CRITICAL LESSONS FROM THE IMPLEMENTATION OF LARGE-SCALE AI TECHNOLOGIES

By

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UNLOCKING AI'S VALUE: AI-DRIVEN BUSINESS IMPACT

- ❑ Digitalization has not fully delivered expected productivity and economic gains.
- ❑ AI investments show unclear returns, with some cases of decreased productivity due to high costs.
- ❑ A critical mass of new technologies, including AI, is needed for significant business impact.
- ❑ Existing siloed enterprise architecture limits integration and causes the fragmented accumulation of knowledge and new technologies (intangible capital).
- ❑ For digital and AI technologies to make an impact on business, intangible capital needs to be accumulated across all levels of the new digital enterprise architecture.

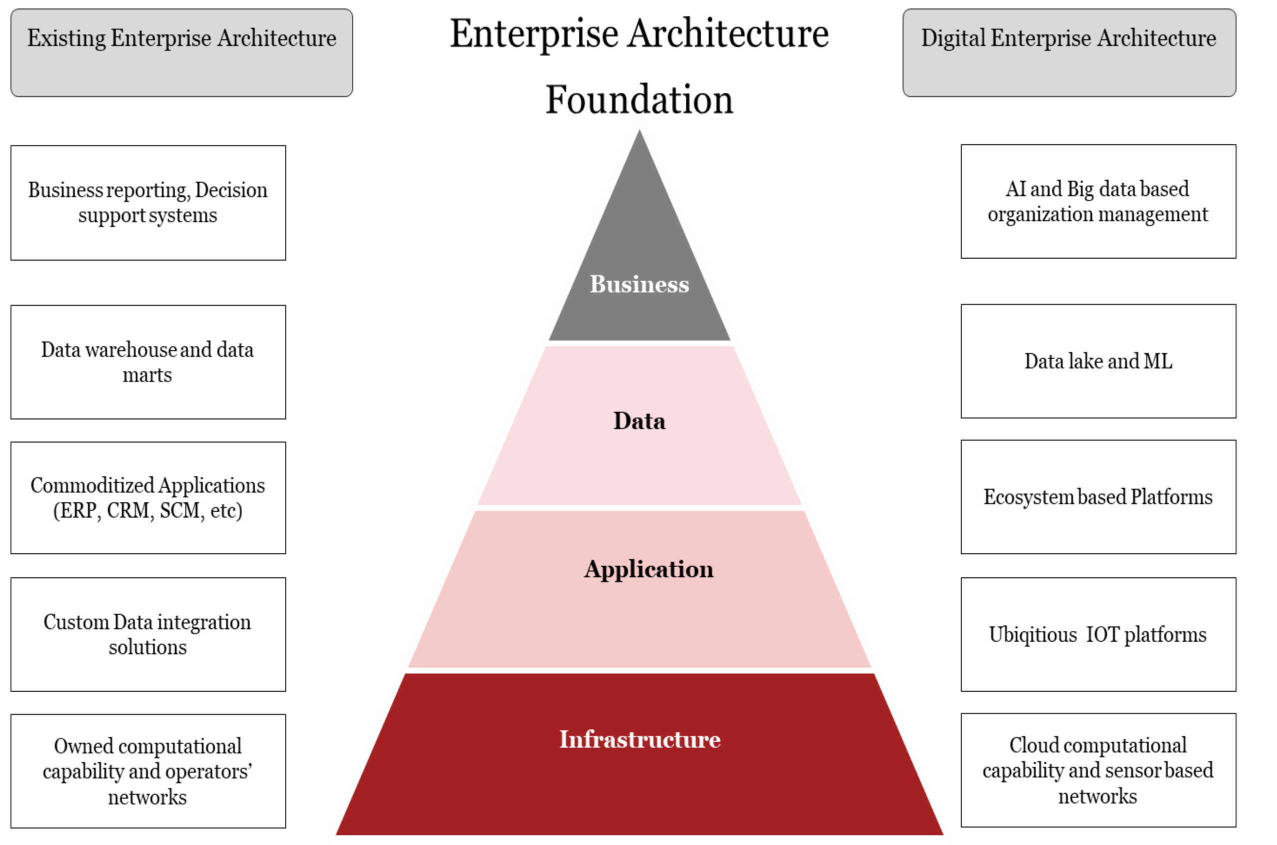


Figure 1. Digital and existing Enterprise Architecture.

RESEARCH OBJECTIVES

- Research Question and Methodology
  - Evaluates key factors impeding large-scale digitalization programs
  - Focuses on AI as a lever to improve productivity and ROI
- Hypothesis – intangible capital to be accumulated for AI implementation success
  - Organizational resistance impacts AI implementation
  - Business processes and managerial competency are crucial
  - Accumulating AI knowledge is essential
- AI Solutions and Productivity
  - Transformation of lower layers of EA to digital state is necessary
  - Enables knowledge-based intangible capital for business layer

METHODOLOGY OVERVIEW

- Qualitative Case Study Approach
  - Focus on companies investing in digital solutions
  - Selected nine enterprises from various industries
- Data Gathering Phase
  - In-depth interviews with C-level representatives
  - Questions on digital and AI program plans and results
  - Discussion on critical factors during implementation
- Analysis Phase
  - Summarized digital transformation programs
  - Presented projects along industry-specific value chains
  - Synthesized factors impacting program implementation
- Key Impediments and Recommendations

ACADEMIC LITERATURE - FACTORS INFLUENCING AI ADOPTION

Brynjolffson: AI Intangible capital stems from

- New business models
- Organizational structures
- Processes

Complement technology by fostering decentralized decision-making, self-managing teams, and expanded job roles

Loonam: 4 elements of Intangible capital

- Strategies
- Customer experience
- Technological integration
- Organizational culture and processes.

Chen: TOE based factors for AI adoption

- Managerial support – motivator to drive organizational and technological changes
- Compatibility – ensures AI solutions align with the organization's needs and culture.
- Complexity – affects how easily AI can be implemented
- The relative advantage of AI – I.e. terms of cost and efficiency improvements
- External factors, e.g. government regulation
- Vendor partnerships – due to the limited internal AI expertise.
- Managerial capability – enabler to motivate teams and adapt to fast-developing AI technologies

Hamm and Klessel: important factors for AI implementation

- Organizational Drivers: Top management support, technical skills, and resources are critical for digital transformation.
- Technological Factors: IT infrastructure compatibility, AI advantages, and quality data are essential for success.
- External Factors: Market competition and government regulations drive digital transformation efforts.

CASE 1: ENERGY GENERATION HOLDING

Project Overview

- Initiated by a large energy holding in Eastern Europe
- Aimed at automating generation plants

Objectives

- Improve equipment reliability with precise data and automation
- Optimize costs by managing fuel consumption using AI

Expected Economic Benefits

- Fuel savings
- Optimized preventive maintenance
- Projected returns on investment in years 3-4

Investment Costs

- Allocated to infrastructure and data management

Overall Value Chain

Inbound Logistics → Operations → Outbound Logistics → Sales Marketing → Services

Electricity generation value chain

Procurement of equipment Procurement and supply of materials, zip Procurement and supply of fuel (gas, coal, etc)	Electricity generation at plants Maintenance of equipment, turbines Reconstruction of generation assets	Transit of electricity to grids and distribution networks	Sales of electricity on local and international exchanges Sale to retails Sale to large end customers GR	Contract management with retail, end customers

Digitalization scope

- Fuel costs optimization (NOT achieved)
- ZIP optimization (achieved)
- Automation of preventive maintenance (NOT achieved)
- Reliability control (achieved)
- AI based dynamic pricing (NOT achieved)

√ Economic effect mainly achieved
☒ Economic effect NOT achieved

Despite significant investments and partial automation success, the project has failed to deliver economic returns due to fragmented implementation, lack of data integration, and insufficient managerial skills to drive necessary process changes.

CASE 2: ENERGY GRID AND DISTRIBUTION HOLDING

Smart Grid Project Overview:

- Automating regional electricity distribution networks.
- Energy monitoring, automate power centers, and launch a management system for the regional distribution network.

Objectives:

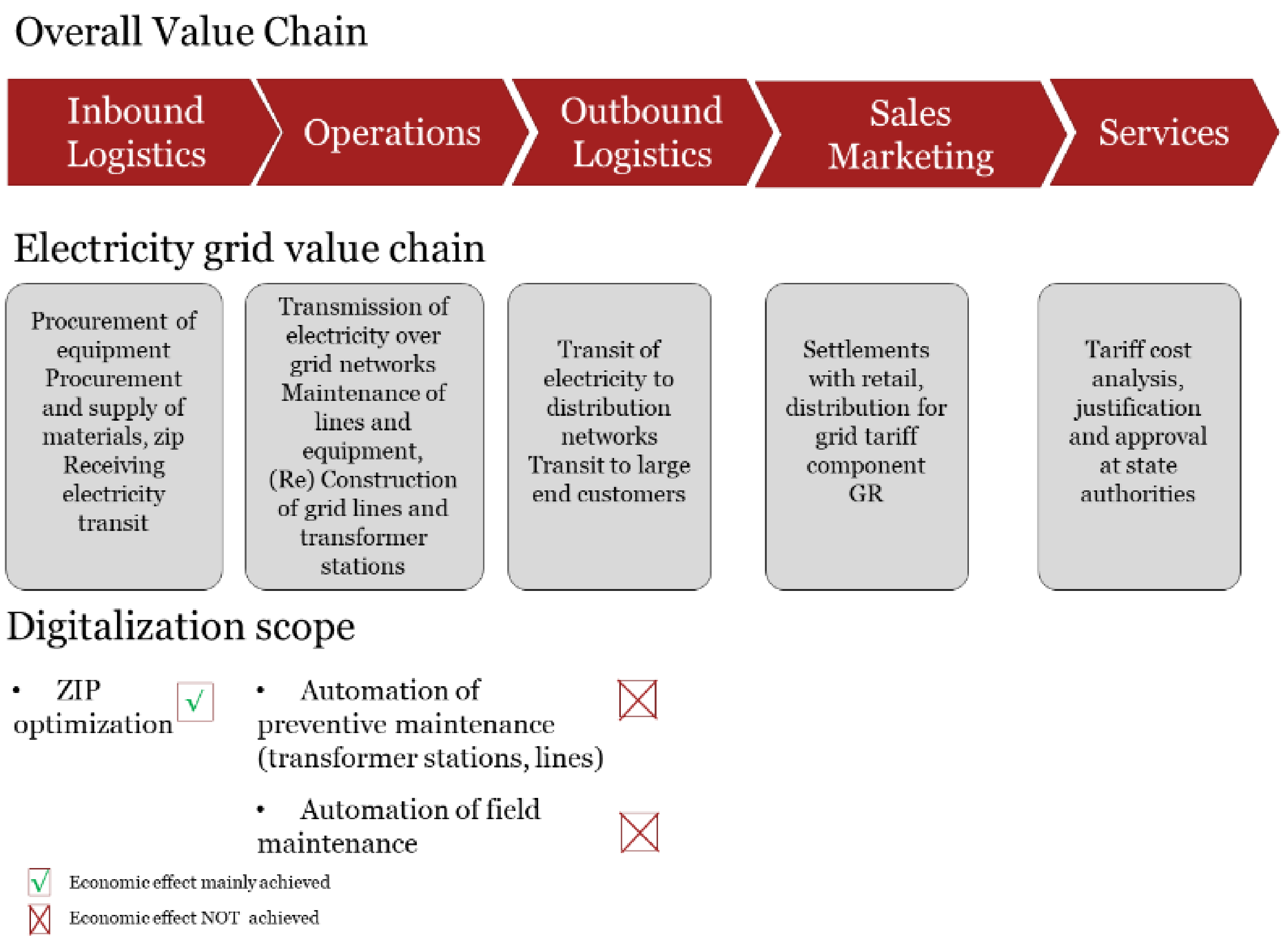
- Improve equipment reliability and optimize maintenance costs.
- Reduce energy losses and manage peak/off-peak network loads based on customer demand.

Expected Economic Benefits:

- Real-time decision making with telematics and AI in network operations.
- Improved monitoring functionality

Investment Costs:

- Infrastructure, platform, and application layers to enable ZIP optimization and preventive maintenance.
- Additional investments were required due to underestimating the complexity of AI and data integration for real-time management.



After five years, economic benefits are seen in infrastructure upgrades, while Big Data and AI remain in pilot mode due to the need for organizational changes despite strong managerial motivation and support.

CASE 3: AGRO-HOLDING

Project Overview:

- Raw material monitoring, fleet management, and a crop-growing intensification system using big data and AI.

Objectives:

- Automate raw material monitoring to reduce waste.
- Improve fleet management efficiency.
- Enhance crop management with AI-driven recommendations based on data like weather, soil, and seed quality.

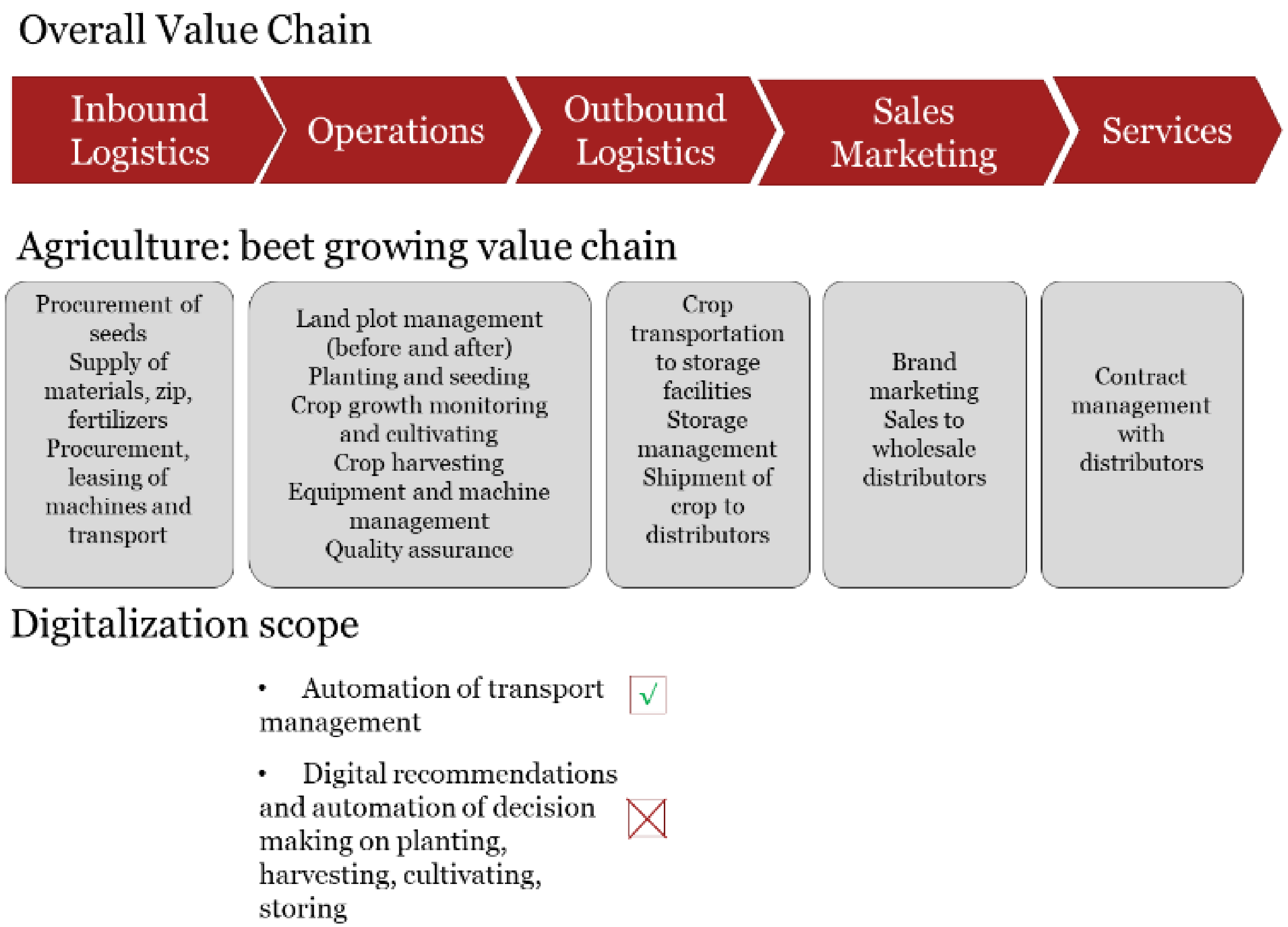
Expected Economic Benefits:

Savings of up to 20% in raw material costs.

- Improved fuel efficiency and equipment workload via fleet management.
- Increased crop productivity through precise AI-based decision-making

Investment Costs:

- > $30M in IoT infrastructure, AI development, and data integration



The agro-company's market-driven AI initiatives achieved limited benefits due to underestimated complexity and lack of organizational changes.

CASE 4: SMART CITY

Project Overview:

- Smart city initiatives to improve security, safety, and city economics.
- Focused on transport management, city infrastructure, and utility monitoring.

Objectives:

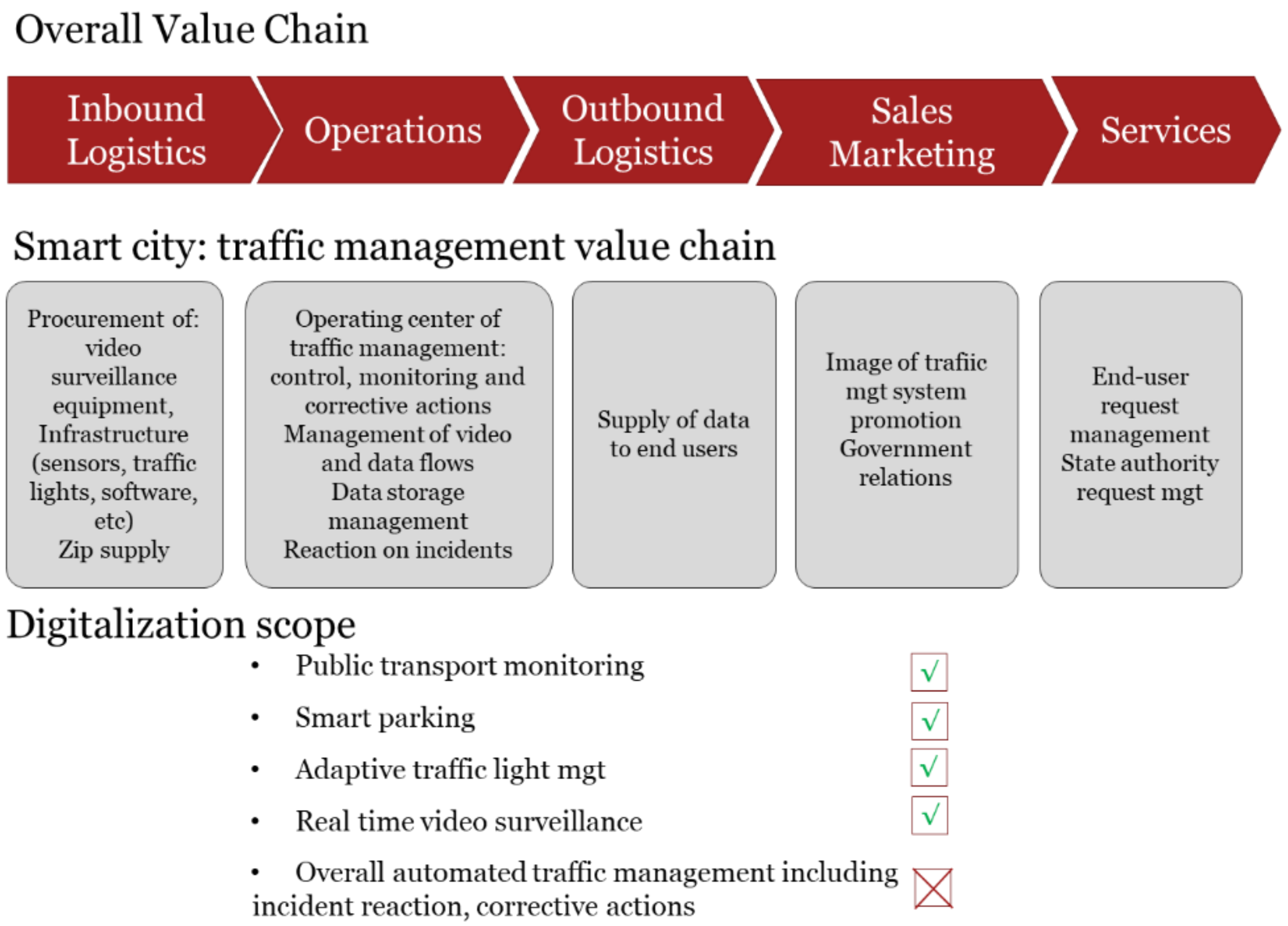
- Implement intelligent traffic routing to reduce congestion and accidents.
- Increase vehicle speed and improve public transport and parking systems.

Expected Economic Benefits:

- Minimize traffic congestion and enhance road safety.
- Improve real-time traffic management using AI and integrated data from various transport systems.

Investment Costs:

- Significant investments in infrastructure, including 90,000 road cameras, GPS-equipped vehicles, and IoT-linked telematics.
- Development of mobile and management apps for public transport, smart parking, and traffic management systems.



Despite strong funding and regulatory support, the city's automated traffic system faced delays and complexity, leading to simpler, more publicly explainable solutions.

SYNTHESIS OF AI ADOPTION FACTORS

	Mng Supp	Mng capability	Compatibility	Complexity	Relative adv	Gov reg	Vend supp
Energy gen	●	◕	◕	○	◕	●	◐
Energy grid	●	◔	◕	○	◕	●	◐
Agro-holding	◕	◐	◔	○	◕	N/A	◕
City - Traffic mgt	●	◔	◕	○	◕	●	◕

Legend. ○ - Factor had crucial negative impact in achieving planned results; ◔ - Factor had some negative impact in achieving planned results; ◐ - Factor had both positive and negative impacts, was not crucial for achieving results; ◕ - Factor had mostly positive impacts; ● - Factor had crucial positive impact on results achieving

Impact of key factors on digital/AI implementation initiatives.

- Digitalization projects met timelines and budgets but achieved only 20-30% of expected returns, while advanced AI systems struggled due to data gaps and complexity.
- Success was hindered by underestimated complexity, misalignment with business needs, and insufficient management capabilities for organizational changes

LESSONS LEARNED

Effectiveness of Digitalization

- Typically focused on automating existing operations
- Proves effective for transactional routine functions

Underestimated Complexity:

- Management consistently underestimated the complexity of AI integration, leading to implementation challenges across organizational processes and decision-making.

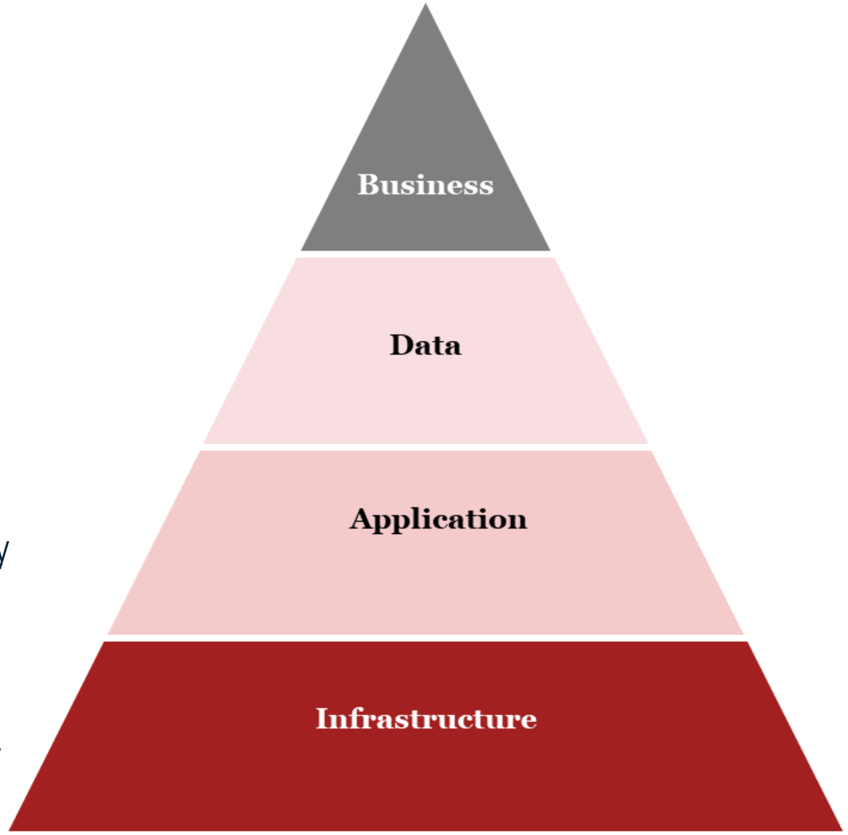
Lack of Compatibility:

- Large-scale AI implementations were often unjustified, with many needs better addressed by non-AI solutions, causing misalignment with business and social requirements.

Inadequate Managerial Capability:

- Top management lacked the ability to effectively assess AI's business rationale, resulting in poor decision-making and failure to support required organizational changes.

Enterprise Architecture Foundation



Digital Enterprise Architecture

Complexity - Firm wide AI based automation overcomplicates processes making them not transparent
Compatibility – Large scale AI implementation in many cases was not justified - most of requirements can be addressed by either standalone or non-AI solutions
Managerial Capability – Management lack transparency or business rationale of AI proposed recommendations

Complexity – as data grows in volumes and data sources it becomes harder to maintain, use and manage. It becomes more like a black box, rather than a crystal ball
Managerial Capability – sufficient investments into non-normalized data with unclear business output are constrained by management

Compatibility – new demands on app flexibility requires agile multi-service architecture
Managerial Capability – business management tend to limit investments into integration and platform layers, rather investing in well known business functionality

Complexity- increased number of infrastructure components create unmanageable and very expensive environment
Managerial Capability – underestimation of the number of potential data sources required for business processes and decision making