Process Management
Process Mapping

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Process representation

- It is common to use a graphic representation or any other kind of model which is simple to read and understand

- It's possible to use one of the structured techniques for process mapping, which have the advantage to create a common language for all the organization.

Business Process Mapping

- **Refers to activities involved in defining exactly what a business entity does, who is responsible, to what standard a process should be completed and how the success of a business process can be determined.**

- **Once this is done, there can be no uncertainty as to the requirements of every internal business process.**

"The first step in gaining control over an organization is to know and understand the basic processes"

(Deming, 1982; Juran, 1988; Taylor, 1911)

Top-down approach

- **Top management:**
  "What we have to do to run the company ?"

- **Es. Texas Instruments processes identification:**
  - **define strategy (strategy process)**
  - **develop competitive products (product development process)**
  - **deliver our products (delivery process)**
  - **publicize our products (communication process)**
  - **make our products (manufacturing process)**

Process identification: ABB

- Strategy plan
- Sales forecast
- Production planning
- Purchasing planning
- Production monitoring
- Material handling
- BOM management
- Production management

Process identification: Rover

- New products
- Logistic
- Sales
- After sales service
- HR
- Strategy plan
- Production
- Maintenance
- Organization
- Product improvement

Core process re-design

- **What we have to do to achieve key factors ?**
- **Es. publishing firms involved in technical publications:**
  - **Time to market**
  - **Information updating**
  - **Communications channels**
  - **Publishing criteria (easy to look up)**

Xerox

- **Customer interface**
- **Logistic**
- **Product delivery**

"Focus on core process"

Electrolux

- **Product development**
- **Brand strategy & trade management**
- **Supply chain improvement**

"Focus on core process"

IBM

- **Product development**
- **Delivery orders management**
- **Logistic**

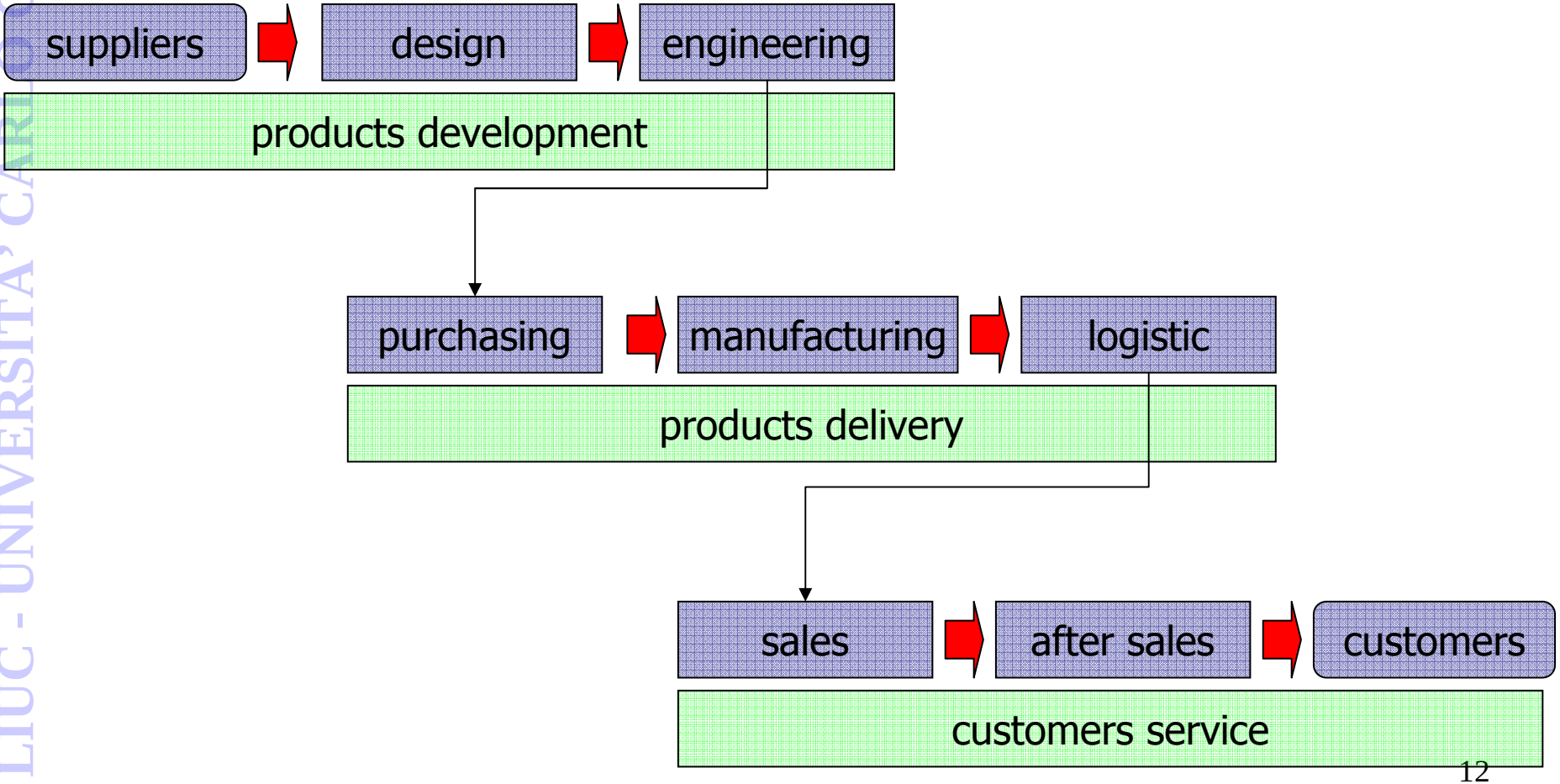
"Focus on core process"

Summarizing

- **In any case, after the identification of critical processes, it's necessary to model the process using a fitting technique**

- **Before to make the flow chart it's advisable to proceed with a deep approach of:**
  - **All process activities**
  - **People's interviews**
  - **IT links**
  - **Quality instructions**
  - **……..**

Manufacturing companies: process mapping example



Suggestions:

- **It's necessary to overtake functional organization chart**
- **One process mapping procedure doesn't exist**
- **It's critical to individuate few strategic and inter-functional process (max 3-4)**
- **It's self-defeating to map all company process.**

Inter-company process

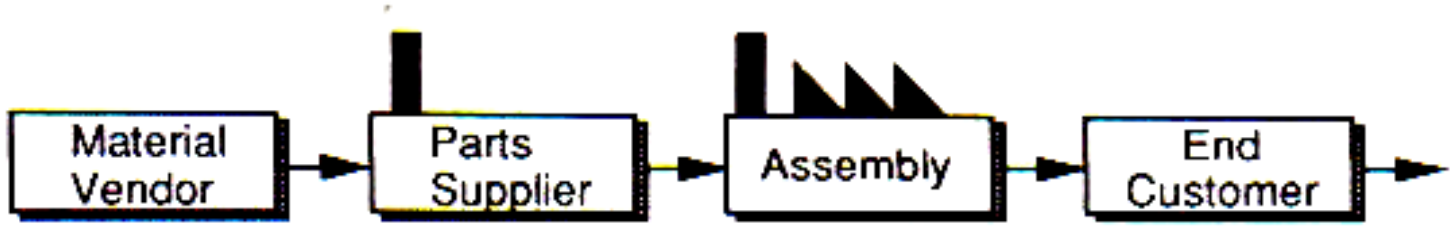
- **In case of multi-business companies it's necessary to map process individually for each business**
- **A lot of companies are characterized by mutual process**
- **Could be interesting to deep into these checking potential synergies**
- **Es. integrated logistic process:**
  Forecast ⇒ Purchasing ⇒ Manufacturing ⇒ Delivery ⇒ Distribution channels

Process mapping development

- **Process can be physical, involve paperwork, be undertaken by computer, …..**
- **Process can be more easily understood by a decomposition "top-down" as sub process sequence**

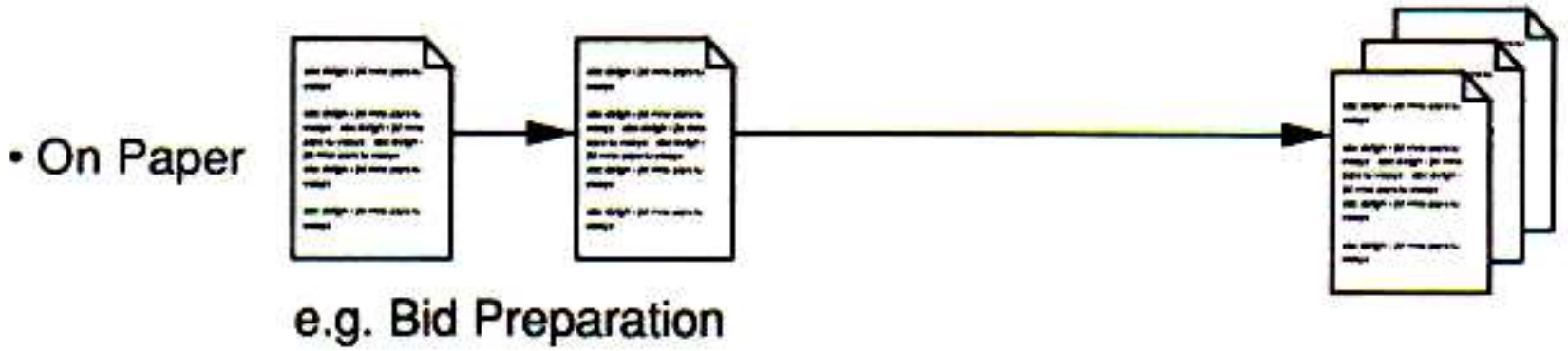
Physical process

- Physical



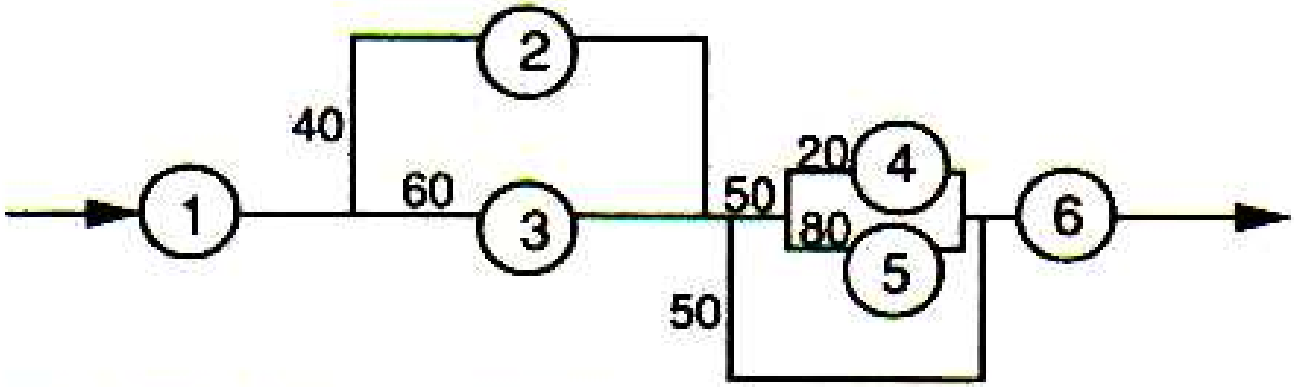
e.g. Materials Supply Chain

Paperwork process



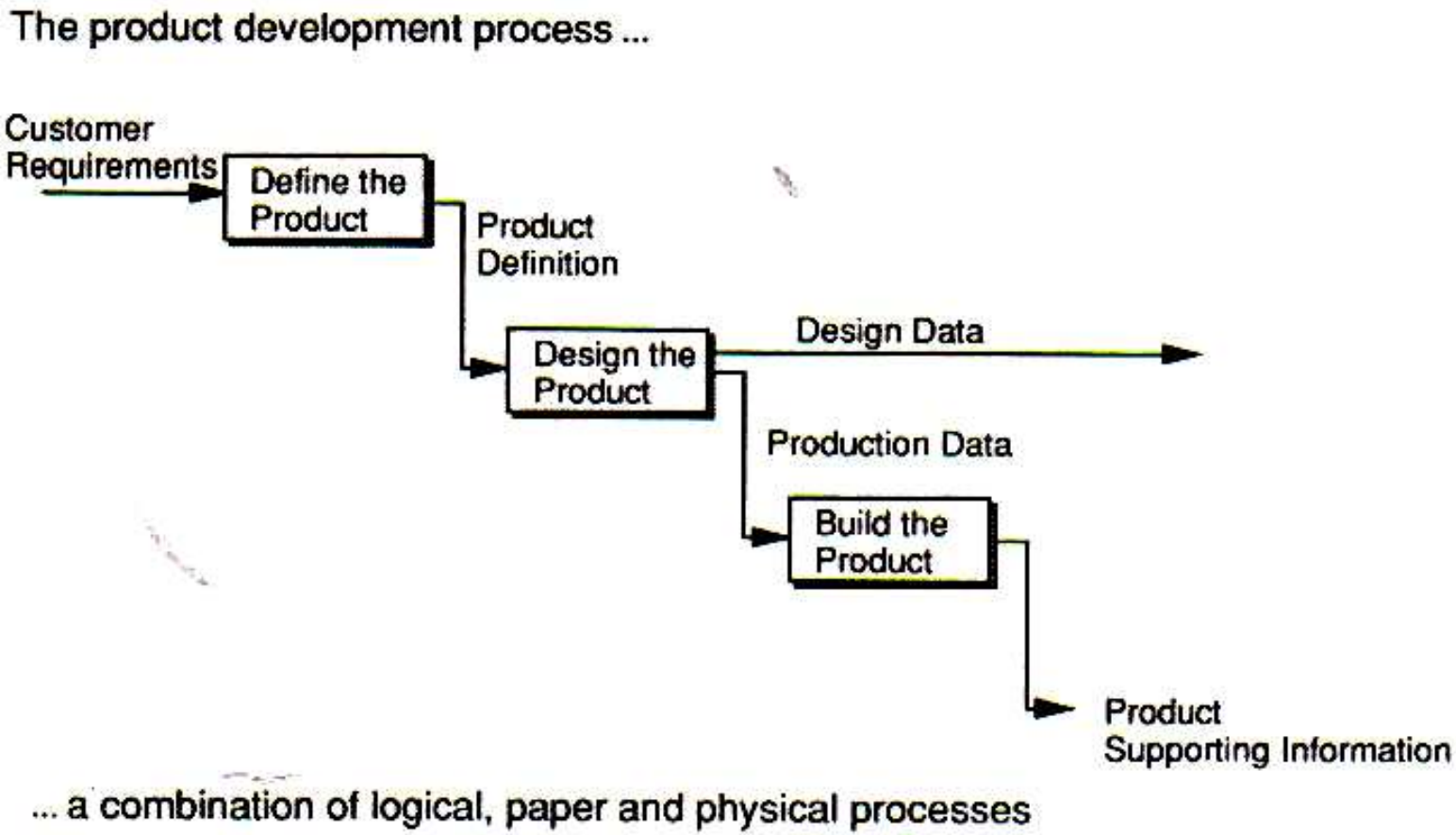
Logical process

- Logical



e.g. Order Entry, Procurement

Es. product development process



Process mapping appliances

- **Process mapping has its roots in a variety of areas:**
  - **Work study in factories**
  - **Organization and method studies**
  - **Process control systems**
  - **Process simulation projects**
  - **Business modelling**
  - **Systems engineering and analysis**
  - **…….**

Process definition

- **To define a process mean to identify:**
  - **Process name**
  - **Customers**
  - **Outputs**
  - **Inputs**
  - **Main activities**
  - **Functions involved**

Process definition

- **Multidimensional representation:**
  - **Activities series**
  - **Lay-out**
  - **Software support system**
  - **Timing**
  - **Quality parameters**
  - **Ability & skills**

Customer expectations

- **Customer expectations must be declared (and written) to:**

1. **Steer process reengineering**
2. **Underline process targets, no functional aims**
3. **Emerge new customer perceptions and team stimulus**

Process flow chart

- **Must be defined core elements:**
  - **Activities logical flow and priority ties**
  - **Organizational units involved**
  - **Timing and way of connection**
  - **Structural links (information, periodicity, origins, destinations)**
  - **……**

Process flow chart

- For each activity must be declared following elements:
  - Input (physicals, informational, …)
  - Controls (procedures, rules, instructions, …)
  - Means (machinery, devices, hardware, …)
  - Output (physicals, informational, …)
  - Timing (time of activities execution)
  - Volumes (how many time, pieces, ….)

Performance indicators

- **Performance indicators system must be defined to check ineffectiveness and inefficiency**

- **Cautions:**

1. **In case of inefficiency it's necessary to analyze deeply each indicators mean**

2. **Could be necessary to change the indicators after process re-engineering**

Representation criteria

- **5 main criteria to decide which process models are strictly needed and save time:**

1. **Process characteristics analysis**
2. **Re-engineering targets to achieve**
3. **Process problems recognition**
4. **Progressive zooms goal-oriented**
5. **Forget "no-value actions" (i.e. starting to analyze and formalize everything)**

Analysis & Reengineering

- **Hammer & Charpy: "green field" approach:**

  "How we could organize our process if we are starting today on this business ?"

Risks and Suggestion

- **Two main risks:**
  - **Existing technical bonds not easy to erase**
  - **Loss of key people, experience and know-how**

Better to free creativity and develop process re-engineering during analysis

History

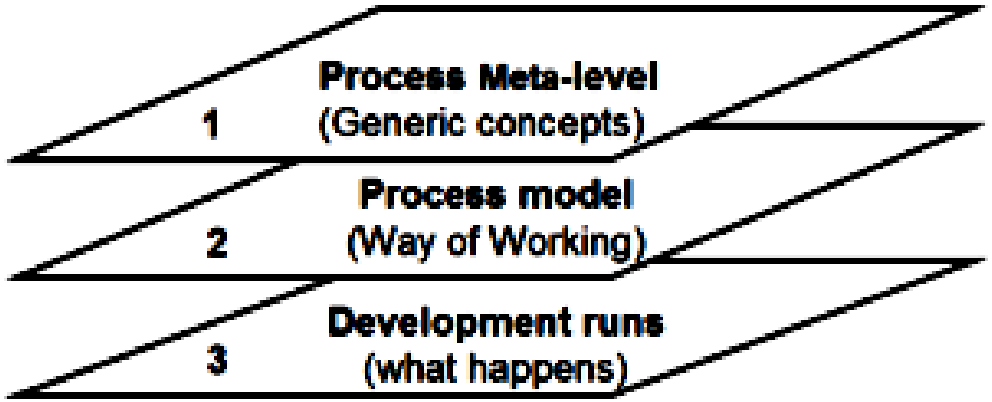
- **The first structured method for documenting process flow, the flow process chart, was introduced in 1921 by Glibreth.**
- **In the early 1930s, an industrial engineer, Mogensen began training business people in the use of some of the tools of industrial engineering at his Work Simplification Conferences in Lake Placid, New York.**
- **A 1944 graduate of Mogensen's class, Art Spinanger, took the tools back to Procter&Gamble where he developed their Deliberate Methods Change Program.**
- **Another 1944 graduate, Graham, Director at Standard Register Corporation, adapted the flow process chart to information processing with his development of the multi-flow process chart to displays multiple documents and their relationships.**
- **In 1947, ASME adopted a symbol set derived from Gilbreth's original work as the ASME Standard for Process Charts.**

Process model

- **Process model is a description of a process. The same process model is used repeatedly for the development of many similar applications**
- **One possible use of a process model is to prescribe how things must/should/could be done in contrast to the process itself which is really what happens.**
- **A process model is roughly an anticipation of what the process will look like. What the process shall be will be determined during actual system development.**

Process model

- **The term process model is used in different contexts. For example, in Business process modelling the enterprise process model is often referred to as the *business process model*. Process models are core concepts in the discipline of process engineering**



Process meta level

- **From a theoretical point of view, the Meta Process Modelling explains the key concepts needed to describe what happens in the development process, on what, when it happens, and why.**

- **From an operational point of view, the Meta-Process Modelling is aimed at providing guidance for method engineers and application developers.**

Process modelling

- **The activity of modelling a business process usually predicates a need to change processes or identify issues to be corrected. This transformation may or may not require IT involvement, although that is common driver for the need to model a business process.**
- **Change management program are desired to put the processes into practice. With advances in technology from larger platform vendors, the vision of business process models (BPM) becoming fully executable (and capable of round-trip engineering) is coming closer to reality every day.**
- **Supporting technologies include Unified Modelling Language (UML), model-driven architecture, and service-oriented architecture.**

Process modelling

- **Process Modelling addresses the process aspects an Enterprise Business Architecture, leading to an all encompassing Enterprise Architecture. The relationships of a business processes in the context of the rest of the enterprise systems, data, organizational structure, strategies, etc. create greater capabilities in analyzing and planning a change.**
- **One real world example is in corporate mergers and acquisitions; understanding the processes in both companies in detail, allowing management to identify redundancies resulting in a smoother merger.**
- **Process Modelling has always been a key aspect of business process reengineering, and continuous improvement approaches seen in Six sigma.**

Classification of process models

- **There are four types of coverage where the term process model has been defined differently:**
  - **Activity-oriented: related set of activities conducted for the specific purpose of product definition; a set of partially ordered steps intended to reach a goal.**
  - **Product-oriented: series of activities that cause successive product transformations to reach the desired product.**
  - **Decision-oriented: set of related decisions conducted for the specific purpose of product definition.**
  - **Context-oriented: sequence of contexts causing successive product transformations under the influence of a decision taken in a context.**

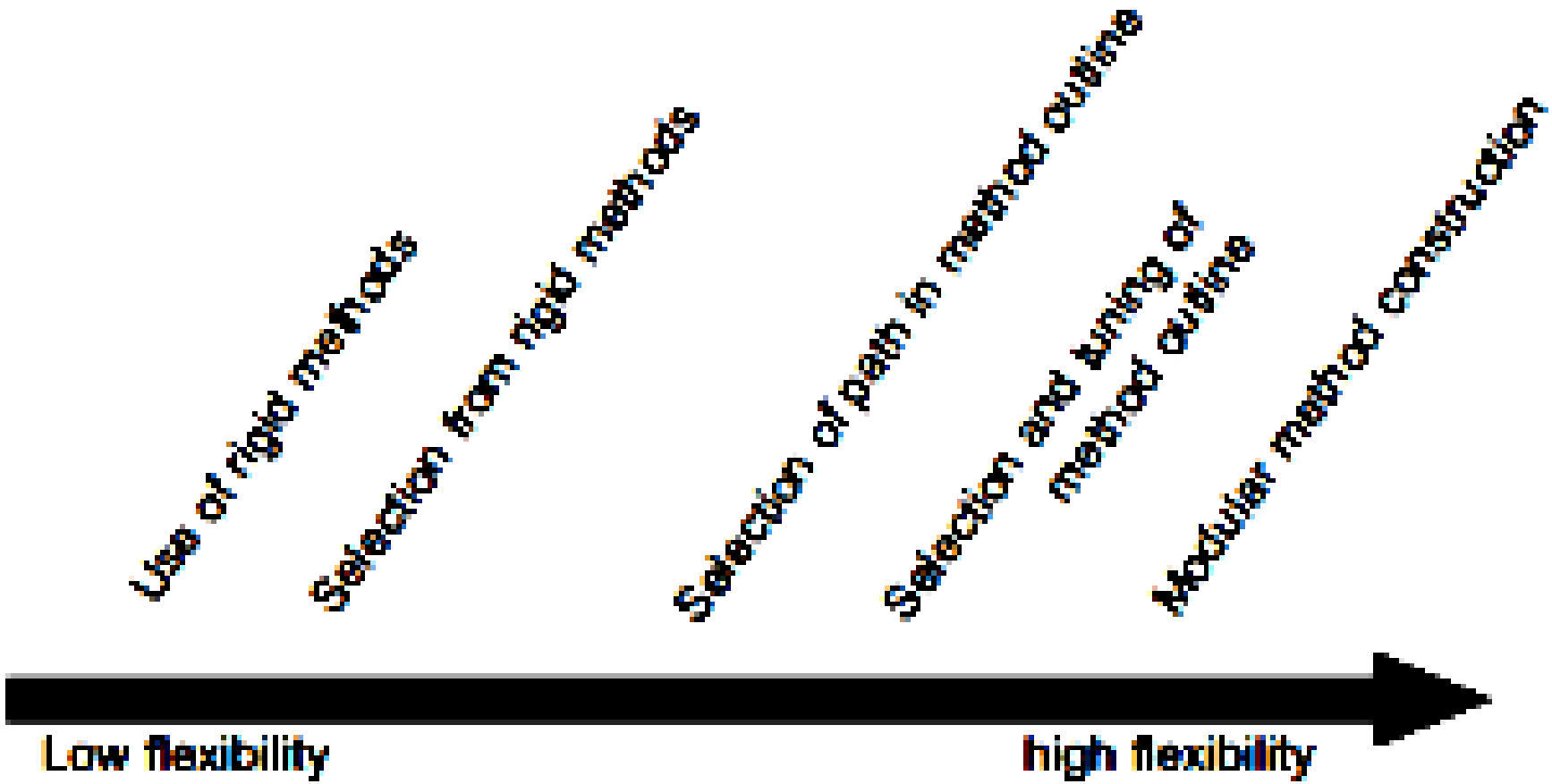
Classification by detail level (Granularity)

- **Granularity refers to the detail level of the process model and affects the kind of guidance, explanation and trace that can be provided. High granularity limits these to a rather coarse level of detail whereas fine granularity provides more detailed capability. The nature of granularity needed is dependent on the situation at hand.**
  - **Project manager, customer representatives, the general, top-level, or middle management require rather large-grained process description as they want to gain an overview over time, budget, and resource planning for their decisions.**
  - **In contrast, software engineers, users, testers, analysts, or software system architects will prefer a fine-grained process model for the details of the model deliver them with instructions and important execution dependencies such as the dependencies between people.**

Classification by flexibility

- It was found that while process models were prescriptive, in actual practice departures from the prescription can occur. Thus, frameworks for adopting methods evolved so that systems development methods match specific organizational situations and thereby improve their usefulness. The development of such frameworks is also called Situational Method Engineering.
- Method construction approaches can be organized in a spectrum ranging from 'low' flexibility, to 'high'.
- Lying at the 'low' end of this spectrum are rigid methods, whereas at the 'high' end there are modular method construction.
  - Rigid methods are completely pre-defined and leave little scope for adapting them to the situation at hand. Selecting a rigid methods allows each project to choose its method from a panel of rigid, pre-defined methods
  - On the other hand, modular methods can be modified and augmented to fit a given situation. Selecting a path within a method consists of choosing the appropriate path for the situation at hand. Finally, selecting and tuning a method allows each project to select methods from different approaches and tune them to the project's needs."

Classification by flexibility



Business process modelling (BPM)

- ***Business Process Modelling*** **(also known as Business Process Discovery, BPD) is the activity of representing both the current ("as is") and future ("to be") processes of an enterprise, so that the current process may be analyzed and improved**

- **BPM is typically performed by business analysts and managers who are seeking to improve process efficiency and quality**

- **The process improvements identified by BPM may or may not require IT involvement,**

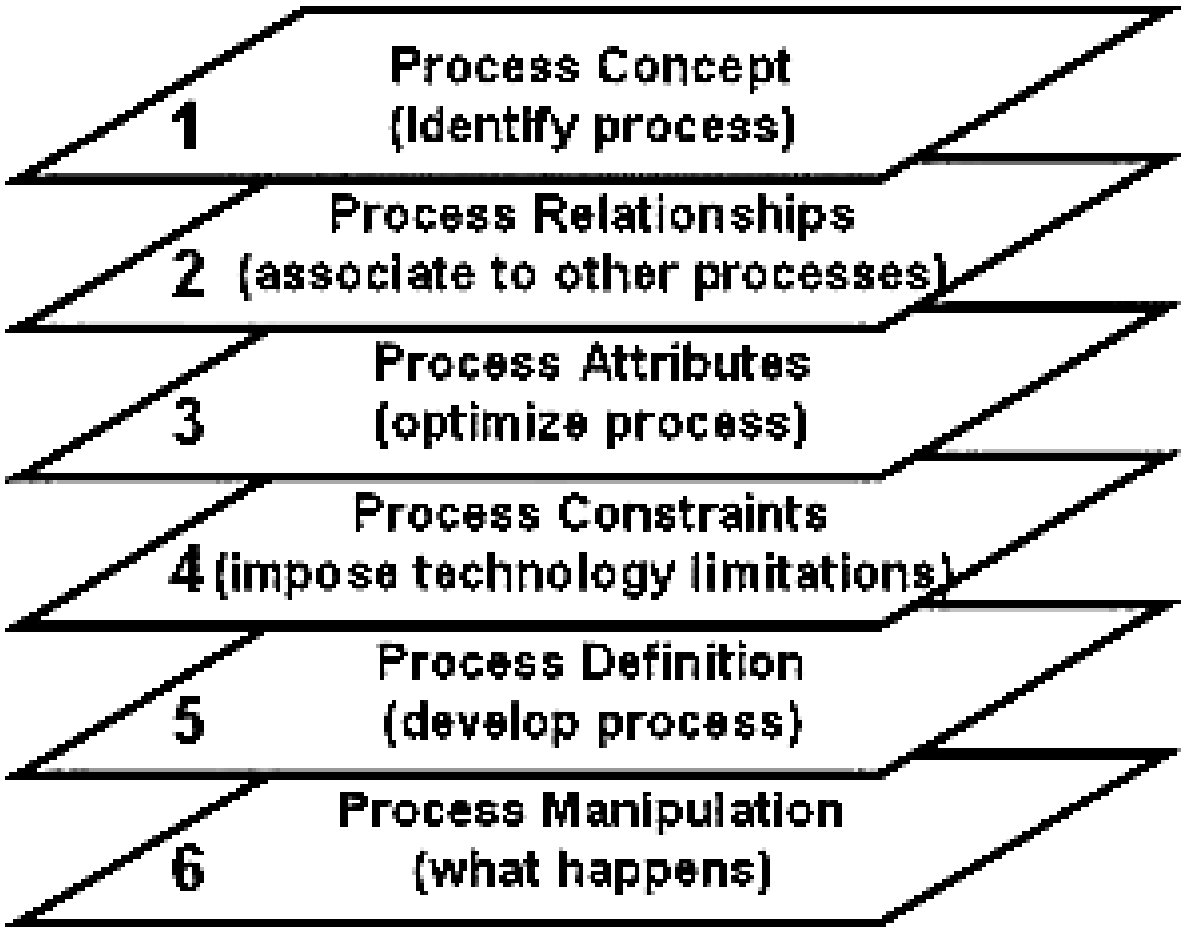
Business process modelling (BPM)

- **Change management programs are typically involved to put the improved business processes into practice.**
- **Business Process Modelling plays an important role in the Business process management (BPM) discipline. Since both Business Process Modelling and Business Process Management share the same acronym (BPM), these activities are sometimes confused with each other**
- **With advances in IT from large platform vendors, the vision of BPM models becoming fully executable and capable of simulations and round-trip engineering) is coming closer to reality every day**

Process model goals

- **Descriptive**
  - **Track what actually happens during a process.**
  - **Takes the point of view of an external observer who looks at the way a process has been performed and determines the improvements that have to be made to make it perform more effectively or efficiently**
- **Prescriptive**
  - **Defines the desired processes and how they should/could/might be performed.**
  - **Lays down rules, guidelines, and behaviour patterns which, if followed, would lead to the desired process performance. They can range from strict enforcement to flexible guidance**
- **Explanatory**
  - **Provides explanations about the rationale of processes.**
  - **Explore and evaluate the several possible courses of action based on rational arguments**
  - **Establish an explicit link between processes and the requirements that the model needs to satisfy.**

Process Focus



Modelling language

- **Modelling language standards that are used for BPM include Business Process Modelling Notation (BPMN), Business Process Execution Language (BPEL), Unified Modelling Language (UML), Object Process Methodology (OPM), and Web Services Choreography Description Language (WS-CDL)**
- **Other technologies related to business process modelling include model-driven architecture and service-oriented architecture**
- **The relationships of a business processes in the context of the rest of the enterprise systems (e.g., data architecture, organizational structure, strategies, etc.) create greater capabilities when analyzing and planning enterprise changes.**
  - **For example, during a corporate merger it is important to understand the processes of both companies in detail so that management can correctly and efficiently identify and eliminate redundancies in operations.**

Modelling language

- There are different styles for representing processes: "scripts," "programs," and "hypertext."
- Process scripts are interactively used by humans as against process programs which are enacted by a machine. They support non determinism whereas process programs can, at best, support process deviation under pre-defined constraints.
- The hypertext style of process representation is a network of links between the different aspects of a process, such as product parts, decisions, arguments, issues, etc.
- Scripts and programs are two styles which may be applicable to prescriptive purposes whereas hypertext is well suited to descriptive and explanatory purposes. Strict enforcement of the prescriptive purpose can clearly be represented in process programs whereas flexible guidance requires the process model to be represented in process scripts. Descriptive and explanatory purposes require the establishment of relationships between different elements of a process trace.

Process representation style

	Process Representation style		
Perspective	**Scripts**	**Programs**	**Hypertext**
Usage	interactively used by humans	enacted by a machine	network of links between the different aspects of a process, such as product parts, decisions, arguments, issues, etc.
Character	support non determinism	support, at best, process deviation under pre-defined constraints	
Applicability	applicable to prescriptive purposes (flexible guidance)	applicable to prescriptive purposes (strict enforcement)	applicable to descriptive and explanatory purposes

Process representation

- **Some of these techniques are:**

1. **Process chart**
2. **Process flow chart**
3. **UML - Unified Modelling Language**
4. **String diagrams**
5. **Other specific techniques:**
   - **Photographic records**
   - **Multiple activities charts**
   - **…….**

1. Process chart

Process chart

- It's a technique that map a sequence of events represented by using standard symbols
- It's a technique used in manufacturing or in industrial process where is important to map operations, people, materials, …
- It's possible to indicate in each symbol a value showing the monitored performance index (labour cost, material cost, cycle time, quality rate, priority ….)

Activities

Operation - indicates the main steps in a process method or procedure. Usually the part, material or product concerned is modified or changed during the operation.

Transportation - indicates the movement of workers, materials or equipment from place to place.

Storage - indicates a controlled storage in which material is received into or issued from store under some form of authorisation, or an item is retained for reference purposes.

Delay - indicates a delay in the sequence of events, for example work waiting between consecutive operations, or any object laid aside temporarily without record until required.

Inspection - indicates an inspection for quality and/or check for quantity.

Hold - indicates the retention of an object in one hand, normally so that the other hand may do something to it.

Symbol	Process Chart			
	Outline	Flow Process Chart		Two handed (or operator)
		Man Type	Material Type	
○	Operation	Operation	Operation	Operation
⇨	Transportation	Transportation	Transportation	Transportation
□	–	Inspection	Inspection	–
▽	–	–	Storage	Hold
D	–	Delay	Delay	Delay

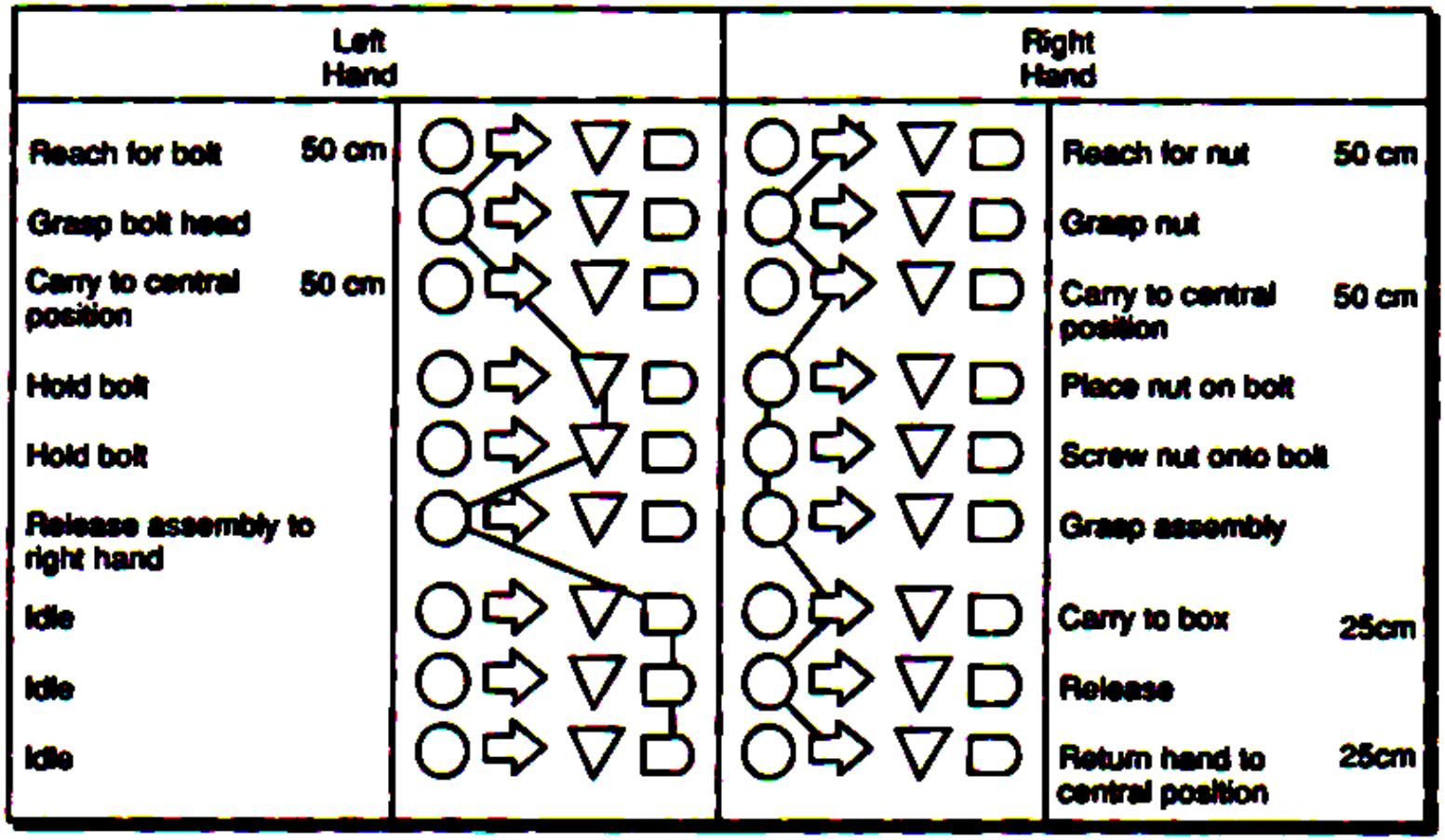


Figure A.5 A two-handed Process Chart.

Flow Process Chart

Method: Present

Type: Man and material

Job: Inspection of component

Begin : Man in inspection department
Material in goods receiving

Finish: Man in inspection department
Material in stores

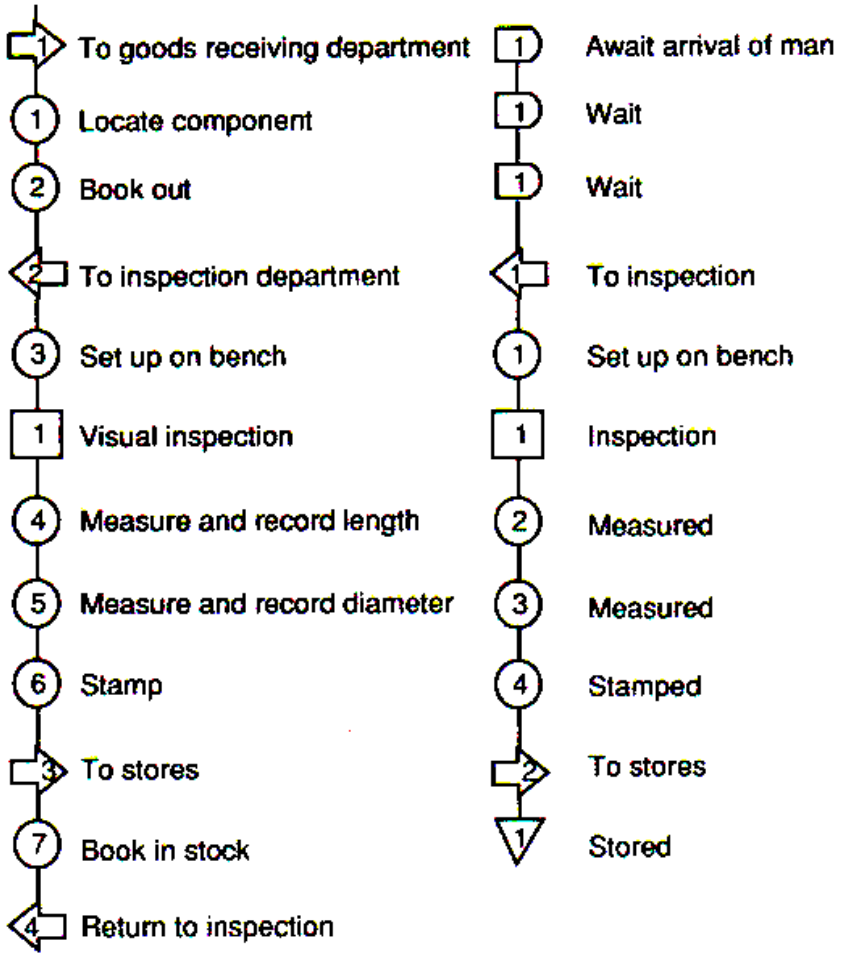
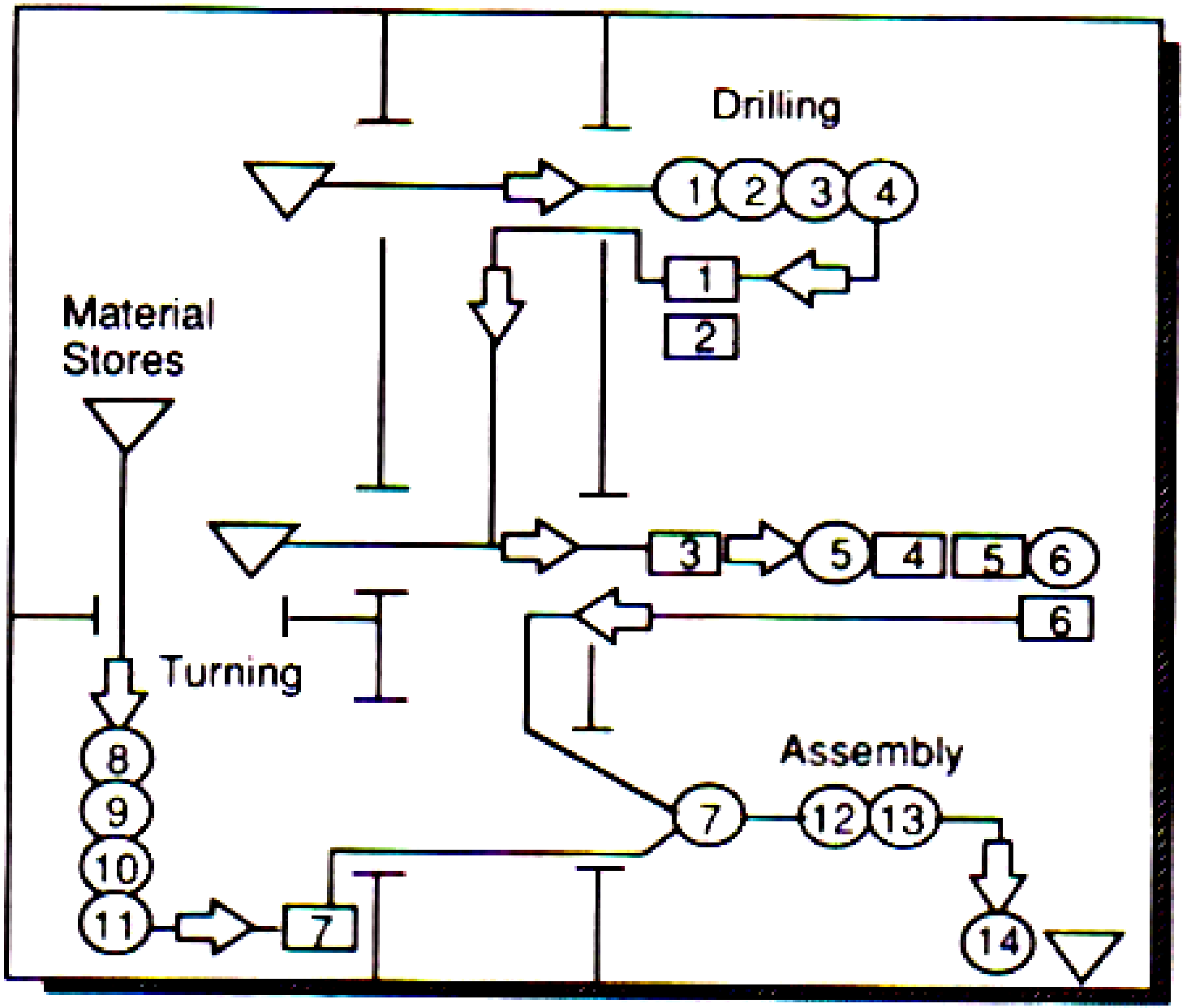


Figure A.6 *Man and material Process Chart.*

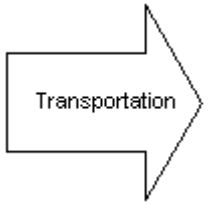


ANSI standard symbols

- **In order to analyze the the making of the product, one should use the ANSI standard symbols.**

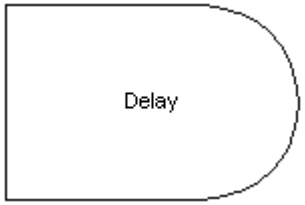
- **The ANSI standard symbols used most often include the following**

Drive Nail, Cement, Type Letter.



Move Material by truck, conveyor, or hand

Raw Material in bins, finished product on pallets, or filed documents.



Wait for elevator, papers waiting, material waiting

Read gages, read papers for information, or check quality of goods.

Any combination of two or more of these symbols show an understanding for a joint process.

2. Process flow chart

Process flow chart

- A flow chart is defined as an evolution of process chart and it's a pictorial representation describing a process being studied or even used to plan stages of a project.
- Flow charts tend to provide people with a common language or reference point when dealing with a project or process.
- Four particular types of flow charts have proven useful when dealing with a process analysis:
  - top-down flow chart,
  - detailed flow chart,
  - work flow diagrams,
  - deployment chart.

History

- As a whole, flow charting has been around for a very long time. In fact, flow charts have been used for so long that no one individual is specified as the "father of the flow chart".

- The reason for this is obvious. A flow chart can be customized to fit any need or purpose. For this reason, flow charts can be recognized as a very unique quality improvement method.

Instructions

- Step-by-Step process of how to develop a flow chart
- Gather information of how the process flows: use
  - a) conservation approach
  - b) exploitation of experience
  - c) product development attitude
- Trial process flow
- Allow other more familiar personnel to check for accuracy.
- Make changes if necessary.
- Compare final actual flow with best possible flow.

Construction

- **Define the boundaries of the process clearly**
- **Use the simplest symbols possible.**
- **Make sure every feedback loop has an escape.**
- **There is usually only one output arrow out of a process box. Otherwise, it may require a decision diamond.**

Interpretation

- **Analyze flow chart of actual process**
- **Analyze flow chart of best process**
- **Compare both charts, looking for areas where they are different. Most of the time, the stages where differences occur is considered to be the problem area or process**
- **Take appropriate in-house steps to correct the differences between the two separate flows.**

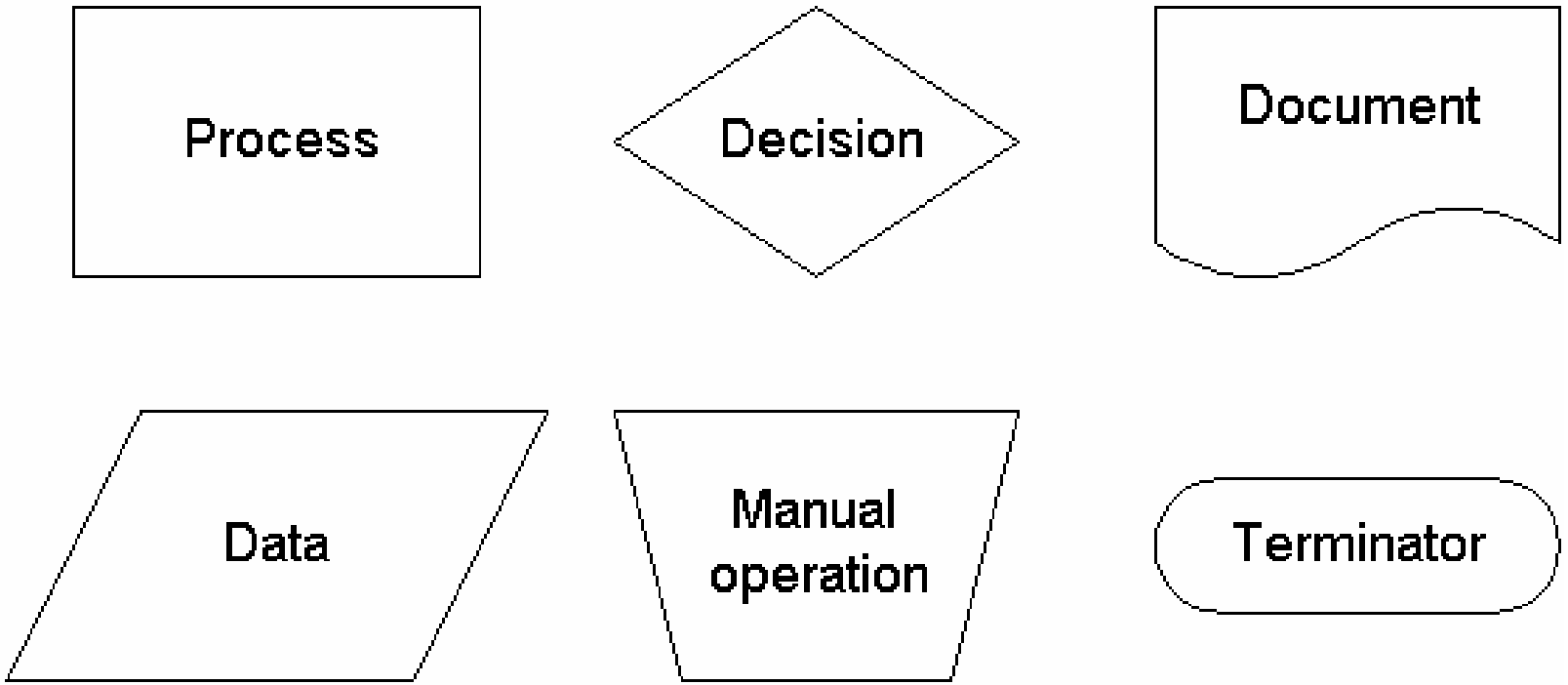
Flow chart types

- **Each of the different types of flow charts tend to provide a different aspect to a process or a task. Flow charts provide an excellent form of documentation for a process, and quite often are useful when examining how various steps in a process work together.**

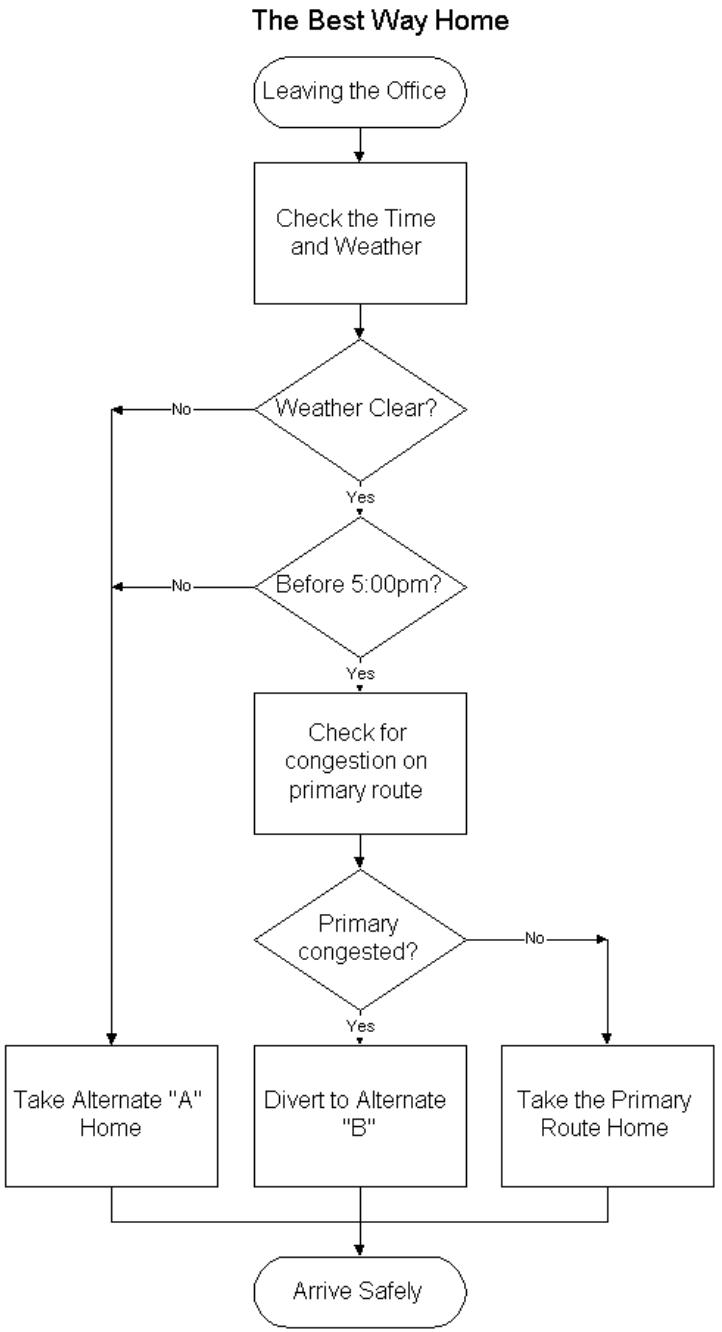
- **When dealing with a process flow chart, two separate stages of the process should be considered: the finished product and the making of the product.**

- **In order to analyze the finished product or how to operate the process, flow charts tend to use simple and easily recognizable symbols. The basic flow chart symbols are used when analyzing how to operate a process**

Basic flow chart symbols



Example



Variations and examples

- **PDF Process Flow Chart**
- **Computer Flow Chart**
  - **IDEF program**

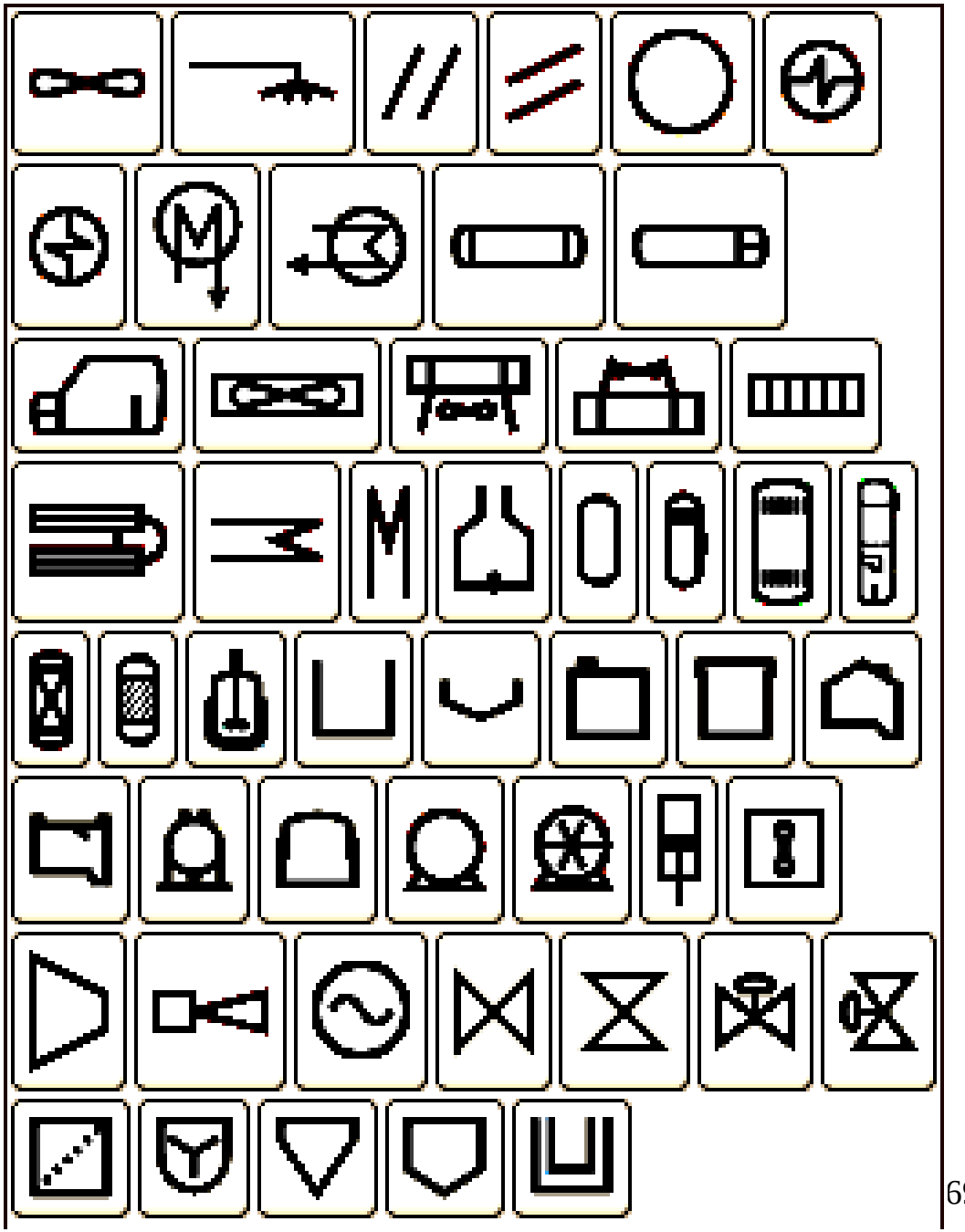
PFD: Process Flow Diagram

- **A process flow diagram (PFD) is a diagram commonly used in process engineering to indicate the general flow of plant processes and equipment**
- **The PFD displays the relationship between *major* equipment of a plant facility and does not show minor details such as piping details and designations. Another commonly-used term for a PFD is a *flow sheet***
- **It's a scale diagram showing the location of specific activities and the sequences of men, materials, machines, equipment used in a process**

Example

- **Typically, process flow diagrams of a single process include the following:**
  - **Process piping**
  - **Major equipment items**
  - **Connections with other systems**
  - **Major bypass and recirculation**
  - **Operational data (pressure, temperature, …)**
  - **Other technologies**

Symbols



Computer flowcharts

- With the arrival of computers onto business scene, databases become integral part of business process re-engineering approach
- Data-driven process mapping techniques have been found very useful to support the management of data integration of systems
- In today's computer market, numerous software packages are available to produce process flow charts

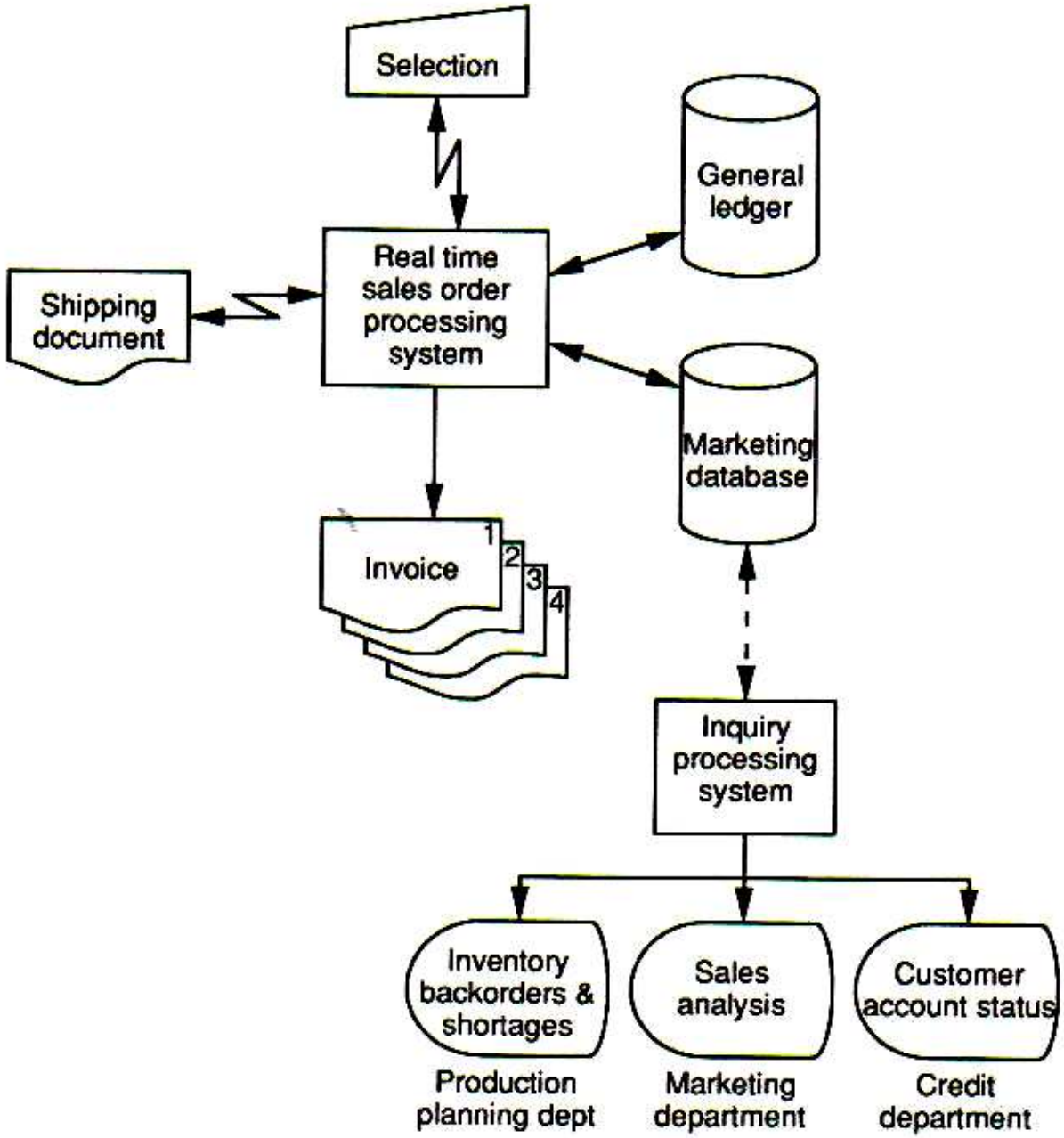


Figure A.7 *A computer flow chart.*

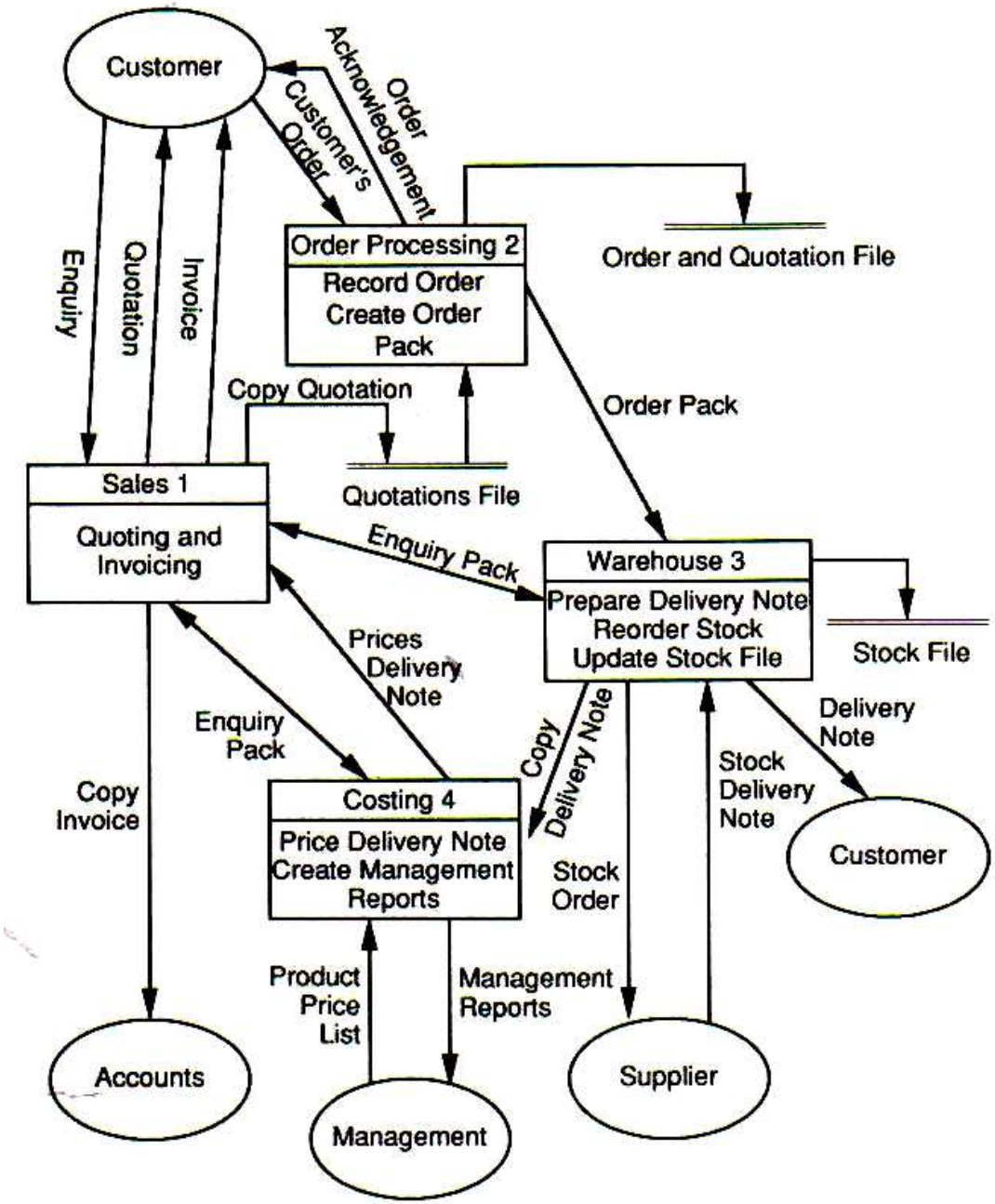


Figure A.8 *A dataflow diagram.*

Ex: IDEF program

- One data-driven process mapping was developed by the United States Air Force (1970)
- The approach was named IDEF (International Definition) and was instigated under the auspices of the Integrated Computer Aided Manufacturing Program (ICAM) to improve analysis and communication techniques for people involved in improving manufacturing productivity

Ex: IDEF program

- A whole business process is at the highest level the representation
- The process defined at this level is broken into several more activity boxes at one level lower.
- The breakdown continue until the point reached is enough detailed to analyze and make changes that are needed
- IDEF describe each process/activity as a combination of processes, inputs, controls and mechanism and offers two advantages:
  - Pyramidal structure that facilitates a quick mapping
  - By working backwards from outputs to inputs, much non-value adding work, data and constraint can be eliminated

The IDEF structure

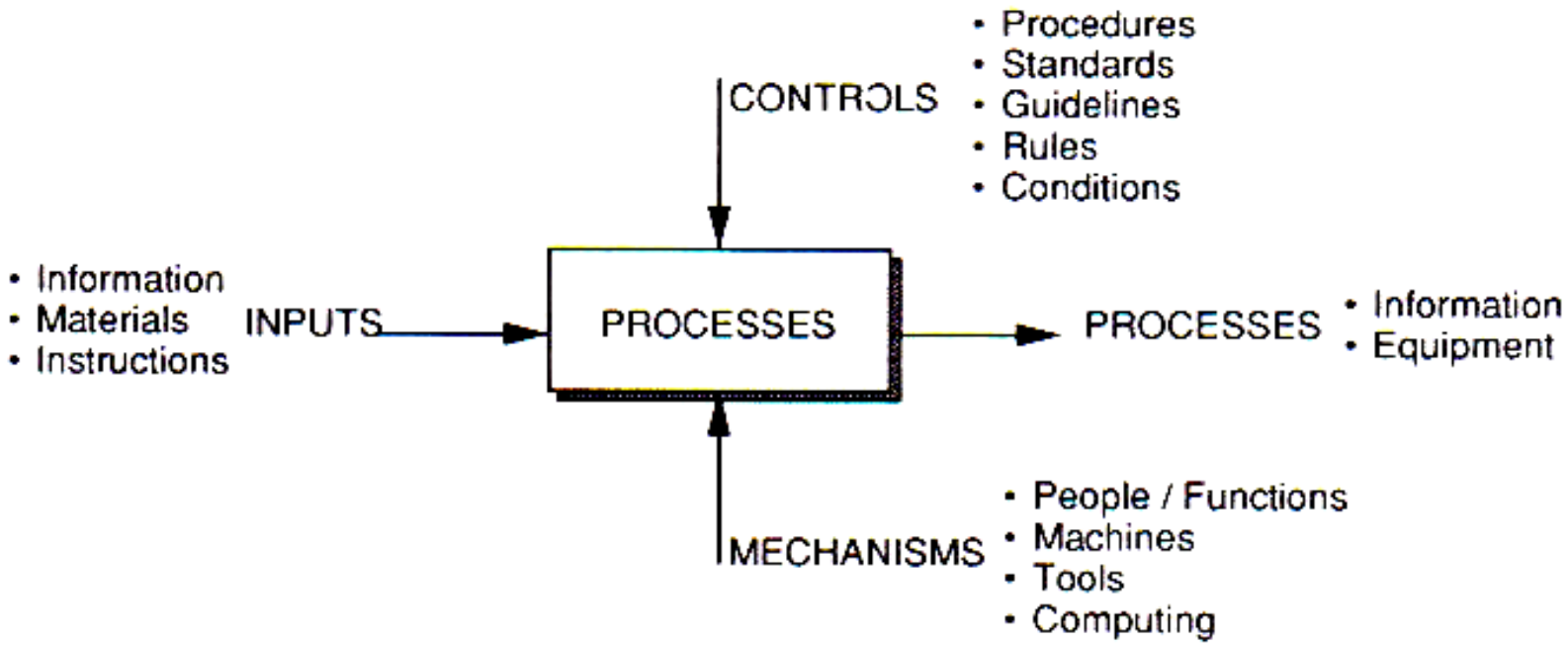


Figure A.9 *The IDEF building block.*

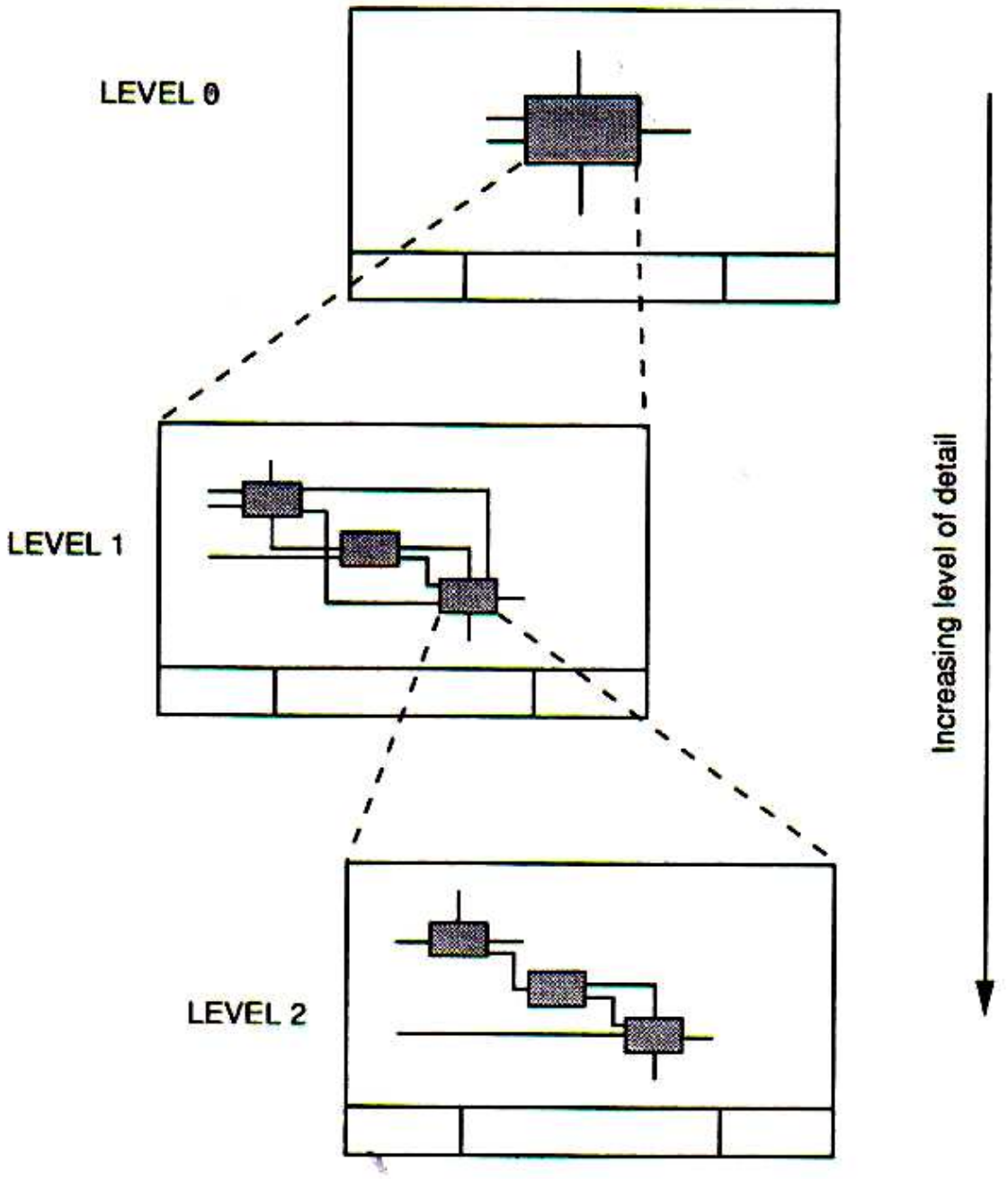
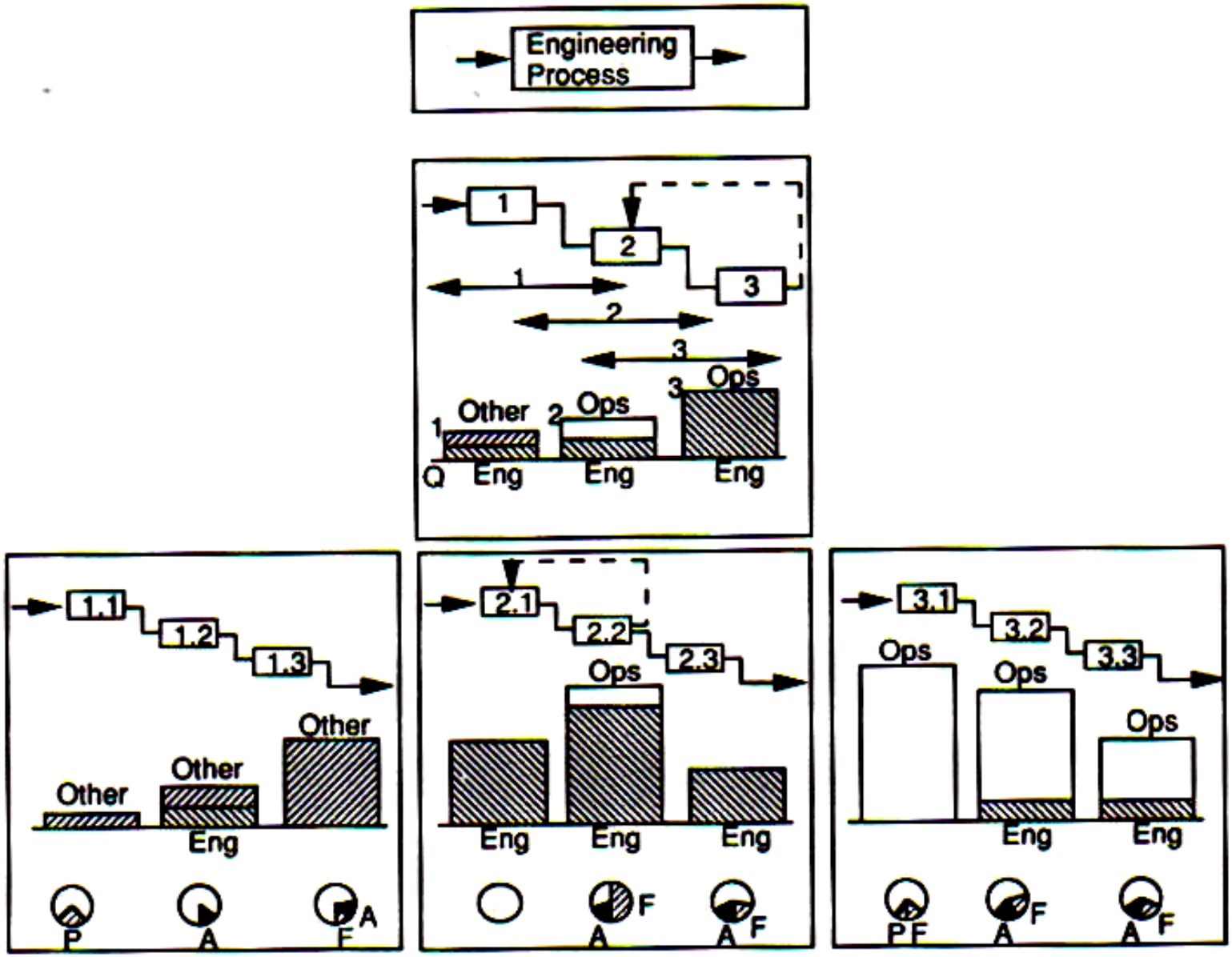


Figure A.10 *Breaking down a process using IDEF.*



P = prevention A = avoidance F = failure

Figure A.11 *A typical use of IDEF.*

3. UML Unified Modelling Language

UML

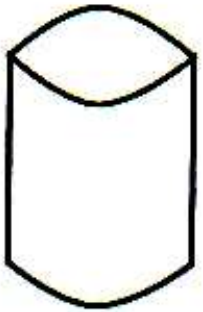
- **UML (Unified Modelling Language) is a standardized language for the modelling of business processes which was developed in the '90 in the area of software development**
- **Anyway, it can be used in order to map business processes, especially when there is the need to identify their informational requirements**
- **The language includes various diagrams which can represent a process from different perspectives:**
  - **Its external behaviour (Case Use Diagram)**
  - **Its internal behaviour (Activity Diagram)**
  - **The information needed (Class Diagram)**

UML symbols

Activity

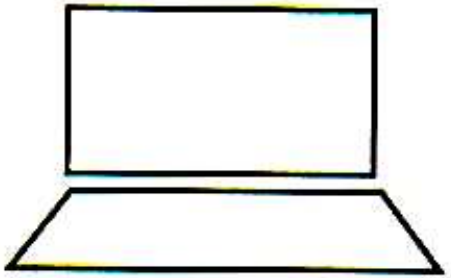
Process
Input/Output

Flow

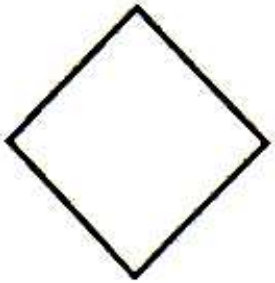


Record

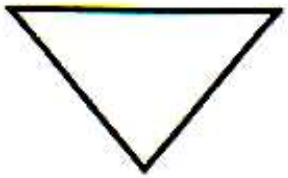
Report



Computer
Activity



Decision



Storage

Modelling

- **It is very important to distinguish between the UML model and the set of diagrams of a system:**
  - **A diagram is a partial graphical representation of a system's model.**
  - **The model also contains a "semantic backplane" — documentation such as written use cases that drive the model elements and diagrams.**

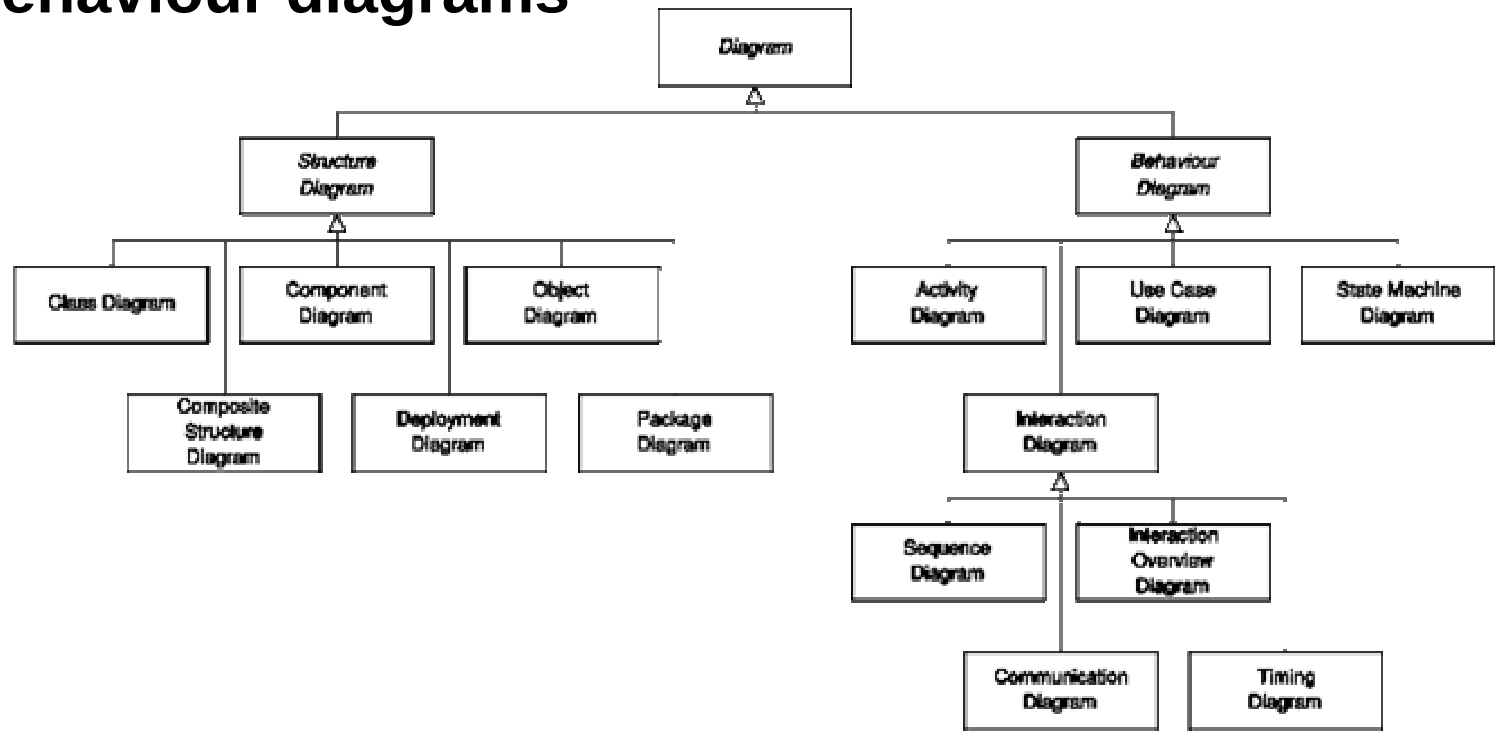
- **UML diagrams represent three different views of a system model:**
  - ***Functional requirements view***
  - ***Static structural view***
  - ***Dynamic behaviour view***

Point of view

- ***Functional requirements view***
  - **Emphasizes the functional requirements of the system from the user's point of view.**
  - **Includes use case diagrams**
- ***Static structural view***
  - **Emphasizes the static structure of the system using objects, attributes, operations, and relationships.**
  - **Includes class diagrams and composite structure diagrams**
- ***Dynamic behaviour view***
  - **Emphasizes the dynamic behaviour of the system by showing collaborations among objects and changes to the internal states of objects.**
  - **Includes sequence diagrams, activity diagrams and state machine diagrams**

Type of diagram

- **Structure diagrams**
- **Behaviour diagrams**



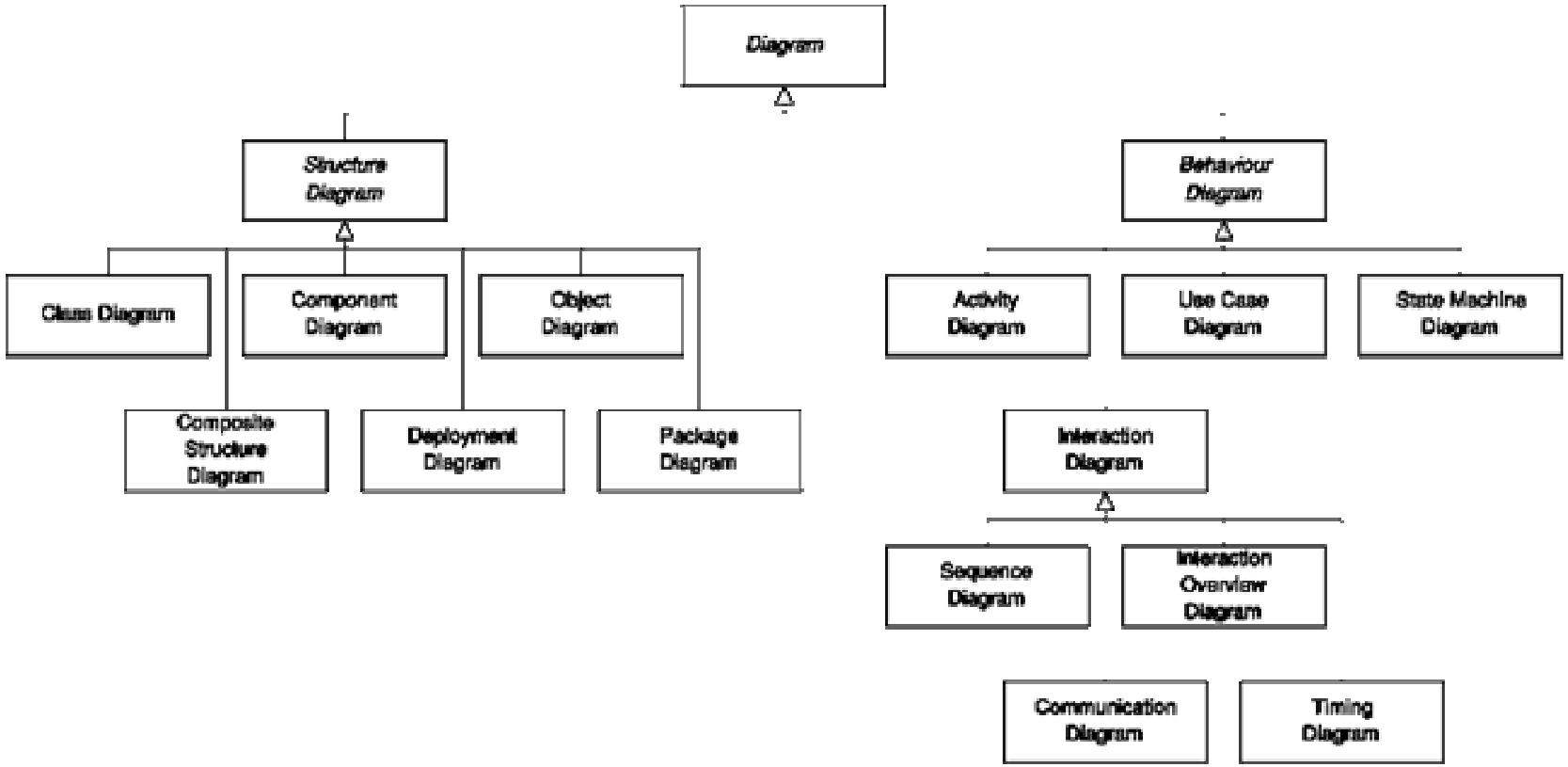
Structure diagrams

- **Emphasize what things must be in the system being modelled:**
  - **Class diagram**
  - **Component diagram**
  - **Composite structure diagram**
  - **Deployment diagram**
  - **Object diagram**
  - **Package diagram**

Class diagram

- **It's a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, and the relationships between the classes:**
  - ***Link:*** **is the basic relationship among objects. It is represented as a line connecting two or more object boxes**
  - ***Association:*** **represents a family of links. Binary associations (with two ends) are normally represented as a line, with each end connected to a class box. Higher order associations can be drawn with more than two ends. In such cases, the ends are connected to a central diamond**

Class diagram

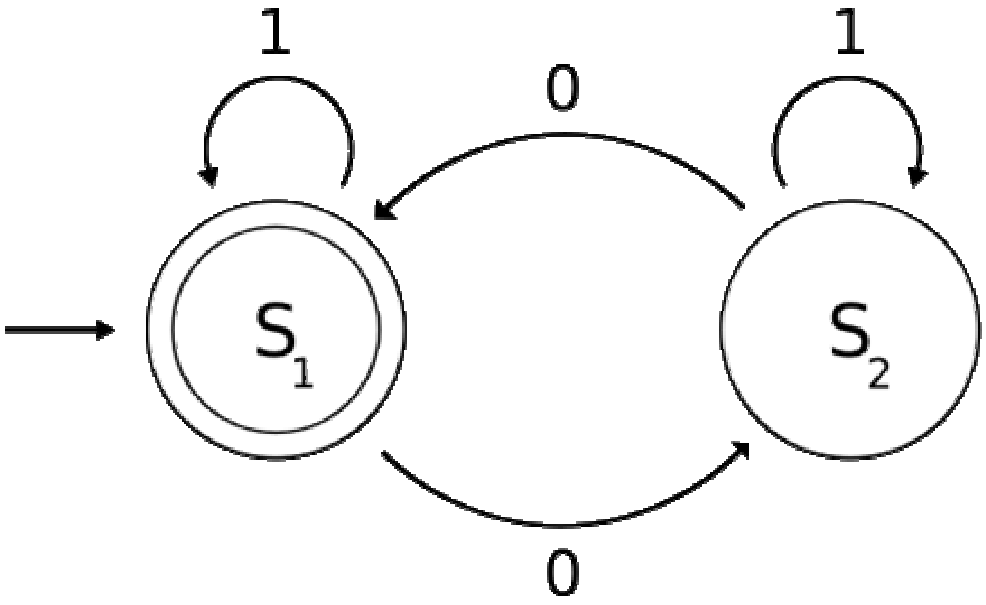


Behaviour diagrams

- ***Behaviour diagrams*** **emphasize what must happen in the system being modelled:**
  - **Activity diagram**
  - **State Machine diagram**
  - **Use case diagram**

State machine diagram

- **State diagrams are used to graphically represent finite state machines. State transition tables are another possible representation.**



Use case diagram

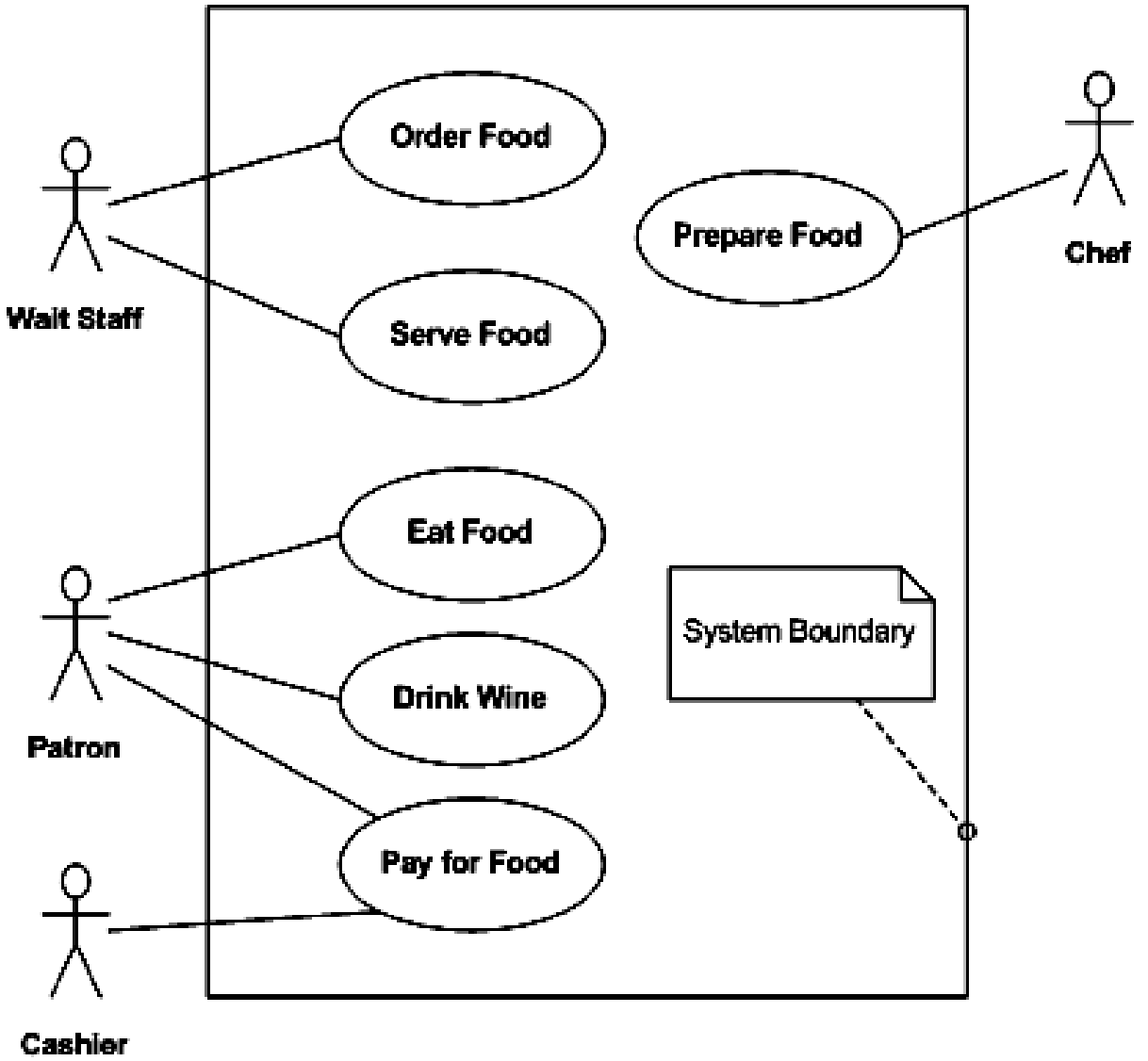
- **Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals—represented as use cases—and any dependencies between those use cases.**

- **The diagram showed as exemple describes the functionality of a simplistic *Restaurant System*. Use cases are represented by ovals and the actors are represented by stick figures.**

- **In particular the Patron actor can Eat Food, Pay for Food, or Drink Wine. Only the Chef actor can Prepare Food. Note that both the Patron and the Cashier are involved in the Pay for Food use case. The box defines the boundaries of the Restaurant System, i.e., the use cases shown are part of the system being modelled, the actors are not.**

- **Interaction among actors is not shown on the use case diagram. If this interaction is essential to a coherent description of the desired behavior, perhaps the system or use case boundaries should be re-examined. Alternatively, interaction among actors can be part of the assumptions used in the use case.**

Use case diagram



Interactions diagrams

- ***Interaction diagrams*, a subset of behaviour diagrams, emphasize the flow of control and data among the things in the system being modelled:**
  - **Communication diagram**
  - **Interaction overview diagram**
  - **Sequence diagram**
  - **UML Timing Diagram**

4. String diagram

String Diagram

- It's a scale plan showing the movement of men and materials using "string" to follow the path of each
- A scale plan showing the movement of materials using "string" to follow the path of each (very similar to Flow Diagrams)
- The diagram show the physical movement of each material till the transformation
- This technique is used to point out logistic performance level and possible problems

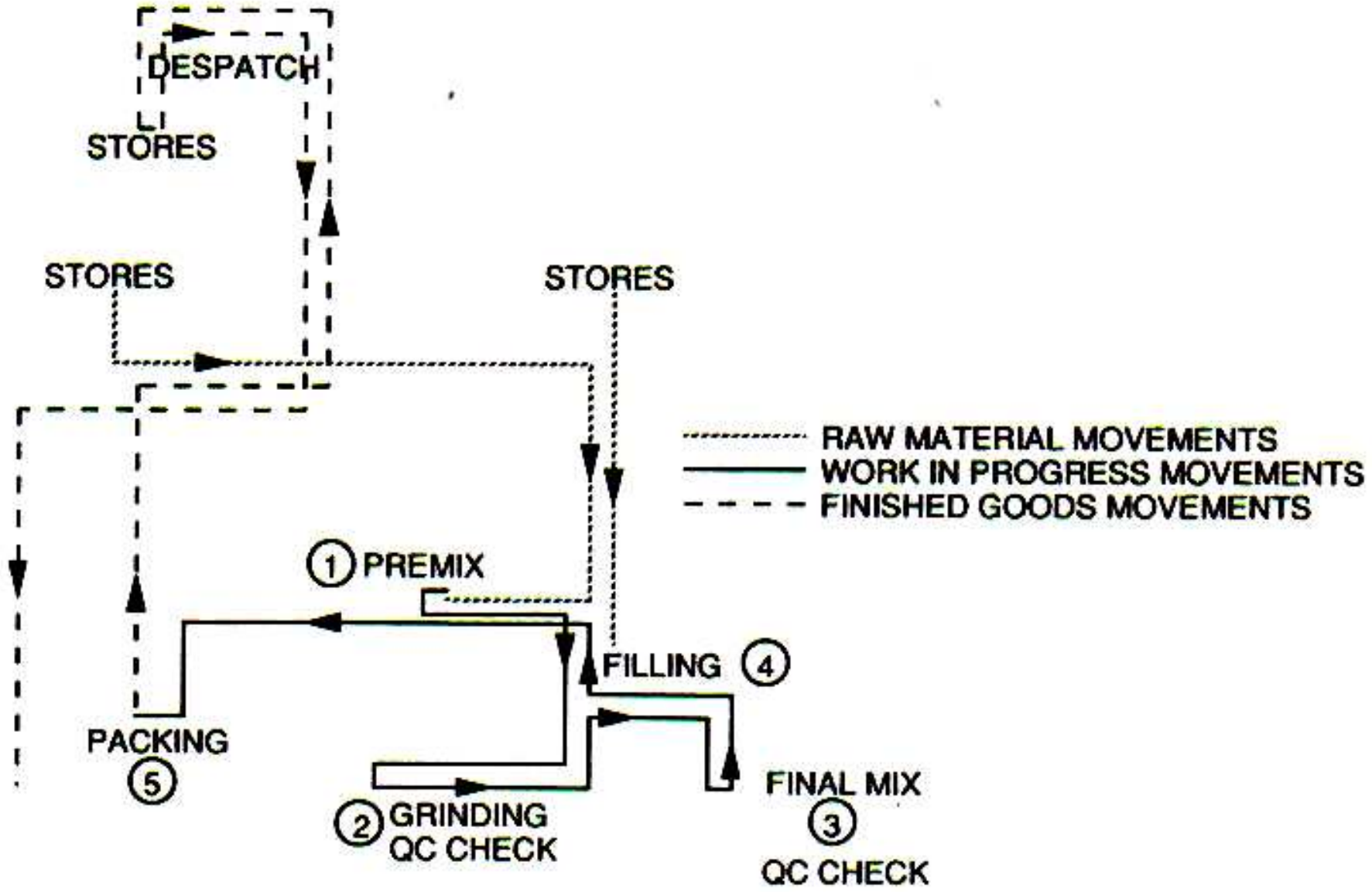
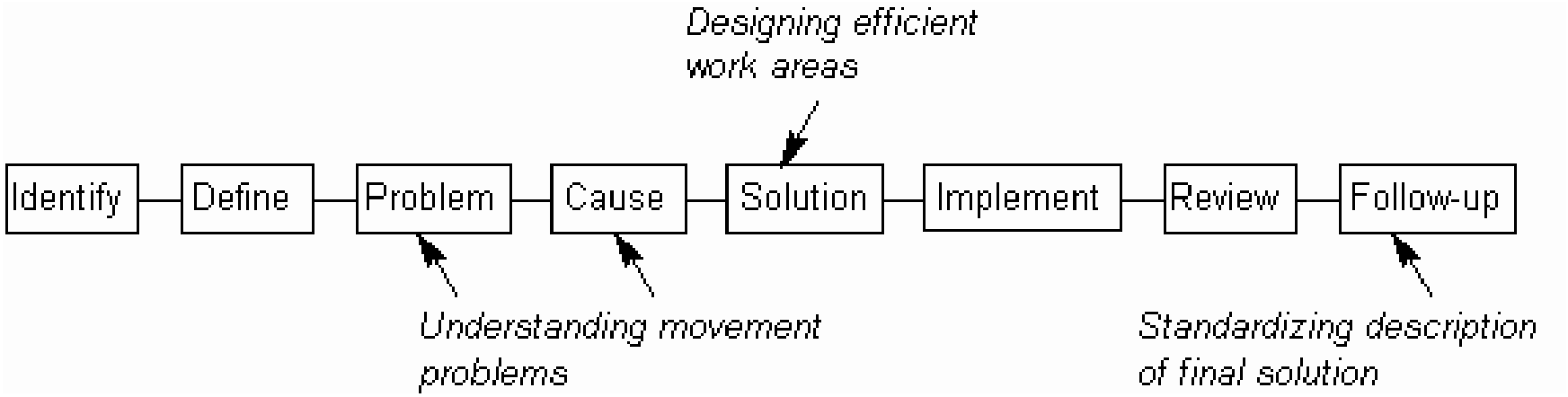


Figure A.3 *A String Diagram.*

When to use it

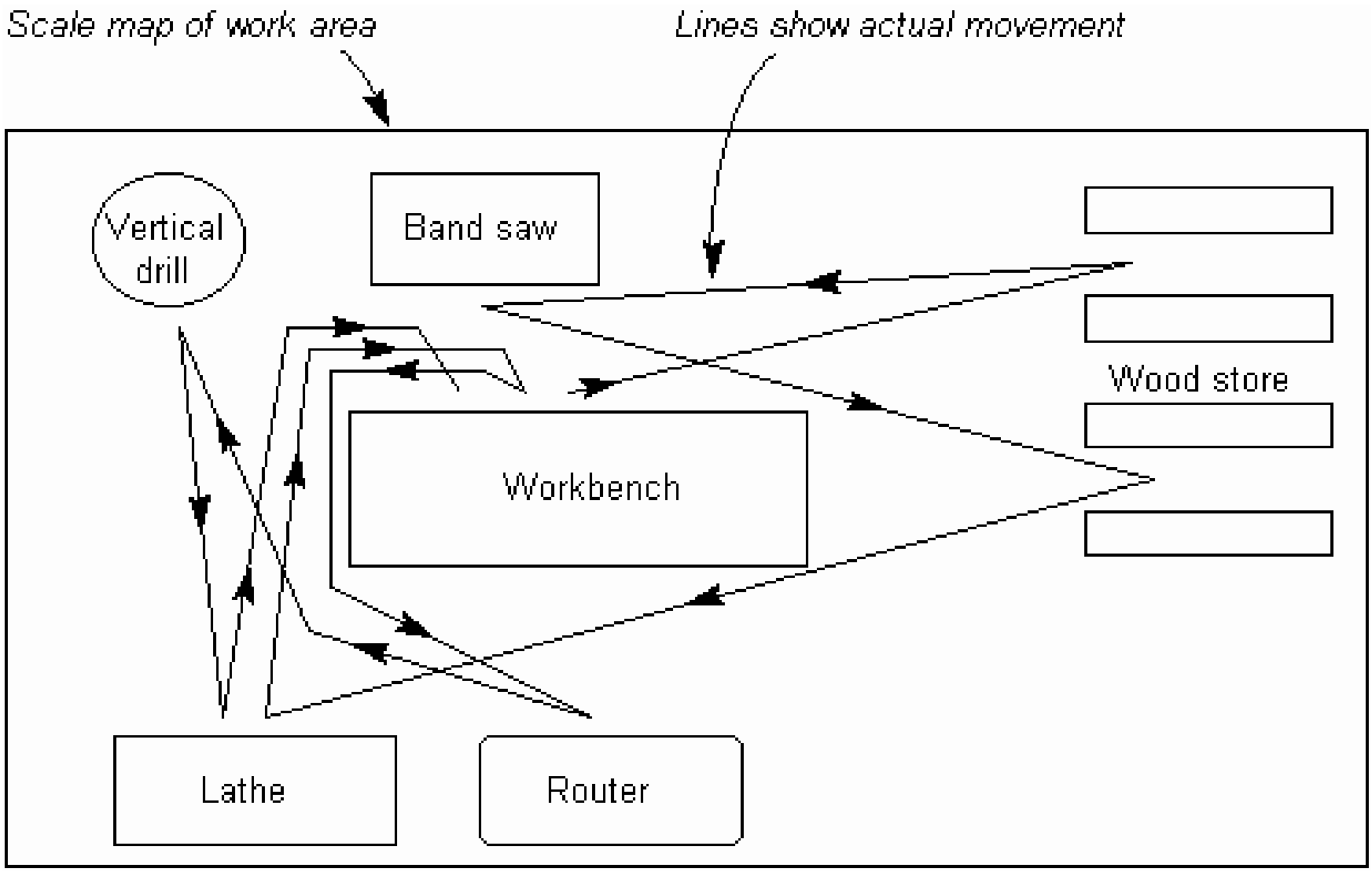
- **Use it when analyzing a manual or physical process that involves significant physical movement, in order to make movements easier and quicker**
- **Movements may be of people, materials or machines**
- **Use it when designing the layout of a work area, to identify the optimum positioning of machines and furniture**

When to use it



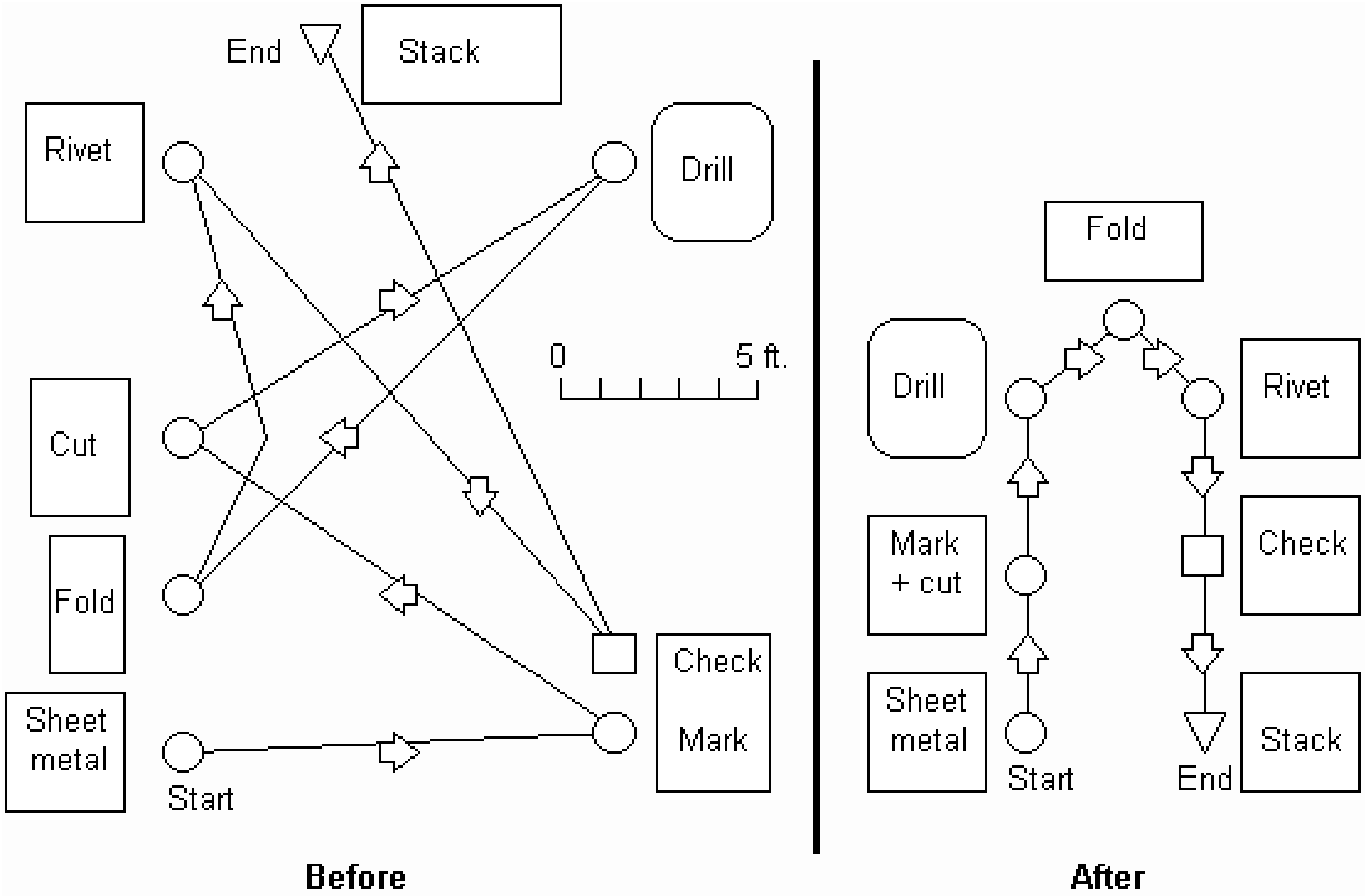
How to understand it

- The placement of equipment and furniture in work areas is often done randomly and sequentially, rather than with any sense of what positioning will make the work easier.
- The result is that subsequent work requires much more moving about than is necessary. A part of the problem is that when designing a work area, it can be difficult to 'see' what movement will be necessary.
- The String Diagram is a simple tool for analyzing and designing work spaces such that movement can be minimized. The basic diagram simply consists of a map of the work area, with the actual movements drawn on top.
- The term 'String Diagram' comes from the way the diagram may be created with a scale drawing, pins and a piece of string (you can then measure the string to see how far the movements are.



Example

- A metal worker became fed up with walking what seemed to be half-way around the machine room just to build a metal box
- With help from the works facilitator, he measured the distance he travelled to build one box, using a scale map of his workshop area, as below.
- Using this, he simply moved the machines into a U-shape. the result was an easier and faster process, which also used less floor space.



Other examples

- **A self-service restaurant team measures the route taken by customers around the food counters and also identifies the most popular meals that they are building. They rearrange the counters and food to enable a logical progression for the most common meals. They also include complementary and high-margin food in this line, which helps to increase the profitability of the restaurant**

- **A maintenance team measures the route taken by engineers making routine checks on key equipment throughout the plant, plotting it on a site plan. They are then able to plot a much shorter route to each of the same machines.**

How to do it

1. **Identify the process to be analyzed. This will be one which involves a significant amount of movement by people, materials or both**

2. **Produce a scale map of the work area, not including machines, but including items that cannot easily be moved, such as power points, air lines, etc. This may be available from the site office.**

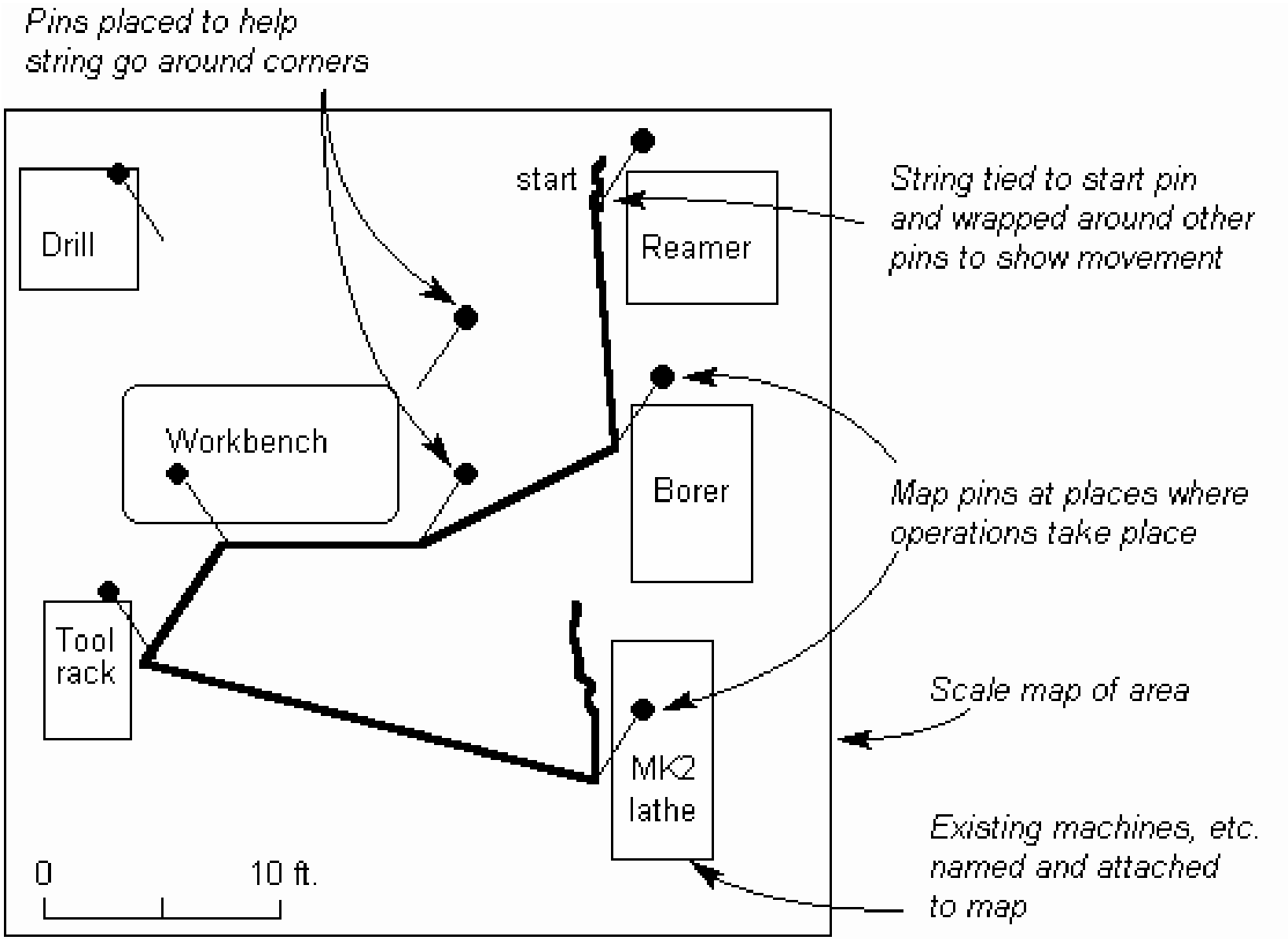
3. **Add all machines, furniture and other equipment to the diagram. If possible, do this in a way that will allow these to be moved, for example by using shaped pieces of card that can be pinned to the work area map from step 2.**

How to do it

4. **Identify the points in the process where actions take place and mark the positions of these on the map with map pins. Where there are different action types, these can be differentiated by marking or pinning down paper action symbols (typically the same as those used in the Flow Process Chart).**

5. **Tie the end of a piece of string to the pin where the process starts, and then wrap it around each pin in turn, following the movement around the process. Tie the string off at the last position (which may be the start point, if the person returns there).**

6. **Mark the string at the start and finish points, using a pen. Remove the string and measure between the pen marks, using the map scale. This will give the total distance travelled during the process.**



How to do it

7. **Rearrange the movable items on the map, aiming to reduce the total distance as measured before. It may be appropriate to change what is done during the process at the same time.**

   For example, some operations may be combined or eliminated. Strategies for deciding layouts include:

   - ***Mobility. Rearrange items and movements around fixed or immovable items, such as heavy machines.***
   - ***Function. Put machines or people together that perform the same function. This is useful when varying loads may be shared between machines.***
   - ***Product. Put machines or people together that make the same product. This works well when each machine is used for only one product.***

How to do it

8. Repeat steps 6-7 to get a new total distance travelled. Using the same piece of string will make it easy to see how much shorter this is.

9. Check that it is feasible to move equipment as planned, then do so. Measure the final process in practice to check that improvements are as expected.

Variations

- **Do a Flow Process Chart first, then follow up with a String Diagram. This helps clarify the actions in the process, making the String Diagram easier to complete. It also results in a more complete analysis.**

- **Draw the map and 'string' on a single sheet of paper. This requires less resources, and gives a result that can be easily copied, although it is less flexible for redesigning.**

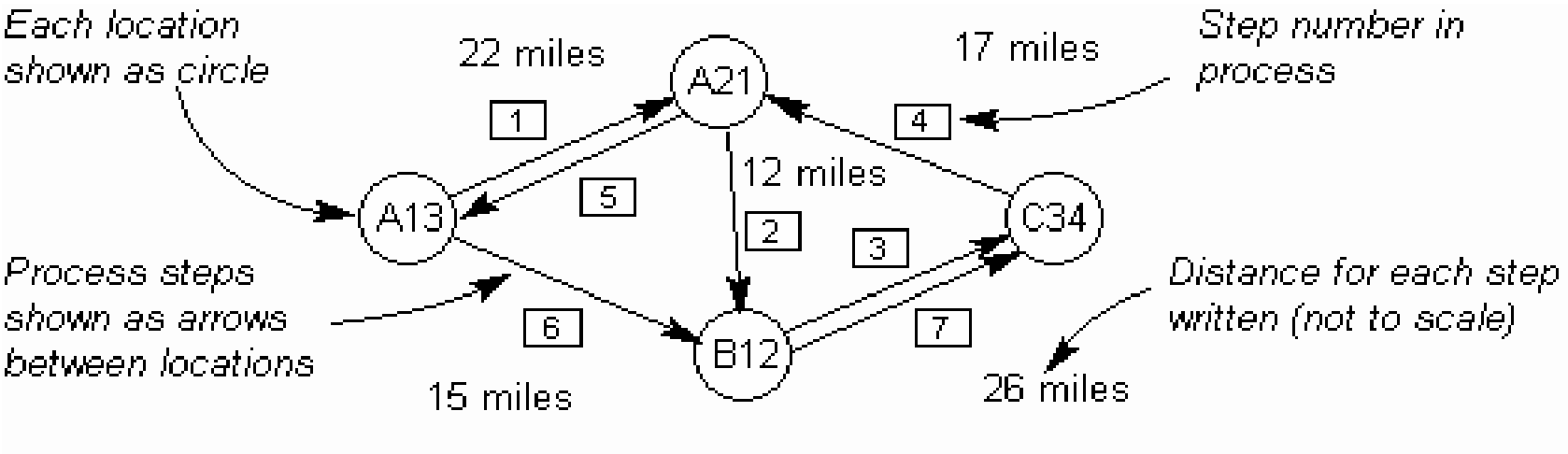
- **Do multiple plots on the same diagram, for example where one person does the same process in a different way, or where multiple people or items are involved.**

Suggestions

- **Use coloured pins to indicate different action types or different plots done on the same map.**
- **Use coloured string to show different plots.**
- **If it is significant, add the time taken for each movement.**
- **Annotate the diagram with pertinent notes to help interpretation, for example by giving notes on what is being done at each point, and why.**

Ex. Topological movement chart

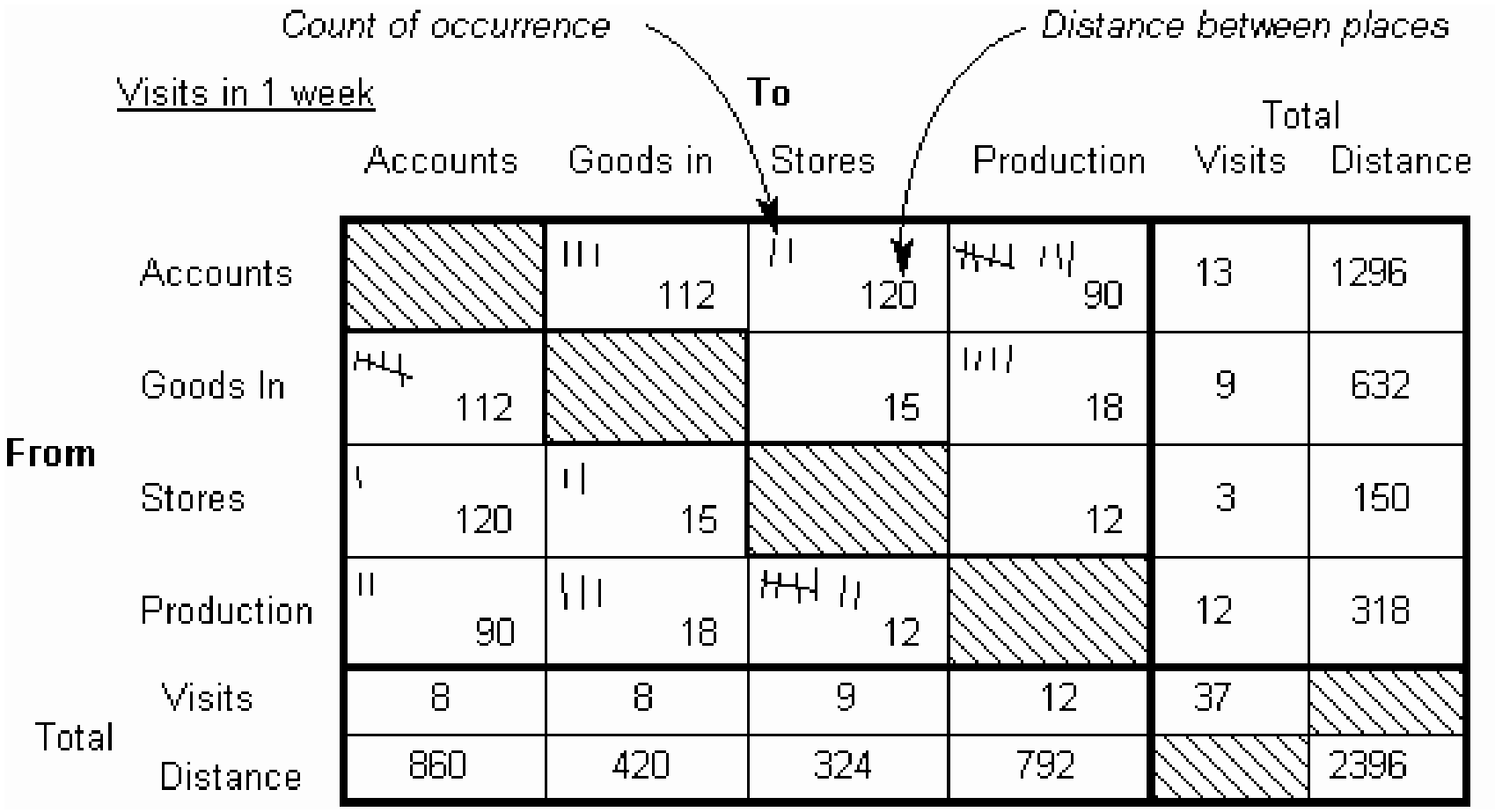
- **A *Topological Movement Chart* represents locations as small circles and movement as lines between them. The distance is written next to each line, as below. This is particularly useful for movement between remote sites, such as travel between buildings or towns.**



Ex. Travel Chart

- **It's a tabular record with data about the movement of the resources used in the production**
- **A *Travel Chart* is useful where there are multiple (and possibly irregular) movement between places.**
- **It is a variation on the Check Sheet, indicating movements from and to any combination of a given set of locations, as showed in next picture**

Travel chart



5. Other techniques

Photographic records

- A recording of movements on the shop floor using a camera over a fixed period of time; the method has gained in popularity with the advent of low cost video recording equipment
- This technique is normally used with string diagram to point out the real volumes of materials handled (string diagram doesn't include usually quantity information)

Multiple activities chart

- **These charts summarize a number of activities that take place concurrently in order to represent in schematic form situations in which many activities in a process are taking place in parallel**

- **It's used when is necessary point out the activities of more facilities working in parallel to show each instant their state**

  - **Ex. To quantify people need to supervise an automatic manufacturing department**

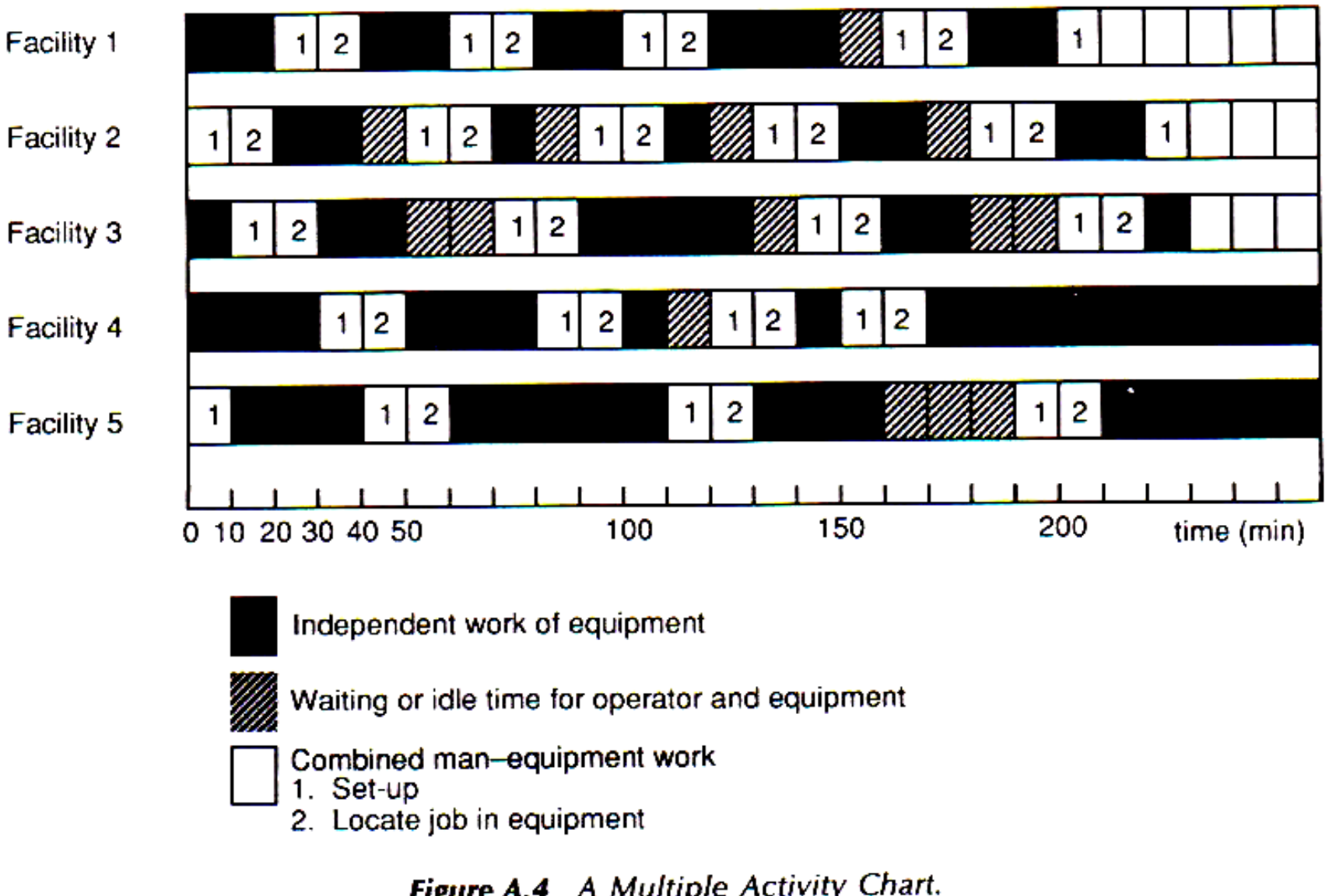


Figure A.4 *A Multiple Activity Chart.*

Final considerations

- **The process mapping is effective and efficient whether:**

1. **Is correct, simple and quick to be used at any level**
2. **Can be applied in order to compare the "As is" process with the "To be" version, using the same language and variables**
3. **Can help the understanding of the process performances in terms of time, costs, quality, resources, utilization, etc…**
4. **Supports analysis with different detail levels on the process and/or specific parts of the same**
5. **It's coherent with the aim of the analysis supported**