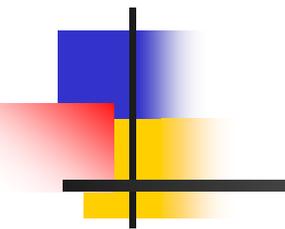


Triggered Learning Process from Production to Product Development



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Delphi Corporation

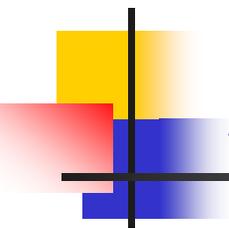
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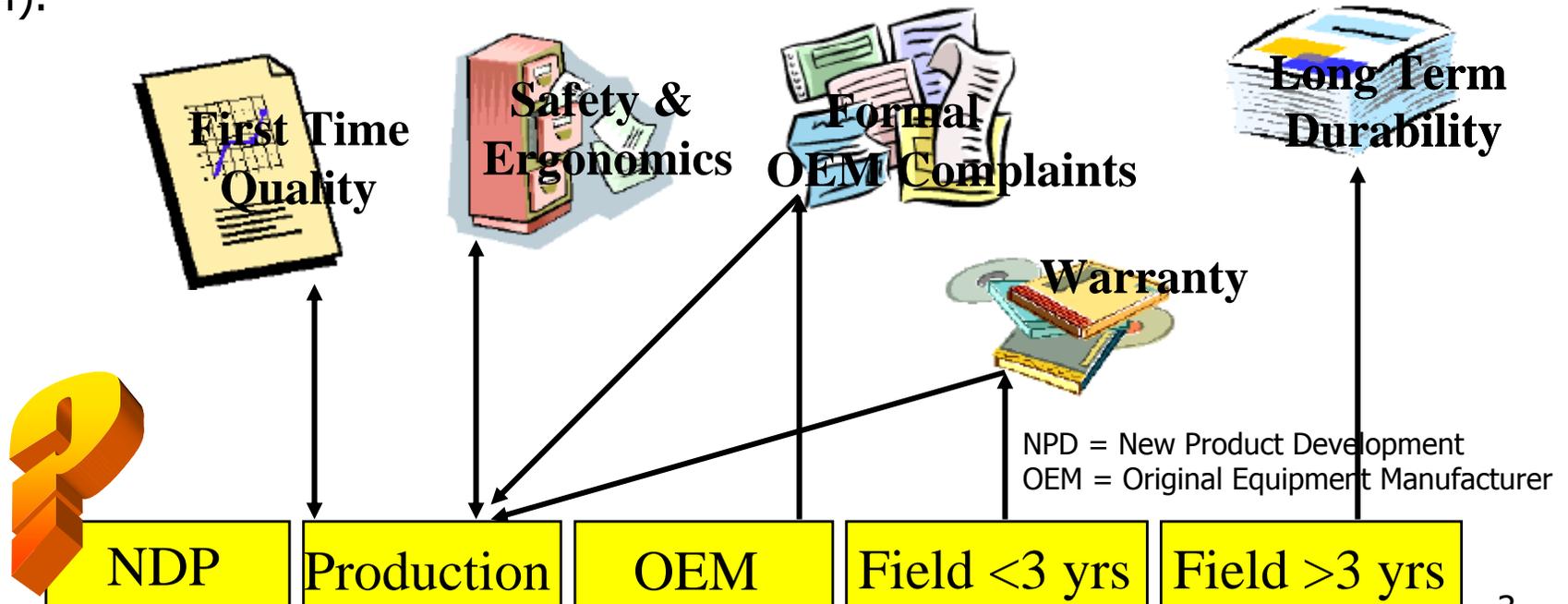


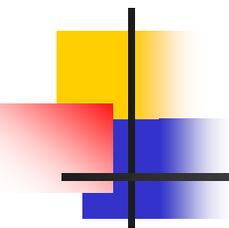
Agenda

- Motivation
- Triggered Learning Process
- Current Implementation
- Managerial Insights
- Bigger picture & Future Work

Motivation

Many problems throughout the production, assembly, and customer use are solved by different parts of the organization. The lessons learned are then archived in different formats and different levels of detail. These lesson learned are not formally communicated to NPD due to organizational boundaries (real or perceived), diverse storage media, and access privileges. If communicated, the documents are sometimes too long, or are written in a context that is not immediately understandable for NPD use. This can result in the NPD activity launching products that contain past problems (Busby, 1999; Von Hippel & Tyre, 1994).



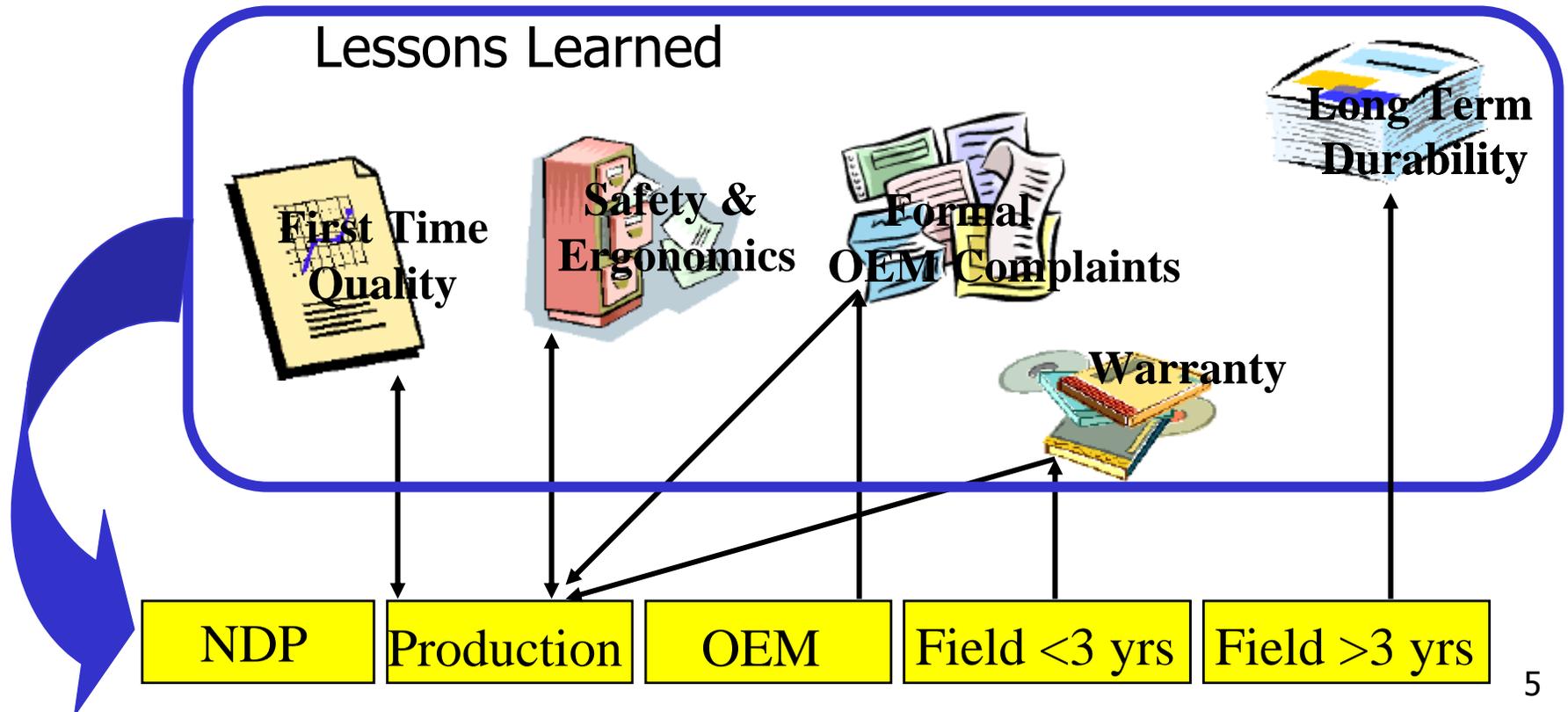


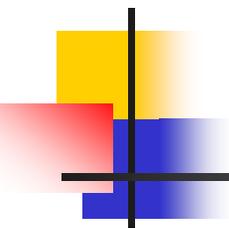
Other attempts

- Post-Mortems
 - Tend to be long reports that require discipline to prepare. For example, Microsoft sites 3-6 months to prepare a 10-100 page post-mortem (Thomke & Fujimoto, 2000)
 - Ambiguous on how NPD will integrate information into new programs
- Design Reviews with downstream stakeholders
 - Downstream personnel cannot readily relate to NPD artifacts (i.e.; digital models) (Black & Carlile, 2002)
 - Cross organizational information transfer (verbal and written) have problem of context and jargon causing poor communication (Uschold & Gruninger, 1996)
 - Time between reviews causes 'batched' learning and a greater chance and cost of iteration (Ha & Porteus, 1995)
- General Lessons Learned Database
 - No process to make sure reviewed

Triggered Learning Process

GOAL: An ontology-assisted triggered learning process (TLP) for getting Lessons Learned communicated and used in NPD activities.

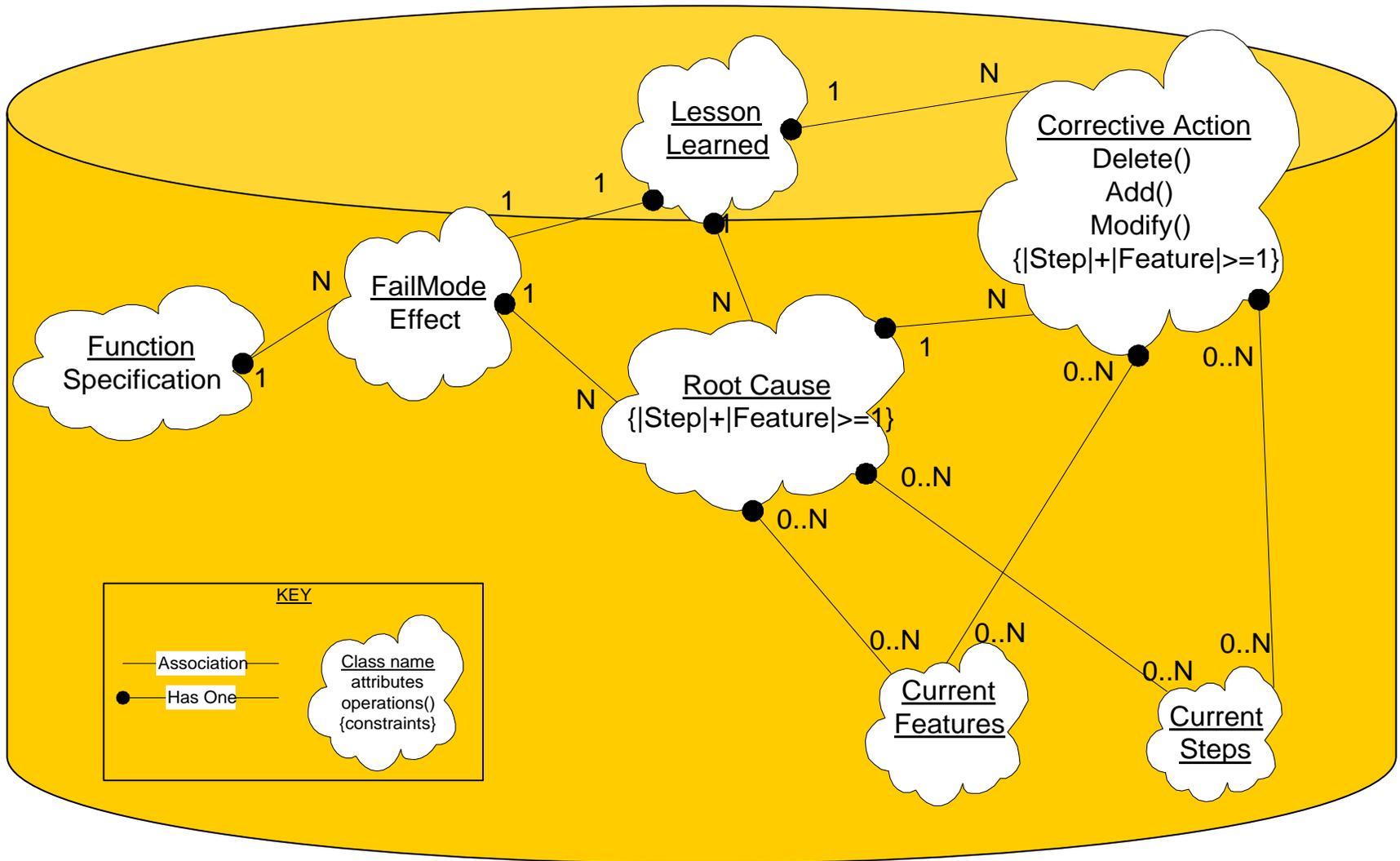




Definitions

- Ontology – “a set of concepts (e.g. entities, attributes, processes), their definition and their inter-relationships; this is referred to as a conceptualization” (Uschold & Gruninger, 1996)
- Trigger - An event, called a *Lesson Learned*, that is communicated and used by NPD
 - Assumption: the lesson learned was a ‘big enough’ problem that it was documented in some manner by a part of the organization.

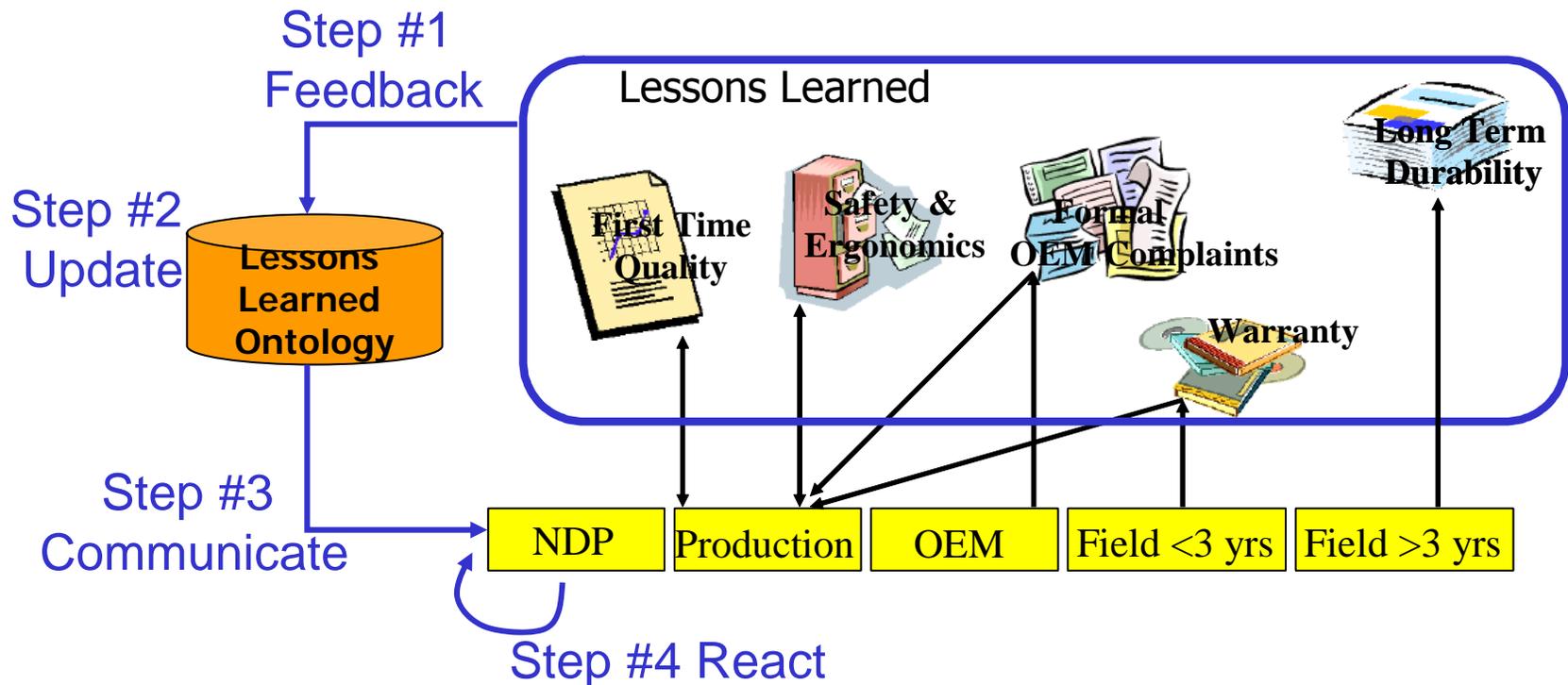
Lessons Learned Ontology Model

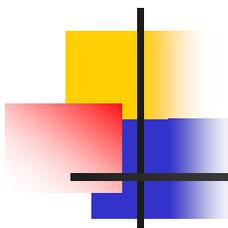


Triggered Learning Process

TLP is a structured approach that

1. Feeds back lessons learned created by downstream organizational personnel
2. To a staff that condenses these lessons learned into an ontology and
3. Communicates these items to NPD
4. NPD personnel reacts to this information as it arrives by incorporating it into the new product or process under development.

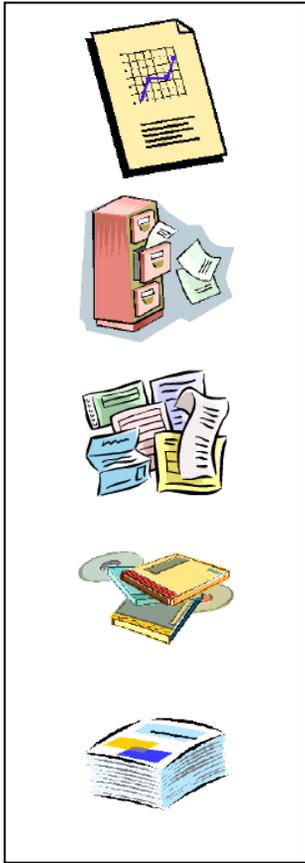




Perspectives/Context

- TLP is consistent with the theory that organizational learning is triggered by external shocks (e.g.; lessons learned) that makes adaptation necessary (Cyert & March, 1963)
- NPD as a problem-solving activity (Thomke & Fujimoto, 2000). Enterprise and Customer requirements are considered *problems* that must be *solved* by new product and process development. Often downstream lessons learned are manifestations of a failure to meet downstream stakeholders requirements.

Step 1: Feedback Details

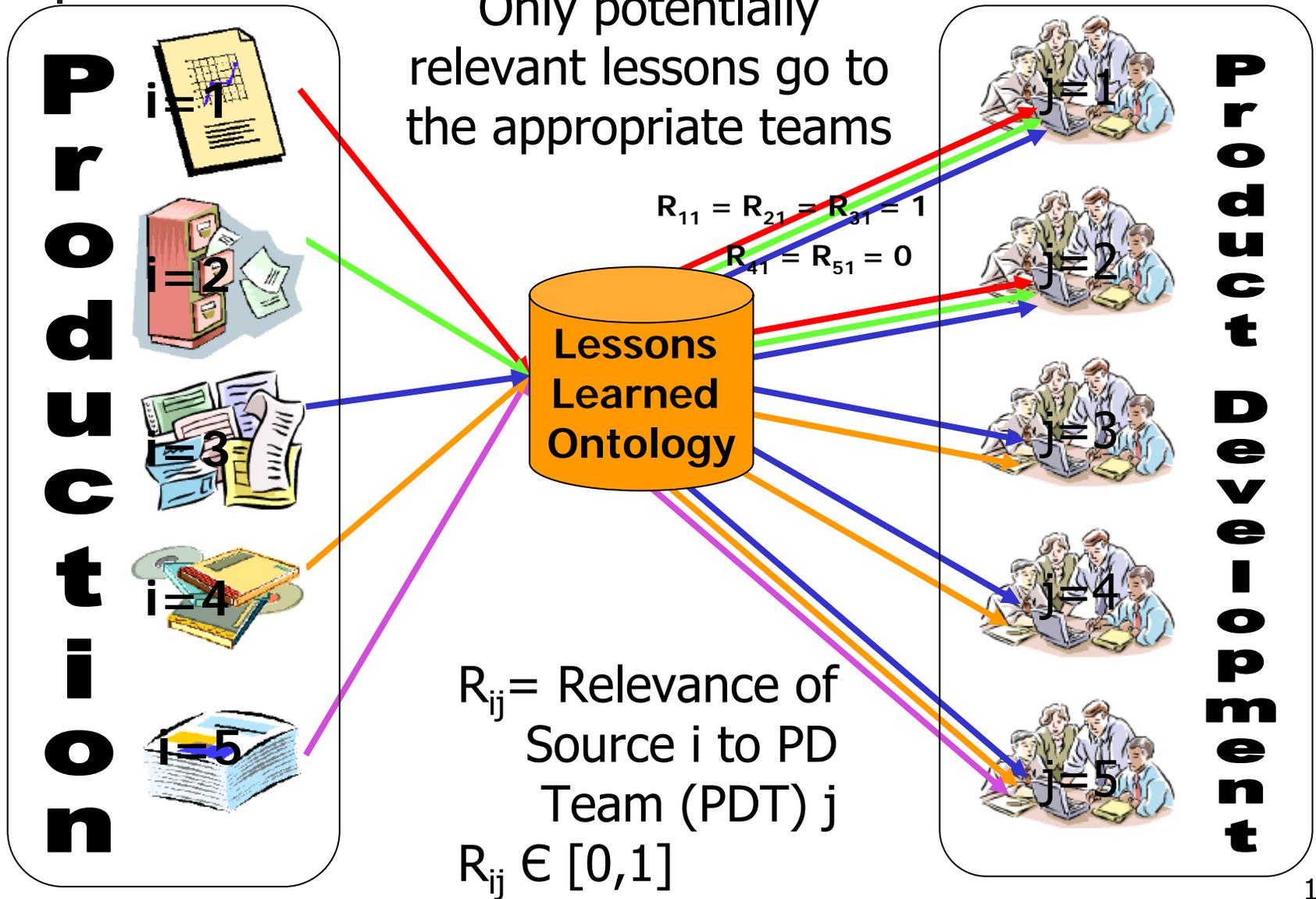


What: Documentation that was created in resolving the problem for the value stream

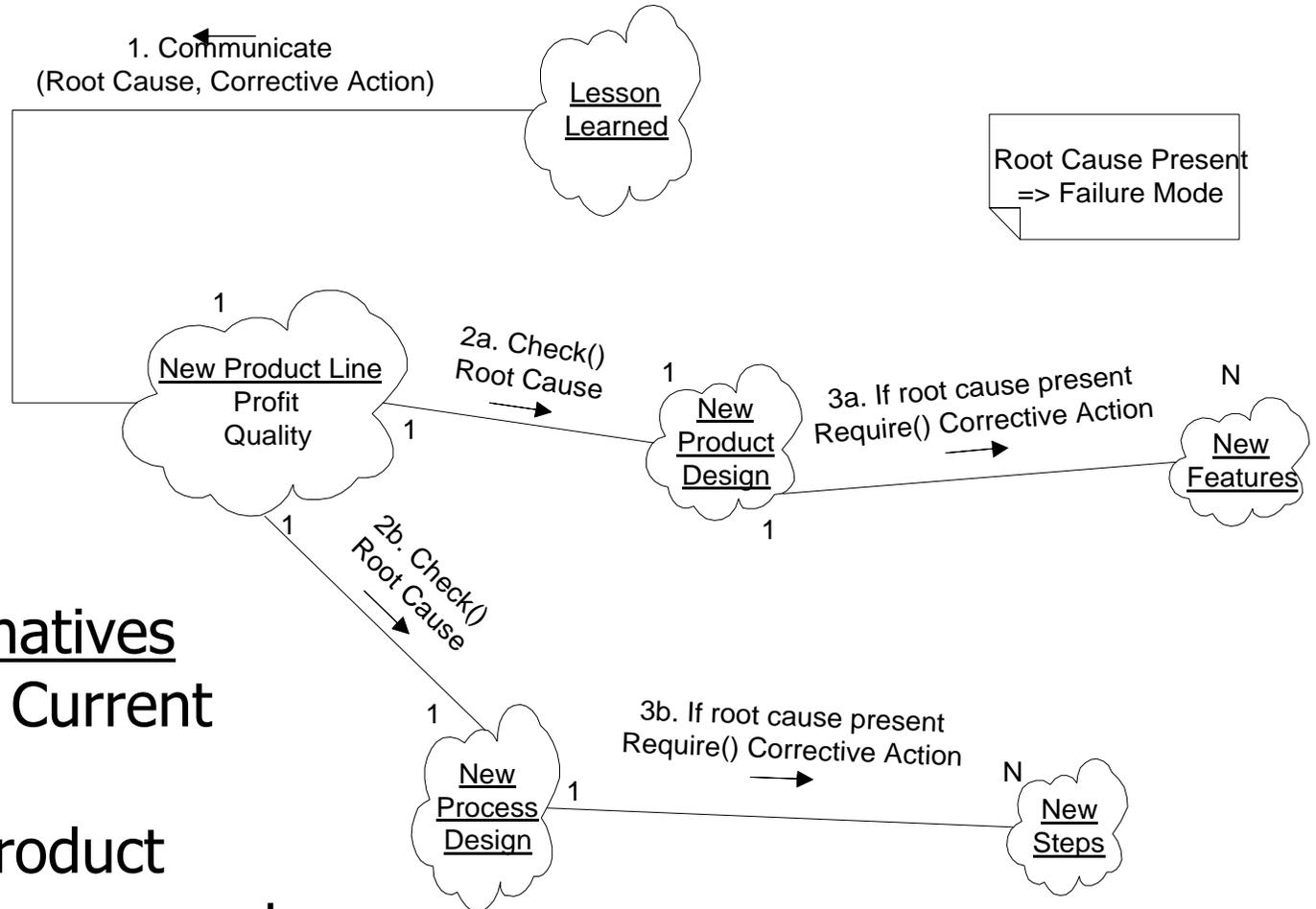
When: Feedback is initiated once a lesson is learned and a value stream problem is resolved.

Who: Each production lessons learned source is owned by a different organization (function) within the enterprise

Step 3: Communicate



Step 4: Reaction



Reaction Alternatives

1. Implement Current Controls
2. Innovate product features or process steps
3. Need to plan
4. Not relevant- Do Nothing

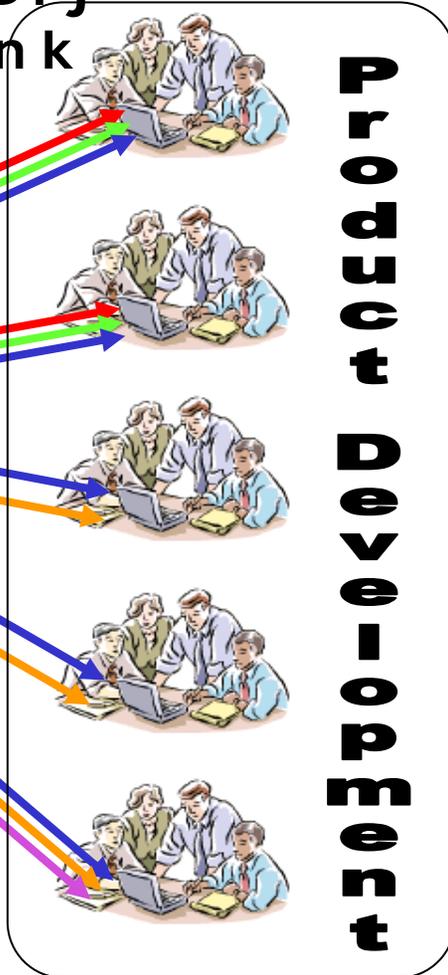
Control Loop



Manager
Monitors
Responses

RXN_{ijk} = Reaction to source i from PDT j regarding lesson k

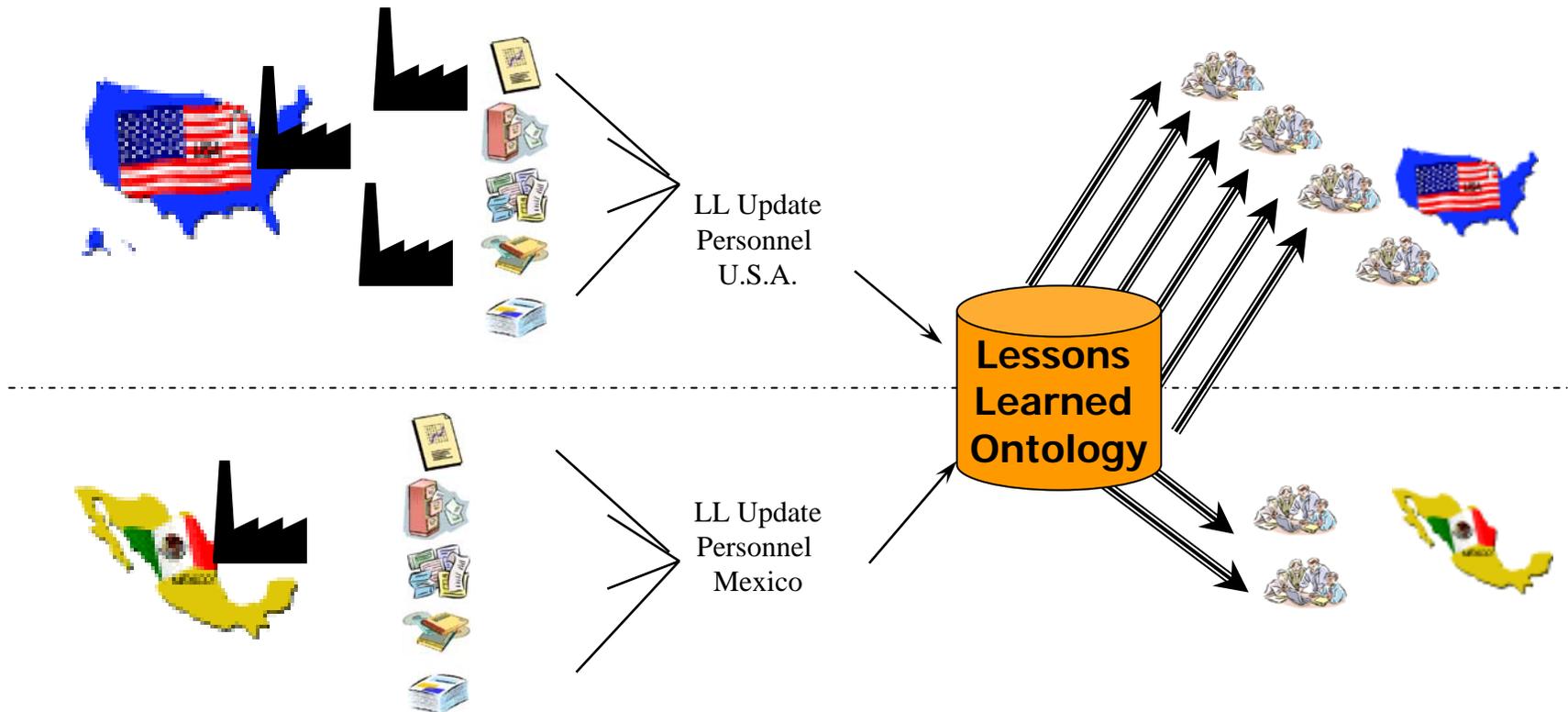
Lessons Learned Ontology

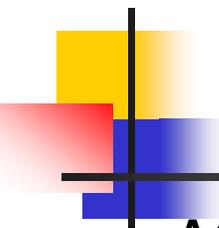


RXN_{i1k}	RXN_{i2k}	RXN_{i3k}	
1	1	3	Lesson Reused
			Team not responding
1	4	3	
1	4	3	
1	2	2	Innovation

Current Implementation

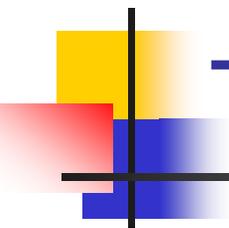
- Feedback established in United States and Mexico Production Value Streams (4 production facilities)
- Product Development teams in US and Mexico are reacting to the information
- Plans to expand to European Production facilities and Product development.





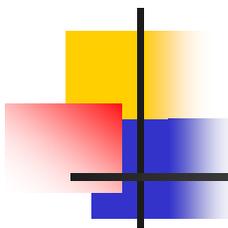
Triggered Learning Take Aways

- ACTIVE Knowledge Movement process
 - Right People: Email to the people developing the next generation products
 - Right Information: Real Stakeholder Concerns
 - Right Amount:
 - Lesson Overview Ontology line item
 - Detailed solution information if required: Attached documents
 - Right Time: When A Lesson is Learned (Trigger)
- Knowledge Application
 - PDTs have a reaction plan to use the new information
- Controls & Standard Management Ensure process is followed



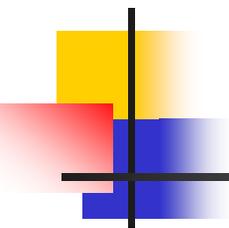
Triggered Learning Take Aways

- Execution
 - Improves Design Reviews
 - Batched learning to triggered learning - do not wait until reviews to share downstream lessons.
 - Reduces Surprises & Opinions based comments
 - Supports flawless launched to ensure past mistakes not repeated
 - Helps maintain FTTQ and Health & Safety gains made in Value Stream by communicating current fixes



Managerial Insights

- When is this systems most valuable?
 - Product Maturity High (i.e.; many small issues)
 - Past product highly relevant to new products
 - High Cost of making or repeating mistakes
 - Project time short & project teams highly utilized
 - Number of independent future projects high
 - Organization structure: Information Bucket Owners different from product process developers



Some Keys for Implementation

■ Feedback:

- Add steps to current problem solving processes to send Lessons Learned to update person
- Be on guard for those partial lessons learned

■ Update:

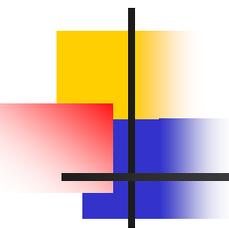
- Development of the Ontology Structure
- Populate with historical projects to prove concept and work out bugs
- Not a Clerk Job, people must have some domain knowledge

■ Communicate:

- Works Best when communication person is also the Manager of Reaction People

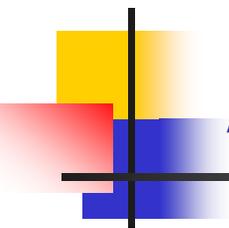
■ React:

- Be patient.
- Team will be getting information they never received before
- Standard Management/coaching commitment in beginning must be high



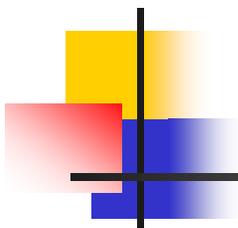
Required Resources

- Information technology already present
- Needed to spend time to develop process and get buy-in.
 - Feedback People
 - Minimal Impact
 - Update People
 - New Responsibilities
 - Communication People
 - Standard Management Responsibilities
 - Reaction People
 - Spend time now or spend time later
 - Not new responsibility, but new information, not always enough time to address issues



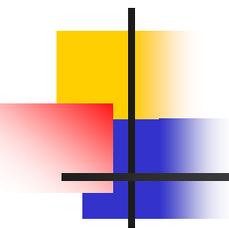
A Bigger Picture

- Interesting Research area slicing across traditional disciplines
 - Management Science
 - Q: How do decision makers know when having system and staff is important?
 - Tools: Analytic Queuing Models
 - Knowledge Management
 - How do we get information to the people who need it?
 - Tools: Organizational Design, Communication Processes.
 - Organization Learning
 - How do groups and people learn?
 - Tools: Observational studies, and experiments
 - Philosophy
 - Q: How do we structure knowledge to best get our questions answered?
 - Tools: Ontology, Taxonomy
 - Computer Science
 - Q: How can this be an even more automatic/active system?
 - Tools: Object oriented programming and systems.



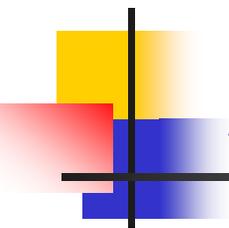
Future Research

- Increase scope of buckets and plants, deeper into supply chain
- Link to “Double Loop” learning (Agyris, 1976). The idea is that a concentration of lessons learned indicates a systematic problem, and Organization policy should be changed.



Observation

- We live in the post-bubble economy
 - Markets in the US and Europe declined and are more 'cautious'
 - Similar story in Japan; however, Toyota still posting record profits and capturing market share
- When asked how much of their time is spent creating value
 - Toyota ?
 - U.S. Companies ?
 - Mid-size Scandinavian Companies ?



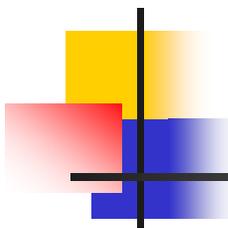
Assumptions

■ Conventional

- Importance of capital
- Mass Production (Volume reduces costs)
- Scientific Management
 - Managers Make Decisions
 - Workers: Execute Decisions
 - Experts: Create Procedures, processes, metrics
- Financial Management
 - Make good financial decisions based on acquiring hot companies and slashing costs

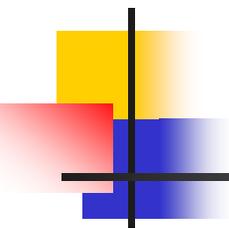
■ Toyota

- Importance of Knowledge
- Knowledge reduces costs
- Only one kind of employee...Those that create knowledge and acts on it for the good of the whole
- Knowledge Cannot be purchased
 - Most learning occurs through product development



Toyota's Focus on Knowledge

- “Toyota applies tremendous rigor to how they capture learning”
- “They study both what works and what doesn't work and they systematically document and disseminate the information”
- “Everyone has ready access to the knowledge and everyone is expected to use it, including management.”



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