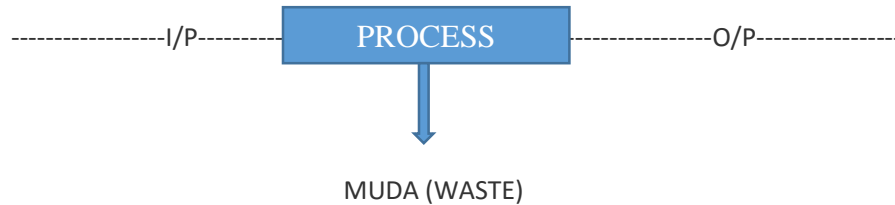


1. WHAT IS PRODUCTIVITY? WHAT WERE THE LEARNING'S FROM THE CASE STUDY – SUPERMARKET WOMAN DISCUSSED IN CLASS?

PRODUCTIVITY DEFINITION:

Productivity is the **ratio** between “Output of Work” and “Input of Resources” used in the **process of creating wealth**.



There is quite a variety of factors which can affect productivity, both positively and negatively. These include:

(C-C-C-E-W-T-W-P-S-Q-Q-L-E-S-G)

1. **Capital investments** in production
2. Capital investments in technology
3. Capital investments in equipment
4. Capital investments in facilities
5. **Economies of scale**
6. Workforce knowledge and skill resulting from training and experience
7. Technological changes
8. Work methods
9. Procedures
10. Systems
11. **Quality** of products
12. Quality of processes
13. Quality of management
14. Legislative and regulatory environment
15. General levels of **education**
16. Social environment
17. **Geographic factors**

The first 12 factors are highly controllable at the company or project level. Numbers 13 and 14 are marginally controllable, at best. Numbers 15 and 16 are controllable only at the national level, and 17 is uncontrollable.

These factors were worked on by GORO and improved productivity at Honest Goro!

APPLICATIONS OF PRODUCTIVITY IN THE CASE:

FUNCTION	OBSERVATIONS - BEFORE	ACTIONS TAKEN - AFTER
<p>MARKETING (5)</p>	<ol style="list-style-type: none"> 1. CUSTOMER COMPLAINTS were NOT paid heed to: <ul style="list-style-type: none"> - Due to shortage of cash with a customer at the billing counter, she wanted to return few of the products at the counter which the manager wasn't allowing, - due to chaos around, the customer broke a packet of egg and panicked because they were asking her to pay for damage, - a rich lady brought her dog at the store although it was not allowed but no one objected, - the store forgot to change the special offer tag on the meat and hence the customer wanted it at offer price, complaints about the beef 2. BILLING Speed & Effectiveness was poor at the counter 3. FEEDBACK on quality of food was never taken 4. Their COMPETITOR Galore was a discounter of poor quality goods 5. Forgot to mention that the OFFER FOR EGGS was valid only for first 1000 customers in newspaper 	<ol style="list-style-type: none"> 1. Customer Complaints were paid heed to and customer-delight by Hanako: <ul style="list-style-type: none"> - The customer was allowed to return the products back due to shortage of cash, - the customer was let go because the egg packet crashed by chaos around and a fresh packet of eggs were given to her, - the rich lady was not permitted to get the dog in and was asked to follow the same rules as applicable to all, - since it was the stores mistake about forgetting to change the special offer tag, the customer was given the meat at offer price and thereafter the tags for remaining were changed 2. Hanako helped improve the speed at the counter to process customer transactions faster 3. House-wife (customers) were invited to try out food items for free and give feedback 4. They put up a strategy of marketing high quality goods 5. They covered up by making sure that all customers who visited their store, got eggs for discounted price (even after 1000 customers) and for those who dint,

	<p>6. UNAVAILABILITY OF FISH <u>during the freezing winters</u> of new year</p>	<p>they got a voucher applicable for one week</p> <p>6. Fish preserved and stored to make sales on New Year</p>
<p>PERSONNEL/HR (6)</p>	<p>1. CULTURE – was <u>not customer friendly</u>. Attacked customer for any issue customer had. No resolutions!</p> <ul style="list-style-type: none"> - No clear policy - Lack of team work between departments - Lack of integrity at senior level <p>2. BEHAVIOR of <u>Manager with Staff was rude</u>. The Professionals had <u>high egos!</u></p> <p>3. TRAINING: <u>Did not train new cooks to prepare Sashimi</u> and hence there was a lot of waiting time</p> <p>4. TRUST: Staff never brought products from their own store due to <u>lack of trust</u> in their processes</p> <p>5. JOB ENRICHMENT missing for the new members. Example: Those who were only <u>watching how to make Sashimi but were never allowed to touch it or help</u> in the process</p> <p>6. JOB SATISFACTION <u>about preparing and serving the customers the best quality products</u> missing. Since products were mixed and re-packed and not fresh</p>	<p>1. Culture – was make customer friendly by addressing all the concerns of both internal and external customers</p> <ul style="list-style-type: none"> - Appreciation for creative inputs - Encouraged across team coordination’s and suggestions <p>2. Behavior of Hanako was friendly towards staff. She asked the pros to keep their ego aside while working!</p> <p>3. Training was provided by Kinchan to new cooks to conduct the process of sashimi making after Hanako’s motivating talk. Therefore, process made time efficient.</p> <p>4. Staff Started buying products from store – shows trust in store</p> <p>5. Job Enrichment was made available for the new members who were now trained by a pro to make Sashimi</p> <p>6. Job satisfaction about preparing and serving the customers the best quality products made available by creating and environment and products of superior quality!</p>

<p>FINANCE (1)</p>	<p>1. PRICING STRATEGY was <u>30% off on 200 items out of 6000</u> total items in store</p> <p>2. STOCKING PRODUCTS such as <u>Kobe Beef which has low demand</u>. It not only blocks working capital but also shelf space which otherwise could have been assigned for fast moving products</p>	<p>1. Pricing Strategy was changed to 10% off on everything (even on products that were previously not on sale). Sales increased to 4 million yen</p> <p>2. FAST MOVING Beef was placed instead of Kobe Beef</p>
<p>PRODUCTION/ OPERATIONS (3)</p>	<p>1. Observed that <u>cabbage guys at the competitor "Bargain Galore" are SLOW IN THE MORNING</u></p> <p>2. CODE ROE RICE <u>was not giving a good taste</u></p> <p>3. RE-PACKING <u>leftover</u> food <u>with new date</u></p>	<p>1. Speeded up their own set up in the morning to make groceries available to the customer</p> <p>2. Hanako did a root cause analysis and went to the source of code roe and found out that mixing was done. It was corrected and then marketed by inviting customers to try it</p> <p>3. This was changed and left overs were not repacked with new date. Leftovers, were trashed. This built trust among staff</p>
<p>MATERIALS (1)</p>	<p>1. <u>Baskets being robbed</u> and <u>carry carts unavailable at the store</u> because no one kept them back at the store after taking them out towards their cars. Therefore the new customers entering the store found it difficult to hold multiple items while shopping without a cart.</p>	<p>1. The customer was informed of not taking the baskets home. This saved a lot of material cost. Carts made available at the store because by bringing them back inside store after use</p>

THE STORY:

- A new supermarket 'Bargains Galore' opens, and threatens the longer-established 'Honest Goro' with its aggressive price cutting.
- The owner of 'Honest Goro' (Goro) inspects the new store, and bumps into an old classmate he hasn't seen for years (Hanako).
- She uses her 'housewife's know-how' to show him why his supermarket is performing so badly.
- He resolves to make his supermarket the best in Japan, and gives her a job as head cashier.
- She helps to improve customer service and introduces new sales techniques and a policy of selling only fresh food.
- In doing so she angers senior staff members who don't want to change their ways. However, the store gradually attracts more customers.
- Hanako gradually manages to change things around, relying on her housewife's savvy. The point is made again and again that as far as supermarket shopping is concerned, moms and housewives are the ones making the purchasing decisions and they know best, rather than the "pros".
- Meanwhile, the manager of 'Honest Goro' is taking back-handers from 'Bargains Galore', and eventually resigns to start work at the new supermarket, trying to take the rest of the staff with him.
- After an impassioned speech by Hanako, the majority decide to remain loyal to Goro, and redouble their efforts to provide customer satisfaction.
- In a last-ditch attempt to sabotage Goro, the old manager and the head butcher attempt to steal all the store's meat.
- Hanako discovers them, and is locked in the back of their freezer van when they drive off. Goro pursues them in a lorry, and after a high-speed chase Hanako is saved.
- 'Honest Goro' opens on New Year's Day to a store full of customers, while 'Bargain's Galore' is practically empty.

2. Tex Ltd. Manufactures products – soaps, face wash, liquid hand wash and shower gel. The input for each of this product is classified as: Human (H), Capital (C), Material (M), Energy (E), and other expenses (X). The General Manager wants to know the productivity of each of its product line. He also wants to know the total productivity of the factory as a whole and productivity of an individual input factor for a particular product.

Product	Amount of Input (In Lakhs)					Total Output of the Product
	H	C	M	E	X	
Soap	20	40	140	50	60	500
Facewash	25	60	100	50	80	550
Liquid Hand Wash	20	30	100	40	100	450
Shower Gel	30	80	130	50	50	400
						1900

SOLUTION:

Product	Amount of input (Rs crores)					I/p	o/p	
	H	C	M	E	X			
Soaps	2	4	14	5	6	31	50	1.61
Face wash	2.5	10	10	5	8	35.5	55	1.5
Handwash	2	10	10	4	10	36	45	1.2
Gel	3	13	13	5	5	39	40	1.1
Total Input	9.5	37	47	19	29	141.5	190	1.34

3. SMED – SINGLE MINUTE EXCHANGE OF DIE.

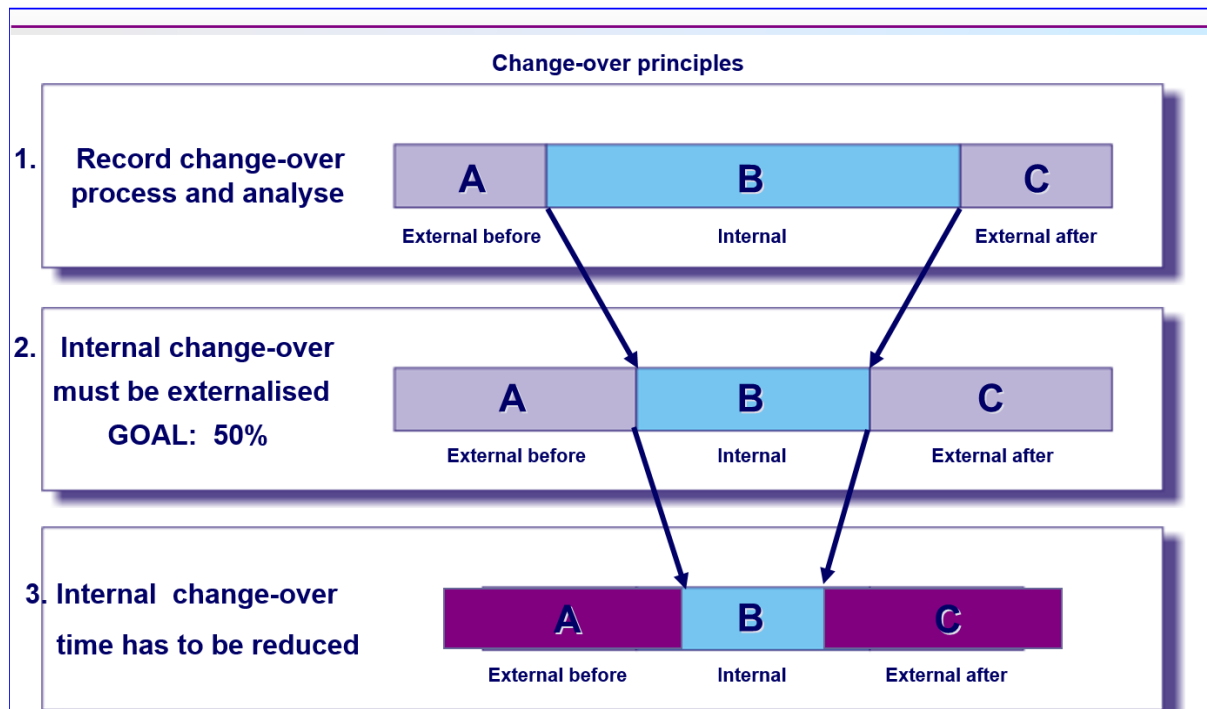
- A system for reducing changeover time
- Goal of reducing setup time to single digit time (<10 mins)

Changeover time: Definition

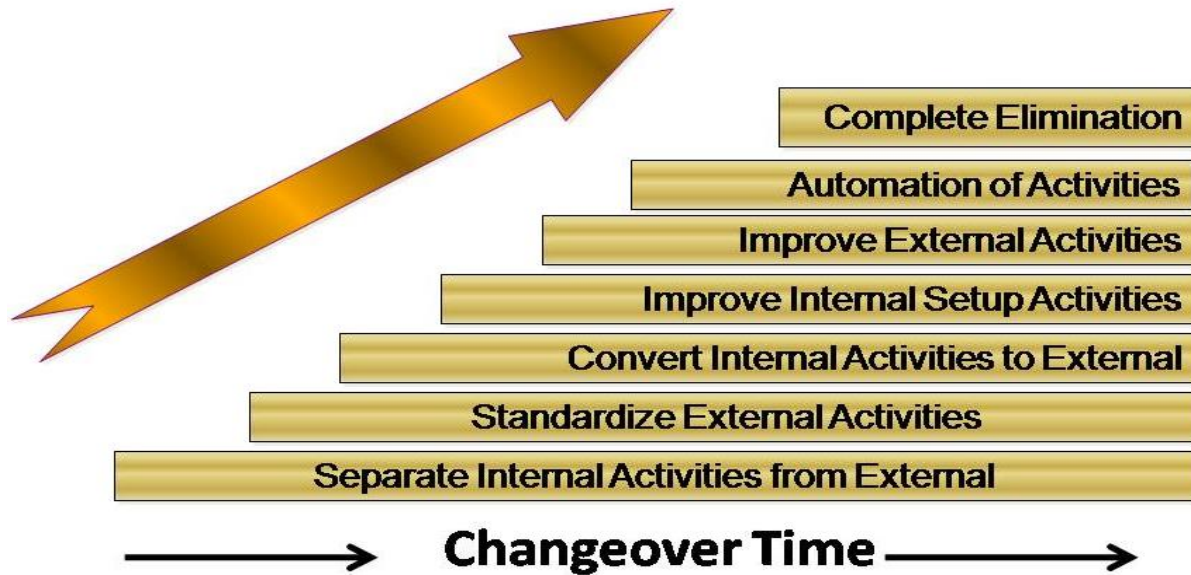
The time elapsed between when the **last good piece** of product A comes off and the **first good piece** of product B starts.



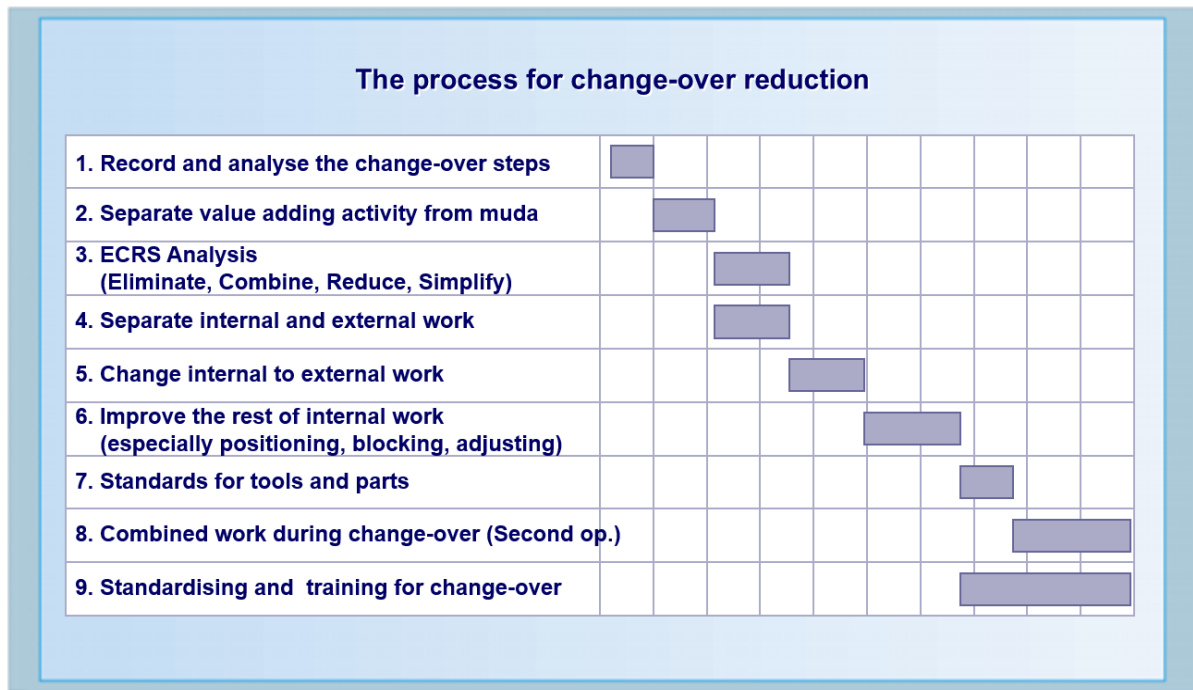
The 3 Step Method



7 Stages of SMED



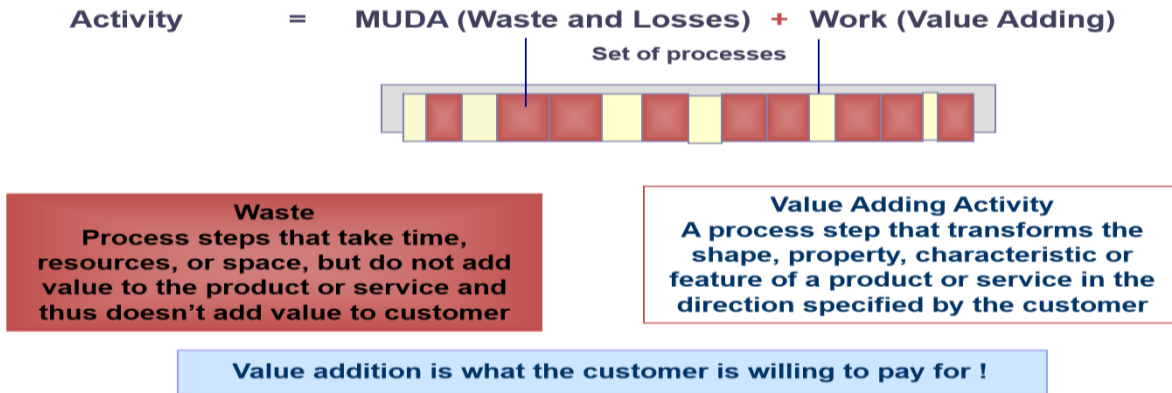
THE 9 STEPS – Analyze & Improve Changeover Time



4. Explain the 3 M's (MUDA, MURA, MURI) and what are the different types of wastes? (Slides on Lean)

MUDA – Waste. 7 non-value adding activities.

What is MUDA?

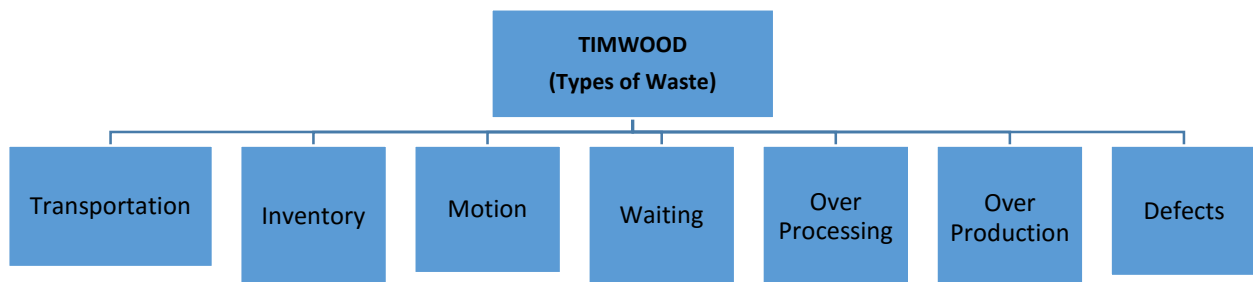


IS CHANGEOVER VALUE ADDING?

MURA – Variation/Unevenness. Deviation from set standard or expected outcome. Variation results in waste in the form of scrap, re-working or re-processing!

MURI – Physical Stress/ Strain – Can be avoided through standardized work

Causes of Muri: Working on processes you are not trained in, unreliable processes, poorly laid out work places, cluttered work places, lack of proper tools/equipment, Poor communication routes, lack of proper maintenance/ unreliable equipment



5. DEFINE VALUE STREAM MAPPING. WHY IS VALUE STREAM MAPPING AN ESSENTIAL TOOL?

A Value Stream is all the actions that are currently required to bring a product to the main flows essential to every product –

- The production flow **from raw material into the arms of the customer**
- The design flow from **concept to launch**

Value Stream Mapping is a paper & pencil tool that helps you to see & understand the flow of the material and information as a product makes its way through the value stream.

VSM means follow a products path from customer to supplier OR from supplier to customer and carefully draw a visual representation of every process in the material and information flow. Then ask a set of key questions and draw a future state map of how value should flow.

VSM is an Essential Tool because:

1. It helps you visualize more than just the single process level e.g.; assembly, welding etc. in production you can see the flow
2. It helps you see more than waste
3. Mapping helps you see the sources of waste in your value stream
4. It provides a common language for talking about manufacturing / service processes
5. It makes decisions about the flow apparent so you can discuss them, otherwise many details and decisions on the game bar (work place) just happen by default
6. VSM becomes the blue print for lean implementation. It forms the basis of an implementation plan by helping you design how the whole door to door flow should operate.
7. It shows the linkage between the information flow & material flow. **NO OTHER TOOL DOES THIS!**
8. It is more useful than quantitative tools and layout diagrams that produce a tally of non-value added steps, lead time, distance travelled, the amount of inventory and so on

VSM is a qualitative tool by which you describe in detail how your facility should operate in order to create a flow.

VSM Measures

Measure	Symb	Description
Takt time	Takt	Customer demand rate (available time/quantity required)
Lead time	L/T	Time to complete a batch (= inventory / process rate (Little's Law))
Production to delivery ratio	P:D	Lead time/Delivery time
Process time	P/T	Time to complete one item (=L/T-waiting time)
Operator cycle time	OCT	Labour time
Machine cycle time	MCT	Machine time
Value added time	V/A	Time to change fit, form or function
On-time delivery	OTD	On-time deliveries/Total deliveries %
Inventory	I	Equivalent number of days good product in stock
Stock turns	ST	Number of times/year stock is turned (Inventory days/365)
Batch size	Batch	Number of pieces per run

6. DEFINE PROCESS MAPPING. WHY PROCESS MAPPING AN ESSENTIAL TOOL?

PROCESS MAPPING DEFINITION: A “process map” visually describes the **flow of activities of a process**. A process flow can be defined as the sequence and interactions of related process steps, activities or tasks that make up an individual process, from beginning to end. **A process map is read from left to right or from top to bottom**. We prefer to minimize “backflow” or arrows that go from right to left or bottom to top because it can greatly confuse the reader.

EXAMPLE: It helps if a process map identifies a Supplier providing Intputs to a Process, which produces Outputs for a Customer. We call this basic format a SIPOC (Supplier, Input, Process, Output, and Customer) diagram

WHY PROCESS MAPPING? Establish what is happening - Measure – Manage - Improve

Why Process Mapping?

Making system changes without truly understanding how the process is working today, and why, can lead to costly mistakes

It can also create conditions that make it difficult for staff to work effectively, and often create further problems

If you do not measure a process, you will not be able to manage it effectively and if you cannot manage a process, you cannot improve it

It has been estimated that people working in organisations can waste about 15 - 20% of their time by re-doing things that are wrong, chasing things without result, querying incomplete instructions, doing other people's jobs and so on

Process mapping enables us to clearly define the current processes in chart form, identifying problem areas such as bottlenecks, capacity issues, delays or waste. Once identified, this knowledge provides a solid basis from which to develop solutions and introduce and plan new improved processes

Process mapping enables an organisation to:

- Establish what is currently happening, how predictably and why;
- Measure how efficiently the process is working;
- Gather information to understand where waste and inefficiency exist and their impact on the customer or partners
- Develop new improved processes to reduce or eliminate inefficiency

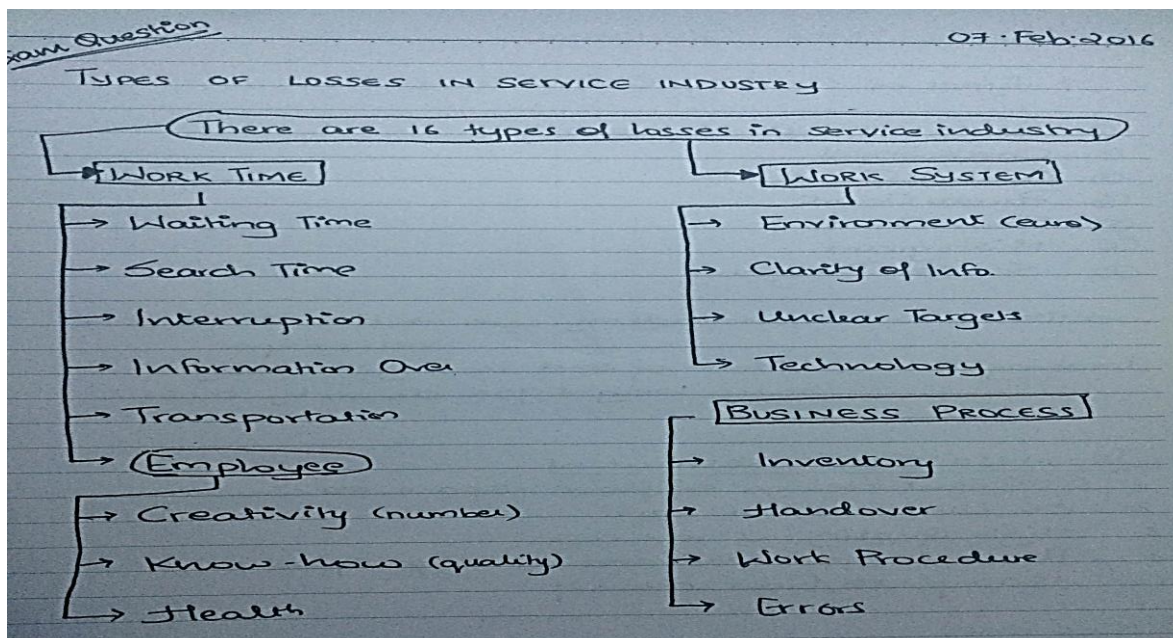
7. WHAT ARE THE 16 TYPES OF LOSSES IN THE SERVICE INDUSTRY?

WORK TIME: W-S-I-I-T

WORK SYSTEM: E-I-T-T

EMPLOYEE: C-K-H

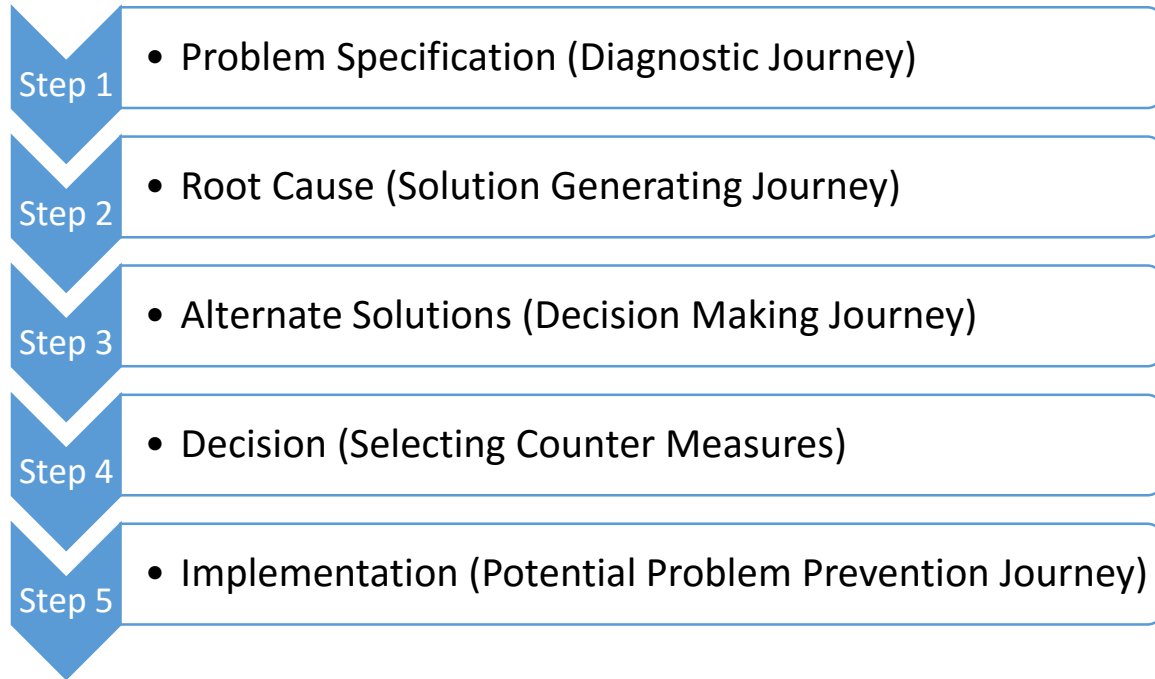
BUSINESS PROCESS: I-H-W-E



8. WRITE SHORT NOTES ON ANY TWO

a. PROBLEM SOLVING TECHNIQUES

Problem solving activities passes through four stages:



DIAGNOSTIC JOURNEY

Forward Thinking (From Cause to Effect)	Backward Thinking (From Effect to Cause)
Ideal for Simple Problems	Ideal for Complex Problems
<ul style="list-style-type: none"> • Define the problem (effect) • Cause-Effect Diagram • Check Sheet (Frequency of Causes) • Pareto Diagram (Identify Most Important Cause) • Five WHY (To find root cause) 	<ul style="list-style-type: none"> • Capture Problem Specifications • Kepner Tregoe Problem Analysis • Phenomenon Mechanism Analysis • Design of Experiments • Laguchi Methods

b. KANBAN

Kanban is a visual signal that's used to trigger an action. The word **Kanban** is Japanese and roughly translated means "card you can see." Toyota introduced and refined the use of **Kanban** in a relay system to standardize the flow of parts in their just-in-time (JIT) production lines in the 1950s.

Six Rules for an Effective Kanban System

To ensure a proper setup of Kanban in the workplace, Toyota has provided us with six rules for an effective Kanban system:

1. **Customer** (downstream) processes **withdraw** items in the precise amounts specified by the Kanban.
2. **Supplier** (upstream) **produces** items in the precise amounts and sequences specified by the Kanban.
3. **No items** are made or moved without a Kanban.
4. **A Kanban** should accompany each item, every time.
5. **Defects** and incorrect amounts are never sent to the next downstream process.
6. The **number of Kanbans** is reduced carefully to lower inventories and to reveal problems.

c. 5S (Refer Prof. Notes)



d. 7 QC Tools

- 7QC are useful in identifying issues related to quality. They are fundamental instruments in improving quality of the product.
- Used to **analyze** production process, **identify** the major problems, **control** fluctuations of product quality & **provide solutions** to avoid future defects
- QC Tools are used to organize the collected data in an easy way to understand and analyze
- Helps to minimize risks of errors or weaknesses in procedures
- Continuous use of these tools enhances personnel ability to think, generate ideas, solve problems and do planning
- All processes are affected by multiple factors and therefore statistical QC tools can be applied to any process (*C-C-C-P-F-H-S*)
 1. Cause & Effects Diagram (Fishbone or Ishikawa Diagram)
 2. Check Sheets (How often the causes occur)
 3. Control Charts (3 Std. Deviations above & below average)
 4. Pareto Chart (Prioritize the problems)
 5. Flow Chart (Step-by-step process flow + Identify an unnecessary problem)
 6. Histogram (Bar Chart of accumulated data)
 7. Scatter Diagram (Shows a pattern of correlation between 2 variables)

e. Dr. Shigeo Shingo

BY 1959: Dr. Shigeo had gained notable fame as an “engineering genius” from his work in developing **JUST-IN-TIME (JIT), and consequently the TOYOTA PRODUCTION SYSTEM**

The basic essence of JIT has been implemented to the new “continuous improvement” or “lean manufacturing” wave in the industry today. The primary objective in implementing JIT to a production facility is to obtain a competitive advantage and increased productivity by eliminating the seven types of wastes!

BY 1961: Dr. Shigeo incorporated his knowledge of quality control to develop the ‘Defects=0’ concept. This concept is also commonly known as **POKA-YOKE OR MISTAKE PROOFING.**

Zero Quality Control Equation = Poka-Yoke Techniques to correct defects + Source Inspection to prevent defects

Dr. Shigeo Shingo’s Zero Quality Control (ZQC) techniques make use of the following engineering principles:

- 100 percent inspections done at the source instead of sampling inspections

- Immediate feedback from successive quality checks and self-checks
- Poka-yoke designed manufacturing devices

BY 1970: Dr. Shigeo developed perhaps the most revolutionary concept in manufacturing called **“SINGLE MINUTE EXCHANGE OF DIES”**. This concept was integrated into the JIT/ Toyota Production System with a significant reduction in operating costs.

SMED was developed in order to reduce the fixed cost associated with the setup and changeover of dies. The basic elements driving the SMED concept are to reduce the setup time of dies, which directly result in smaller batch sizes for parts. A smaller batch size translates as lower costs associated with work in process inventory storage. This concept is especially beneficial as it allows the manufacturing system to quickly adjust to engineering design changes with very little costs. In addition, SMED allows for higher machine utilization and in turn results in higher productivity

9. EXPLAIN BRIEFLY ANY 2 OF THE FOLLOWING CREATIVITY BASED TECHNIQUES. HOW DO THESE TECHNIQUES HELP IN PRODUCTIVITY IMPROVEMENT?

a. BRAINSTORMING

The original approach to brainstorming was developed by Madison Avenue advertising executive, Alex Osborn, in the 1950s. Since then, many researchers have explored the technique, and have identified issues with it.

What is Brainstorming?

Brainstorming combines a relaxed, informal approach to problem-solving with lateral thinking. It asks that people come up with ideas and thoughts that can at first seem to be a bit crazy. The idea here is that some of these ideas can be crafted into original, creative solutions to the problem you're trying to solve, while others can spark still more ideas. This approach aims to get people unstuck, by "jolting" them out of their normal ways of thinking.

During brainstorming sessions there should therefore be no criticism of ideas: You are trying to open up possibilities and break down wrong assumptions about the limits of the problem. Judgments and analysis at this stage stunt idea generation. Ideas should only be evaluated at the end of the brainstorming session – this is the time to explore solutions further using conventional approaches.

Individual Brainstorming

- ✓ While group brainstorming is often more effective at generating ideas than normal group problem-solving, study after study has shown that when individuals brainstorm on their own, they **come up with more ideas**

(and often better quality ideas) than groups of people who brainstorm together. Partly this occurs because, in groups, people aren't always strict in following the rules of brainstorming, and bad group behaviors creep in. Mostly, though, this occurs because people are paying so much attention to other people's ideas that they're not generating ideas of their own – or they're forgetting these ideas while they wait for their turn to speak. This is called "blocking".

- ✓ When you brainstorm on your own, you'll tend to produce a wider range of ideas than with group brainstorming - **you do not have to worry about other people's egos or opinions**, and can therefore be more freely creative.
- ✓ For example, you might find that **an idea you'd be hesitant to bring up in a group session develops into something quite special when you explore it with individual brainstorming.** Nor do you have to wait for others to stop speaking before you contribute your own ideas. You may not, however, develop ideas as fully when you brainstorm on your own, as you do not have the wider experience of other members of a group to help you.
- ✓ When Brainstorming on your own, **consider using Mind Maps** and develop ideas

Group Brainstorming

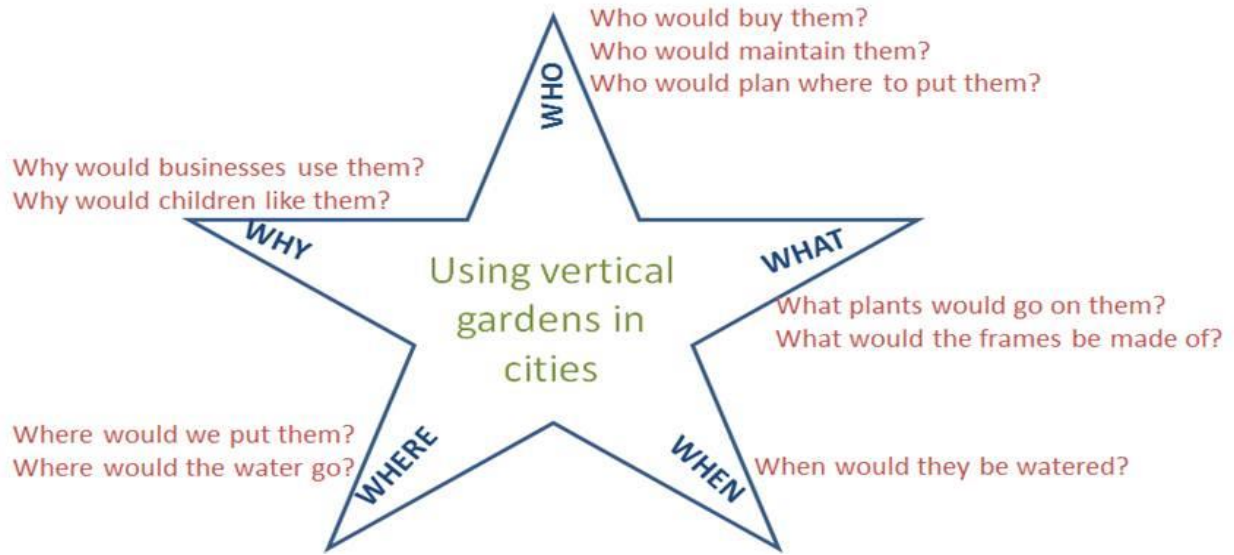
- ✓ When it works, group brainstorming can be very effective for bringing the full experience and creativity of all members of the group to bear on an issue. When individual group members get stuck with an idea, **another member's creativity and experience can take the idea to the next stage.**
- ✓ Group brainstorming can therefore develop **ideas in more depth** than individual brainstorming.
- ✓ Another advantage of group brainstorming is that it **helps everyone involved to feel that they've contributed to the end solution,** and it reminds people that other people have creative ideas to offer.
- ✓ What's more, brainstorming is fun, and it can be **great for team-building!**
- ✓ Brainstorming in a group can be risky for individuals. **Valuable but strange suggestions may appear stupid at first sight.** Because of this, you need to chair sessions tightly so that ideas are not crushed, and so that the usual issues with group problem-solving don't stifle creativity.

Comments that reduce Brainstorming to Braindrizzling



- | | |
|-----------------------------|--------------------------------------|
| • That won't work | • It's against our policy |
| • That's too radical | • We haven't done it that way before |
| • It's not our job | • That's too expensive |
| • We don't have enough time | • That's not practical |
| • That's too much hassle | • We can't solve this problem |

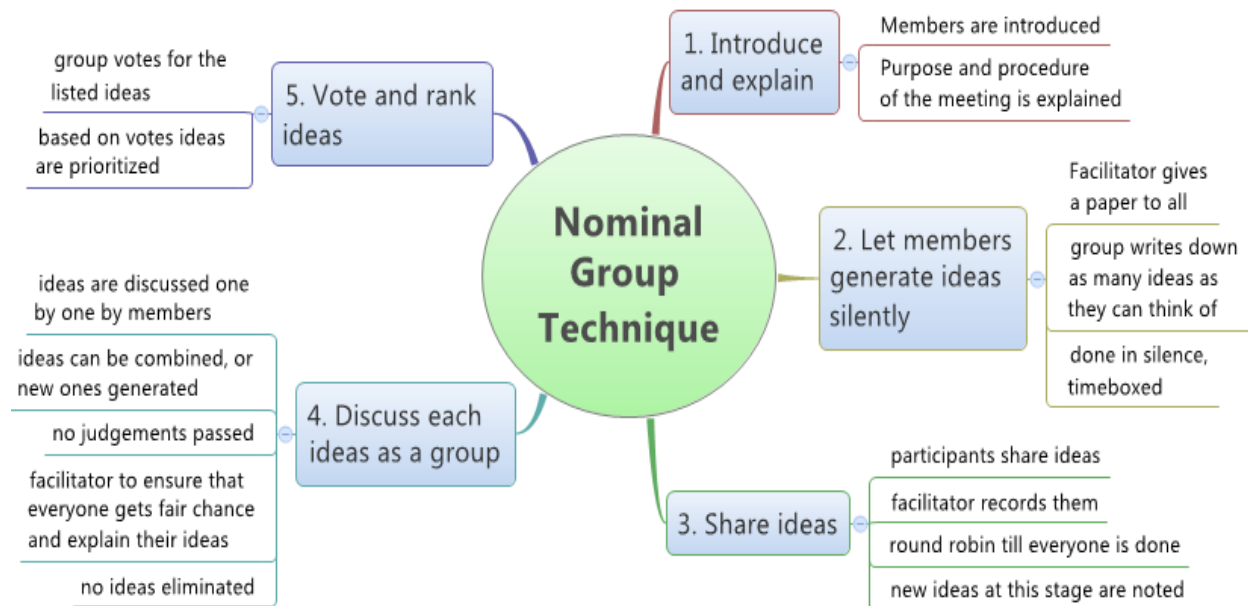
EXAMPLE OF BRAINSTORMING – VERTICAL GARDENS IN CITIES



b. Nominal Group Technique

When to use Nominal Group Technique:

- When you want to generate a lot of ideas to and want to assure all members **participate freely without influence from other participants.**
- When you want to **identify priorities or select a few alternatives** for further examination.



Guidelines for Conducting the Nominal Group Technique Activity:

- 1. Provide tables for participants.** Have participants seated where they can write and provide paper and pencils if needed. Members are introduced. Purpose of meeting explained.
- 2. Develop the focus question.** Write the question as an issue statement which defines the issue in general but does not offer solutions. Participants should be assured there are lots of alternatives and there is not "one right answer." The statement should be written on flip chart paper so all group members can see it.
- 3. Silently brainstorm ideas.** Participants are allowed 5 – 10 minutes to write down all their responses.
- 4. Sharing Ideas/Round robin.** Each person shares one idea at a time in a round robin format until all ideas have been listed on flip chart paper. Encourage "hitchhiking" of ideas even if they were not written down. Don't combine similar ideas at this time – list each separately.
- 5. Discuss and clarify all ideas on the flip chart.** Each idea is fully discussed. Participants are encouraged to share thoughts, both pro and con about items. Everyone in the group should be clear on the meaning of each item. Ask contributors to further explain if necessary. If the contributors agree some ideas are the same, delete duplication. However, combining of two or more ideas into one should not be done at this time. Number each alternative.
- 6. Ranking of alternatives.** Each group member is asked to rank order their **top ten alternatives**. Ten being the most important. This may be done by having participants write the rank beside the idea directly on the flip chart or by listing the idea on a 3X5 index card and writing their rank in the bottom right corner of the card. The facilitator collects the cards and records each ranking beside the alternative, assuring anonymous rankings. The ranks for each alternative are averaged
- 7. Ranked items are discussed.** All items receiving a rank are listed so all participants can view. The ranking of each item is designated. (The higher the total, the higher the rank.) Further discussion and clarification of the ranked items is led by the facilitator to ensure that all participants understand what is meant by each priority.
- 8. 2nd Ranking.** From among the ranked items on the previous list, each participant ranks the ten items he now considers most important. This is done silently and independently as in step 6. (This ranking might be limited to **five items per person**.) The rankings are again averaged.
- 9. Final rankings are discussed.** The group reviews the ranking and discusses the outcome of the activity.
- 10. Format for sharing results.** Create a table listing all ranked items, beginning with the item ranked the highest. Include a column indicating the total votes each item received and the number of persons casting a vote for that item.

EXAMPLE OF NOMINAL GROUP TECHNIQUE:

Issue	Paul	Mary	Peter	Total
Inadequate training	5	2	5	12
Unclear standards	3	6	3	12
Poor materials	2	3	1	6
High turnover	1	1	2	4
Inefficient processes	4	5	6	15
Hidden agendas	6	4	4	14

c. Delphi Technique

Definition: Delphi represents a useful communication device among a group of experts and thus facilitates the formation of a group judgement.

The Basics of the Delphi Method. The Delphi method is an exercise in group communication among a panel of geographically dispersed experts. The technique allows experts to deal systematically with a complex problem or task. The essence of the technique is fairly straightforward. It comprises a series of questionnaires sent either by mail or via computerized systems, to a pre-selected group of experts. These questionnaires are designed to elicit and develop individual responses to the problems posed and to enable the experts to refine their views as the group's work progresses in accordance with the assigned task. The main point behind the Delphi method is to overcome the disadvantages of conventional committee action. **According to Fowles** *anonymity, controlled feedback, and statistical response characterize Delphi*. The group interaction in Delphi is anonymous, in the sense that comments, forecasts, and the like are not identified as to their originator but are presented to the group in such a way as to suppress any identification.

In the original Delphi process, the key elements were **(1)** structuring of information flow, **(2)** feedback to the participants, and **(3)** anonymity for the participants.

Clearly, these characteristics may offer distinct advantages over the conventional face-to-face conference as a communication tool. The interactions among panel members are controlled by a panel director or monitor who filters out material not related to the purpose of the group.

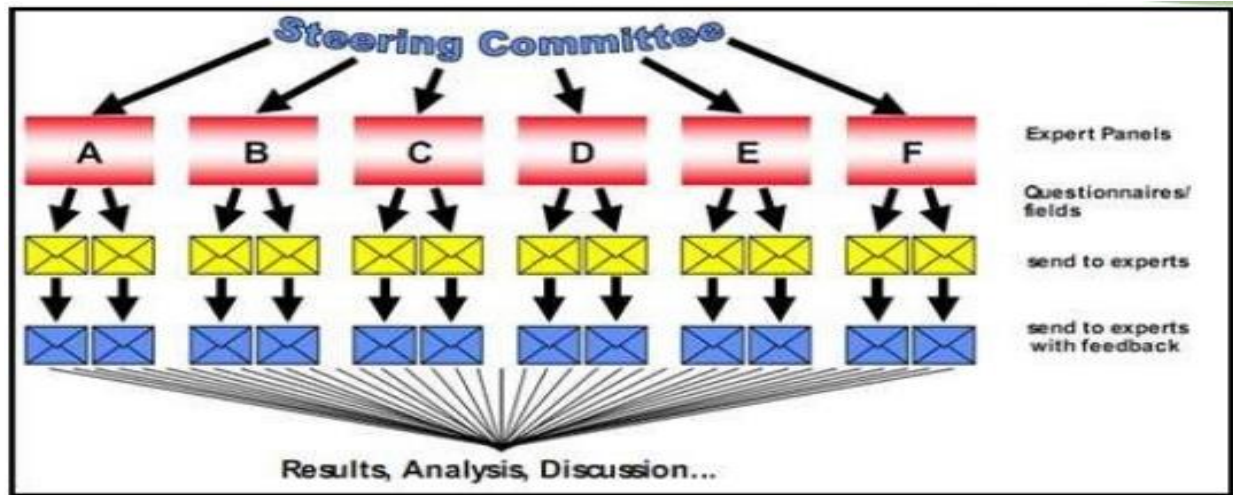
The usual problems of group dynamics are thus completely bypassed. Fowles describes the following ten steps for the Delphi method:

- i. **Formation of a team** to undertake and monitor a Delphi on a given subject.
- ii. **Selection of one or more panels** to participate in the exercise. Customarily, the panelists are experts in the area to be investigated.
- iii. **Development of the first round** Delphi questionnaire
- iv. **Testing the questionnaire** for proper wording (e.g., ambiguities, vagueness)
- v. **Transmission** of the first questionnaires to the panelists
- vi. **Analysis of the first round** responses
- vii. **Preparation of the second round** questionnaires (and possible testing)
- viii. **Transmission of the second round** questionnaires to the panelists
- ix. **Analysis of the second round** responses (Steps vii to ix are reiterated as long as desired or necessary to achieve stability in the results.)
- x. **Preparation of a report** by the analysis team to present the conclusions of the exercise

The Delphi method has got criticism as well as support. The major concerns about the Delphi method:

- **Discounting the future:** Future (and past) happenings are not as important as the current ones, therefore one may have a tendency to discount the future events.
- **The simplification urge:** Experts tend to judge the future of events in isolation from other developments. A holistic view of future events where change has had a pervasive influence cannot be visualized easily. At this point cross-impact analysis is of some help.
- **Illusory expertise:** some of the experts may be poor forecasters. The expert tends to be a specialist and thus views the forecast in a setting which is not the most appropriate one.
- **Sloppy execution:** there are many ways to do a poor job. Execution of the Delphi process may lose the required attention easily.
- **Format bias:** it should be recognized that the format of the questionnaire may be unsuitable to some potential societal participants.
- **Manipulation of Delphi:** The responses can be altered by the monitors in the hope of moving the next round responses in a desired direction.

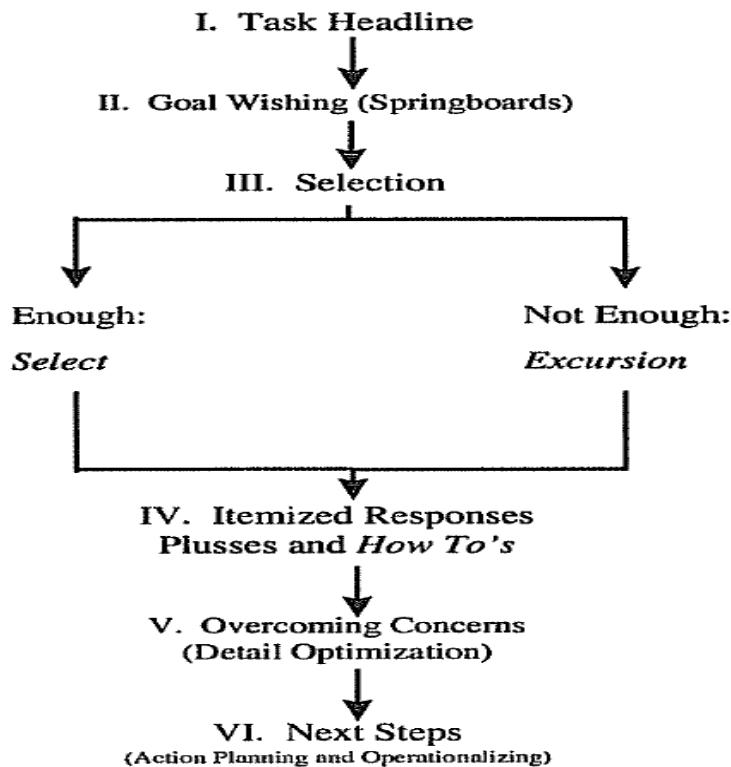
EXAMPLE OF DELPHI:



d. Syntetics

One brainstorming tool is syntetics, developed by William J Gordon in 1961 as an approach to creative thinking. Syntetics stimulates thought processes of which the subject is generally unaware. It is a systematic process that allows random connections and intuition to develop unique solutions.

Syntetics Creative Problem Solving Method



Sample Four Box Synectics for Database (using common household items)

<p>Closet</p> <p>A database is like a closet because it is used for storing information.</p>	<p>Drawer</p> <p>A database is like a drawer because it helps to keep information organized.</p>
<p>Trashcan</p> <p>A database is like a trashcan because you can delete any information you no longer want.</p>	<p>Doorway</p> <p>A database is like a doorway because it is a portal to your information.</p>

A _____ is like a _____ because...

Instructional Strategies for Engaging Learners
 Guilford County Schools TF, 2002

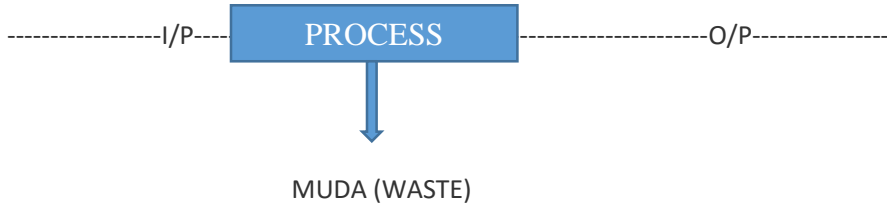
10. Traditional Versus Modern Productivity Techniques

TRADITIONAL	LEAN
Make product/services according to forecast (push) E.g. Maruti 800 white cars	Customer demand triggers production or services requirement – Pull System
Longer Lead Times	It can fill the customer order very quickly
Inventory was necessary buffer for uncertain demand	Modern Production techniques aim for zero product inventory
Allowed few changes to standard products and follow-ups (Fixed line content & equipment)	Change quickly to the next model and grow easily in the product life cycle
	Adjust capacity by assigning resources based on daily demand (The correlation is to the TAT)
Key suppliers of product/services were kept in dark with respect to growth, technology, production, NPD, Introduction	Choose strategic supplies that help the company to grow capacity technology, quality, flexibility etc.

11. EXPLAIN THE FOLLOWING TERMS

a. PRODUCTIVITY

Productivity is the ratio between “Output of Work” and “Input of Resources” used in the process of creating wealth.



Hence, there are two major ways to increase productivity: increase the numerator (output) or decrease the denominator (input).

Productivity is useful as a relative measure of actual output of production compared to the actual input of resources, measured across time or against common entities. As output increases for a level of input, or as the amount of input decreases for a constant level of output, an increase in productivity occurs. Therefore, a "productivity measure" describes how well the resources of an organization are being used to produce input.

Productivity measures can be divided in measures of:

- 1. Partial productivity of labor or capital**, given by the relationship between the values of obtained production (in a given interval) and the quantity of labor or capital used in the production process.
- 2. Total productivity or global factor productivity**, given by the value of the production and the value of the factors employed in the productive process.

b. PARTIAL PRODUCTIVITY

The standard definition of productivity is actually what is known as a partial factor measure of productivity, in the sense that it only considers a single input in the ratio. The formula then for partial-factor productivity would be the ratio of total output to a single input. The labor partial productivity index (LPI) is given by:

$$P = Y / L; \text{ where } P = \text{Partial Productivity, } L = \text{Labor, } Y = \text{Year}$$

Time comparison between present year “t” and previous year “s” is given as:

$$P = Y_t / L_t \text{ divided by } Y_s / L_s$$

Managers generally utilize partial productivity measures because the data is readily available. Also, since the total of **multifactor measures provides an aggregate perspective, partial factor productivity measures are easier to relate to specific processes**. Labor-based hours (generally, readily available information) is a

frequently used input variable in the equation. When this is the case, it would seem that productivity could be increased by substituting machinery for labor. However, that may not necessarily be a wise decision. Labor-based measures do not include mechanization and automation in the input; thus when automation replaces labor, misinterpretation may occur.

Partial Productivity

Definition : Ratio of output to one class of input

- At a given time it considers only one input and ignores all other inputs
- It is important as it focuses utilization of one resource
- Labour productivity is measured using utilization of labour-hours, whereas capital productivity is measured in Rupees

Other partial factor measure options could appear as output/labor, output/machine, output/capital, or output/energy. Terms applied to some other partial factor measures include capital productivity (using machine hours or dollars invested), energy productivity (using kilowatt hours), and materials productivity (using inventory dollars).

c. TOTAL FACTOR PRODUCTIVITY (*Labor & Capital*) – *Output & Input Need not be expressed in same units*

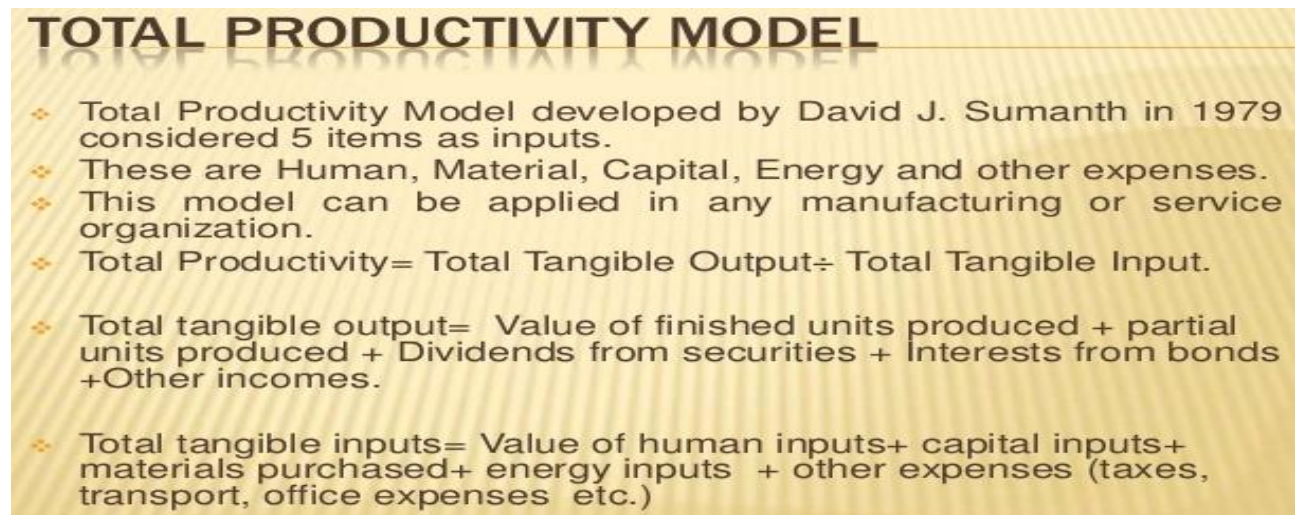
Total Factor Productivity

- In an effort to improve productivity of labour, company may install more machinery. Then productivity of labour will go up bringing down the capital productivity
- Partial productivity that typically uses only one resource at a time fails to grasp this paradox
- Historically labour and capital were considered to be the most significant contributors in the process of production
- John Kendrick in 1951 emphasised labour and capital as only two input factors
- Disadvantage of considering total productivity factors is that it does not consider impact of material and energy inputs (material typically forms 60% of the product cost)

Total output must be expressed in the same unit of measure and total input must be expressed in the same unit of measure. However, total output and total input need not be expressed in the same unit of measure. Resources are often converted to dollars or standard hours so that a single figure can be used as an aggregate measure of total input or output. For example, total output could be expressed as the number of units produced, and total input could be expressed in dollars, such as **tons of steel produced per dollar input.**

Total productivity ratios reflect simultaneous changes in outputs and inputs. As such, total productivity ratios provide the most inclusive type of index for measuring productivity and may be preferred in making comparisons of productivity. However, they do not show the interaction between each input and output separately and are thus too broad to be used as a tool for improving specific areas.

d. TOTAL PRODUCTIVITY MODEL (*Human, Material, Capital, Energy, Other Expenses*)



TOTAL PRODUCTIVITY MODEL

- ❖ Total Productivity Model developed by David J. Sumanth in 1979 considered 5 items as inputs.
- ❖ These are Human, Material, Capital, Energy and other expenses.
- ❖ This model can be applied in any manufacturing or service organization.
- ❖ $\text{Total Productivity} = \frac{\text{Total Tangible Output}}{\text{Total Tangible Input}}$.
- ❖ $\text{Total tangible output} = \text{Value of finished units produced} + \text{partial units produced} + \text{Dividends from securities} + \text{Interests from bonds} + \text{Other incomes}$.
- ❖ $\text{Total tangible inputs} = \text{Value of human inputs} + \text{capital inputs} + \text{materials purchased} + \text{energy inputs} + \text{other expenses (taxes, transport, office expenses etc.)}$

e. MULTI FACTOR MODEL OF PRODUCTIVITY (*Labor, Material, Energy*)

Multi-Factor Model of Productivity

- **Total Factor productivity model was further developed by Scott D Sink as Multi Factor Productivity Measurement Model in which he considered Labour, Material and Energy as major inputs**
- **Capital was not considered in this model as it is the most difficult part to estimate how much of a capital is being consumed in a unit of time**
- **Depreciation applied by accountants makes it further difficult to estimate actual capital being consumed**

$$\text{MFP} = \frac{\text{Output}}{\text{Inputs (labour + energy + material)}}$$

Changes in MFP reflect the effects of changes in:

- management practices,
- brand names,
- organizational change,
- general knowledge,
- network effects,
- spillovers from production factors,
- adjustment costs,
- economies of scale,
- The effects of imperfect competition and measurement errors.

Growth in MFP is measured as a residual, i.e. that part of GDP growth that cannot be explained by changes in labor and capital inputs. In simple terms therefore, if labor and capital inputs remained unchanged between two periods, any changes in output would reflect changes in MFP. This indicator is measured as an index and in annual growth rates.

f. APC MODEL

American Productivity Centre (APC) Model

American Productivity Centre has been advocating a productivity measure that relates profitability with productivity and price recovery factor

Profit = Revenue - Expenses

Profitability = Sales / Costs = $\frac{\text{Output Quantities X Prices}}{\text{Input Quantities X Unit Costs}}$

Productivity x Price Recovery Factor

The APC model is different from other models in its treatment, by inclusion of Price Recovery Factor

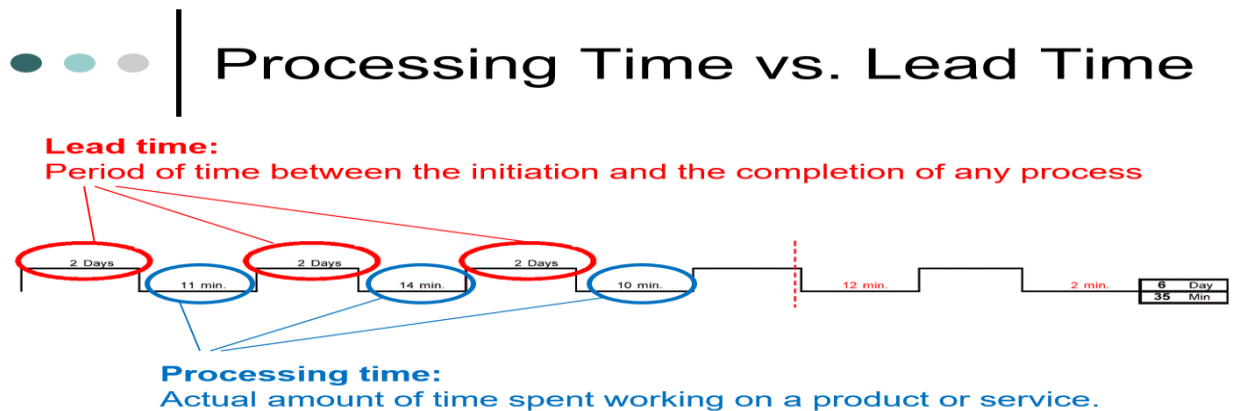
g. CYCLE TIME

It is the total time from the beginning to the end of your process as defined by you and your customer. Cycle time includes process time, during which a unit is acted upon to bring it closer to an output and delay time, during which a unit of work is spent waiting to take the next action.

$$\text{Lead Time} = \text{Cycle Time} * \text{WIP OR WIP/Throughput}$$

Lead time is measured by elapsed time (minutes, hours etc.) whereas cycle time is measured by the amount of time per unit (mins/customer, hours/part etc.)

12. PROCESS TIME VERSUS LEAD TIME



Note:

Lead time can easily be reduced by eliminating interfaces, whereas reducing processing time requires usually investments in better equipment and training.

13. PROCESS MAPPING VERSUS VALUE MAPPING

Value Stream Mapping

1. gathers and displays a far broader range of information than a typical process map.
2. tends to be at a higher level (5-10 boxes) than many process maps.
3. tends to be used at a broader level, i.e. from receiving of raw material to delivery of finished goods.
4. tends to be used to identify where to focus future projects, subprojects, and/or kaizen events