ZeFMaP: Productivity in ATM

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Zero Failure process at Maximum Productivity in Safety Critical Environment

What can we learn from Mass Production Processes?
The Hypothesis

• Applying processes from mass production improves productivity and safety in ATM Systems.

• Assumptions
  • An ATM Control Room is a sociotechnical system
  • An ATM Control Room is producing “something”

• Main Questions
  • Can ATM be seen as production process?
  • Can the production be divided into value adding production steps?
  • Which process tools fit best?
Basics: Today's situation in Mass Production

• Continuous Improvement Processes
  • *Part of the philosophy of mass production*
  • *Has its origin in automotive mass production*
  • *Productivity combined with Zero Defect Policy*

• Decisions
  • *are analysed with impact on the overall production output*
  • *are weighed in several “quality” steps*
Basics: Today's situation in ATM

• Continuous Improvement Processes
  • *not seen in ATM business* ("production") process
  • *if then focussed on error prevention*

• Decisions
  • *are seen isolated without of cross impact analyses (on the overall System).*
  • *are “right” (safe) or “wrong” (unsafe)*
Basics: Sociotechnical System

Sociotechnical System

Technical Part
- Production Input
- Automation Tools / Machines
- Rooms / Building

Social Part
- Team Members
- Qualification and Training
- Human Needs

System Purpose
- Production Output
- System Maintenance
- System Regulation
“ATM Mass Production”

• What do we produce in ATM?
  • *Safe Airmiles*?
  • *Safe starts and landings*?
  • *To be elaborated further together with KPIs*
  • ...

ZeFMaP - Safety Critical Mass Production

„Production Process“ (Value Adding)

1. Domain Know How:
   - Workflow Analyses
   - Business Blue Printing

2. Usability Engineering:
   - Optimized
   - Man/Machine Symbioses

3. HF Safety:
   - Decision Points -> all possible decisions:
     - xFMEA Analyses

4. HF Productivity:
   - x6sigma
   - Optimisation Loop „KVP“
What is the right tool to improve productivity in ATM?

Process modelling
Problem solving
Toyota Production System approach
Load analysis
...

?
Process modelling

• Business Process Modeling (BPM) is the activity of representing processes of an enterprise, so that the current process may be analyzed and improved.

Stakeholder map for a Norwegian hospital
Basic flowchart for a customer complaint process
Load Analysis/Bottlenecks

• An organization consists of a system for transforming input to products or services.
• Everything that is used in this transformation process are resources, e.g., machines, storage space, people.
• All such resources can be classified as either bottlenecks or non-bottlenecks.
• A bottleneck is defined as:

  “... a point in the transformation process that limits the flow the process can output.”
How to proceed?

- Perform analytical evaluation of existing approaches, methods and tools
- Adapt the methods and tools to ATM domain
- Apply them on TWR process in several iterations

Some challenges:

- Barrier against seeing 'a big picture'
- Conflicts between lean principles and safety
- Inner drive in the organisation is important
How to validate our claims?

• Hamburg Airport Scenario
  • Sufficient complexity to require higher automation tools
  • Simple enough to analyse it with production methods

• Simulated with real peak hour traffic scenario from the past
  • University of Salzburg Simulator
  • Airport seen as black box
  • Inbound and outbound traffic life scenario from past peak hour
• KPI comparison with and without ZeFMaP
  • Definition of KPIs (ATM KPIs, others - team performance indicators…)
  • Baseline simulation run without ZeFMaP help
  • Up to 3 runs with (offline) ZaFMaP optimisation of decisions

• Expectations
  • Improvement of productivity KPIs (punctuality, time to runway, time to gate) especially in high traffic load
  • Improvements will continue to a lesser extend with each iteration
  • Acceptance (satisfaction) by air traffic controllers will be equal or slightly improved
  • Follow up projects
Thank you for your attention!

Questions? Suggestions?

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