

## Breakout Session B-3: Layouting

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### Recent trends in layout design

- In the past the difference between state of art in FLP in academia and industry was big. Is this still the case?
  - Academia has covered it extensively, but is there a company that actually applies it?
- When starting the layouting of a facility, a lot of other design work has already been done (we assume)
  - We do not start by saying what are the functional requirements, what does the system have to do? How do we organize them?
  - If we start facility design process with layouting, we start in the wrong place
- Now layouts are more flexible, the problem can be solved multiple times and more dynamic
  - How can traditional methods keep up with the complexity of today's systems?
  - Detachment of traditional tools (charts, matrixes and algorithms) and today's complexity of systems
- New customer channels, how are we including different channels into one layout?
- What are the KPIs that we should be looking at, what is the objective function? With automation, is it still distance? Is it space?
  - "We don't know what we want, but we do know what we value"
  - Cost is still a factor
  - If you would take a conventional approach to systems design (the last step is to choose the technology), you cannot do that without determining other factors before
  - Robustness and sustainability might be new objectives that also make the problem more complex
  - Something that has improved is evaluating a solution, so now we can automate the generation process
- To solve the facility layout problem you usually start with  $n \times 2$  matrix (pairwise flow), minimize distance and flows
  - Issues: are those flows validated? Often, they are not, leading to inefficiencies
  - Solution more and more: Sensors that measure the actual movement of the people to feed it back into the optimization model
- Is layouting really an optimization problem?
  - There is a gap between an optimization problem and designing a facility, design has more complex requirements and evaluation criteria by a lot of stakeholders, it is an artistic process
  - Are we using layout and design interchangeably? A lot of time it happens, but they are not the same thing
  - Do we need to solve the layouting problem mathematically all the time?
    - How do you characterize a problem where there is a big difference between different layouting solutions and problems where different solutions have similar KPIs?
  - We are more concerned about a feasible solution than an optimal one
    - What does optimal mean? How long does the optimal solution stay optimal?
- Not much progress over the past 45 years in facility design

- Lots of progress in OR and tools

### Teaching layouting

- We are currently not teaching systems design (including layouting) practical enough
- What would be required to give industrial engineers a design class?
  - We don't teach design, do we teach layouting?
- Starting as a freshman, include more design tasks into optimization classes
- We do not have a structured process that we can teach students from scratch to a facility?
- More collaboration between mechanical engineering and industrial engineering
- There are competing system design processes and methods that are being used in industry (and academia)

### Trends in healthcare layout design (where should rooms be located in a building?)

- Trend in utilizing adjacencies comes back
- Different stakeholders: nurses, patients, doctors, they all have different requirements
  - More variability in flow (patients vs. boxes in warehouses)
- With Covid it got much more complicated (it was important, which departments have adjacencies)