

IE102 A Process Outlook for Industrial Engineering

Bilkent University

Recapture

Meaning of the word “Process”

Engineered Processes

- A series of actions, changes, functions; steps
- A particular “economic” motive
- May be repetitive
- Part of another process
- Structured – “well-defined”
- Measurable outcome

Last week-Rice Cooking Example

- Existence of Alternatives
- Actions – decisions
 - ✓ Duration of frying
 - ✓ Duration of boiling/ intensity of heat
 - ✓ Quantity of water to use
 - ✓ Cooking duration for low heat
 - ✓ Duration (waiting) before serving
- Worthwhile? Catering firm? Army?
 - Longer-term decisions (type of rice, stove, energy source,

Airport Operations

- Sub-processes after plane reaches the gate until it leaves for another destination.
- Name those sub-processes. The ones we are familiar are detailed!
- Possible improvement ideas to decrease the total time the plane stays at the gate.

Airport Operations

On board 😊

Potential Subprocesses

- Engagement to the gate (1)
- Passengers out (2)
- Crew out (3)
- Security check for left material (4)
- Cleaning crew (5)
- Crew in (6)
- Catering Service (7)
- Newspaper service (8)

Potential Subprocesses

- Head Phones (9)
- Passengers in (10)
- Equipment (in plane) check (11)
- Finalized flight information available (12)
- Passenger safety instructions (13)
- Final OK from air traffic controller (14)
- Final equipment check, locks (15)
- Disengagement from the gate (16)

Potential Subprocesses

- Engine check (A)
- Equipment check (Pilot's cabin) (B1-B...)
- Gas refill (C)
- Wheel checks (D)
- Other maintenance procedures (E)
- Baggage out (I)
- Baggage in (II)
- All are related – how?

Summary of Improvements Suggested (with our additions)

Passenger in/out (boarding/exiting)

- Passengers in an order (change process)
- Increase aisle width
- Use of moving-platforms/elevators
- Shorter distances – redesign gates
- More doors
- Cabin baggage locations restructured
- More gates
- New gate layout designed

Improvements (continued)

Unload/load Baggage

- Standardize baggage
- Better handling - crew schedules
- Crews with more people
- Design new equipment – simultaneous
- Redesign a new system

Cleaning

- Plane Crew starts cleaning

Others:

- Use of standard (smaller) planes
- Speed up **Check-in** operations (e-ticket, ..)
- Training crews

Improvements (continued)

Improvement Ideas - in General

- More resources (personnel, gates, ...)
- Redesign (reorganize) the process – change the order, new operations, remove operations, change precedence, ...
- Schedule (change, improve, ..) – flight times, cleaning crews, ...
- Space utilization (layout)

Improve Boarding

Many different boarding strategies:

Certain codes in the boarding passes which differentiate boarding times.

Issues to consider:

-passengers blocking in the aisle due to:

- pass to their seat (aisle seated before window)
- place their hand luggage

Improve Boarding

Many different boarding strategies:

1. BackToFront (B2F)
2. Random
3. WindowMiddleAisle (WMA)
4. Steffen (Mixture of B2F and WMA with skipping and performing one side at a time)
5. SortedBoardingGroups (SBG)
6. DynamicallyOptimizedBoarding (DOB)
(Similar to Steffen, considers cliques - who wants to board together)

Improve Boarding

Videos :

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- ✓ Boarding
 - ✓ The Flying Carpet
 - ✓ What's the Best Plane Boarding Plan

Zeineddine, Hassan. "A Dynamically Optimized Aircraft Boarding Strategy." *Journal of Air Transport Management*, vol. 58, 2017, pp. 144–151.,
doi:10.1016/j.jairtraman.2016.10.010.

Improve Boarding Simulation

Time parameters	Time
Avg. Walk time between 2 adjacent rows	1
Avg. Time stow luggage	3
Avg. Time to sit with 1-seat interference	10
Avg. Time to sit with 2-seat interference	16
Avg. Passangers' inter-arrival time	4

Strategy	Time units
B2F	667,56
Random	661,26
SBG	547,56
WMA	496,86
Steffen	487,86
DOB	490,1

Wrap-up – your experience

- Simple ideas – may work – trade-off: demand effect
- More sophisticated – requires planning (schedule, layout) or investment
- Requires technical knowledge of the process, hence we have less suggestions
- Smart ideas that require further analysis before implementation

Wrap-up (continued)

- Airport Operations –
 - Numerous processes
 - Complexity of the situation (history of IE)
 - Decisions are embedded in the processes
 - Decisions are interrelated
- IE's role – improvement via changing the implementation (decisions)
- Improvement with respect to a performance measure (total duration – Toast Kaizen)
- Examples for improvement: schedule, layout, equipment selection, boarding

Generalizations

- Time span of decisions: Short, Medium, Long (operational, tactical, strategic)
- Importance – All affect processes – not all are handled for a given purpose
 - rice cooking, airline operations

How do IE's handle these decisions?

➤ Engineering approach - a process, as well!

How is IE different than other similar jobs?

➤ Mathematical orientation - structured decisions repeated consistently - main value-added for IE's over “smart” people

Issues Summarized/Keywords

- Interrelated processes, complex decision making – IE emphasis
- Performance measure(s)
- Mathematical representation – Rice Cooking – **Abstract thinking, *modeling, decision variables***
- Improvement idea
- Time span of decisions

Important Generic Areas for Decision Making

Generic: A lot applications approached with similar abstraction

Example 1: Layout

- The way in which different parts of an area, volume is arranged
- Examples – factory, gate, warehouse, office
- Decision variables: size (continuous), function discrete)

Important Generic Areas for Decision Making (cont.)

Example 2: Schedule

- A plan of activities or events and when they will happen
- Examples – assembly line, construction, course
- Decision variables for course scheduling: when (time - continuous), where (location of class – discrete)

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