Industry 4.0: Digitization in Danish Industry

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Denmark & Industry 4.0

A Background section
Denmark’s industrial sector lags behind those of its European counterparts

- 99% of businesses are SMEs
- Shortage of skilled labor and engineers
- 75% of GDP generated by Service Sector
- Increase in industrial outsourcing
Aspects of Danish culture can help solve some industrial problems
Our Project

1. Identify company attributes indicative of a successful implementation of Industry 4.0 Technologies

2. Recommend companies for participation in the Copenhagen School of Entrepreneurship’s Digital Growth Path
Industry 4.0 = Augmented Operations + Increased Productivity
Industry 4.0

Data Management

- Augmented Reality
- Internet of Things
- Big Data
- Cloud Computing
- Machine Learning & Artificial Intelligence
- Machine Vision
- Advanced Robotics
- Automation
- Drones
- 3D Printing
- Cyber-Physical
How We Did It
A Methodology section
Objectives

- Identify SMEs Involved with I40 Technologies
- Determine the Applications and Effectiveness of Digitization
- Evaluate Characteristics of Companies Using I40
- Determine Method of Assessing I40 Readiness in Companies
Identify SMEs Involved with I40 Technologies

- Mapped companies developing I40 tech
- Mapped companies utilizing I40 tech
- Established connections with companies
Determine the Applications and Effectiveness of Digitization

- Acquired product attributes and statements from company representatives
- Performed supplementary research
Evaluate Characteristics of Companies Using I40

- Identified benefits and drawbacks of utilizing I40 tech
- Determined the attributes needed for digitization
Determine Method of Assessing Industry 4.0 Readiness in Companies

- Creation of an Industry 4.0 Readiness Assessment Tool
What We Found
A Findings & Analysis section
Distribution of Industry 4.0 Technologies in Interviewed Companies

- Data Management: 63.2%
- Cyber-Physical: 26.3%
- Intersection: 10.5%

n=19 companies
Industry 4.0 technologies positively affect company performance

Finding 1: Coordinated data management techs improve business operations

Finding 2: Data management techs are easy to implement

Finding 3: Cyber-physical systems expedite traditionally human performed processes
“No human could do what those robots do today

-David Coen, Haarslev Industries
Cultural and societal externalities directly affect the implementation of Industry 4.0

Finding 4: Using I40 tech results in a shift to technical skills, but not a decrease in employment

Finding 5: Time and resource constraints prevent companies from investing in digitization
Cultural and societal externalities directly affect the implementation of Industry 4.0

Finding 6: Measures can be taken to decrease fears of cyber attacks from digitization

Finding 7: People are skeptical of I40 due to its new and experimental nature
“Industry 4.0 is a leap of faith

-Ole Feddersen, Novo Nordisk CVP
What We Recommend

A Recommendation section
For the Digital Growth Path

- We recommend that CSE continue to treat participant and client companies on a case-by-case basis
For the Digital Growth Path

- We recommend that companies exhibit five key attributes before attempting implementation of I40 technologies

- 1. Adequate financial capacities
- 2. Adequate technological infrastructure and background
- 3. Strong connection between management and operator
- 4. Solid understanding of the benefits of digitization
- 5. Desire to innovate
### Company I40 Readiness Tool

- **Financial and Legal**
- **Technical**
- **Cultural and Societal**

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Readiness Tool Example

Average Financial & Legal Readiness: 2.4

Average Overall Readiness: 2.63
Recommendations for Encouraging Industry 4.0 Adoption in Denmark

- We recommend CSE focuses on improving inter-industry collaboration and communication.
- We recommend CSE and other academic organizations increase emphasis on technical education for Danish students and manufacturing employees.
Recommendations for Future Research

- Perform more interviews with representatives from company demographics that were not covered
- Determine possible methods of increasing awareness of Industry 4.0 benefits
Acknowledgments

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- Xenia Obel, Ivan Butler
- SlidesCarnival & Unsplash
Questions?
Bibliography


Colotla, Ian, & Hoengaard, Peter. (2016). Winning the Industry 4.0 race: How ready are Danish manufacturers?. Copenhagen, DK: Boston Consulting Group, Inc.


Bibliography Cont.
