

The image features a horizontal banner with a blue background on the left and a photograph on the right. The photograph shows a man in a black wetsuit holding a surfboard against a clear blue sky. The Protegra logo is overlaid on the blue part of the banner.

Protegra

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Lean

Agenda

- **Introduction to Lean**
- **Lean Manufacturing**
- **The tools in Lean Manufacturing**

Lean



- **Lean is about delivering the values the customers demand using the least possible effort.**
- **Lean is not a project but a new way of working. A culture.**
- **At it's heart Lean is about finding and eliminating waste**
- **Give the clients what they want, when they want it, and nothing more**

History of Lean



- **”Lean” was first used at Toyota’s production in Japan.**
- **Today Lean is the most common tool to optimize value streams world wide.**

What is “Lean”



- **The application of the Toyota Production System principles focused on value and the elimination of waste:**
 - **Value.** The value that citizens look/pay for from this organization
 - **Value Stream.** Activities that are linked together to deliver this value
 - Use these to see the waste and design future-state of such value streams that are free of waste.
 - **Flow.** Value streams without bottlenecks, re-work, endless approval loops, duplication of effort and activities that simply add no value to the citizens
 - **Pull.** Let the next operation downstream pull from the previous; only produce what is necessary, when it is required (like Just-in-Time).
 - **Perfection.** This is the magic wand, lean’s silver bullet, if ever there was one. Without the ability to reduce/eliminate errors, organizations always spend too much to achieve too little
- **The use of *Lean* tools and techniques**
- **Developing people and a *Lean* culture – problem-solvers needed!**

7 types of Waste



- **1. Overproduction**

- Producing more than the internal or external customer needs
- Producing sooner than the internal or external customer needs
- Why is it waste? Overproduction results in obsolescence, handling damage and undetected defects. It
- requires extra handling, extra space, extra interest charges, extra machinery and extra labour.
- Causes? Lack of communication, inappropriate reward system, focus on keeping busy rather than meeting customer needs

- **2. Delays (waiting time)**

- People waiting for: Machinery, Tooling, Raw Materials, Maintenance, etc.
- Machinery waiting for: Maintenance, People, Materials, Tooling etc.
- Causes? Inconsistent work methods, long changeover times

Reference: North America's Largest Lean Manufacturing Conference, October 6-10, 2003

7 types of Waste - continued



- **3. Transportation**

- Moving materials or people over long distances can double or triple handling
- Causes? Poor layout, lack of co-ordination of processes, poor housekeeping, poor workplace organization, multiple storage locations

- **4. Processes**

- Unnecessary or inefficient processing e.g. removing burrs caused by dull tools
- Causes? Inappropriate tooling or equipment, poor tooling maintenance, failure to combine operations

- **5. Inventories**

- Inventory hides problems and causes extra handling, extra paperwork, extra space and extra cost
- Causes? Long changeover times, unreliable equipment, unbalanced flow, incapable suppliers, inaccurate forecasting, large batch sizes

Reference: North America's Largest Lean Manufacturing Conference, October 6-10, 2003

7 types of Waste - continued



- **6. Motions**
 - Any motion of people or machines which does not add value to the product or service
 - Causes? Lack of workplace organization, poor layout, inconsistent work methods, poor machine design
- **7. Defective products**
 - Scrap, rework, customer returns, customer dissatisfaction
 - Causes? Incapable processes, insufficient training, lack of standardized procedures
- **7 + 1. Defective Design**
 - Designs which do not meet customers needs, unnecessary extra features
 - Causes? Lack of customer input in design, over-design

Reference: North America's Largest Lean Manufacturing Conference, October 6-10, 2003

Principles of Lean Thinking - Value



- **Define value precisely from the perspective of the end customer, in terms of a specific product, with specific capabilities, offered at a specific price and time.**
- **As Taiichi Ohno, one of the creators of the Toyota Production system put it, all industrial thinking must begin by differentiating value for the customer, from muda – the Japanese term for waste.**

Reference: North America's Largest Lean Manufacturing Conference, October 6-10, 2003

Principles of Lean Thinking – Value Stream



- **Identify the entire value stream for each service, product or product family and eliminate waste. The value stream is all the specific actions required to bring a specific service or product through three critical activities in any business:**
 - Product/Service definition – from concept through detailed planning through launch
 - Information management – from order taking through detailed scheduling to delivery
 - Physical transformation – initial concept, to the receipt of the service/product by the customer
- **Identifying the value stream almost always exposes enormous amounts of waste in the form of unnecessary steps, backtracking, and scrap, as the throughput travels from department to department and from company to company.**

Reference: North America's Largest Lean Manufacturing Conference, October 6-10, 2003

Value Stream



- **Value and Value Stream**
 - Specify value from the customer's viewpoint
 - Value stream maps the flow of information deployed by the organization to deliver value
 - Flow links all the processes . Generate the shortest lead times with the required quality and minimal waste.
 - Pull : the previous process in the value stream only produces what the next process needs; when it needs it.
 - Perfection: doing the right things right, the first time.
- **Beware of activities that are not on the value stream; do they help the organization deliver value or reduce waste? If not, why are you doing them?**

Principles of Lean Thinking – Flow



- **Make the remaining value-creating steps flow. Making steps flow means working on each design, order, and product continuously from beginning to end so that there is no waiting, downtime, or waste, within or between the steps. This usually requires introducing new types of organizations or technologies and getting rid of “monuments” – obstructions whose large scale or complex technology necessitates operating in a batch mode.**

Reference: North America's Largest Lean Manufacturing Conference, October 6-10, 2003

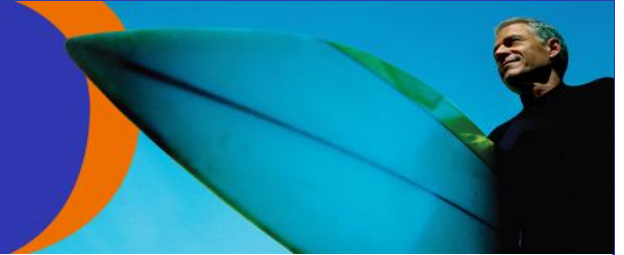
Principles of Lean Thinking – Flow



- **Design and provide what the customer wants only when the customer wants it. Letting the customer pull the product/service from the value stream eliminates the following types of waste:**
 - designs that are obsolete before the product is completed, finished goods, inventories, elaborate
 - inventory/information tracking systems, and “left overs” no one wants.

Reference: North America’s Largest Lean Manufacturing Conference, October 6-10, 2003

Principles of Lean Thinking – Perfection (Continuous Improvement)



- Pursue perfection.
- A lean thinking enterprise sets their sights on perfection. The idea of total quality management is to systematically and continuously remove the root causes of poor quality – with the ultimate goal of achieving Zero defects.

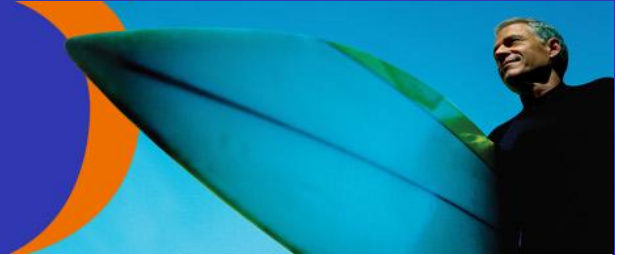
Reference: North America's Largest Lean Manufacturing Conference, October 6-10, 2003

Lean Principles



- 1. Define the value demanded by the customer.**
- 2. Define the value stream that creates the value.**
- 3. Create flow in the value stream.**
- 4. Create pull (based on orders).**
- 5. Continuous improvements**

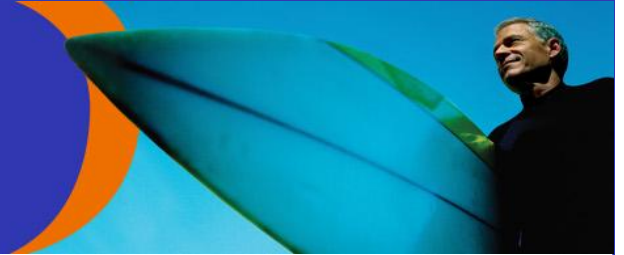
Lean Manufacturing



- **Lean Manufacturing covers a major tool box used in production and manufacturing, all supporting the 5 principles of Lean.**
- **Lean Manufacturing can be used in all kinds of production, in all sizes of production and in the production of any kind of product.**
- **This includes Software Development!**

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Focus



- **Focus on "value to customers".**
- **Flow in and between all processes.**
- **Focus on continuous improvements.**
- **A common language.**
- **Improved quality, reduced inventory, faster throughput time, improved service and a much better bottom line.**

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Lean Results



- **Increased productivity and capacity.**
- **Shorter lead-time.**
- **Improved customer service.**
- **Reduced inventory.**
- **Improved quality level.**
- **Visibility in performance measuring.**
- **Improved work environment.**

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Lean Tools



- **5S system and order.**
- **Mapping of value streams.**
- **OEE and SMED.**
- **Flow and pull.**
- **Kanban stock control.**
- **Planning boards.**
- **Continuous improvements.**

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Value Stream Mapping Workshop



- **Can anyone suggest an example or two we can use to demonstrate Value Stream Mapping?**

5S and System Order



- **5S is a tool to create system and order in a production site.**
- **Items used daily are placed at hand. Others are placed centrally or removed.**
- **5S is not just a clean-up. There is focus on continuous improvement of the 5S-level.**
- **How to get started**
 1. Sort all parts, tools and fixtures in "daily in use", "regularly in use" and "never in use".
 2. Place "daily in use" at hand and "regularly" centrally in department.
 3. Throw out the "never in use".
 4. Make standard for maintaining and improving the achieved 5S-level.

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5S Results



- **Improves ergonomics and safety.**
- **Easier to take over a work place from a colleague.**
- **Reduces change-over time.**
- **Time spent on searching is reduced.**
- **Improves productivity.**
- **Improves quality – always right tools.**

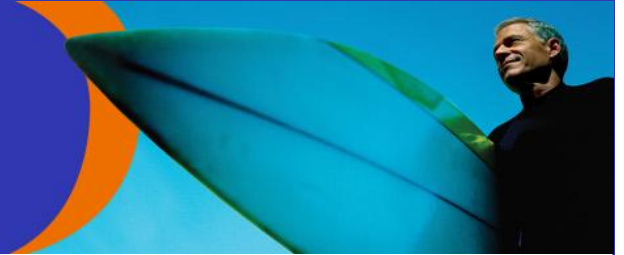
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The 5 S's

- **Organization (seiei)** – keeping on hand only what's needed for the process – the rest is red-tagged & removed, making it easy to see the naked process in it's uncluttered state.
- **Orderliness (seiton)** – a place for everything and everything in its place for immediate retrieval and use.
- **Cleanliness (seiso)** – Keep the workplace clean, spotless, and shining. A necessity as we begin to achieve global defect rates of 10 faulty parts per million and less.
- **Standardized Cleanup (seitetsu)** – It's the condition we achieve when we maintain the first 3 pillars. Everyone plays a role.
- **Discipline (shitsuke)** – Through the strength of personal will and self-esteem, make a habit of maintaining the established procedures every day.

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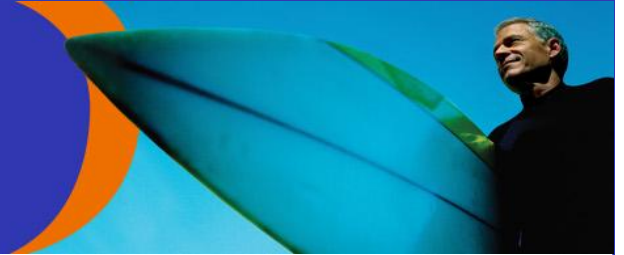
Value Stream Mapping



- **Map the current value stream.**
- **Set-up goals for future value stream and define gaps to close.**
- **Define the future and the tasks!**
- **How to get started**
 1. Define the value you wish to map. E.g. a product family.
 2. Invite the interested parties.
 3. Map the current value stream.
 4. Set-up goals for the future stream.
 5. "Map" the future value stream.
 6. Implement the future value stream.

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Value Stream Mapping Results



- **Understanding of the situation and why there is a need for change.**
- **Focus on value stream – and what creates value in the stream.**
- **Knowledge of the conditions to create flow and reduce inventory.**
- **Focus on flow instead of departments/machines.**

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OEE and SMED



- **High utilization of machines and shorter change-over times are conditions to create flow.**
- **Knowledge of machine utilization and loss factors using an OEE-measuring gives all possibilities to improve the capacity.**
- **Reduction of change-over times using SMED reduce batch sizes.**
- **How to get started**
 1. Localize the bottlenecks.
 2. Record OEE on these bottlenecks.
 3. The OEE-records are converted into OEE-curves which show the loss factors and the size of these.
 4. The highest loss factors are reduced. E.g. machine stops, change-over times and lack of material.

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OEE and SMED Results



- **An improvement of the utilization at a bottleneck by 10% – increases the capacity in a value stream by 10%!**
- **Reduction of change-over times is often used to improve the utilization of a machine.**
- **Knowledge of loss factors gives a clear picture of the way to prioritize the effort to improve capacity.**

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Flow and Pull



- **Flow creates value with minimum waste down the value stream.**
- **Lean has focus on flow between processes, departments and companies.**
- **With flow and a short lead-time the basis is ready for pull – production based on customer orders.**
- **How to get started**
 1. Stabilization of all processes that are part of a future flow is a must.
 2. Processes are physically moved close to each other in a flow.
 3. Flow shortens the throughput time. The production can now be based on customer orders (pull) instead of on forecasts (push).

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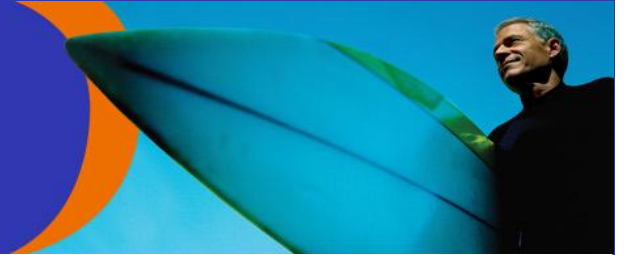
Flow and Pull Results



- **Shortened throughput time and hence also a shorter lead-time to customers.**
- **Less need for inventory.**
- **Less scrap – quality problems are discovered faster.**
- **Improved cash flow.**
- **The need for forecasts is decreased**

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Kanban stock control



- **Unlike MRP-planning*, Kanban is a demand-based stock control system.**
- **Stocks are only replenished when necessary.**
- **Kanban can be used at all levels – raw, semi and finished parts.**
- **How to get started**
 1. Kanban is implemented where flow cannot be created.
 2. Define demand, size of box, replenish time and calculate the Kanban-levels.
 3. Make procedure and Kanban-cards.
 4. Regular audit of the Kanban-level.

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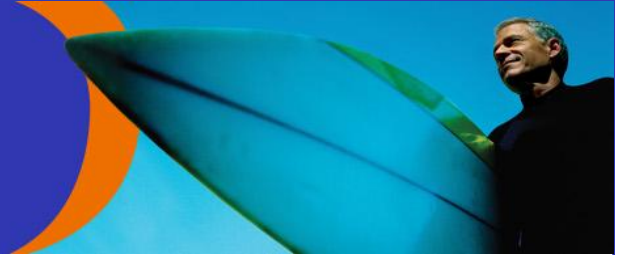
Kanban Results



- **Kanban continuously adjusts the stock level to the actual demand. When the demands increases/ decreases – Kanban follows.**
- **Kanban limits the stock level and improves delivery service.**
- **A more understandable and visible system than MRP.**

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Planning Boards



- **Detailed planning on boards is an important part of the visual control in Lean.**
- **A short planning horizon is a great advantage of using planning boards.**
- **A short planning horizon demands small batch sizes, which again demand short change-over times.**
- **How to get started**
 1. Data and planning horizon are defined. Boards are made. Procedure agreed. Daily planning meetings.
 2. Change-over times are reduced on machines and the planning horizon is reduced. At the same time batch sizes are reduced.

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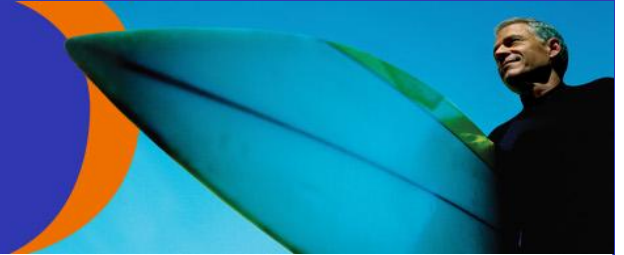
Planning Boards Results



- **Deviation from the planned production is visible immediately. This enables the management to save the situation or to inform the customers.**
- **A short planning horizon improves flexibility and visibility, reduces the number of urgent orders/changes and reduces the throughput time.**

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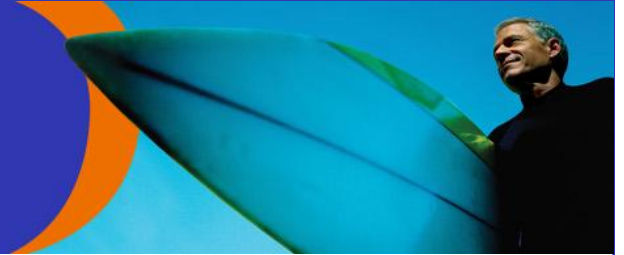
Continuous Improvements



- **Suggestions for improvements are found everywhere in all companies.**
- **The suggestions just need to be structured to create a huge potential in a company.**
- **Continuous improvement focuses on reducing waste – activities that do not add value for the customers.**
- **How to get started**
 1. The contents of a problem- solving/ improvement board are defined. Board is made. Procedure agreed. Regular meetings and follow-up on improvement activities.
 2. The management leads the way by making improvements at the strategic level. Things that irritate the organization are changed.

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Continuous Improvement Results



- **Suggestions do not disappear in frustrations but are used to improve.**
- **Improved motivation and ownership.**
- **Better and faster implementation – people are committed.**
- **A very cheap tool – significant results.**
- **Reduction of costs.**

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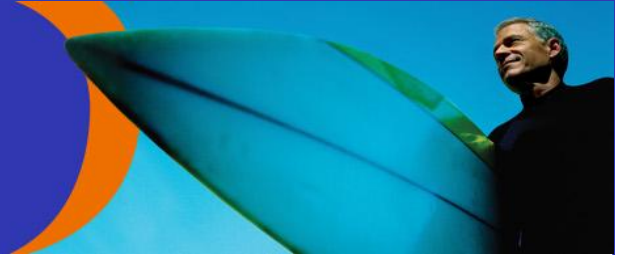
Tool Summary



- **All tools have focus on minimizing waste in processes. Waste is activities that do not add value!**
- **In Lean the word "Muda" is used about waste in processes.**
- **Typically the amount of waste is proportional to the throughput time in a production.**
- **Experience shows that approx 60% of all activities in a company are waste. Another 35% are necessary waste. Only 5% add value!**

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The 8 types of waste in Lean



Unexploited knowledge
Lack of exploiting the knowledge and talent of the employees.

Overproduction
Producing too much, too early and/or too fast.

Transportation
Unnecessary movement of people or parts between processes.

Motion
Unnecessary movement of people or parts within a process.



Waiting time
People or parts waiting for a work cycle to finish.

Rework
Sorting, repetition or making scrap.

Inventory
Materials parked and not having value added to them.

Over-processing
Processing beyond the demand from the customers.

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Lean Change Management



- **Lean is basically a new way of working and thinking.**
- **Many activities will be questioned in the company.**
- **Lean does not think in small bits, but in the overall flow.**
- **Change in attitude and habits.**
- **There is no key answer to how Lean should be implemented. Every implementation of Lean should be adjusted to the company.**
- **However today each tool is so well-described that many companies can get started with the right resources.**

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Lean Costs



- **With these significant results, one would expect to have to make huge investments.**
- **But Lean only demands moderate financial investment.**
- **On the other hand, Lean demands a huge investment in people and change management.**

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Lean Resources



- **Lean demands resources at all organizational levels to become a success. Especially in the first period, Lean requires an extra effort.**
- **The time should be used on training, education and – most important – physical and mental change!**

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Why Lean?



- **Why choose Lean when it is such a huge change? Because Lean can yield significant continuous improvements!**
- **Still one should not just opt for Lean. To become a success the whole organization must be ready for change!**

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Lean Journey



- **“Lean is not something you are – it is a way to do business”.**
- **A company starts to be Lean when the top management constantly focuses on Lean, when 5S is maintained and improved, when the throughput time and the planning horizon are reduced and when visibility is created using boards.**

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Lean Motivation



- **Understanding the purpose.**
- **Clear and ambitious vision.**
- **No secrets about number of jobs.**
- **Respect for everyone's work place.**
- **Involvement, influence and ownership.**
- **Realistic ambitions and goals.**

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Lean Advice



- **Focused and visible leadership.**
- **Openness and dialogue.**
- **The right and necessary resources.**
- **Use resistance actively and celebrate successes.**
- **The right words and tools.**
- **Sufficient time.**

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But Software Development?



- **The Basic Principles of Lean Software Development**
 - Add Nothing But Value (Eliminate Waste)
 - Center On The People Who Add Value
 - Flow Value From Demand (Delay Commitment)
 - Optimize Across Organizations

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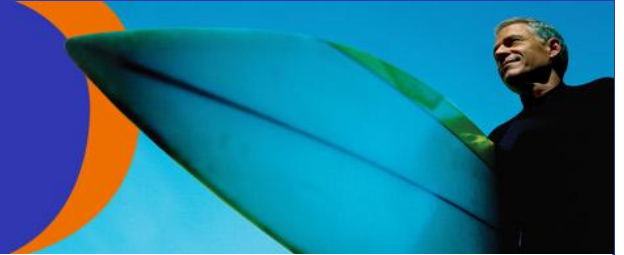
Seven Wastes of Manufacturing



- **The Seven Wastes of Manufacturing**
 - Overproduction
 - Inventory
 - Extra Processing Steps
 - Motion
 - Defects
 - Waiting
 - Transportation

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Seven Wastes of Software Development



- **The Seven Wastes of Software Development**
 - Overproduction = Extra Features
 - Inventory = Requirements
 - Extra Processing Steps = Extra Steps
 - Motion = Finding Information
 - Defects = Defects Not Caught by Tests
 - Waiting = Waiting, Including Customers
 - Transportation = Handoffs

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Seven Wastes of Software Development



- **Extreme Programming (XP) is a set of practices which focuses on rapid software development. It is interesting to examine how XP works to eliminate the seven wastes of software development:**
- **Extra Features → Develop only for today's stories**
- **Requirements → Story cards are detailed only for the current iteration**
- **Extra Steps → Code directly from stories; get verbal clarification directly from customers**
- **Finding Information → Have everyone in the same room; customer included**
- **Defects Not Caught by Tests → Test first; both developer tests and customer tests**
- **Waiting, Including Customers → Deliver in small increments**
- **Handoffs → Developers work directly with customers**

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Questions?

