ENTERPRISE LEVEL WASTE

Module to Support Team Assignment

in Course 16.852J/ESD.61.J – Fall 2002

"Integrating the Lean Enterprise"

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The elimination of "waste" is one of the fundamental tenets of "lean thinking". "Waste" may be defined as *"any action, process or activity that consumes resources and does not directly add value for a stakeholder"*.

We will first review how waste is traditionally viewed when value stream maps are developed within production operations. We will then consider comparable wastes within information systems. There are other wastes at the enterprise level that must be considered when performing enterprise-level value stream mapping and analysis

Waste in Production Operations

Traditional value stream mapping efforts have been performed primarily in production operations. The developers of the Toyota Production System identified seven basic categories of waste:

- *Waiting*: A condition caused by (1) a production operation waiting for maintenance, for material/parts from previous operation, tooling, operator readiness, etc., or (2) production parts waiting in a queue (perhaps in batches).
- *Transportation*: Excessive movement of materials/tools between production operations, between facilities, or to and from storage.
- *Over-Processing*: Using oversized equipment or equipment not designed for the task at hand, thereby requiring excess running time and costs; using equipment that has not been properly maintained, thereby requiring excess processing.
- *Excessive Inventory*: Maintaining stocks of raw materials in excess of current production requirements; or stocks of finished goods in excess of current customer demand; or stocks of work in progress as buffers between un-synchronized production operations.
- *Unnecessary Motion*: Human actions/motions beyond the minimum required to achieve the task at hand, i.e. tasks which, in themselves, do not add value.
- *Defective Products*: Parts, materials, sub-assemblies or products that do not meet specifications and which must be scrapped or reworked to bring into conformance.
- *Overproduction*: Producing more than is required or producing before required; any work performed which is not "pulled" by the next stakeholder in the value stream.

See Table C.1 in Appendix C for examples and associated causes of each of these production waste categories.

In general, these seven categories of waste have proven to be sufficient for dealing with efforts to convert production operations to "lean". When engaged in mapping the value stream of a product family, these categories of waste are the primary targets for elimination or reduction.

As efforts have been made to apply value stream mapping outside production operations, these seven categories have been found to be lacking. We will first consider how we may use these categories for categorizing wastes found in information systems, then we will move to the enterprise level and explore additional categories of waste needed.

Seven Types of Information Waste

Clearly, waste also occurs outside production operations. An important enterprise element in which significant waste can occur is the information system of the enterprise.

The seven types of information wastes discussed in this section are analogous to the seven types of manufacturing wastes for any environment where there is not a physical product involved. The handling, exchange or transportation, and processing of information has some unique and some common characteristics with the handling, transportation, and processing of physical material.

- *Waiting:* Idle time due to unavailable information.
- *Transportation (unnecessary movement):* (In the case of information, this waste category is the same as *Excess Processing*, below.)
- *Excess Processing:* Processing information beyond requirements, e.g. unneeded precision.
- *Inventory:* Information that is unused or is "work in progress".
- *Unnecessary Motion:* Any human movement necessitated by poor Information System design.
- *Defects:* Any element of data, information or intelligence that is erroneous.
- *Overproduction:* Producing and distributing more information to more people than is needed.

See Table C.2 in Appendix C for examples and associated causes of these information waste categories.

Enterprise Level Wastes

More broadly, waste occurs at the enterprise level in a wide variety of contexts. Many of these wastes can be mapped into Toyoto's seven fundamental categories. Some, however, are unique and require additional categories.

- *Waiting/Delays:* Idle time due to late decisions, cumbersome and excessive approvals, and unsynchronized enterprise processes.
- *Excessive Transportation:* Unnecessary movement (including electronically) of administrative paperwork; multiple approvals and handoffs.
- *Inappropriate Processing/Ineffectual Effort:* Effort expended which does not increase value to any of the enterprise's stakeholders; can occur within the workforce, within management ranks, or across the entire enterprise.
- *Inventory:* Unnecessary levels of any enterprise resource: capacity, space, workforce, suppliers.
- *Excessive Motion:* Any human effort that does not increase stakeholder value.
- *Defects/Rework:* Erroneous results from enterprise processes and decisions.
- *Overproduction:* Any creation of enterprise outputs which does not increase stakeholder value.

In addition, two other categories are added to accommodate waste categories at the enterprise level.

- *Structural Inefficiencies:* Waste resulting from inappropriate organizational structure, policies or business model structure.
- *Opportunity Costs:* Wastes resulting from lost opportunities, e.g., untapped talent in the workforce.

See Table C.3 in Appendix C for examples and associated causes of each of these enterprise level waste categories. Also, see Table C.4 in Appendix C for a Taxonomy of Enterprise Wastes.

Enterprise Monuments

Another aspect of faulty enterprise design is that of "monuments", which can be considered another factor contributing to waste. Books focusing on Lean Manufacturing stress that "monuments" need to be eliminated. Womack defines a "monument" as any machine or process which is too large to be moved to accommodate dynamic reconfigurations as the value stream changes and whose scale requires operating in a batch and queue mode. A "right-sized tool", on the other hand, is a "design, scheduling or production device that can be fitted directly into the flow of products within a product family so that production no longer requires unnecessary transport, storage and waiting." Example of monuments are huge presses, centralized paint booths, etc.

Analogous enterprise monuments are:

- Centralized command and control structure
- Centralized, tightly coupled information systems
- Highly bureaucratic rules, regulations and procedures

- Excessive Layers of Middle management
- Highly Concentrated, Centralized Headquarter Facilities
- Excessive, Bloated Corporate Staff Functions
- Monolithic Functional Organizations (Silos): Purchasing, H.R., Finance, Engineering, etc.

APPENDIX C

WASTE IN THE ENTERPRISE

Table C.1 PRODUCTION WASTE

Table C.2 INFORMATION WASTE

Table C.3 ENTERPRISE LEVEL WASTE

Table C.4 ENTERPRISE WASTE TAXONOMY

TABLE C.1 PRODUCTION WASTES

TYPES OF PRODUCTION WASTE	EXAMPLES	CAUSES
Waiting *Idle time in which no value is added*	Employee waiting for • tooling • equipment repair • quality inspector • material machine to complete operation	 • Poor scheduling, work coordination • Inadequate preventive maintenance • Lack of employee empowerment • Push system • One employee assigned to each machine
	Machine waiting for • tooling • equipment repair • quality inspector • material • employee • set-up changeover	 • same • same • same • same • Inattention; poor scheduling; unbalanced operations; no back-up or cross training of co-workers • Long set-up times; monolithic equipment
	Production order waiting for • machine availability • transport to next operation	 • Push system; unbalanced operations • Poor coordination; functional process layout

TYPES OF PRODUCTION WASTE	EXAMPLES	CAUSES
Transportation *Excessive movement of material, tools or parts*	Materials/tools moved between functionally grouped equipment or processing centers, or between different facilities/sites	• Batch and queue (push) system • Functional process layout • Monolithic equipment/processes • Irrational facility/site locations
	Production orders moved to and from stores	• Push system; poor layout
	Finished items moved through multi-level distribution channels	• Traditional hierarchical distribution system

TYPES OF PRODUCTION WASTE	EXAMPLES	CAUSES
Over-processing *Effort expended which does not add customer value*	Work that could be combined with other operations via fewer individual parts or multiple operations on same equipment	• Poor product design • Poor process planning/manufacturing engineering
	Work performed on wrong-sized equipment, requiring excess running time, or excess operating costs	• Improperly sized equipment; poor maintenance; poor instructions and training
	Enhancements, precision beyond customer needs	• Lack of clear customer requirements; tendency for engineers to over-design
	Improper material	• Lack of current knowledge of alternative material capabilities
	Rework	• Inadequate preventive maintenance; lack of automated process controls; poor workmanship
	Excessive testing	• Poor product/process design; lack of qualified performance certification system

TYPES OF PRODUCTION WASTE	EXAMPLES	CAUSES
Inventories *Accumulations of materials beyond JIT requirements*	Excessive raw materials and supplies	• Maintaining stocks of materials in excess of current production requirements; inadequate selection of suppliers; lack of JIT discipline in supply base; lack of coordination with suppliers; inaccurate inventory records
	Excessive finished goods	• Push system; building to forecast; multi-level distribution system; production to maintain employment level
	Excessive work in progress	• Push system; batch and queue; buffers between unsynchronized production operations; high variability in process times; "lost" production orders
	Obsolete and out-of-production parts and materials	• Waiting too long to dispose; frequent design changes; undisciplined configuration management; lack of understanding of "sunk cost"
		•

TYPES OF PRODUCTION WASTE	EXAMPLES	CAUSES
Unnecessary Motion *Any human move-ment that does not add value*	Excessive reaching, bending, stretching	• Poor work design; lack of standard methods; poor work-space design
	Searching for tools, parts, materials	• Poor layout; poor facility design; poor housekeeping and organization
	Excessive walking for tools, parts, materials	• Poor facility design; poor tool and material access
	Excessive handling of work pieces	• Lack of one-piece flow; lack of cellular layout; stop and go processing
	Excessive force, energy required for operations	• Poor work design; lack of ergonomic standards; poor part design
	Long set-up times	• Lack of disciplined set-up minimization effort

TYPES OF PRODUCTION WASTE	**EXAMPLES**	**CAUSES**
Product Defects *Any item that does not meet specifications*	Defects occurring in internal production	• Poor process capability; poor standard operation specifications; inadequate training and instruction; lack of consideration of process capability during product design phase; lack of mistake-proofing discipline
	Defects occurring in supplier parts/materials	• Inadequate quality certification/verification regimen
	Defects occurring during final test	•
	Defects discovered by customer after delivery	•

TYPES OF PRODUCTION WASTE	EXAMPLES	CAUSES
Over Production *Producing more or sooner than required*	Producing more than required	• Producing to forecast rather than to current customer demand; large lot production; producing to maximize machine/labor utilization; producing to avoid layoffs; producing ahead for planned marketing promotion; lack of coordination (demand management) with customers
	Producing before required	• Push production system; unsynchronized production operations; poor production planning and control system

TABLE C.2 INFORMATION WASTES

TYPES OF INFORMATION WASTE	EXAMPLES	CAUSES
Waiting *Idle time due to unavailable information*	People waiting for information	• Lack of access; untimely updating of data bases; lack of interoperability among IS components; multiple approvals
Unnecessary Movement (same as ***"Excessive Processing"***, below)		

TYPES OF INFORMATION WASTE	EXAMPLES	CAUSES
Excessive Processing *Information processing beyond requirements*	Excessive/custom Formatting	• Lack of standardization
	Numerous, Fragmented Reports That Could be Combined	• Poor output design; lack of understanding of user requirements
	Unnecessary Detail and Accuracy	• Tendency to "over-design"
	Unnecessary Serial Processing	• Poor system design; lack of understanding of concurrent processing capabilities
	Excessive Approvals for Information Release	• Stove pipe, command and control mentality • Turf protection
	Excessive Information Distribution	• Broadcasting information to people other than those who need it; information overload

TYPES OF INFORMATION WASTE	EXAMPLES	CAUSES
Inventory *Information that is unused or is "work in progress"*	Too much information	• Poor understanding of user needs
	Multiple/redundant Files	• Tendency for everybody to maintain their own files (e.g., paper files of the same information maintained in several places, in addition to electronic files
	Outdated/obsolete Information	• Lack of "version control"; lack of disciplined system for updating new and purging old; tendency to retain raw data long after it has been summarized and incorporated into higher level information
	"Just-in-Case" Information	• Collection, processing and storage of every element of data that the system designers can think of, whether or not a specific end-use has been identified

TYPES OF INFORMATION WASTE	EXAMPLES	CAUSES
Unnecessary Motion *Any human movement necessitated by poor IS design*	Walking to Central Information Access Point	• Lack of distributed, direct access
	Excessive Keyboard, Mouse Operations	• Lack of training; poorly designed, incompatible user interfaces; incompatible software suites
	Retrieving Printed Instruction Manuals	• Lack of on-line access

TYPES OF INFORMATION WASTE	EXAMPLES	CAUSES
Defects *Erroneous data, information, reports*	Errors in Data Reporting/Entries	• Human error; poorly designed input templates
	Errors in Information Provided to Customers	• Lack of disciplined reviews, tests, verification

TYPES OF INFORMATION WASTE	EXAMPLES	CAUSES
Over Production *Producing, distributing more information than needed*	Pushing, Not Pulling Data, Information	• Poor IS design
	Over-Dissemination	• Poor understanding of each user's requirements; "send all information to everyone", rather than targeted distribution to meet specific needs

TABLE C.3 ENTERPRISE WASTES

TYPES OF ENTERPRISE WASTE	EXAMPLES	CAUSES
Waiting/Delays *Idle time due to late decisions, bottlenecks in enterprise processes*	In making decisions	• Unnecessary levels/steps in decision structure and approval processes; multiple handoffs • Information unavailable or inaccessible • Risk aversion mentality • Inflexible policies and procedures; excessive rules and regulations
	In administrative processes	• Undisciplined processes and practices • Variability in enterprises processes • Lack of standardization; lack of common tools and systems • Errors in data • Linear, serial task sequencing • Batch and queue mentality in enterprise processes • Lack of flow – lack of level scheduling of administrative processes • Unsynchronized enterprise processes • Delays in information processing, dissemination and consequent actions • Ineffective, inefficient business systems; lack of connectivity and interoperability

TYPES OF ENTERPRISE WASTE	EXAMPLES	CAUSES
Excessive Transportation *Unnecessary movement of administrative paperwork, multiple approvals/handoffs*	Movement of forms, reports, other paperwork	• Poor design of business processes
	Multiple handoffs	• Unsynchronized enterprise processes
	Expediting Administrative Paperwork	• Poor design of business processes
	Dispersed Facilities	• Poor location decisions

TYPES OF ENTERPRISE WASTE	EXAMPLES	CAUSES
Inappropriate Processing/ Ineffectual Effort *Effort expended which does not increase stakeholder value*	Poor workforce performance	• Rigid job classifications, narrowly trained employees • Lack of congruence between reward structure and enterprise objectives • Undisciplined processes and practices • Lack of employee empowerment • Employee empowerment without accompanying training • Inadequate job skills • Poor employee selection & placement to facilitate Lean • Disheartened, de-motivated work force • Lack of consistent, timely communication
	Poor management performance	• Lack of congruence between reward structure (scorecard) and enterprise objectives • Excessive QA inspections, re-inspects • Time spent in reacting, fixing problems • Excessive and uncoordinated initiatives • Confusion regarding roles, responsibilities • Excessive meetings; poorly prepared/facilitated meetings with no followup • Excessive data collection and storage • Counterproductive performance measures • Risk aversion mentality
	Poor enterprise performance	• Inefficient, ineffective process interfaces • Physical, information and conceptual disconnects – lack of connectivity and interoperability • Lack of standardized processes; lack of common tools, systems and platforms • Bloated middle management

		• Outdated, counterproductive financial systems and performance measures • Enterprise managers not on the same page • Inflexible policies & procedures, excessive rules and regulations • Organizational rigidity, lack of responsiveness and adaptability • Unsynchronized enterprise processes • Wrong metrics • Poor strategy and execution • Business systems are cumbersome and disconnected

TYPES OF ENTERPRISE WASTE	**EXAMPLES**	**CAUSES**
Inventory *Unnecessary levels of capacity, space, work-force, suppliers*	Excessive capacity	• Poor planning
	Excessive Space	• Poor planning, re-deployment of freed up resources
	Excessive Workforce	• Poor planning, re-deployment of freed up resources
	Excessive Technical Staff	• Poor staffing planning
	Excessive Suppliers	• Lack of rationalized lean supply chain network

TYPES OF ENTERPRISE WASTE	EXAMPLES	CAUSES
Excessive Motion *Any human effort that does not increase stakeholder value*	Redundant activities	• Poor integration; cumbersome business systems
	Excessive and uncoordinated initiatives	• Lack of discipline and focus; chasing fads
	Wasted effort	• Excessive number of meetings, status reporting; • Unsynchronized enterprise processes

TYPES OF ENTERPRISE WASTE	EXAMPLES	CAUSES
Defects/Rework *Erroneous results from enterprise processes and decisions*	Errors	• Physical, information and conceptual disconnects – lack of connectivity • Undetected errors in data entry and processing • Out of date policies and procedures – lack of configuration control • Variation in enterprise processes • Misinterpretation of data
	Incorrect, inappro-priate decisions	• Optimizing within one function causes sub-optimal enterprise performance • Errors (defects) in enterprise processes • Unsynchronized enterprise processes • Misinterpretation of processed information • Confusion regarding roles and responsibilities • Lessons learned are not captured and archived • Decisions re-decided or changed later • Excessive metrics; inappropriate metrics • Poorly prepared and facilitated meetings • Multiple handoffs

TYPES OF ENTERPRISE WASTE	**EXAMPLES**	**CAUSES**
Over-production *Any creation of enterprise outputs which does not increase stakeholder value*	Excessive dissemin-ation of data, reports	• "Push" mentality prevails • Outdated policies and procedures • Wrong metrics
	Over-managing	• Lack of appropriate delegation, employee empowerment • Command and control mentality prevails
	Exuberant pursuit of illogical initiatives	• Too many "movements" (initiatives) being pushed, some at cross purposes, leading to diffusion of commitment • Failure to stay grounded in fundamentals • Over-reliance on "solutions of the month"
	Marketing campaign	• Belief that "pushing" sales via incentives will result in overall increase in sales volume, but usually results in short term demand amplification and then sharp drop in demand

TYPES OF ENTERPRISE WASTE	EXAMPLES	CAUSES
Structural Inefficiencies *Wastes resulting from inappropriate organization, policies, business model structure*	Organizational structure	• Redundant activities; overlapping command and control • Failure to deploy critical resources horizontally along the value stream • Bloated middle management • Unclear chain of command • Unsynchronized enterprise processes
	Supplier relations	• Tendency to view suppliers in an adversarial way • Failure to create "win-win" relationships • Reluctance to share detailed operations data
	Partner relations	• Lack of interconnectivity and interoperability • Reluctance to share detailed internal data
	Customer relations	• Failure to focus on customer needs and values • Failure to anticipate how we can help our customers be successful

TYPES OF ENTERPRISE WASTE	**EXAMPLES**	**CAUSES**
Opportunity Costs *Wastes resulting from lost opportunities that are acieveable*	Customer disconnects	• Remoteness from customer • Failure to focus on what customer values
	Untapped talent in workforce	• Failure to capitalize on the "whole person" by helping each employee grow to full potential; underutilization of people • Inappropriate reward/incentive systems
	Failure to view knowledge as a corporate asset	• Managers unaware of potential of knowledge management • No tradition of capturing lessons learned, of growing corporate knowledge base; lack of knowledge transfer internally
	Unmotivated workforce	• Workforce not empowered; people have no authority or accountability

TABLE C.4 ENTERPRISE WASTE TAXONOMY

	8 Types of Enterprise Waste								
Enterprise activities/beaviors which may contribute to Waste	**Overproduction:** parts, product, paper, deliverables	**Waiting**	**Transport:** parts, product paper, deliverables	**Overprocessing**	**Inventories**	**Unnecessary Movement:** parts, paper, deliverables	**Defects/Rework:** Deliverables and Processes	_	**Non-Integration**: (P=people, M=money)
Poor Motivation				X			X		P
- improper incentives									
- lack of trust									
- lack of empowerment									
- impowerment without training									
- inefficient use									
- poor communications									
- bad fit									
Non-standard Processes/Systems/Tools		X					X		M
- variability in enterprise processes									
- uncommon part types									
Regulatory Agency							X		P
- non compliance (audits, documentation)									
Poor Integration						X			P,M
- redundant activities									
Wrong Metrics	X						X		P
- leads to wrong behavior									
- wrong financial systems									
- excessive									
Linear, Serial Task Sequencing		X					X		M

Lost Knowledge, Transfer										P
- lessons learned not captured or shared										
- knowledge not viewed as corporate asset										
Change Activity		X						X		
- rework										
- delays										
- shortages										
Poor Strategy & Execution		X						X		P,M
Labor Issues										P
- lack of cross-training										
- multiple classifications										
Schedules							X	X		M
- non-integrated										
- reschedules										
Obsolete Materials						X				
Business Systems			X		X		X	X		P,M
- cumbersome										
- lack of connectivity& interoperability										
- inefficient										
- information unavailable or inaccessible										
- multiple legacy ways										
Product/Process Specialization (Customer Specs)					X		X			M
- over specification										
- excessive QA inspections, re-inspects										
Buy-offs & Inspection					X					
Poorly Prepared & Facilitated Meetings								X		P
Approvals (verbal, written)			X		X					
Moves/Queues (people, product, paper)			X				X			
Multiple Handoffs			X	X	X		X	X		P
Expediting		X		X		X	X			P,M
- parts & paper										
Transportation							X			

Excess Equipment / Oversize Capital		X				X				M
Unbalanced Resource Allocation			X							P,M
- resources not deployed along value stream										
Organizational Structure		X	X		X		X	X		P
- unsynchronized enterprise processes										
- stovepipe										
- redundant activities										
- bloated middle management										
- unclear										
Equipment Down Time			X							
Bad Decisions			X					X		P,M
- late decisions										
- redecided or changed later, indecision										
- flavor of the month										
- unsupported request for business case										
Unsupported Initiatives					X		X	X		P,M
- exuberant pursuit of illogical initiatives										
- excessive & uncoordinated initiatives										
Too Many Suppliers		X		X		X	X			P,M
Excessive Data Collection & Storage					X			X		P,M
Facility			X	X				X		
- layout poor										
- poor location										
- excess space										
Excessive Number of:		X	X		X		X			P
- meetings										
- status										
- reports										
Overlapping Command & Control		X			X					P
- excess command media										
- maintaining, updating & changing procedures										
Processes								X		P

- excessive process steps										
- inefficient, ineffective process interfaces										
- cumbersome										