose of the presentation is to be used as a training tool for lean enterprise deployment. Please expect to spend a minimum of two full days training participants. Due to the intensity of this training program, the Evolver™ program is separated into ten chapters to provide the option of conducting the training over a longer period of time.

How To Use This Guide

The top left hand corner of each page of the guide contains a slide from the Evolver™ presentation. The text below each slide contains additional information and insight about each lean topic discussed in the slide. The chapters of the book, as well as the slides, are in the same order as the presentation.

Over-Production Waste

- Occurs when firms produce more parts than their customers need at a given time.
- This type of waste consumes raw materials and pays employees to produce parts that are not needed by the customer.
- Additional costs attributed to over-production waste include the cost of carrying unnecessary inventories, and the loss of floor space and equipment required to store the extra parts.

Over-Production Waste (Cont.)

- To eliminate over-production waste, production quantities should be based on a combination of:
  - customer demand; and
  - the time required to set-up a piece of equipment.
- Example: Let's assume that a customer orders only one part.
  - It takes four hours to set-up the machine and ten minutes to run the part.
  - In this case, it would not make sense to produce strictly based upon customer demand.
  - You would need to find the lowest run quantity that covers your machine set-up costs while keeping your inventory levels to a minimum.

Over-Production Waste

Over-production waste is one of the more common forms of waste found in manufacturing facilities. Based upon my experience, when a company encounters problems with extremely long lead times and high inventory costs, they are usually producing too many parts that are not required at that particular moment in time. This normally occurs when production batch sizes are too large and when push systems are in place. (Note: Push and pull systems are covered in Chapter 3, "Lean Tools and Concepts.")

When firms overproduce, raw materials are consumed and employees are paid to produce parts that are not yet needed. In addition to the material and labor costs of producing these parts, there are storage and inventory costs to consider. If over-production waste is to be reduced or eliminated, production quantities should be based as close to customer demand as possible. In general, factors such as the type of products, production processes, product mix and volume, will have an influence on your optimum batch sizes.

In recent years, the concept of one-piece or a continuous flow has been made popular by those teaching traditional lean manufacturing. This is similar to the assembly line concept where parts travel from one station (or step) to another in one continuous flow, from raw materials or components to a finished assembly using what is known as a pull system. This type of approach reduces WIP (work in process), reduces lead times and virtually eliminates overproduction. In a true pull system, the previous step in a production process only produces the amount of products that are to be consumed by the following steps in a production process, thereby eliminating overproduction. The last step of the production process is the heartbeat or focal point of the system which is driven strictly by customer demand. As a result of firms striving to achieve one-piece-flow, the words "batch" and "batch processing" are frowned upon by traditional lean manufacturing practitioners.

Despite the fact that a continuous or "one-piece-flow" is a great goal to have when implementing lean manufacturing, in many cases there are other constraints that make one-piece-flow either unattainable or simply not as cost effective as many lean practitioners would lead you to believe. For many businesses, where numerous short-production runs and diverse product lines exist, one-piece-flow may not be the best course of action. In cases such as these, you need to get creative. For example, you may have the ability to apply the one-piece-flow concept at the component level vs. the top assembly level or apply one of the exclusive Evolver lean tools such as best-batch-flow. Best-batch-flow can be described as simply analyzing a production process and deciding the best batch size or best-batch-flow. This simple, but highly effective approach requires the analysis of a current batch size and attempts to find a happy medium between producing too many parts (over-producing) and producing barely enough. (Note: One-piece-flow and best-batch-flow are covered in Chapter 3, "Lean Tools and Concepts .")

When deciding on an optimum batch size, one must decide which is more expensive, carrying some additional inventory or reducing capacity and paying more for the parts that you produce. As a rule of thumb, I prefer to reduce set-up times first. Then, I find the optimum batch size (best-batch-flow) based on the new set-up times. As a word of caution, I have often witnessed manufacturing firms during a lean transition drastically reduce their batch size to the extent that it costs them more money and reduces capacity, thus further straining their production. This normally occurs for a few reasons:

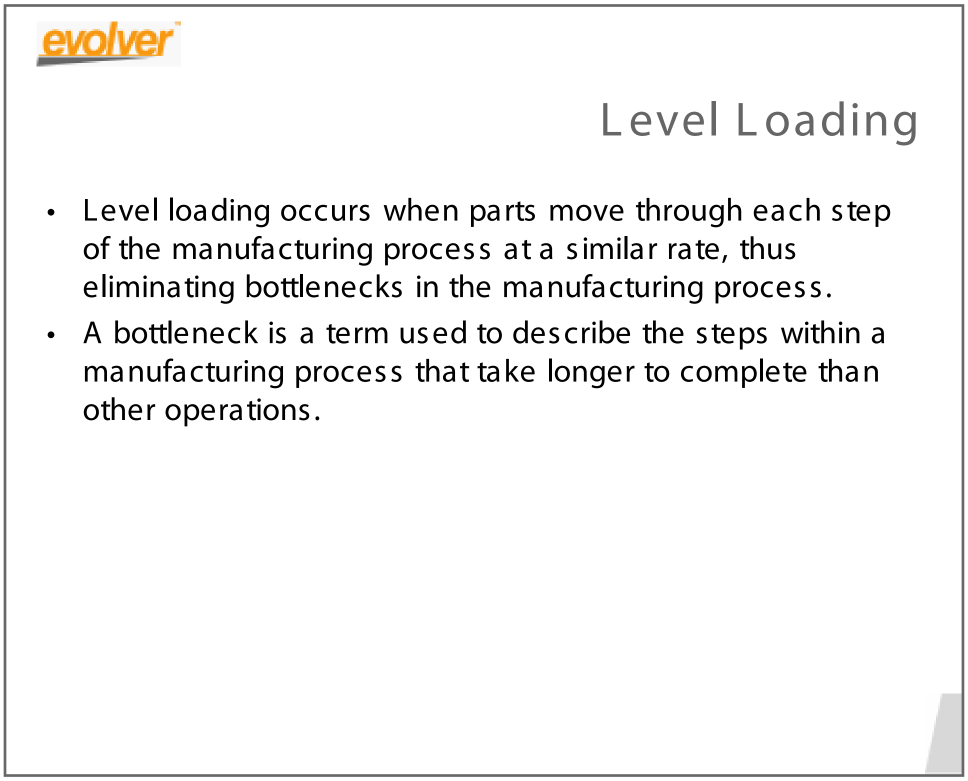
1. Failure to consider the set-up costs when producing a product. The cost to set-up the machine must be rolled into the cost of the total quantity of parts produced during a single run or batch.
2. Management attempts to reduce batch sizes on machines requiring long set-ups before a "set-up reduction" program is in place.
3. Management does not consider the machine down time that occurs during a long set-up. This reduces capacity.

Improperly set-up Material Resources Planning (MRP) Systems will also cause overproduction, thus creating a push system. The actual MRP system itself is not the problem, as the MRP software only performs what the operator tells it to do. You can still have a lean environment and have an MRP system in place. Here are some suggestions that have worked for me in the past:

- Reduce your set-up times first.
- Establish a best-piece-flow for all of your components and enter these numbers into the system (these are the minimum run or "batch" sizes).
- Enter your customer orders into the MRP computer system on a daily basis and run your MRP on a daily basis.

With this particular approach, it is possible to produce on a daily schedule based on a combination of customer demand and the established best-batch-flow estimates. This approach still reduces inventory to the bare minimums, maintains or improves capacity and virtually eliminates most overproduction problems without the use of a one-piece-flow system.

Important Note: The best lean manufacturing concepts require nothing more than a little common sense to apply. With this in mind, it is important to do what is right and what makes sense for a particular project. For example, some important project goals could be cost reduction, improved quality, employee satisfaction, providing value to your customers, etc. The lean methods used to achieve these goals are not as important as long as they make sense and they achieve results. Do what works best for your particular application!



Level Loading

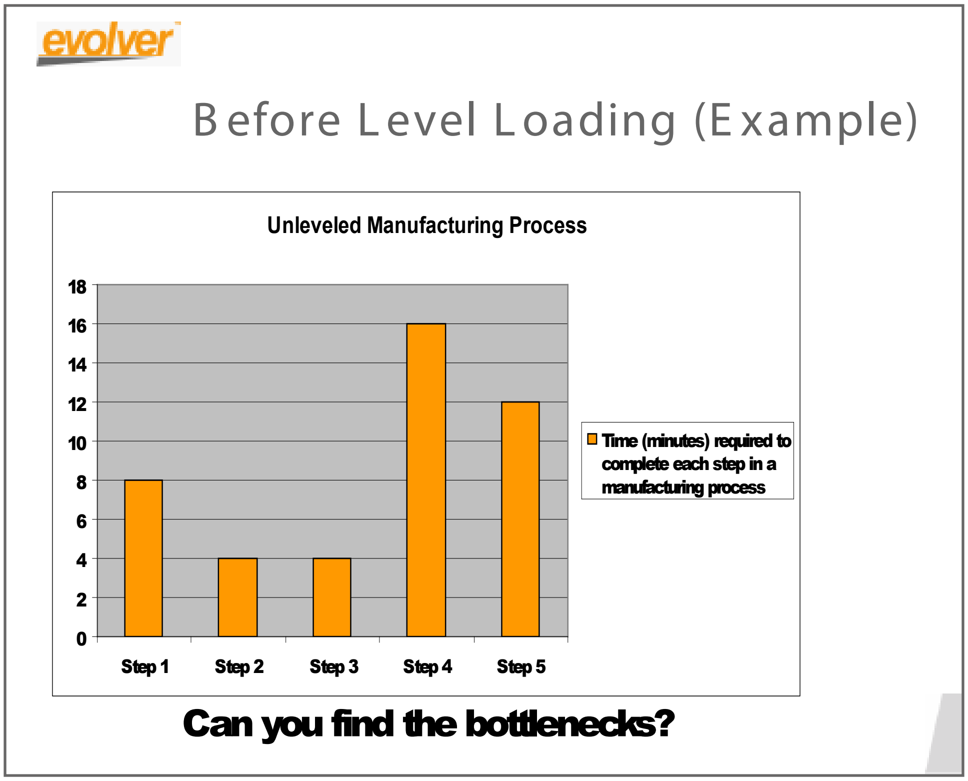
In its simplest description, level loading occurs when parts (either a batch of parts or single pieces) move through each step of the manufacturing process at a similar rate. The main requirement for level loading is that each step in the manufacturing process takes approximately the same time to complete. When this occurs, parts can move at a similar rate from one step to another step becoming a level loaded manufacturing process.

The concept of level loading can often be difficult to explain in a group setting because different firms have different needs. Individuals who have been involved in manufacturing for some time may quickly object to the theory of level loading because some steps in "their" processes take longer then others to complete. Therefore, imagine a manufacturing process in a "perfect world" where every step in the manufacturing process takes exactly the same time to complete. If this perfect world existed, parts (either a single piece or a batch of parts) could move from step to step at a similar rate. This constitutes a level loaded manufacturing process.

In a traditional lean program, instructors teach the participants to use the concept of level loading only in a one-piece-flow setting. One-piece-flow, also known as single-piece-flow, is the concept of moving one piece at a time through a series of steps within a work cell, ultimately producing a completed product or assembly. In a one-piece-flow environment, parts are not staged or queued in front of the operators. Instead, each piece moves directly from one step to the next step. No batching! While one-piece-flow may be an excellent concept for firms with high volume/

low mix operations, for those with volumes too low to justify a dedicated piece of equipment for each process, one-piece-flow is NOT the answer.

Unlike a traditional lean program which frowns on the use of batch processing, Evolver™ acknowledges the fact that one-piece-flow is not for everyone. However, the concept of level loading is for everyone! Whether you are using one-piece-flow or batch processing, having a level loaded process eliminates bottlenecks, waiting waste, and establishes a smooth production flow throughout the facility. (Note: The concepts of one-piece-flow and batch processing are discussed in greater detail following level loading.)



Before Level Loading (Example)

- This is an example of an unleveled manufacturing process.
- There are five manufacturing steps with times varying from 4 minutes to 16 minutes.
- Steps 2 and 3 have the lowest times and Step 4 has the longest time.
- The biggest bottlenecks are Steps 4 and 5.

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When to Apply One-Piece-Flow

One-Piece-Flow Is Not For Everyone

- One-piece-flow is best applied on product lines or manufacturing processes that produce a large number of similar or identical parts.
- Best applied in a cellular environment, either in a dedicated manufacturing cell or dedicated assembly cell.
- Not recommended for firms where short-production runs and highly diverse product lines exist.
- Not recommended in a smaller "job shop" or a machine shop environment that performs multiple machine set-ups each day.

When To Apply One-Piece-Flow One-Piece-Flow Is Not For Everyone

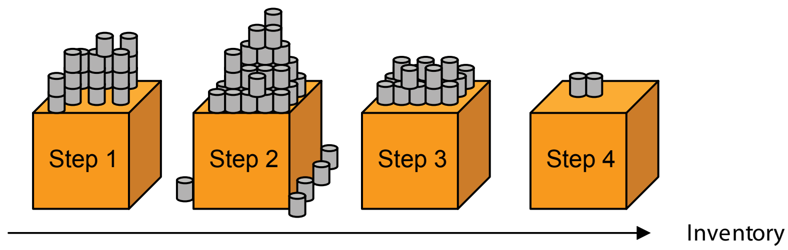
The concept of one-piece-flow has long been considered the ultimate goal for those using traditional lean manufacturing techniques. Contrary to popular belief, one-piece-flow is not for everyone. One-piece-flow is best applied on high volume/low mix product lines using a dedicated work cell. While one-piece-flow may be an excellent concept for firms with high volume/low mix product lines, for those with volumes too low to justify a dedicated piece of equipment for each manufacturing process, one-piece-flow is NOT the answer.

One-piece-flow is also not the best choice for those in a smaller "job shop" or machine shop environment that performs multiple machine set-ups each day. (Note: For those of you who have a machine shop that produces components for an assembly operation, the one-piece-flow concept may be applied successfully during an assembly process after the individual parts are machined using a dedicated assembly cell, assuming that you have the volume and equipment to support a one-piece-flow process.)

In addition, one-piece-flow is not the best choice in adhesive operations that require a long cure time or in processes that require heat treating. These types of processes normally work better in a batch environment using the "outside process effect."

In conclusion, one-piece-flow works best when you have a dedicated work cell with dedicated machinery that is always set-up to perform the same operation day after day. If this describes your manufacturing operation, then the one-piece-flow concept is for you. For everyone else, there is the best-batch-flow concept which is found in the upcoming segment.

Push System Example



- Parts are pushed from one step in a manufacturing process to the next step where they sit in queue waiting to be processed.
- Parts are made for inventory.
- Not driven by customer demand.
- Generally, the processes are not level loaded.

Push System (Example)

The slide depicts a typical push system. As each step in the production process is completed, the parts are pushed to the next step where they sit in a staging or queuing area waiting to be processed. Generally, when these parts are finally completed, they will be stored in an inventory location until the customer places an order.

Key Points

- In a push system, the process begins at Step 1 with a work order created to replenish inventory. Parts are then pushed from step to step. Conversely, in a pull system, the process "technically" begins at the end of the manufacturing process (after Step 4) when the customer orders a part.

- The steps in this example are not level loaded, which may explain why Step 2 has so many parts and Step 4 looks as if it is ready to run out of work.

Although level loading and push systems are two completely different concepts, based on my experience, firms that utilize push systems usually have unleveled operations. When push systems are in place, employees are accustomed (culture) to seeing parts queued or staged at each step in the operation. As a result, little or no thought is given to level loading the manufacturing process. In fact, most operators become nervous and fear job loss when they do not have several jobs staged in front of their machine!

This does not imply that there is always a direct correlation or relationship between the two concepts, meaning one problem contributes to the other problem. However, a combination of the two problems severely disrupts the flow of materials through the manufacturing processes. The good news is that these problems are easily rectified with the proper lean training and lean concept application.

Functional Layout

Functional Department

A functional department is best described as a department that is designated to perform a specific centralized function or operation. Functional department examples include: the lathe department, the mill department, the inspection department, the stockroom department, the accounting department, the human resources department, etc. Poor functional layouts exist when steps within a manufacturing process are not arranged with product flow in mind.

Flow

Flow in a lean application is best described as how (good or bad) parts travel through the production process. Good production flow is similar to an automotive freeway where traffic travels (flows) in a smooth manner without interruption. Using the same analogy, poor production flow is similar to driving a car in congested city traffic where it starts and stops, does not move smoothly, and lacks a direct path. In other words, a layout with poor production flow is not smooth, nor is it the shortest distance between two points.

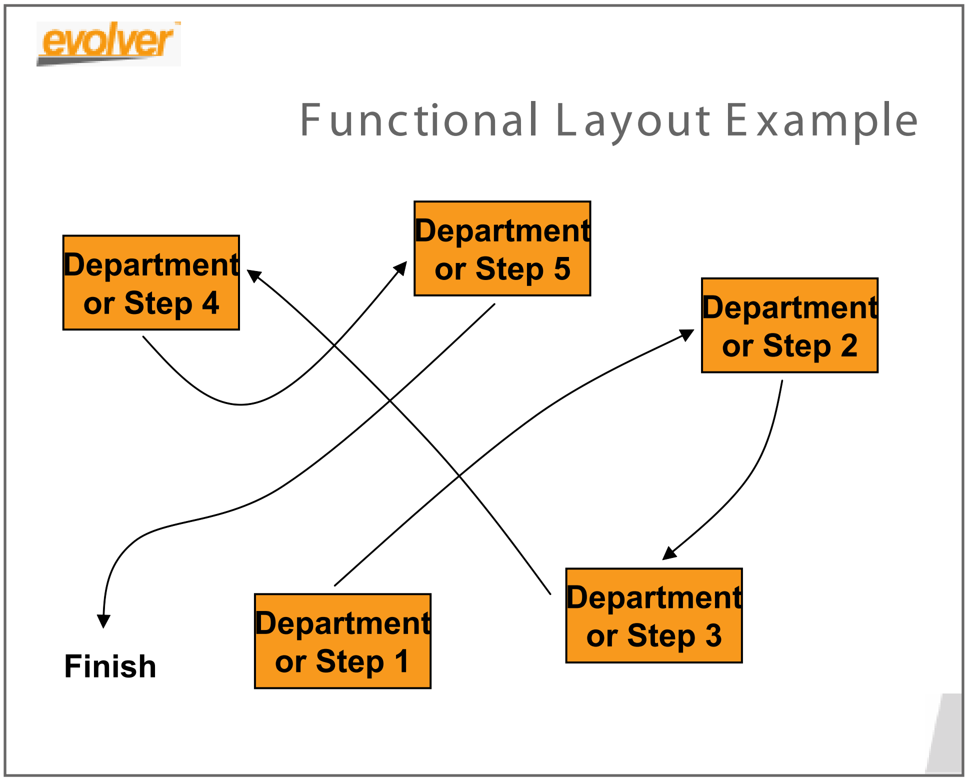
Functional Layout

A functional layout is a factory layout that meets the following conditions:

- Its operations or steps are separated into functional departments.
- The arrangement of the functional departments throughout the factory does not take into consideration the actual product or part being produced. In other words, the functional departments are arranged in a manner which contributes to excessive transportation waste and poor production flow.

Other problems associated with functional layouts include poor communication between operators, as well as problems with the detection and isolation of defects. When you have a manufacturing process with functional departments scattered throughout the facility, the long distance between the various steps tends to hinder communication between the operators and the interdependent departments. This lack of communication often contributes to a whole host of other problems in the manufacturing process.

For example, I once performed a time study on a fabrication process. The material was cut incorrectly due to of a faulty cutting fixture. The welders who received the incorrectly cut material filled the gaps with weld, which wastes both time (labor) and materials (welding wire). Due to the heavy globs of weld, employees in the grinding and deburr departments wasted both time (labor) and materials (sanding belts and discs) grinding down the globs of weld. All of this unnecessary waste of labor and materials occurred because the employees from the various departments never communicated since their departments were physically far apart from each other. In fact, the distance between these departments was so far apart that the leads in each department also failed to communicate!



Functional Layout (Example)

Department

In this slide the term "department" is used to describe a functional department. For example, the lathe department, the mill department, the inspection department, etc.

Step

A step is a sequence in a production process. Within each step, you may have multiple operations occurring, either simultaneously or consecutively. For example, within one step we may perform both a drill and tapping operation.

Operation

An operation is the type of work (mill, lathe, drilling, tapping) being performed within a step.

The term "department or step" is used in this slide to illustrate how a part moves within a manufacturing process. Although the words department and step are different terms, the problems associated with poorly arranged departments or steps are very similar. Keep this in mind.

This is an example of a functional layout. There are five (departments or steps) in this example. The arrows depict the "flow" or the direction a part travels through the manufacturing process. Notice how the various departments or steps are not arranged in any logical order resulting in transportation waste. This is an example of poor production flow. If this type of layout resembles your facility, consider changing it immediately to a product layout which is described on the following page.

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Beginning Your Present Layout

- Every item on the shop floor needs to be drawn (i.e., machinery, cabinets, toolboxes, material carts, aisles, doors, etc.).
- Accuracy is important! Measure equipment as accurately as possible. Shortcuts here may cause you problems later!
- Tools required – Use tape measures and a measuring wheel. Avoid laser tools unless you have proven them to be accurate.
- If you own drafting software, use it.

Beginning Your Present Layout

Begin by accurately drawing every item on the shop floor. This includes machinery, cabinets, trashcans, employee toolboxes, material carts, aisles, doors, etc. If it is on the floor, draw it!

Draw the equipment as accurately as possible. Avoid the temptation of drawing "boxes" instead of drawing an accurate footprint of a machine. Yes, it takes a little longer to draw the equipment correctly; however, it is a small investment that pays large dividends for years to come. Your new layouts will be easier to create and easier for others to read. The entire Evolver™ program focuses on reducing costs and eliminating non-value added activities. With this in mind, I would not advise you to do something that actually takes more time if it was not necessary.

Tools Required

Normally, when I begin a layout, I utilize the following tools:

- Two 30 foot tape measures or two 25 foot tape measures. I personally prefer the 30 foot tape measures as the extra five feet may save some time. Use these tape measures for laying out the building parameter or an area designated for lean improvement.
- One 15 foot tape measure for measuring equipment. The 15 foot tape is lighter and easier to maneuver when measuring machines and other equipment on the shop floor. (Note: A 12 foot tape measure also works fine for this task.)
- One 100 foot tape measure (the type that winds up manually). Normally, I only use the 100 foot tape measure for measuring aisles. You could also use the 100 foot tape

measure if you are measuring an empty building or an area without equipment.

- A measuring wheel for performing a quick accuracy check. (Important Note: Avoid the temptation of using the measuring wheel as a shortcut. I only use the wheel when I have an extremely long distance and a perfectly straight line for the wheel to travel. If you are going to use the wheel, use it correctly and with accuracy. When taking a measurement, try to walk in a straight line. Also, take notice of your handle position. I prefer to start the measurement and stop the measurement with the handle at 90 degrees (vertical). I do this because moving the handle changes the measurement reading. Yes, it's only a few inches, but I prefer to be as accurate as possible. Do it right the first time!
- Black magic markers - I use black magic markers to write on the floor. For example, let's assume that you are measuring a distance of about 45 feet. Measure off the first 30 feet with your tape measure. Then make a small mark on the floor with the marker. From there you can use the mark on the floor to measure the remaining 15 feet of distance. Then simply add up the two measurements. This approach is great when you cannot run a measuring wheel in a straight line due to equipment or other obstructions on the factory floor.

Drafting Software

If you have drafting software, use it. It is faster and more accurate than using a piece of paper, plus it allows you to establish layers in your drawing.

Layer Suggestion (Drafting Software)

The following is just a suggestion. This is my personal preference and what has worked well for me in the past. If you have a more effective method or merely your own personal preference, that's okay too.

Create layers for the following:

1. Create a layer for the building or area perimeter. This is where you will draw your building or area.
2. Create a layer for your present layout. I always keep a copy of the present layout, even after the changes are made because it allows me to refer to how things were previously arranged. I simply turn the layout off and on as required. You never know when you might need to look at the old layout. Having a layer for the present layout also helps with the new layout because you can switch back and forth to check aisle spacing, machine spacing, etc.
3. Create a layer for your new layout. This is where you will draw your new layout. Having a layer for the new layout allows you to start with a clean uncluttered drawing.

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Walking The Existing Process
Present Layout

- Walk the manufacturing process that you are trying to improve (follow the path that the parts travel).
- Measure the total distance traveled with the measuring wheel. (Note: You can also measure the individual distance of each manufacturing step. Then, you can add your individual distances to obtain your total distance traveled.)
- Using your layout, create a spaghetti diagram as you walk the process to illustrate the movement of the product through the facility.
- Create a description of every step of the process.

Walking the Existing Process - Present Layout

The purpose of walking the process is to gather information about how a part or family of parts travel through the manufacturing process. The information gathered while walking the process is somewhat different than the information gathered during a time study.

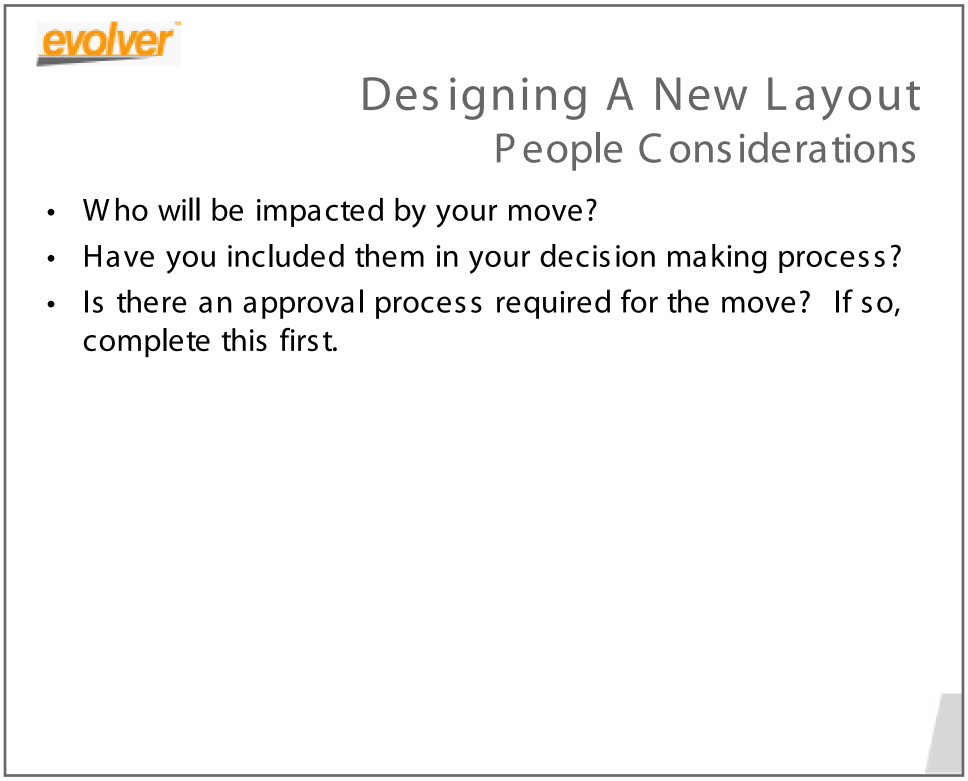
In a detailed time study, we are interested in collecting detailed information regarding a manufacturing process or a step within a process for the purpose of collecting and improving run times, removing waste, looking for cost reductions, error-proofing, etc.

When you walk a process for the purpose of creating a new layout, we are interested in collecting information about how a part or family of parts travel through the manufacturing process for the purpose of improving the layout or creating a cell.

Examples include:

- How are the parts transported (cart, pallet, bins, etc.)?
- How heavy are the parts? Do you need special handling equipment for the parts?
- How heavy is the tooling? Where is the tooling located? Do you need special lifting equipment for the tooling?
- If you are using best-batch-flow, what are the optimum batch sizes?
- How wide do your aisles need to be?
- How much space is required around each machine?
- What are the power requirements for each machine?

(Note: The topics of equipment and people considerations are discussed in greater detail in the upcoming segment.)



Designing a New Layout - People Considerations

Before you begin, deeply consider who will be impacted by your move. You need to consider everyone! This includes, but is not limited to: the rank and file employees, maintenance staff, shop floor supervisors, middle and upper management, office employees and even those in different departments. There is nothing worse than spending days working on a layout only to discover someone has created a "roadblock" and your new plan needs to be altered. What is even worse is discovering a roadblock in the middle of a move! Take your time and consider everyone.

Sometimes a move may require an approval from management. If so, you may want to consider obtaining the approval first. Hint: I personally prefer to create a "rough draft" layout which often helps management visualize what you are trying to accomplish. It is easier to obtain approval when they can see the end results. Remember, money is the operative language for management. In addition to your rough draft, advise management of the projected savings. Always be conservative with this number! It is perfectly fine to exceed your original savings estimate; however, falling short will destroy your credibility in a hurry.

Standard Work Instruction - Example

1. Attach air line to detail #1 and apply air pressure to value per blueprint.
2. Measure torque to spec. 99-996S Section 2.1 (See Figure #2).
3. Torque should measure between 10 and 15 inch pounds with air pressure applied.
4. Lever Torque Test per blueprint PN#27022 Rev. B.
5. Place valve (in closed position) & details 1 and 2 into test fixture

Figure 1. Position of valves and details 1 & 2

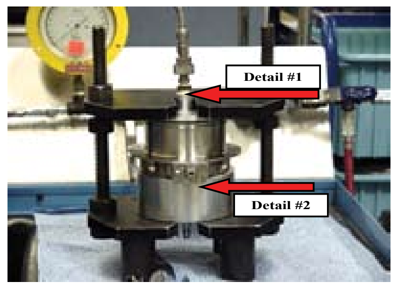
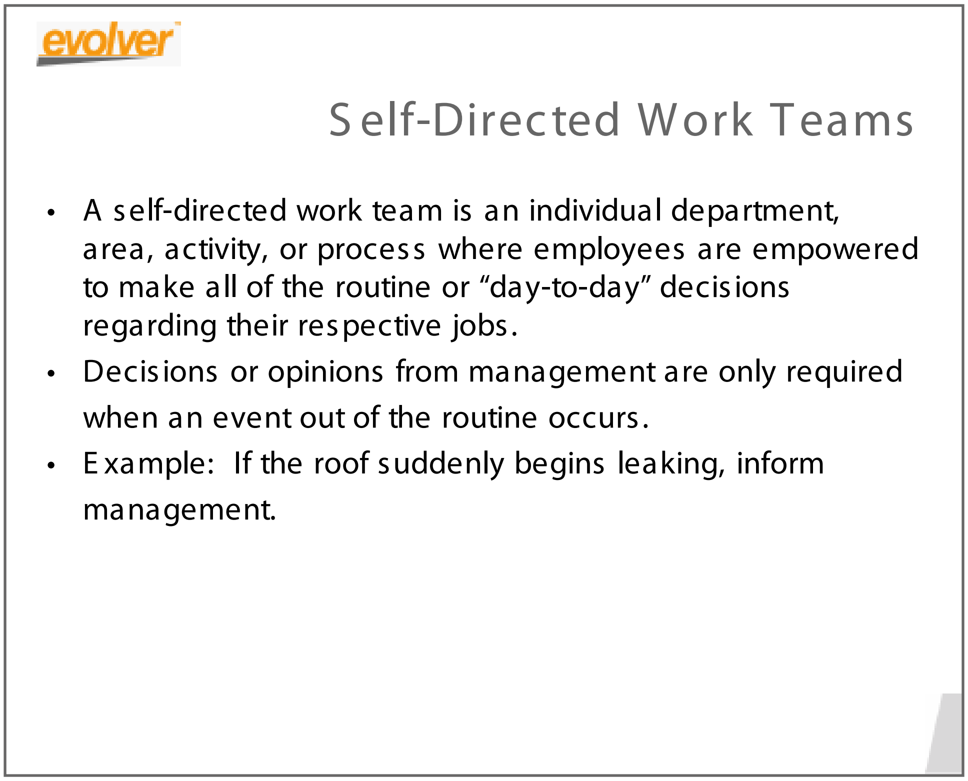


Figure 2. Actual torque test in progress

Standard Work Instruction - Example

This example is very similar to a page from an actual work instruction used in the torque testing of a valve lever. Prior to having this work instruction, employees relied solely on the blueprint to assemble and test the part. The blueprint did not show the employees what tools to use, how to assemble the part or how to actually perform the test. With the absence of a standard work instruction, each employee had his/her own method of completing the task. While each employee did in fact get the job done, it took some employees much longer to complete the same task than others.

To eliminate the confusion, all of the employees that assembled this product attended a lean event and created a set of standard work instructions. During every step of the process, each employee explained how he/she built the product. The employees then voted for the best method of performing each step of the assembly process. During the lean event, we also discovered that a few employees had fabricated "custom tools" that made certain portions of the assembly process easier and faster. Upon this discovery, we duplicated the custom tools and integrated them in the standard work instructions. Work instructions can be more or less detailed than this example as long as the task is accomplished.



Self-Directed Work Teams

In a self-directed work team, employees are taught and empowered to make all of their daily decisions regarding their respective jobs. Self-directed work teams also have "departmental or area leads" that have the same authority as a traditional supervisor, but serve a different function. Instead of micro-managing the employees, the lead is present to assist in making decisions that are not a part of the routine process, as well as to perform other supervisory tasks that are integral to running a department, such as time and attendance, etc. The following example is provided to better illustrate what activity is considered "routine" and what events require supervisory or management intervention.

Company A is a bicycle manufacturer with self-directed employees. They assemble bicycles from parts produced in-house and from outside sources. The bicycle assemblers are experienced and they know how to perform their jobs. Each day when the assemblers come to work, they are handed a schedule. The schedule indicates what types of bicycles to build and the length of time the company expects the employees to spend building each bicycle. With a work schedule and a time standard, each employee is aware of what is required of them. As long as the employees build bicycles correctly and within the company's time standards, they do not require a supervisor standing over them. Assembling bicycles is a routine part of their normal workday.

Today, when the assembly employees arrived at work, they quickly discovered that the bicycle frames had serious flaws in the paint. Dealing with defective bicycle frames is not *part of their day-to-day routine. In this type of situation, the lead person is useful in assisting the work team members with resolving the problem.*

Requirements For Building Self-Directed Work Teams

- **Quality Management** - Top and middle management, supervisors, and department leads all need to take less of a supervisory role and more of a leadership/mentoring role.
- **Quality Employees** – Let's face the facts. The old saying, "when the cat's away the mice will play," does have some truth to it. Based on my experience, most employees go to work with the intention of performing a good job. As a result, most employees do not have a problem performing in a self-directed work team. In fact, they prefer it! For the small percentage of employees that require some babysitting, the department lead or lead person is there to keep an eye on things and act as a check and balance.
- **Tools and Measurement Systems** - Other requirements for self-directed work teams include tools such as work schedules, and performance measurement systems that assist the employees in managing themselves. These are the same or similar set of tools that a manager or supervisor would use to schedule work and measure employee performance.
- **Training** – Employees require appropriate training to succeed in their positions and become as self-sufficient as possible.

Having worked my way through the ranks from a machinist to a Vice President of Operations, I know firsthand what it is like to be on both sides of the fence. Based on my personal experience, I can make the following statement very comfortably: the higher a manager is on the organizational chart, the less he/she is likely to know about the day-to-day activities and details of the factory operation.

While working as a machinist earlier in my career, I encountered my fair share of jobs that were very difficult to run. In addition, I also made my fair share of mistakes. A friendly note to any machinists reading this: The little “tink” sound that you hear before the tap breaks in half has stressed out my day on more than one occasion! Whenever possible, I hid both my struggles and my mis-

evolver

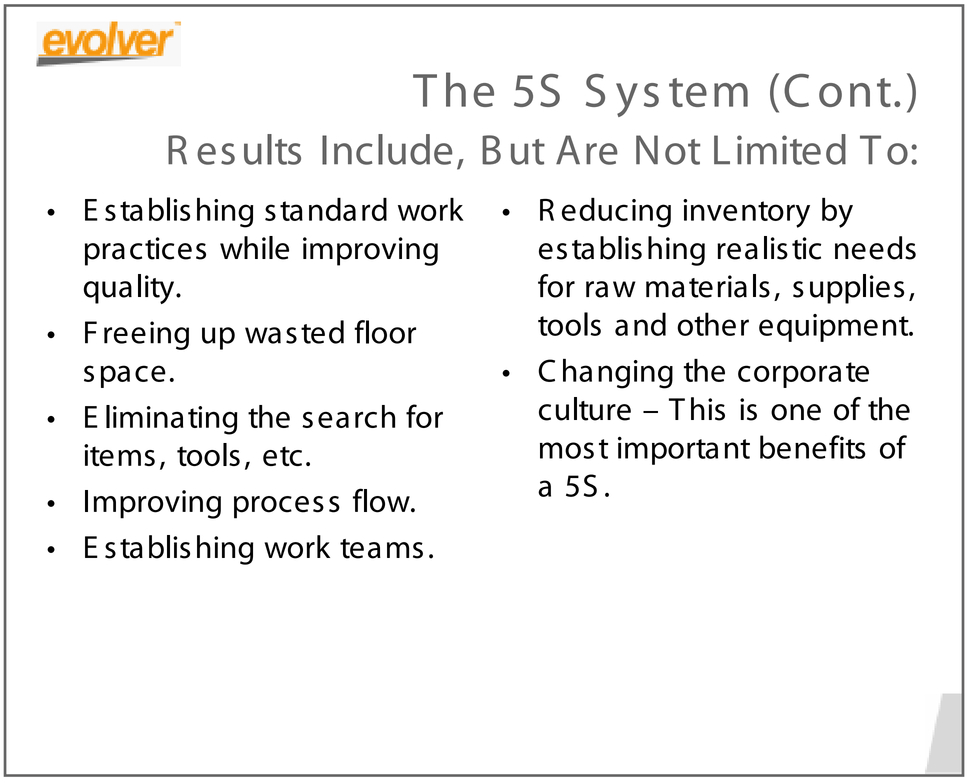
The 5S System

- The 5S system establishes a culture that is focused on creating a clean, organized, and safe work environment.
- This is accomplished through a combination of:
  - waste elimination exercises;
  - visual controls; and
  - standard work procedures.
- The 5S system is an excellent tool for firms just beginning their lean transition.

The 5S System

The main objective of the 5S is to establish a neat and organized work environment where everything has a place and everything is ready to use at a moments notice. However, properly facilitated 5S events go far beyond basic housekeeping by improving operator efficiencies, reducing various forms of waste and increasing employee job satisfaction. A clean and organized workplace is the foundation for lean initiatives and the early stages toward becoming a world-class manufacturer. By using the 5S system, you can quickly achieve an organized workplace, establish standard work methods, and create the self-discipline required to sustain the results. The 5S system can be used by itself or as part of a larger more complex lean event.

A clean and organized workplace is the foundation for lean initiatives and the early stages toward becoming a world-class manufacturer.



The 5S System (Cont.)

The changing of corporate culture is one of the most difficult challenges a firm faces during the lean transition. The 5S system is a great starting point for building teamwork within a department or manufacturing process simply because it may be the first time that the employees have a real voice to make the changes that **they** want in their respective processes.

This in turn creates a sense of accomplishment, pride, and best of all, ownership of their department. When the employees have ownership of their departments, the real lean transition begins. This is when employees begin making process improvements on their own or bringing to the surface problems that need immediate attention.

Current Management and the Relationship to Cultural Change

If the current manager has an autocratic approach and is not well-respected in the workplace, the cultural change will **not** take place until the autocratic manager either changes his/her management approach or is removed from the area. While this may seem like a harsh statement, there is no need to sugarcoat the truth – autocratic managers have no place in a lean environment.

The ultimate goal in lean manufacturing is the creation of self-directed work teams. A self-directed work team is an individual department, area, activity, or process where employees are empowered to make all of the "day-to-day" decisions regarding their respective jobs. It is not possible to have an autocratic manager and a self-directed work environment at the same time.

The better the leadership and management style of the current manager, the shorter the transition to a self-directed work team. However, if the current manger has caused substantial damage, meaning that the employees are absolutely miserable when they drive into the parking lot simply because of the presence of the current manager, the transition to a self-directed work team will probably never happen.

Cultural change does not occur overnight! It took years to create the current culture and it will take some time to change it.

The real lean transition begins when employees possess ownership of their departments.

5S Results - Hardware Project
Before And After Photos

Visual Controls - All of the bins are labeled and arranged in a logical order.

5S Results - Details for the Hardware Project

Project Background

In this work cell, employees assemble hardware kits (screws, nuts, bolts, caps, assembly instructions, etc.) for household furnishing products. The completed hardware kits are shipped along with the other main components and later assembled by the customer.

Before Photo Description

The before photo depicts the area prior to the lean event. As you can see, the area was very disorganized. Although many boxes appear to be labeled, most of the boxes contained more than one part making it very difficult for a newer employee to assemble a kit correctly. In addition, the area was very dark due to the high piled storage racks which surrounded the area and a lack of proper lighting. Notice the inoperable track lighting that was installed on the upper left side of the photo.

Major Problems

- The hardware itself was not identified correctly.
- Various components were mixed together in old torn up boxes.
- The employees spent more time looking for parts than assembling the kits!
- Absence of a bill of materials.

As you can imagine, customers complained