Aalto University
School of Business

Session 10:
Digital Logistics
35E00750 Logistics Systems and Analytics

Dr. Tri M. Tran
Assistant Professor of Operations Management
University of Groningen
https://www.rug.nl/staff/tri.tran/

Course contents

Part 1. Background

1. Understanding supply chains
2. Achieving supply chain fit
3. Mathematical programming for Logistics & SCM
4. Guest lecture: Janne Kilpua

Part 2. Transportation

5. Urban logistics
6. Vehicle routing problems

Part 3. Facilities

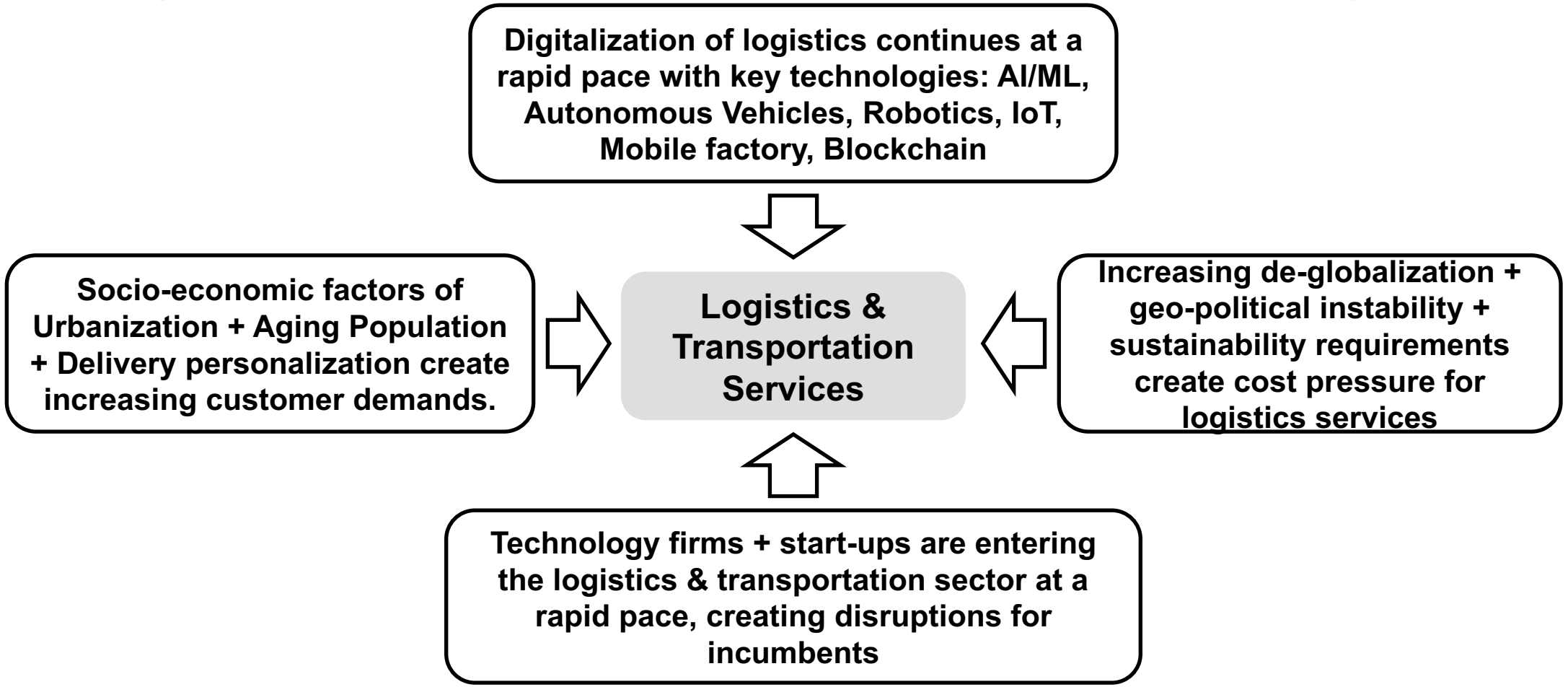
7. Warehousing technologies
8. Guest lecture: Konecranes
9. Facility location problems

Part 4. Digitalization

10. Digital logistics
11. Logistical drivers and metrics

Logistics & Transportation Mega-Trends

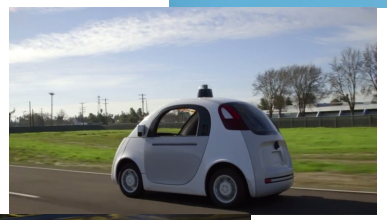
four mega-trends that have identified to impact the industry sector

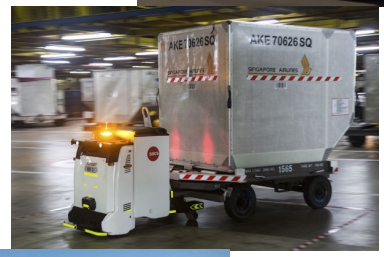


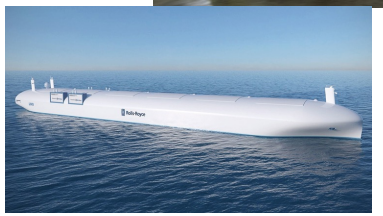
Threats in logistics industry

Digital transport?

- Drones
- Self-driving cars/trucks
- Autonomous cargo handling equipment
- Autonomous vessels
- Or something else?







Digitalization of transportation documents

Digitalization of transportation documents

- Documents used in the transportation and forwarding of cargo **differ** by traffic mode (air, rail, sea, road), e.g., for the bill of lading /waybill documents

- The generic reference architecture requirements specification most often used in the UN/CEFACT standard. It is applied, for instance, in UBL 2.X by OASIS and ISO → use of XML schemas

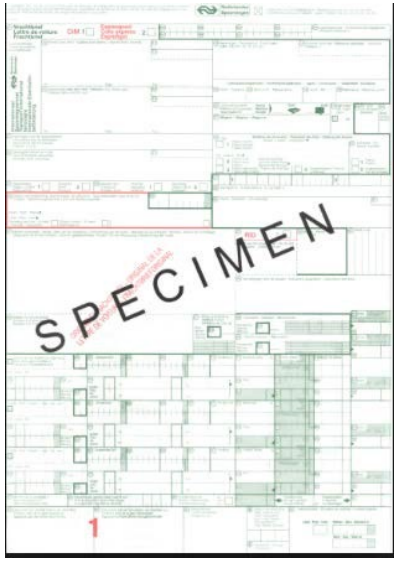
High-level Transportation Information Reqs.
Information flow within logistics services functions

Examples

CMR/ECMR(Road)

AirWaybill(Air)

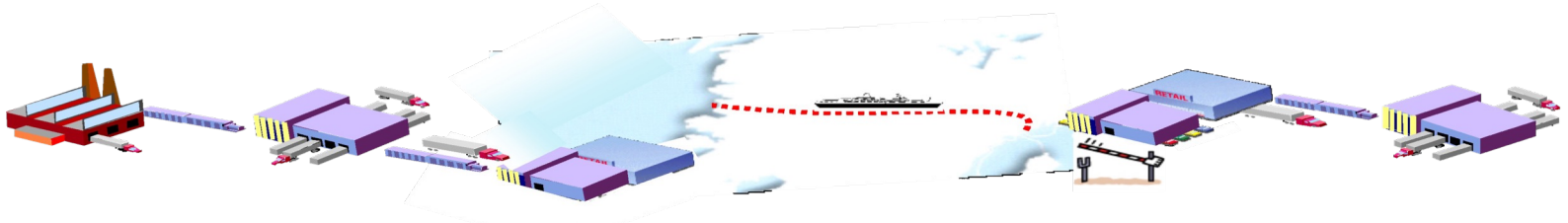
CIMWaybill(Rail)



Non-standardized and lack of digital transport documentation create supply chain and logistics performance challenges

Multiple Supply Chain Stakeholders w/ non-standard Documents

(Increases the operational and administrative complexity)



Manufacturer Distributor | Freight Forwarder | Port Authority "A" Customs | Transport Carrier | Port Authority "B" Customs | Distribution Centre

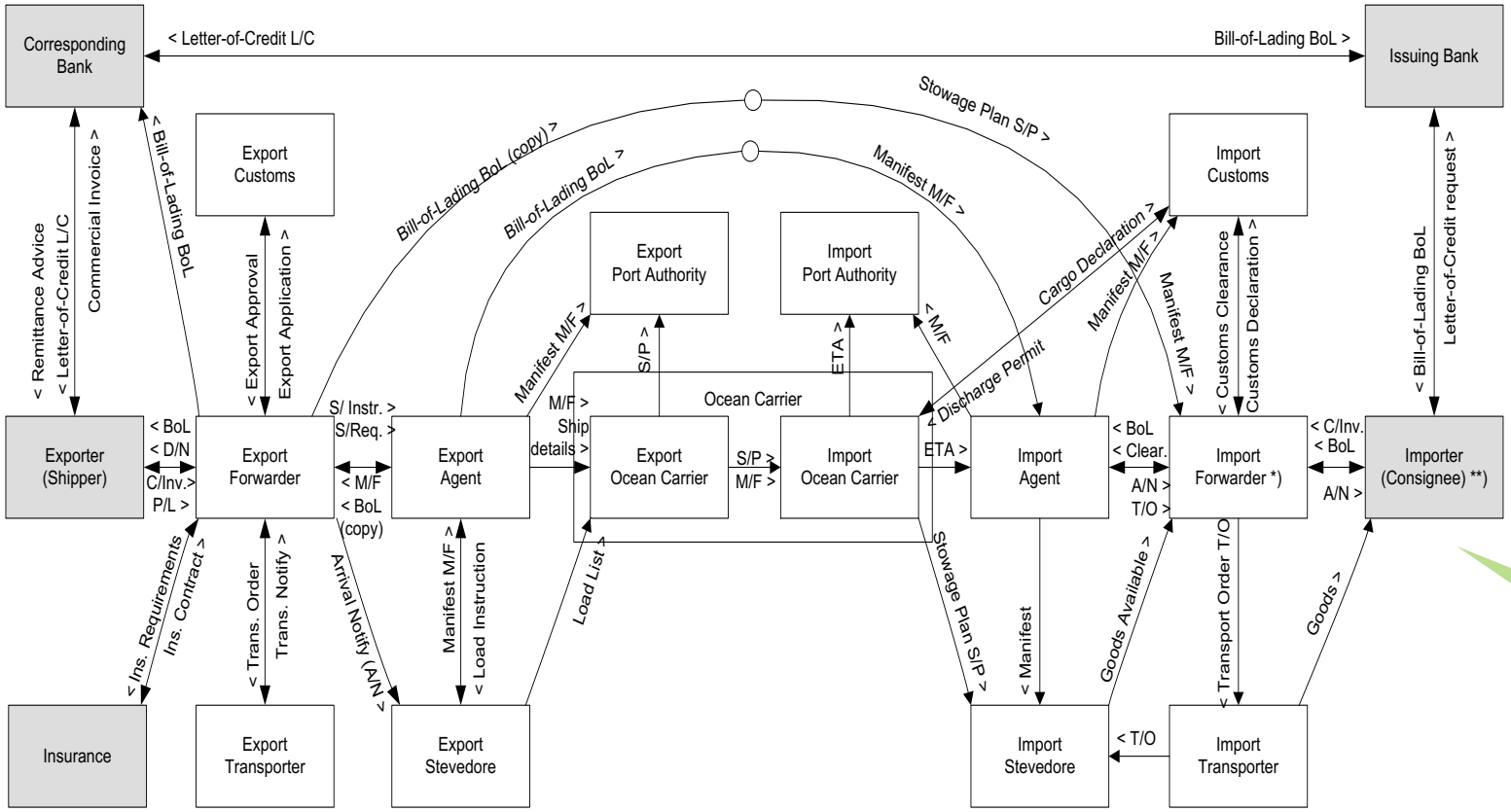
sometimes complementary – sometimes conflicting

Supply Chain Performance Challenges

(= In-Efficiency, Un-Reliability, Costly)

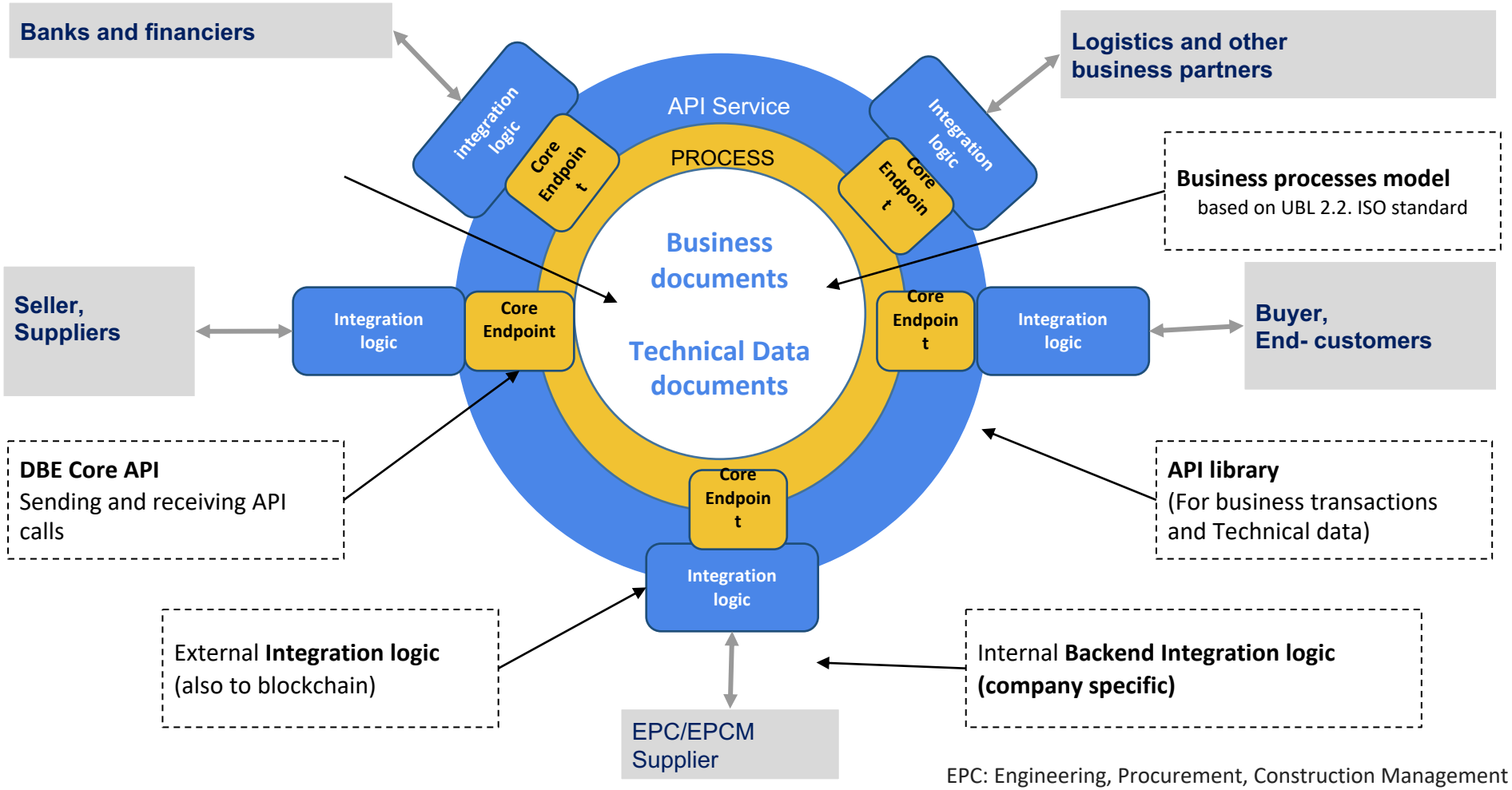
(ensure trade facilitation by developing common transport documentation and data standards and exchange)

The current state of transportation data exchange and processing has a lot of room for improvement



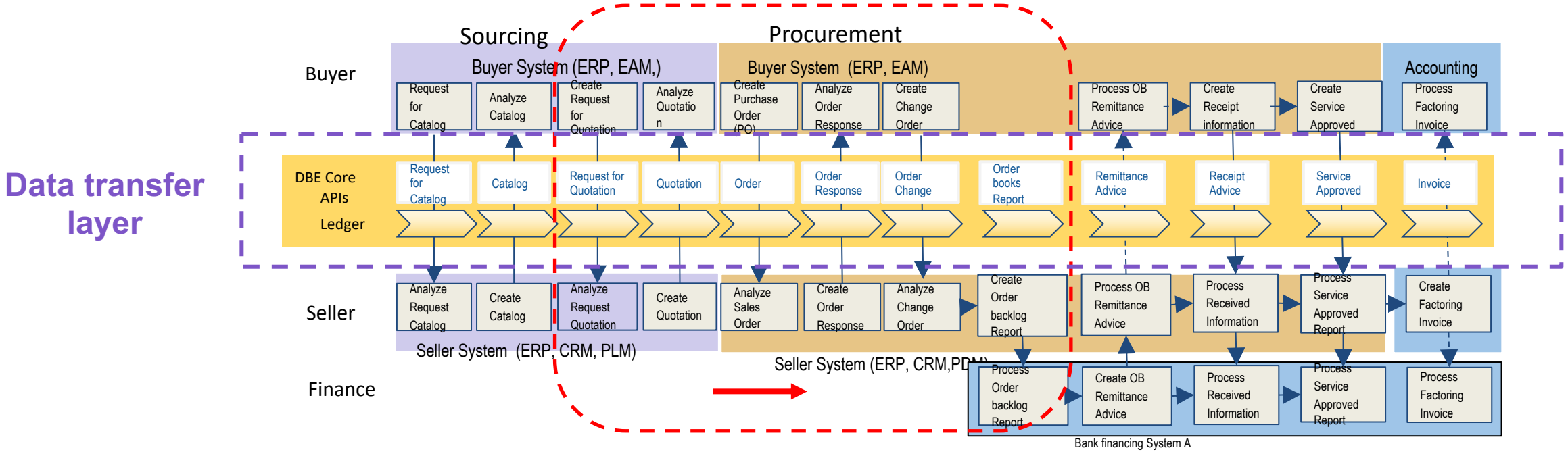
Complexity?
Probability of errors?

Solutions?



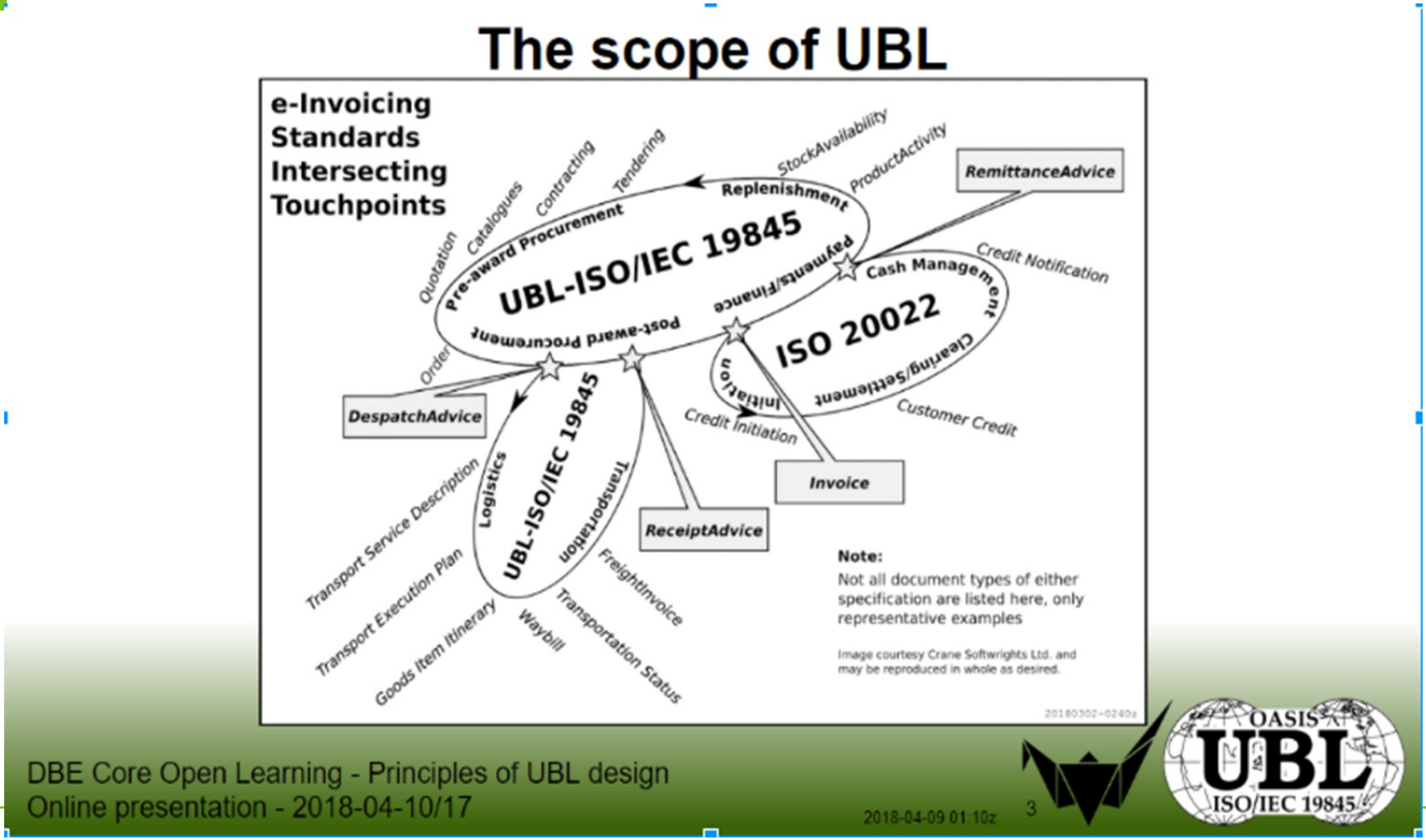
EPC: Engineering, Procurement, Construction Management

Digital sourcing and procurement process



Source: DBE-core project presentation

Using UBL and other standards with the Core Concept Idea



Aalto University
School of Business

The solution

- **What problems this system solves:**
  - Buyers execute trade transactions manually, with large amounts of non-productive work, errors, waiting time, non-flexible financing, insurance, logistics, and non-reliable data.
  - Ecosystem integration and collaboration remain low

- **How does this system solve the problem:**
  - Agree on message structures used in trade transactions between ecosystem parties
  - Facilitate flexibility in messages to include necessary documents
  - Create an immutable trusted transaction register of trades
  - Create solid data for ecosystem-level analysis

Blockchain?

Digital logistics data

Logistics data is a key resource, as it forms the basis for domestic and international trade.

It enables cooperation between supply chain actors:

- Better supply chain visibility
- Real-time management of traffic and cargo flows
- Simplification and the reduction of administrative burden
- Allows for improved utilization of
  - Logistics resources
  - Assets and infrastructure
- While increasing operational efficiency and reducing costs

Digital logistics data

- In order to reap those benefits, transport should become digital
- Electronic data should flow seamlessly through supply chains including the exchange of data with business partners and public authorities
- Data should be to generate added value for business
- The standardization of data models and harmonization of digital data exchange of logistics (e.g., bills of lading, import/export declarations, packing lists) reap substantial benefits
  - €28-35 billion in cost savings (Traficom, 2018)

Why it is so difficult?

Despite…

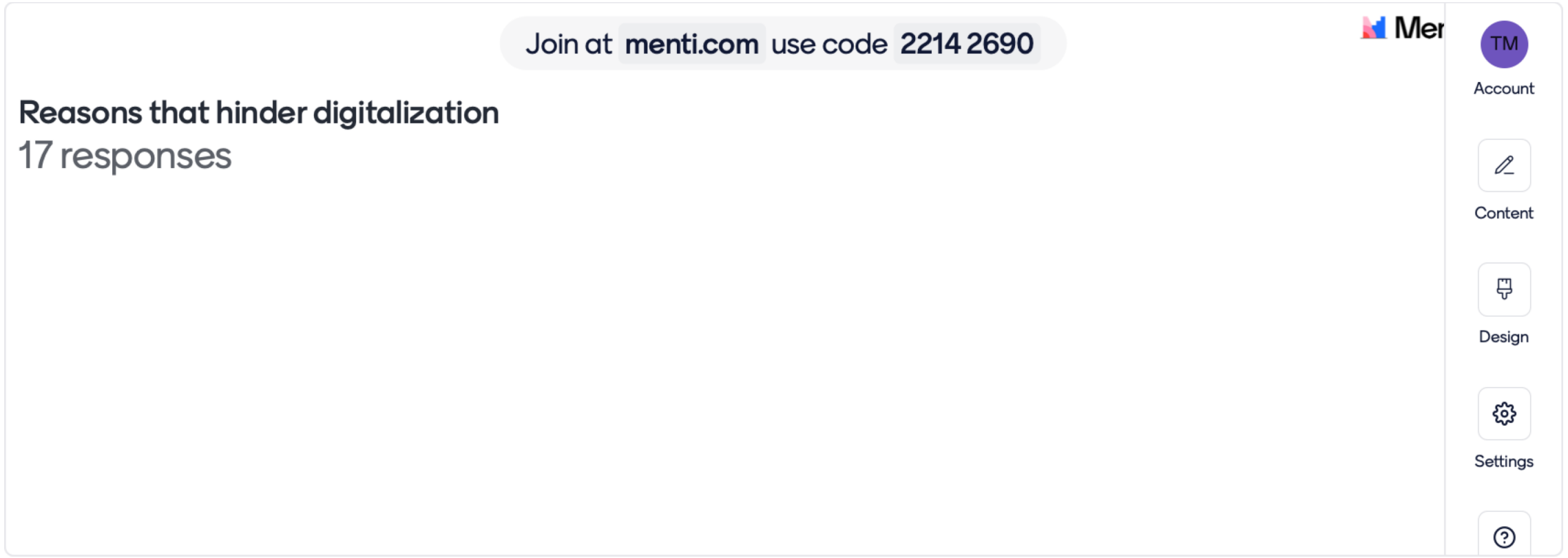
- Different standards have already been developed already tens of years
- New technology is not needed for digitalization
- All parties in the supply chain win
- The Finnish economy alone has the potential to save €28-35 billion

Reasons that hinder full exploitation of digitalization

Mentimeter

Aalto University
School of Business

Reasons that hinder full exploitation of digitalization



Reasons that hinder full exploitation of digitalization

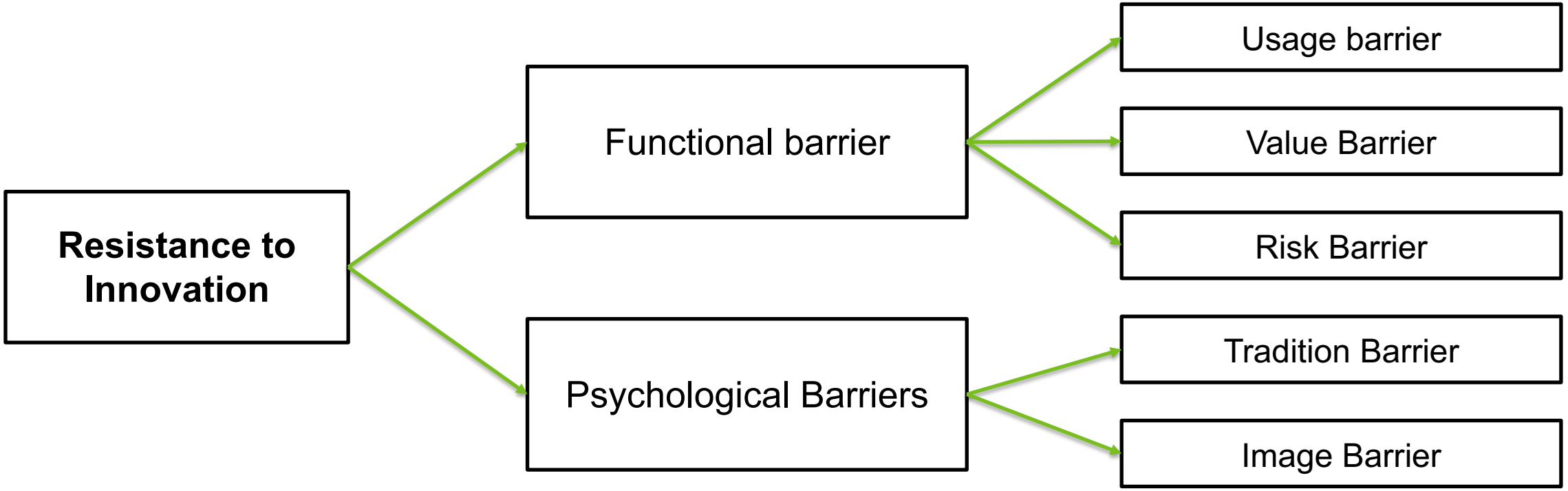
1. Not trusting others
2. Changes required to own information systems
3. Benefit sharing in the supply chain
4. What else?

Aalto University
School of Business

Some theoretical lenses

Innovation Resistance Theory

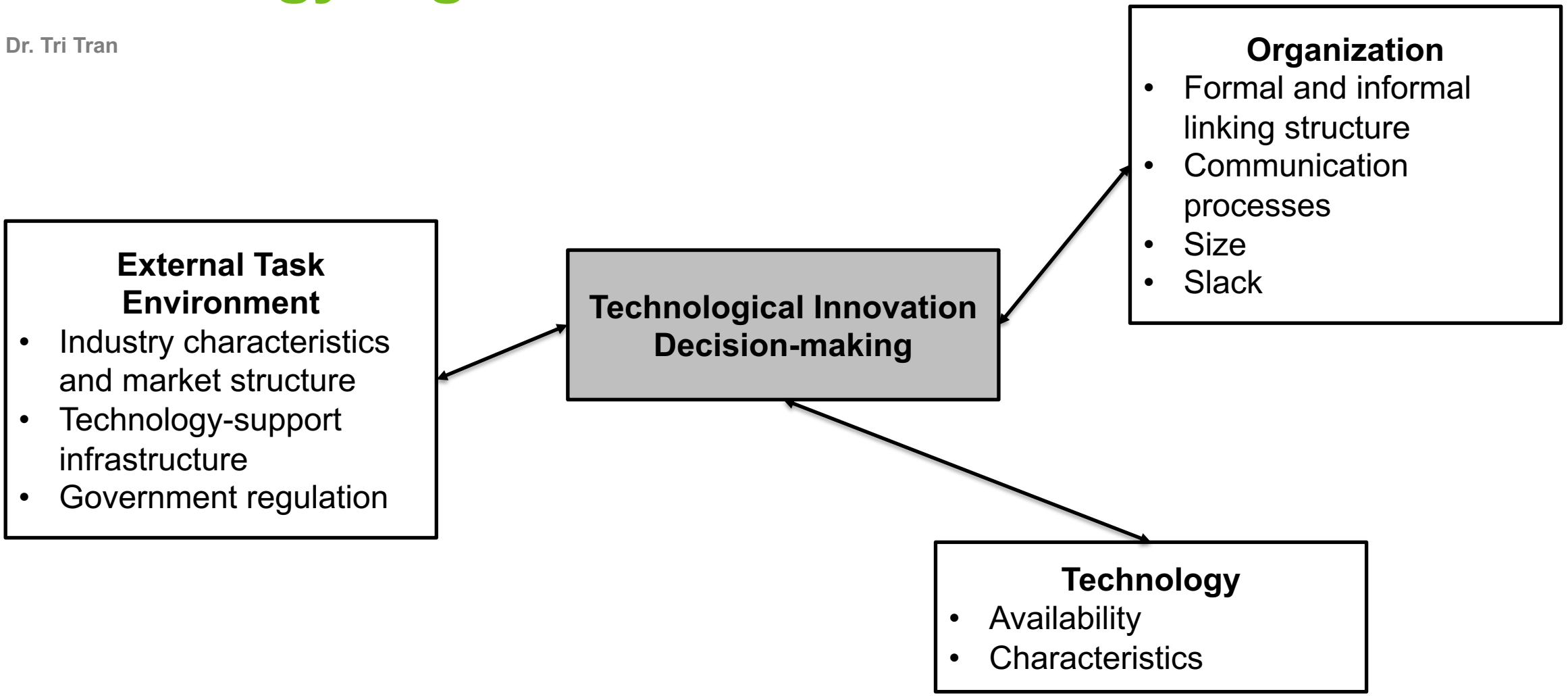
Dr. Tri Tran



Source: Ram, S., & Sheth, J. N. (1989). Consumer resistance to innovations: the marketing problem and its solutions. *Journal of Consumer Marketing*, *6*(2), 5-14.

Technology-organization-environment Framework

Dr. Tri Tran



Source: Tornatzky, L. G., & Fleischer, M. (1990). Technology-organization-environment framework. *The Processes of Technological Innovation*.

Aalto University
School of Business

Business Analytics

Levels of business analytics

Descriptive	Diagnostic	Predictive	Prescriptive
What has happened?	***Why did it happen?***	***What will happen?***	***What should we do?***
▪ Descriptive statistics ▪ Data visualization ▪ Dashboards	▪ Regression models ▪ Time Series Analysis ▪ Dimension Reduction Techniques ▪ Machine Learning/AI	▪ Regression models ▪ Time series analysis ▪ Monte Carlo Simulation ▪ Machine learning / AI	▪ Monte Carlo Simulation ▪ Decision analysis ▪ Mathematical optimization / programming
Courses: Introduction to Business Analytics, Introduction to Statistics, Econometrics, Data Science for Business 1	Courses: Introduction to Business Analytics, Introduction to Statistics, Econometrics, Data Science for Business 1	Courses: Introduction to Business Analytics, Introduction to Statistics Statistics & R, Econometrics, Data Science for Business 1	Courses: Business Analytics 1, Business Analytics 2. Decision Making and Choice Behavior. Data Science for Business 2

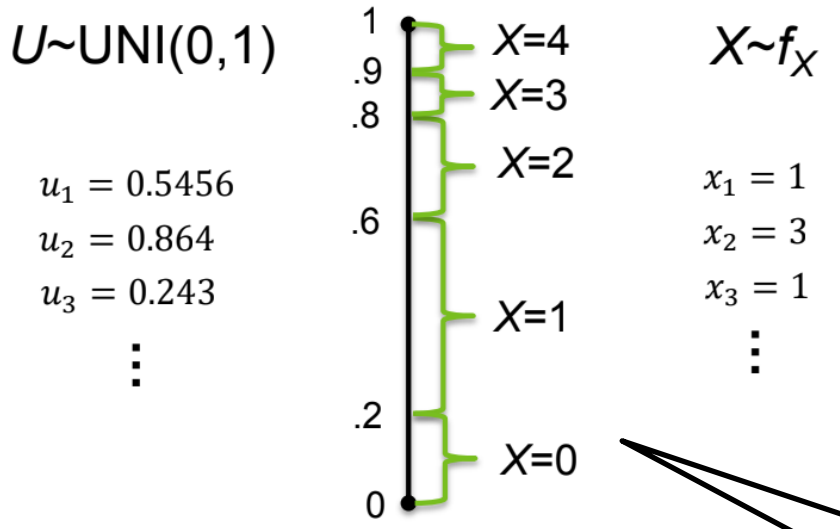
Monte Carlo Simulation with Excel

Monte Carlo Casino → Rolling the dice → Randomness

We can use this simulation to simulate the uncertainty

Monte Carlo Simulation with Excel

=RAND() function generates random number from 0 to 1 with equal likelihood



This corresponds to cumulative probability (from 0 to 1)

We then use the =RAND() function to simulate the following demand

# of shipments demanded per week, x	Probability of demand, f(x)
0	0.2
1	0.4
2	0.2
3	0.1
4	0.1

All these values should sum up to 1

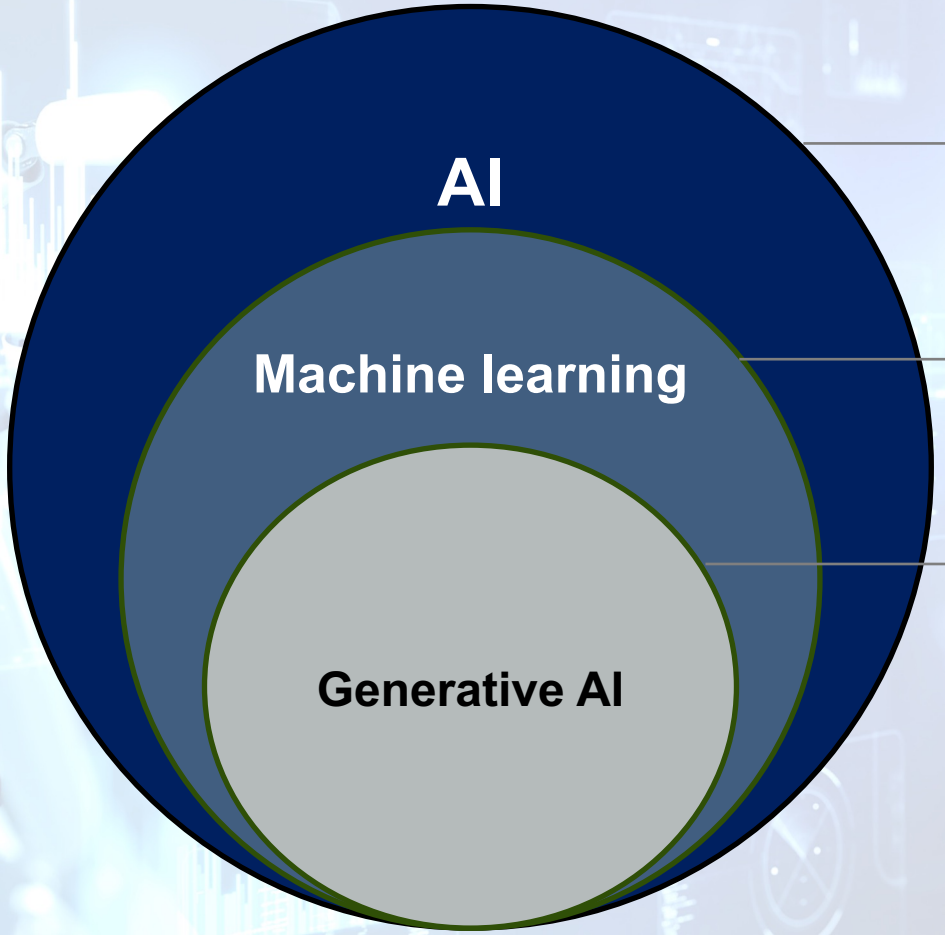
Monte Carlo Simulation with Excel

Please refer to the Excel file

Aalto University
School of Business

Artificial Intelligence

AI vs. Generative AI

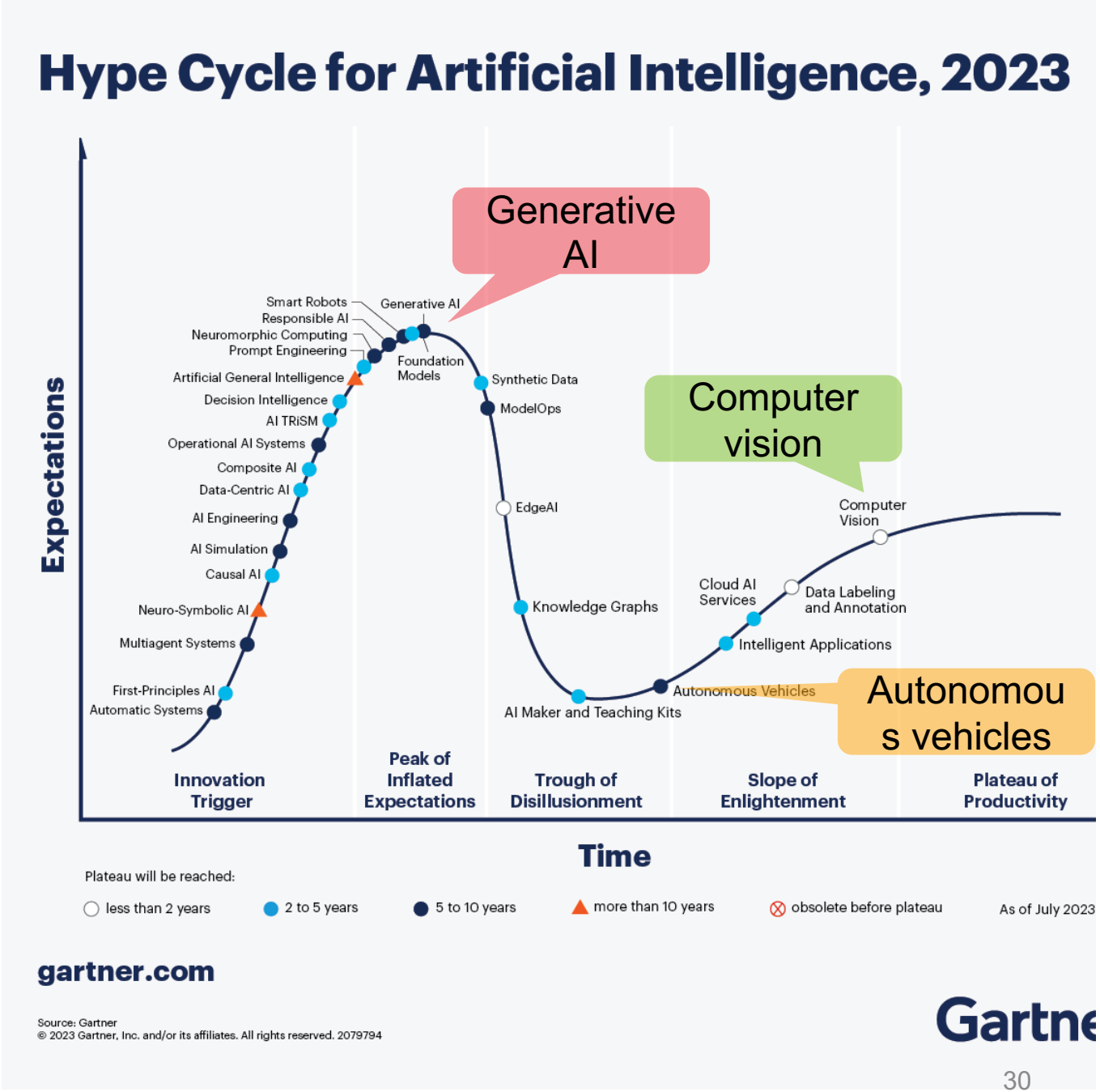


Overarching concept

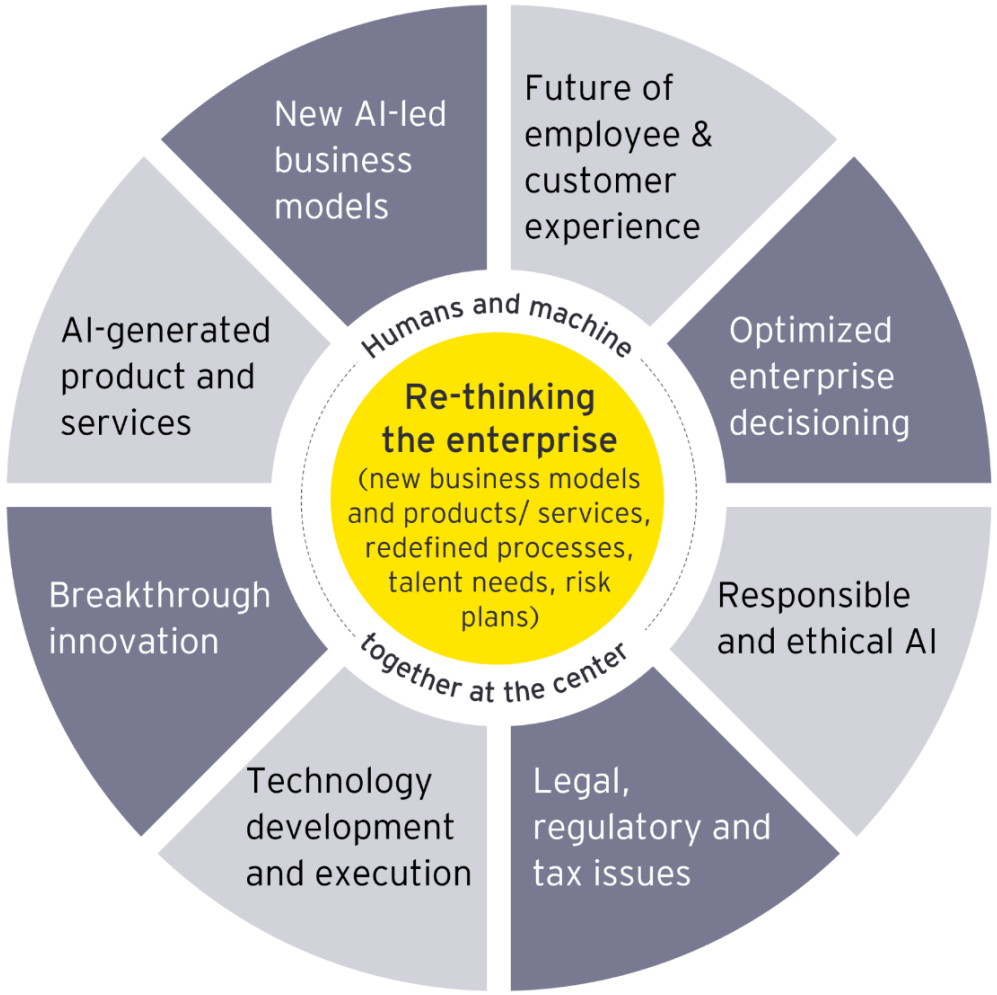
Sub-field of AI

Use machine learning techniques to generate new content based on patterns learned from training data

Beyond the hype



AI-enabled transformations



Source: EY (2023)

3 promising cross-sector use cases for AI

PREDICTIVE MAINTENANCE

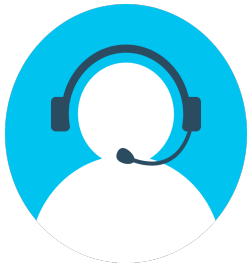
1. Predictive maintenance

AI-informed predictive maintenance can more accurately project when maintenance will be needed

LOGISTICAL OPTIMIZATION

2. Logistics optimization

AI-optimized logistics can reduce cost through real-time forecasts and behavioral coaching



CUSTOMER SERVICE

3. Customer service

AI techniques in call centers can enable a more seamless experience for customers and better processes

Source: McKinsey and Company (2023)

AI-enabled customer service (1/2)

Nine critical components

Reimagined engagement

1. New or updated self-service channels with automated journeys
2. Modernized assisted channels with tech enabled front-line
3. Preemptive, proactive end-to-end customer communication
4. Reimagined service journeys with standard operating procedures across channels
5. Simplified templatized service-to-sales interaction

Source: McKinsey and Company (2023)

AI-enabled customer service (2/2)

Nine critical components (cont.)

AI empower decisioning

6. AI-enabled automated intent recognition and resolution layer
7. Measurements and governance nerve center for descriptive and predictive analytics

Core tech and data

8. Technologies embedded into an API-driven tech stack

Operating model

9. Integrated service, business, and product operating models with capability-building academy

Source: McKinsey and Company (2023)

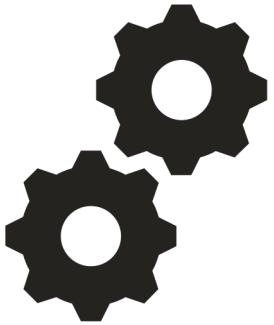
Concerns regarding general AI

Ethical

Bias and Fairness
Transparency
Accountability

Social

Job displacement
Inequality



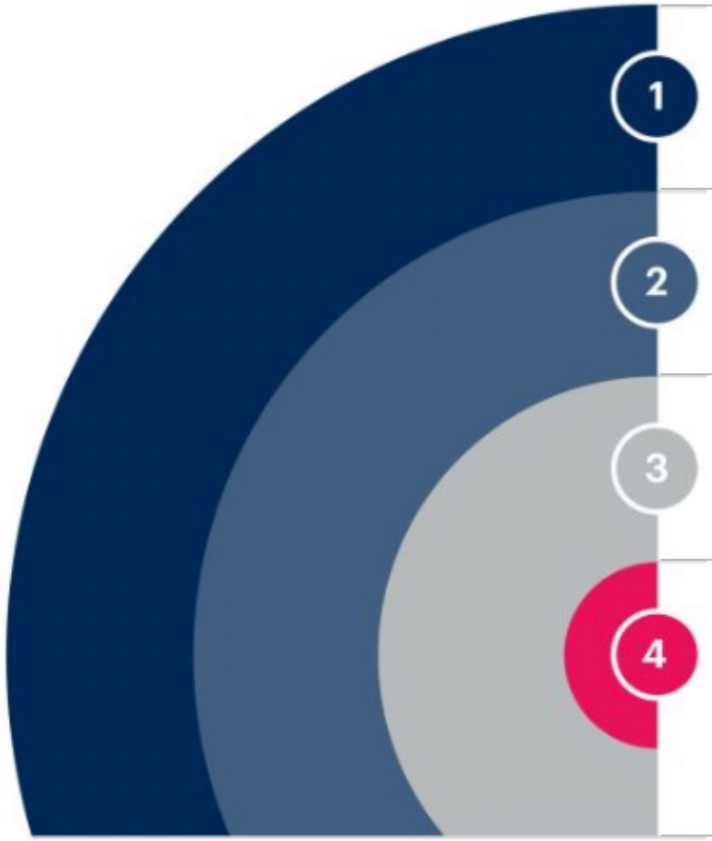
Technical

Explainability
Limit by historical data

Security

Malicious use
Privacy

What is Generative AI?

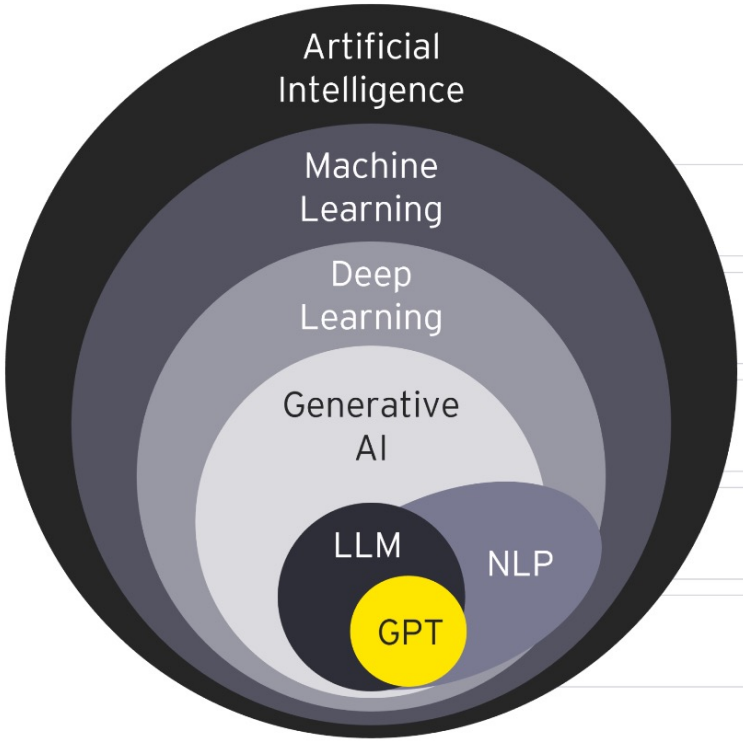


Generative AI	AI techniques that learn from data about existing artifacts and use this to generate new artifacts.
Foundation Models	Large machine learning models that are trained on a broad set of unlabeled data and are fine-tuned to a wide range of applications.
Large Language Models (LLM)	AI that is trained on vast amounts of text to interpret and generate human-like textual output.
ChatGPT	An OpenAI service that incorporates a conversational chatbot with LLM to create content.

Source: Gartner (2023)

Understanding GENAI

Large Language Models (LLMs) sit at the heart of GenAI, which in itself, can be categorised as a subset of Artificial Intelligence (AI).



GenAI capabilities:

- Summarizing
- Expanding
- Chatbots
- Inferring
- Transforming

Typical applications:

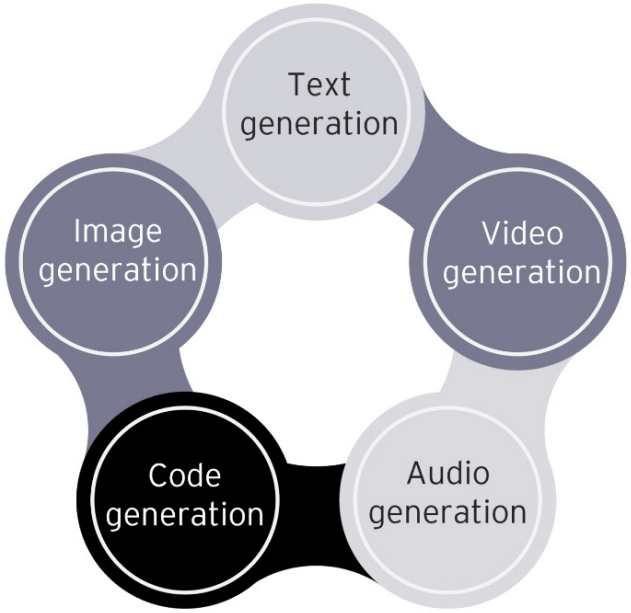
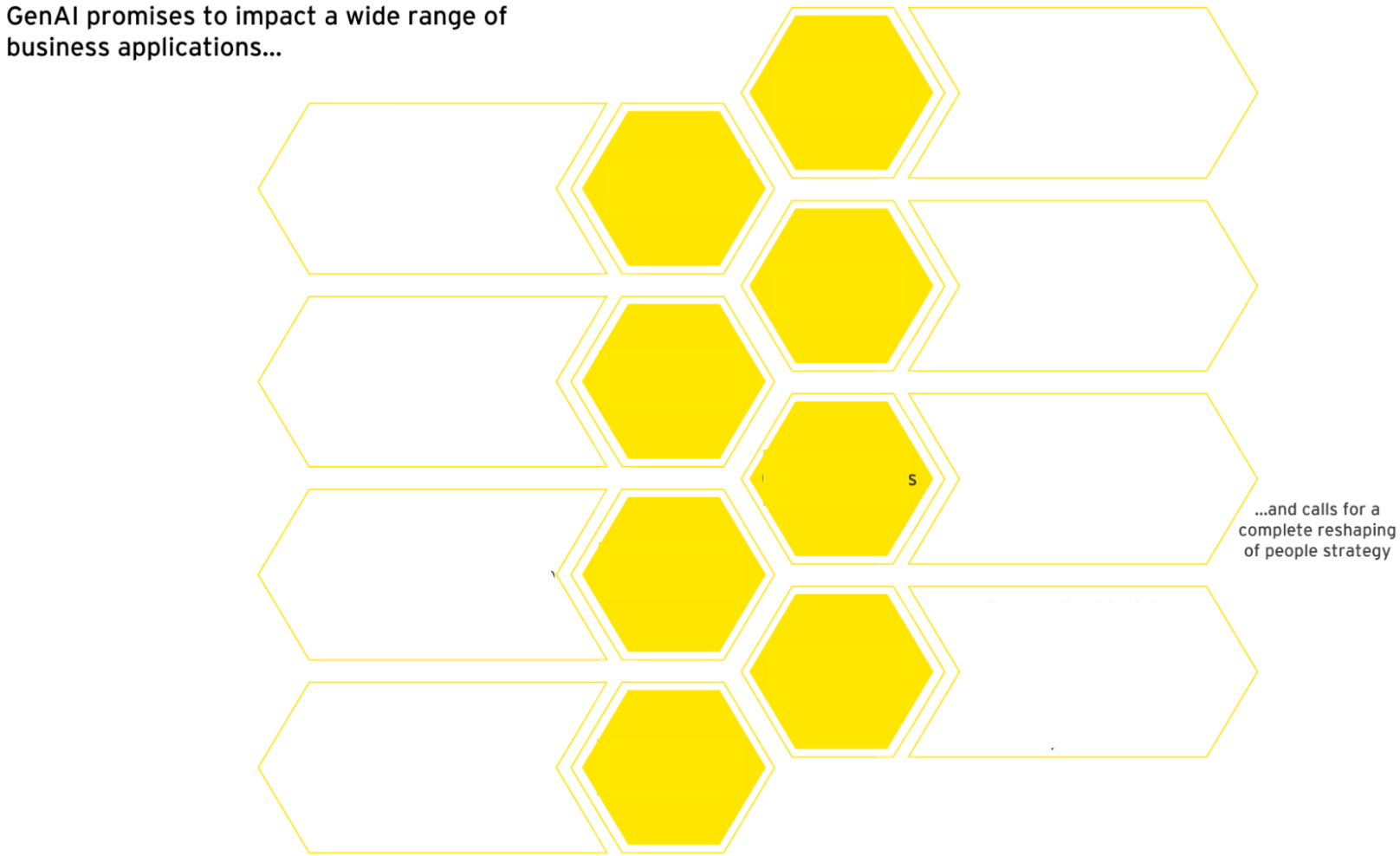


Figure 1. Understanding GenAI

Generative Pre-trained Transformer (GPT) uses a combination of LLM and Natural Language Processing (NLP) capabilities to provide a host of fundamental capabilities which find a host of generative applications.

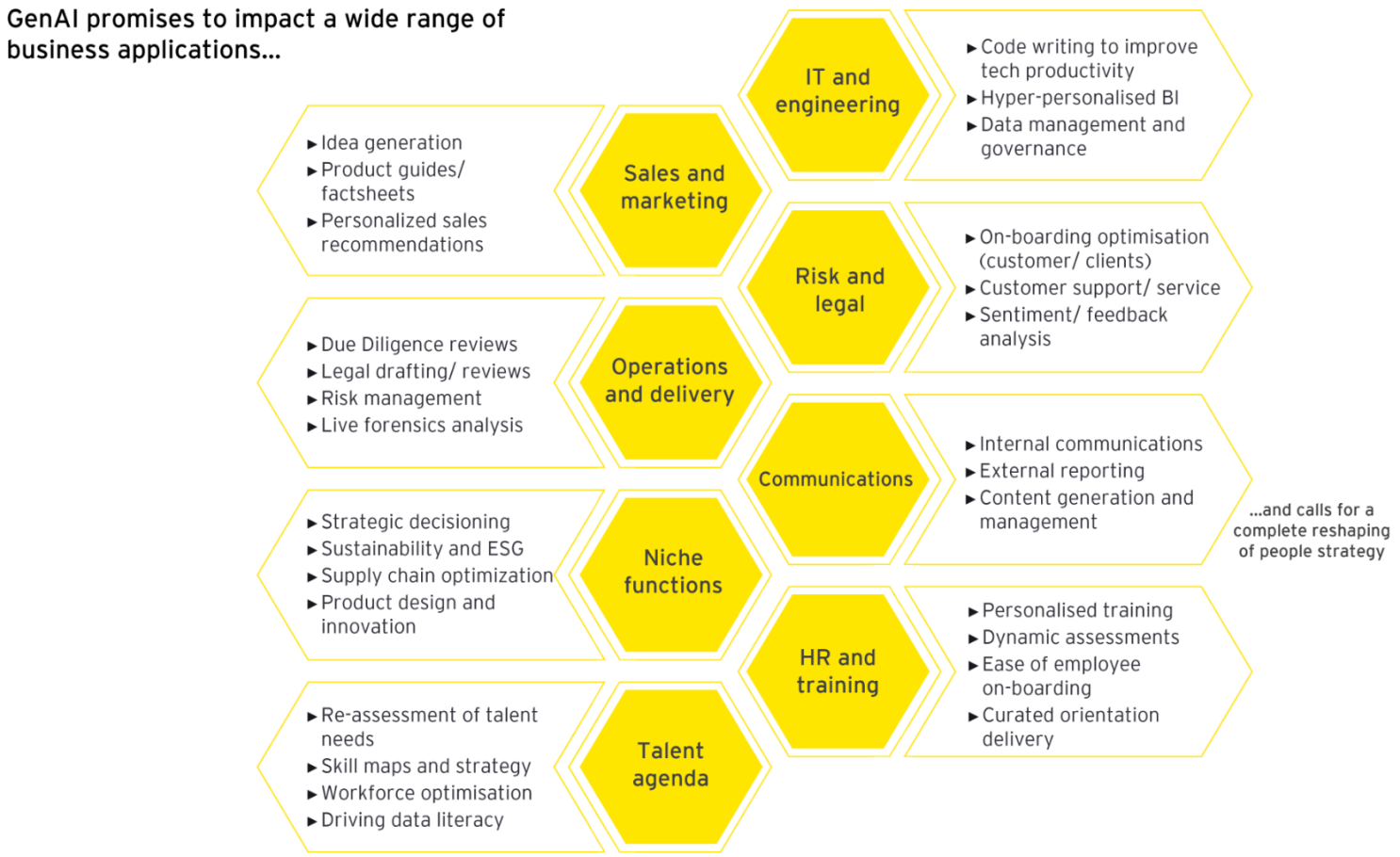
Source: EY (2023)

GENAI in business applications



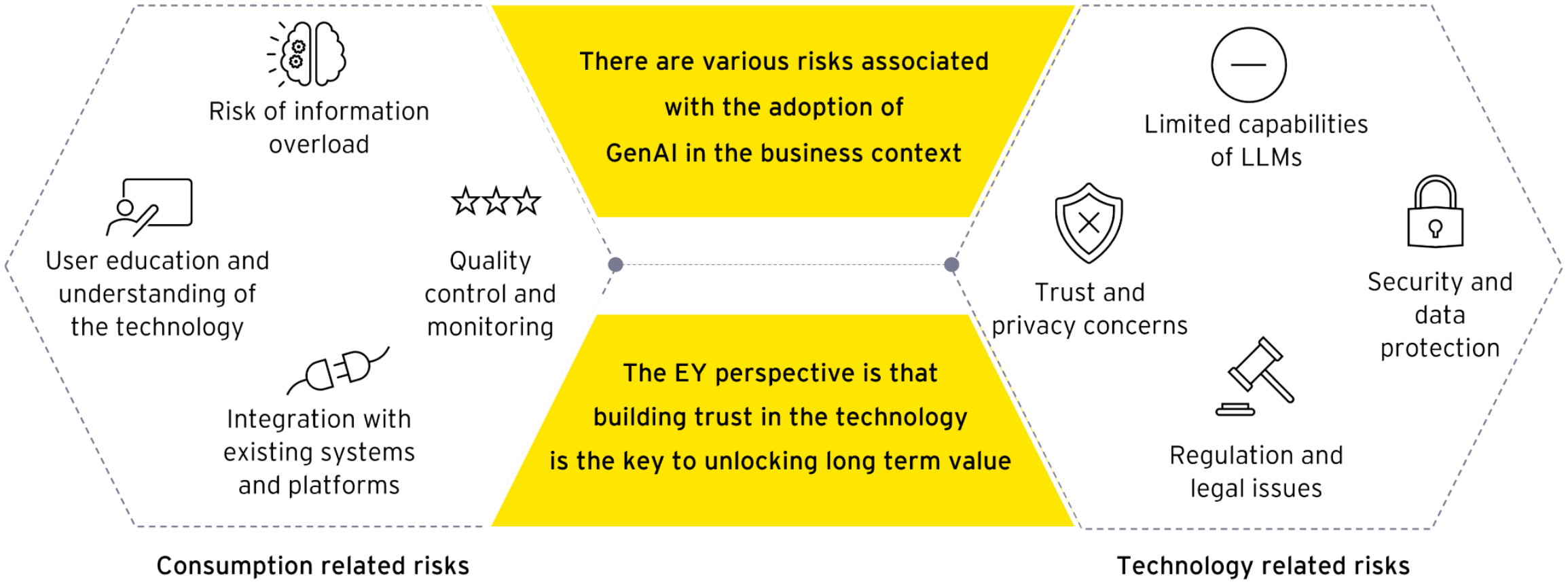
Source: EY (2023)

GENAI in business applications



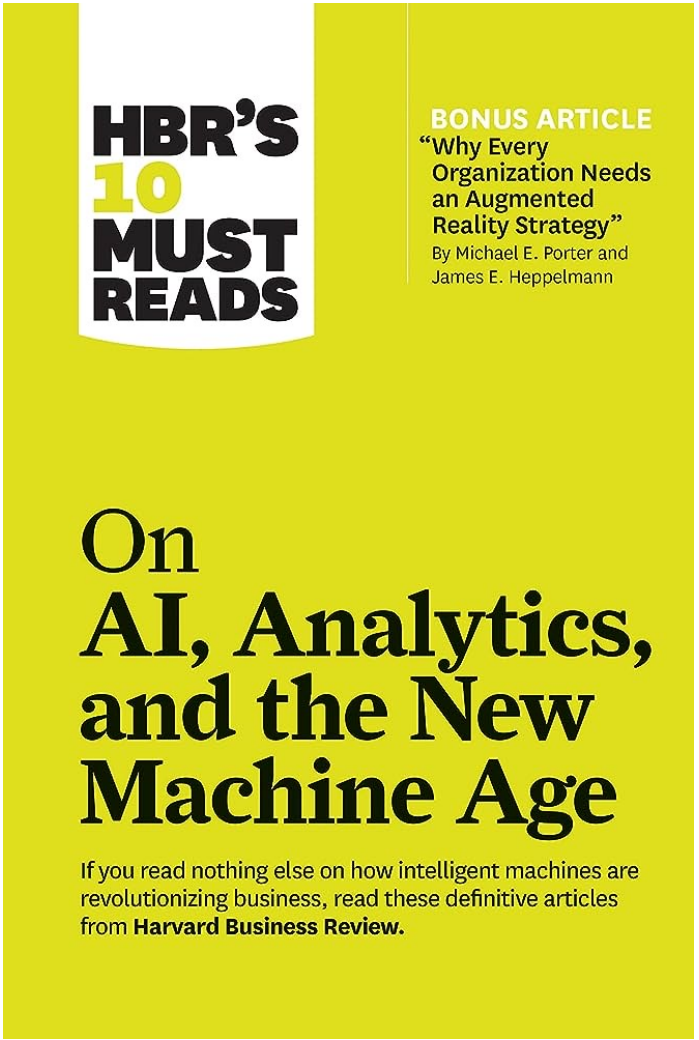
Source: EY (2023)

Important considerations of GENAI



Source: EY (2023)

If you're interested …



Aalto University
School of Business

university of groningen
faculty of economics and business

Thank you!

Questions?

Dr. Tri M. Tran
tri.tran@aalto.fi