

**Service science: At the  
intersection of management,  
social, and engineering  
sciences**

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**BABALIC ANDREI**

**SEM MASTER**

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# Introduction(1)



- What is a service?
- What is service science?
- Why the 3 layer approach?

# Introduction(2)



## Service definition:

1. Services are economic activities offered by one party to another. In exchange for their money, time, and effort, service customers expect to obtain value from access to goods, labor, professional skills etc. But they do not normally take ownership of any of the physical elements involved. (LOVELOCK & WIRTZ, "Services Marketing: People, Technology, Strategy," 6/e; Upper Saddle River NJ: Prentice Hall 2007).
2. A service is a time-perishable, intangible experience performed for a customer acting in the role of a co-producer. (FITZSIMMONS & FITZSIMMONS "Service management", New York, NY: McGraw-Hill 2003).
3. Services are the application of specialized competences, deeds, processes and performances for the benefit of another entity or the entity itself. (LUSCH & VARGO, "The Service-Dominant Logic of Marketing." Armonk, NY: ME Sharpe. 2006).

# Introduction(3)



**Service science** is a term introduced by IBM to describe an interdisciplinary approach to the study, design, and implementation of services systems – complex systems in which specific arrangements of people and technologies take actions that provide value for others.

- High percentage of GDP
- Determines the creation of a new type of engineer
- Covers a broad and diverse range of activities

# Introduction(4)



- **Engineering component:** efficient solution for purely technical challenges. Computer science, electrical engineering, mathematical modeling etc.
- **Social component:** The human element is almost always present in the analysis. Narrow, purely technical solutions are not adequate for service systems
- **Management component:** planning and managing of large infrastructure capital investment projects, pricing, promotion etc.

# Three-way analysis history



## **A.K. Erlang**

- invented the mathematical theory of queues in the period 1909–1917
- new invention—the centralized telephone switch or “automatic telephone exchange
- brought management and social science into his analysis
- the psychology of queuing is almost as important as the physics of queuing

## **Frederick W. Lanchester**

- In 1915 created a simple mathematical model of warfare
- implicitly, rather than explicitly, incorporated management and social science issues into his analysis

# CESF research initiatives in services(1)



- CESF= Center for Engineering Systems Fundamentals
- Small group of researchers at the Massachusetts Institute of Technology (MIT)
- Established in 2005
- Works at the intersection of engineering, management, and social sciences

# CESF research initiatives in services(2)



Research Topic Area	Engineering Science	Management Science	Social Sciences
Demand management for critical infrastructures	Electrical and systems engineering	Planning large capital investment projects; maintaining systems	Understanding cost-benefit relationships for users in order to shave peak demands
Voting systems	Operations research of queuing	Managing the pre-election day deployment and real-time re-deployment of resources	Understanding voters' decision to abandon voting lines
Social distancing in influenza pandemic	Modeling the physics of disease progression	Planning responses of government, businesses, and families	Understanding and managing human behavior in the presence of a pandemic
Hurricane preparedness and response	Modeling the physics of hurricane progression	Managing evacuations and related responses	Understanding people's propensity to follow evacuation orders
e-learning in developing countries	Computer science, electrical engineering, and operations research	Managing the deployment of technology and human assets and maintaining the system	Understanding learners' responses to pedagogy by culture, gender, age, and related measures

# E-electricity management system



- System for optimizing energy consumption in a personal home, workspace and other locations
- The system may use Bluetooth, the Internet, Wi-Fi (wireless network access), RFID (radio-frequency identification), and other new communication technologies
- 2 types of usage: user control mode and provider control mode
- User control mode - time of day or dynamic state-of-the-system pricing
- energy-optimizing system
- The lifestyle energy optimizing system would also include data-mining and algorithmic software

# Voting systems



- Voting systems are very important service systems in democracies
- Potential voters were discouraged from voting in both the 2000 and 2004 presidential elections in the US due to long lines
- Systems designers must compete and offer total voting systems, utilizing the analysis tools of service science
- traditional engineering involves the industrial engineering or operations research of the physics of queues
- Social science is involved in the psychology of queuing
- Management science is involved with the supervision of implementing a voting machine deployment system and in responding to unanticipated long queues on election day

# Conclusions



- Engineering systems is different from systems engineering
- Engineering systems uses three-science intersection
- engineering must be the dominant paradigm
- Service engineers must become experts in the integrated analysis of systems, incorporating social, management, and engineering science