Business Case Evaluation Methodology (BCEM) for Factories Digitalization

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UBICOMM 2019 – IFDA, September 26, 2019 - Porto, Portugal
Agenda

➢ Introduction

➢ Holistic migration methodology advantages

➢ FAR-EDGE Business Case Evaluation Methodology (BCEM)

➢ FAR-EDGE Project use case 1: WHR

➢ FAR-EDGE Project use case 2: VTC

➢ Conclusion
Introduction
Some existing methodologies

To develop a methodology able to identify, guide and evaluate migration paths for a specific business case towards holistic digital transformation
BCEM for Factories Digitalization

**Blueprint Migration**

1. Competitive differential in the company value chain
   - SWOT analysis
   - KPIs definition
   - Porter’s value chain revisitation

2. Assessment
   - Questionnaire: Technical, Operational, Human dimension
   - Collaboration with use case experts
   - Migration matrix preparation
   - AS-IS scenario definition

3. Migration scenarios
   - Collaboration with OEMs and solution providers
   - TO-BE scenario definition
   - Migration matrix completion

4. Gap Analysis
   - Required components
   - Possible integrations
   - Steps for application

5. Value Added identification
   - KPI improvements estimation
   - Unmeasurable advantages evaluation

6. Economic Analysis
   - Economic KPIs estimation
   - Cost estimation
   - Economic appraisal

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H2020 Research and Innovation Action - This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N. 723094
The first step of the methodology aims to open the way toward digital transformation. This section contains only dynamic tools which should be updated periodically, as the environment continuously change also the company should continuously adapt and take advantage of it.

A strict subdivision of the primary activity must be overcome. Standardization of the data management architecture should be able to break the barrier of the primary activity, making data available through all the factory activities.

1. Competitive differential in the company value chain
   - SWOT analysis[1]
   - KPIs definition
   - Porter’s value chain[2]

The main goal of this assessment is to clearly define the AS-IS situation in the technical, operational and human dimension.

The three-dimensional structure has been adopted to offer a holistic migration, not only technical-centred. No dimension is independent from the others, thus it would be a substantial mistake to consider the enhancement in a certain issue, without considering the effect on the others.

To assess the various issues related to the three dimensions a maturity model has been exploited.

BCEM – step 3

- Migration scenarios
  - Collaboration with OEMs and solution providers
  - TO-BE scenario definition
  - Migration matrix completion

➢ There could be more than one way to reach the desired result and the TO-BE scenario could not be unique.

➢ The possible scenarios depend on specific information which should be researched in collaboration with solution providers.

➢ A collaboration with OEMs and solution providers is required at this point in order to assess the feasibility of the scenarios and provide solutions able to improve the KPIs defined in step 1.
BCEM – step 4 & step 5

- Gap Analysis
  - Required components
  - Possible integrations
  - Steps for application

- Value Added identification
  - KPI improvements estimation
  - Unmeasurable advantages evaluation

- Also the gap analysis between the AS-IS and the TO-BE scenarios represents an outcome of the collaboration with the solution providers.

- Required components, possible integrations and steps for application are the three main steps to carry on.

- The improvement KPIs refer to the measurable performance of the systems, not to a business economic goal.
BCEM – step 6

- **Economic Analysis**
  - Economic KPIs estimation
  - Cost estimation
  - Economic appraisal

  ➢ From performance improvement to €/year
  ➢ TCO model for on premise application \(^4\)
  ➢ Discounted Cash Flow method \(^5\)

- A cost-benefit analysis to justify the investment in digital transformation is the last step of the methodology.
- This analysis is performed in a differential way comparing the TO-BE situation with respect to the AS-IS situation.
- If the analysis is performed in a correct and meaningful way, subtracting benefits and costs from one another, it becomes clear which situation is preferable from a profit perspective.

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\(^4\) M.S. Grobelny. Evaluating the Total Cost of Ownership for an On-Premise Application System, 2017

\(^5\) G. Azzone, U. Bertelè. L’impresa - sistemi di governo e valutazione, 2017
AS-IS scenario

**SWOT Analysis**

<table>
<thead>
<tr>
<th>Internal factors</th>
<th>Strengths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• ISA-95 automation pyramid integration (ERP, MES, SCADA)</td>
</tr>
<tr>
<td></td>
<td>• Solid competences developed in many manufacturing factories worldwide</td>
</tr>
<tr>
<td></td>
<td>• Internal digital knowledge in others Industry 4.0 research projects</td>
</tr>
</tbody>
</table>

| Weaknesses       | • Sorting system unreliability (production stoppages, hardware problems) |
|                  | • Sorting system rigidity (long reconfiguration time)                   |

<table>
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<th>Opportunities</th>
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<tr>
<td></td>
<td>• FAR-EDGE improves system flexibility, adaptability (Plug‘n’Produce) and reliability</td>
</tr>
<tr>
<td></td>
<td>• Lead the digital transformation disruptive trend</td>
</tr>
<tr>
<td></td>
<td>• Creation of a standardized architecture shared with all Indesic factories</td>
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</table>

| Threats          | • Architecture changing projects require long time to observe useful results |
|                  | • Digital projects applied to big companies are very expensive           |
|                  | • Lack of widespread competences about Edge Computing and Distributed Ledger |

❌ Sorter unreliability
❌ Sorter rigidity
BCEM – use case 1

➢ TO-BE scenario

➢ KPIs:
  ➢ OEE
  ➢ Reconfigurability

➢ Qualitative impacts:
  ➢ Improved dispatching policy
  ➢ Operators’ stress relief
  ➢ Field-simulation model synchronization
  ➢ Complication of the IT system
  ➢ Specific technical skills required
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BCEM – use case 2

UC#1 – Plug’n’Produce of a Nutrunner Automatic Re-Configuration

Main impact on:
- Tools adaptation time
- Rework rate

UC#2 - Operator Support for Smart Sequencing

Main impact on:
- System throughput
- Reduction of penalties
BCEM – use case 2

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Conclusion

Even if the smart technologies implementation is becoming a paramount trend in the manufacturing world, the path toward I4.0 is often encountered several obstacles. Possible barriers regarding investments in digital transformation are represented by the difficulty of assessing and easily predicting the tangible benefits that this cultural and technological evolution can bring. For this reason they must be guided by clear managerial objectives and quantifiable business benefits.

The impacts evaluation of migration towards digital transformation can be a useful tool to identify and analyze the steps to be taken, trying to predict risks and threats and leveraging strengths and opportunities.

A holistic view must consider migration from the technical, operational and human point of view, trying to evaluate the potential tangible and intangible benefits.
Thanks for the attention!

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Insight
BCEM – use case 1: matrix

Porter’s Value chain

- B2B process which adds value on top of transforming raw materials, delivering the product and providing services to the final user (e.g. product warranty)
- The particular use case impacts on the primary activity of
  - Operations: by making the final sorting system more flexible and increasing the system reliability.
  - Outbound logistics: by simplifying the collection of the pallet from the final bays with an improved sorting policy
  - Services: by making available the information about each bay content
- In general Firm infrastructure leads the digital transformation, Human resources guarantee proper training, Procurement assures services alignment with the novel architecture, and R&D develops the technologies.
- Data can move unbounded thanks to the NGAC.
BCEM – use case 2: step 1

SWOT Analysis

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<td>• Ordinary non-optimized assembly line managing policies (no simulation support)</td>
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<td>• Solid competences developed in many manufacturing factories worldwide</td>
<td>• Manual tool configuration is time-consuming and leads to assembly errors</td>
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<td>• Simulation for system optimization (e.g., improved truck sequences)</td>
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<td>• Analytics for data awareness (e.g., more precise assembly activities time)</td>
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<td>• Automation for Plug’n Produce purposes (e.g., improved reconfigurability)</td>
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Porter’s Value chain

• B2B process which adds value on top of transforming raw materials, delivering the product and providing services to the final user (e.g. product warranty)

• The particular use cases impact on the primary activity of
  - Operations: by assuring a correct tool parameters settings (UC#1); by shortening the tools set up time (UC#1); by optimizing the truck choice from the buffer (UC#2).
  - Outbound logistics: by reducing and simplifying the management of tardy deliveries (UC#2).

• In general Firm infrastructure leads the digital transformation, Human resources guarantee proper training, Procurement assures services alignment with the novel architecture, and R&D develops the technologies.
### Assumptions for the economic analysis:

1. The appraisal is a differential analysis between the AS-IS and one TO-BE scenario at a time.
2. The evaluation period is 1 year, the number of periods is 10.
3. The investment is concentrated in the initial instant, at the beginning of the first period.
4. The investment has zero residual value at the end of period 10.
5. The discount rate is fixed and it is equal to 10%.
6. Unlimited budget: it is preferable to select the scenario which maximizes the NPV.
7. No depreciation or financing is considered: the project is completely financed by the company's own funds.
8. Scenarios are not necessarily mutually exclusive: the implementation of one scenario does not imply the certain exclusion of another in the future.
9. The project implementation is not compulsory: there is the possibility to maintain the AS-IS scenario.
10. Sunk costs and sunk benefits are not considered.