Essential Implications of the Digital Transformation in Industry 4.0

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Industry 4.0 represents the coming fourth industrial revolution, which will lead the way to the Internet of Things, Data and Services. To help industrial companies successfully become true digital enterprises in the Industry 4.0 era, this study aims to survey the essential implications of the digital transformation by conducting focus group discussions. Seven major implications for industrial companies are explored, and six critical issues are identified by experts. For anyone involved in digital transformation research and those seeking strategies to enter the global Industry 4.0 ecosystem, this study should offer some necessary fundamentals in terms of theoretical analysis and problem resolution.

Keywords: Industry 4.0, Digital Enterprises, Digital Transformation, Focus Group

Introduction

The manufacturing industry is currently experiencing huge changes¹,². Industry 4.0 represents the coming fourth industrial revolution, leading the way to the Internet of Things, Data and Services³,⁴. As show in Table 1, while Industry 3.0 focused on the automation of single machines and processes, Industry 4.0 focuses on the end-to-end digitization of all physical assets and integration into digital ecosystems with value chain partners⁵,⁶. To help industrial companies successfully become true digital enterprises, this study aims to survey the essential implications of digital transformation in the Industry 4.0 era.

Focus group research method

A focus group is one of the most important qualitative research techniques⁷. In a focus group, participants are asked for open-ended responses conveying thoughts or feelings⁸,⁹. A focus group typically consists of a small number of participants, usually around six to twelve¹⁰. Within a focus group, a moderator poses a series of questions intended to gain insight into the way the group views a brand or product, as well as related images, slogans, concepts or symbols. A focus group is generally more useful when the outcomes of research are very unpredictable and the researcher is looking for more open feedback, as opposed to comparisons of potential results, as in quantitative research methods. A focus group also allows participants to express clear ideas and share feelings that do not typically come out in a quantitative survey or paper-based test. Because of the open conversation among group members, topics and discussion are more free-flowing, and members can react to the comments of others. Based on the benefits mentioned above, we invited ten participants to join the focus group discussions and investigate the essential implications of digital transformation in Industry 4.0, as shown in Table 2.

Essential implications of our focus group survey

In this section, we explore the seven major implications obtained from the focus group discussions.

Table 1 — A history of industrial revolutions
(Source: surveyed by this study)

<table>
<thead>
<tr>
<th>Generation</th>
<th>Representative</th>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st (1780s)</td>
<td>James Watt</td>
<td>Based on mechanization driven by steam power</td>
</tr>
<tr>
<td>2nd (1870s)</td>
<td>Henry Ford</td>
<td>Based on mass production or assembly line enabled by the division of labor and the use of electricity</td>
</tr>
<tr>
<td>3rd (1970s)</td>
<td>Gordon Moore</td>
<td>Base on the use of electronics and IT to further automate production</td>
</tr>
<tr>
<td>4th (Tomorrow)</td>
<td>“Internet of Things”</td>
<td>Base on cyber-physical systems enabled by end-to-end digitization</td>
</tr>
</tbody>
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Digitization drives great leaps in performance

Companies in every industry sector expect significant cost reductions. The cost savings can be achieved by implementing smart manufacturing initiatives. Such systems combine data from within the companies – from sensors all the way through to enterprise resource planning (ERP) systems – with information from horizontal value chain partners. For example, companies that deploy cloud-based planning systems to become better integrated with horizontal value chain partners may improve efficiencies and reduce inventories. In addition, revenues from digitizing the product and service portfolio will grow significantly in future.

Digital integration deepens customer relationships

As Industry 4.0 develops, it will greatly enrich opportunities to retain and improve customer relationships. Digital integration with customers and new technological opportunities to move production closer to customers will enable the greater individualization and customization of products. The use of data analytics will substantially improve customer relationships and customer intelligence along product lifecycles. Moreover, the greater integration of data between manufacturers and customers will open up new collaboration opportunities.

Digital culture drives transformation

Industry 4.0 has massive implications for company organization. The major challenges may center on internal issues, such as digital culture and training, rather than external issues, such as rights standards, infrastructure, intellectual property protection, and data security. Without the right digital culture and training, the talents will not want to stay. Hence, industry companies need to retain and train employees who are comfortable working in a digital environment. All employees need to think and act like digital natives, willing to experiment with new technologies and to learn new ways of operation.

Data analytics is the foundation of Industry 4.0

Data lie at the heart of the Industry 4.0 revolution, but even massively increasing information flow has little value without the right analytics techniques. Effective data analytics is essential in using data to create value. Companies that are already ahead of the curve regarding their digitization and integration journey are much more likely to put data analytics to work. Thus, data and analytics are becoming increasingly important for decision-making as a means of controlling and improving overall business planning and manufacturing operations.

Companies should develop robust data analytics capabilities

Industrial companies should understand that it is critical to have data analytics capabilities in order to successfully drive digital transformation. To reach excellence in data analytics, industrial companies will require access to a wide variety of skillsets, including those of data scientists and algorithm architects. They will also need process expertise, advanced algorithms and workflow integration for decision support.

Companies should accelerate globalization but with distinct regional flavors

Many applications will be closely linked to local companies because customized products often require regional manufacturing capabilities. However, the fourth industrial revolution binds companies and countries more tightly together through worldwide supply chains and data networks and will increasingly promote globalization. Companies in emerging economies can leverage digitization to increase efficiency in their horizontal value chains, working efficiently within a global manufacturing network to supply key components, products and systems.

It is time to commit to big investments

Within the next several years, the advanced implementation of Industry 4.0 will become a qualifier to compete and will also likely to be seen by investors as a qualifier for funding. A major focus of this investment will be digital technologies, such as sensors and connectivity devices, as well as software and applications, such as manufacturing execution systems (MESs). Companies are also investing significantly in training their employees, hiring new specialists, and driving organizational change.

Discussions

To move forward with Industry 4.0, acquiring and rolling out digital capabilities across companies is
important. In order to lead tomorrow’s competitive digital landscape, companies will require the commitment of top management and a clear vision. The participants also suggested the following six critical issues:

- The Industry 4.0 strategy will shape every further step companies take on the path towards becoming fully digital enterprises, so it is important to evaluate digital maturity and set clear targets for the next several years.

- It is important for companies to create the right pilot projects. Possible options include vertical integration within one or two manufacturing sites, including digital engineering and real-time data-integrated manufacturing planning. Horizontal integration with selected key suppliers is another option.

- Map out in detail what capabilities companies need. The most successful approaches consider which capabilities are needed to enable new digital business models and internal digitization.

- Make sure to maintain a strong focus on building digital trust. The goal should be to ensure information security and trust in a collaborative environment by providing for the end-to-end management of risks, threats and, security issues.

- Identifying and gathering the right data, deploying them for the right purposes, and effectively analyzing them will be critical in making the right Industry 4.0 decisions.

- Actively plan an ecosystem approach. First movers achieve breakthrough performance by going a step further to understand consumer needs and use digital technologies to create and deliver value to the customer via an integrated, innovative solution.

Conclusion

Industry 4.0 digitizes and integrates processes vertically across the entire organization, from product development and purchasing to manufacturing, logistics, and service. All data about operations processes, process efficiency, and quality management, as well as operations planning are available in real time, supported by augmented reality, and optimized in an integrated network. Horizontal integration goes beyond the internal operations of suppliers to customers and all key value chain partners. This study went to the heart of companies considering their progress towards becoming digital enterprises. Thanks to the focus group discussions, we have distilled the results of our research into seven distinct, essential implications. In addition, we have also explored the six critical issues suggested by the experts. The analysis results may provide references to the development and implementation of digital transformation in the future.

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