

Implications of  
**Industry 4.0 for CIOs**



# Abstract

Industry 4.0 is the name of the next industrial revolution which is fueled by the advancement of digital technologies<sup>1</sup>. It is dramatically changing how companies engage in business activities. As a result, the disruptive nature of Industry 4.0 demands a reassessment of the requirements for IT. On the one

hand, there is the possibility that the responsibilities of Chief Information Officers (CIOs) could be taken over by other executives such as the Chief Digital Officer (CDO) or the Chief Technology Officer (CTO). On the other hand, this recent development creates entirely new perspectives for positioning

themselves and their IT departments within the business. The impact of digital technologies is reaching a magnitude at which IT is considered a substantial business driver, potentially placing CIOs in the driver's seat.



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<sup>1</sup> Capgemini (2014) Industry 4.0 – The Capgemini Consulting View. Sharpening the Picture beyond the Hype.

# 1. Industry 4.0 is causing changes in the way companies do business

Disruptive technologies are appearing at a greater number and variety in less time and are adopted more comprehensively and much quicker than ever before. For instance, while it took the social network Facebook 4 years to reach 100 million users<sup>2</sup>, the text messaging service WhatsApp reached the same mark after 2 years<sup>3</sup>. As another example, it took Amazon less than 10 years to turn their web services into a 6 billion<sup>4</sup> dollar business by deploying the transformational trend of cloud computing. As recently as 2010, cloud computing was labeled as a hype and buzzword. Today, however, three of the nine leading

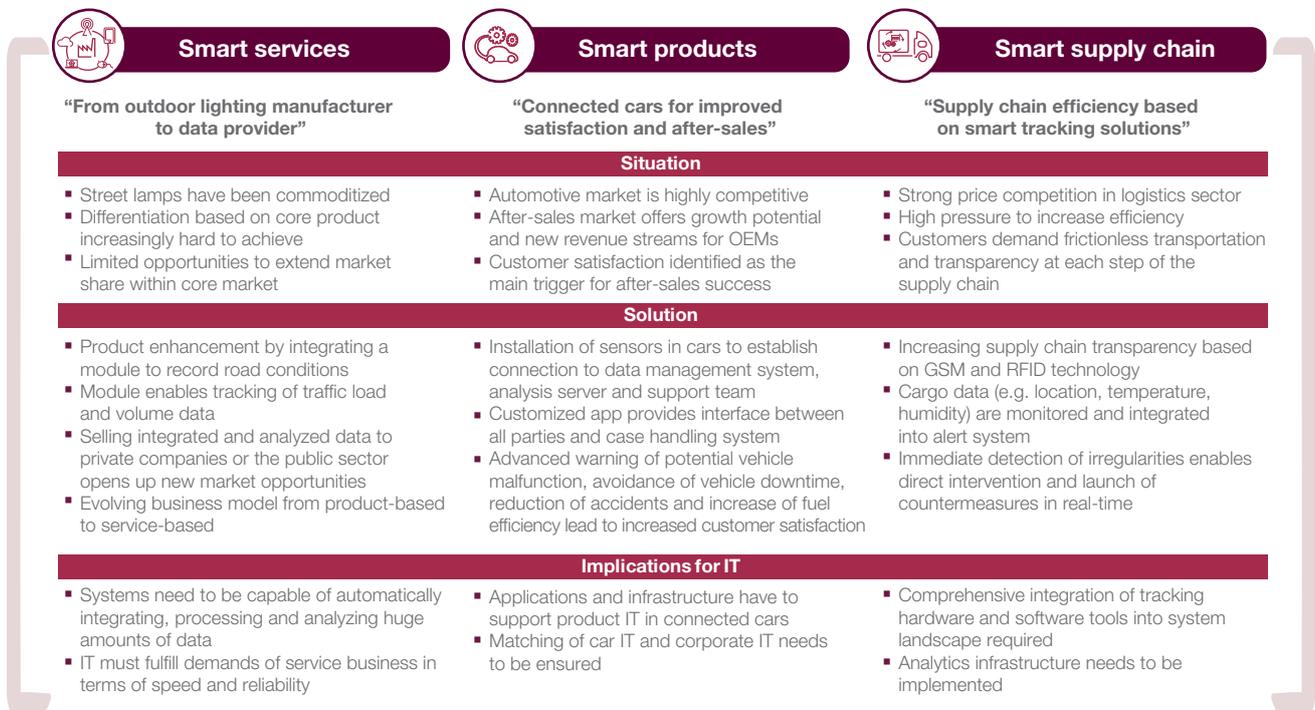
companies on Forbes' Most Innovative Companies List also occupy a leading market position in cloud computing<sup>5</sup>.

First of all, this disruptive development is affecting **WHAT** companies are doing, what they are producing and what they are selling. Added value is now being generated not only based on core products, but also through information-driven services developed on the basis thereof. As a result, smart services and products are enabling innovative business models and creating new revenue streams and growth potential.

In addition, digitization and automation have a vast impact on **HOW** companies are operating and producing. Smart supply chains and smart factories are generating high potential for efficiency gains. Agile collaboration networks are increasing flexibility and allowing businesses to offer customized services and products in any market. Furthermore, production-related information is providing the foundation for achieving data-driven operational excellence.

Figure 1 gives examples of new requirements for IT that result from the scenarios mentioned above.

**Figure 1: Examples for smart services, products and supply chain**



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2 International Business Times (2012) A Timeline Of Facebook History: From Fledgling Startup To \$114 Billion Giant.

<http://www.ibtimes.com/timeline-facebook-history-fledgling-startup-114-billion-giant-699093>.

3 Statista (2015) - <http://de.statista.com/statistik/daten/studie/285230/umfrage/aktive-nutzer-von-whatsapp-weltweit/>

4 Business Insider (2015) Amazon just revealed it has a profitable, 6\$ billion beast of a business.

5 Forbes (2015) The World's Most Innovative Companies.

# 2. Industry 4.0 is changing companies' IT landscapes

The changes that businesses are undergoing due to Industry 4.0 are associated with considerable implications for IT departments. They have to satisfy two fundamentally different sets of requirements. On the one hand, they have to maintain traditional IT systems, whereas on the other hand product and service-related IT is becoming increasingly relevant. If CIOs manage this bimodality successfully, they will have the chance to become major strategic players and act as equivalent counterparts at the board level. However, in our work with clients, we have noted that business departments are increasingly tending to set up a shadow IT that bypasses internal IT departments. This development threatens the relevance and budgets of IT departments and will eventually diminish the influence and importance of CIOs.

## 2.1 IT departments often cannot fulfill new requirements

IT departments often fail to fulfill the needs driven by the Digital Transformation. Existing organization and governance models together with the traditional skills and mindset of the employees are no match for these new business requirements in terms of speed and quality. In many cases, it takes significantly more time for requested services to be provided by the internal IT in comparison to external service providers. If provided internally, the services are not always delivered in the desired quality, leading to time and budget-consuming rework cycles and iterations.

The reasons for the growing discrepancy between business and market requirements and IT service delivery capabilities are similar in most industries. In many cases, IT management is lacking a clear strategic vision and thus is not fully committed to the new requirements. In

addition, we have observed that in most companies, IT management and staff are busy with their daily business and cannot spend time and resources on innovative and strategic topics. Furthermore, when looking at the current IT departments, we see a lack of the digital skills required to understand business needs accurately. Moreover, HR departments often struggle to cope with the increased competition on the market for hiring digitally skilled and experienced experts. Finally, long-established practices and a grown IT organization have led to time-consuming internal processes and guidelines that have to be adhered to.

## 2.2 IT service providers compete with IT departments and drive the establishment of shadow IT

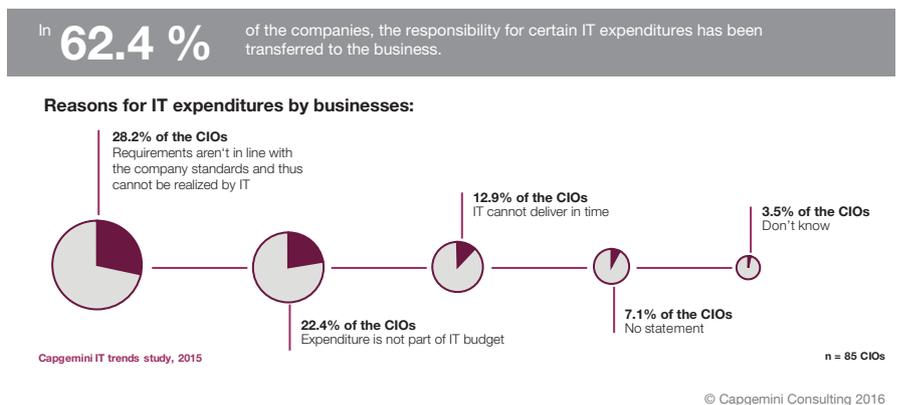
Within this environment, the pressure from well-known external service providers and innovative startups focusing on sensor data as well as information-driven business models is growing and taking on speed. The market is often much faster than internal IT departments to embrace and provide the latest technologies and features in a stable and reliable manner. Startups are searching for niches to occupy in

order to quickly gain market share and attention. On top of that, established IT players with innovative and committed leadership are turning around their entire business models and pinning everything on the opportunities that Industry 4.0 is opening up.

## 2.3 Industry 4.0 drives the development of shadow IT

As a consequence, the business often bypasses internal IT departments. As our IT trends study<sup>6</sup> reveals, business departments are responsible for a continually growing number of major technologies and IT expenditures. They have already taken over responsibility for certain parts of the IT budget in 62.4% of the companies. The growing importance of advanced technology (applications, infrastructure and data) as the game changer for Industry 4.0 means that at 28.2% of the participating companies the requirements of the business units are not in line with existing company standards and thus cannot be realized by IT. 22.4% mention that the corresponding expenses are not part of the IT budget and 12.9% point out that IT cannot deliver in time. See Figure 2 for further reasons for IT spending by businesses.

Figure 2: Reasons for IT spend by the business



6 Capgemini (2015) IT trends study 2015. Digitization gives collaboration between business and IT a new quality.

Examples from projects and discussions with our clients show how businesses are circumventing IT in order to obtain required services in due time and quality. At an insurance company, for instance, the marketing division ordered public cloud servers to support a short-term marketing campaign to benefit from instant service deployment and pay-per-use pricing models. In another example, leading engineers at a global manufacturing company store sensitive data and documents at a public cloud storage provider due to increased usability and faster data and service provisioning<sup>7</sup>. Furthermore, the product IT of one manufacturing company repeatedly buys CPU power and storage for hosting their own applications to evade the many internal barriers and gain easier access to the latest technologies.

## 2.4 Consequences for the CIO

CIOs could experience a reduction of their IT budget, which makes them less effective in executing investments to support the business. Additionally, CIOs could lose the transparency of technology expenditures in the business departments. This development leads to an increasing establishment of shadow IT structures, which will ultimately result in a loss of governance. Increased risks for IT security and business continuity are to be expected if IT decisions are not evaluated, keeping the respective company guidelines and policies in mind. IT security as an overarching initiative with companywide impact has to be governed and steered centrally by an empowered and knowledgeable IT department. Furthermore, a lack of

central coordination and decision making leads to the loss of synergies in the fields of IT sourcing (buying power), IT architecture, infrastructure and internal skills and capabilities. Additionally, the uncoordinated and often unevaluated use of silo technologies or applications leads to increasing complexity of the companies' IT landscapes. This complexity becomes harder to handle with the existing resources and capabilities. Finally, IT services procured by businesses are not tracked as IT costs. As a consequence, financial controlling is affected, ambiguous cost allocation occurs and the IT budget and areas of responsibility get blurred.

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<sup>7</sup> Capgemini Consulting (2015) - *Securing the Internet of Things Opportunity: Putting Cybersecurity at the Heart of the IoT*.

# 3. Levers to tackle challenges arising from Industry 4.0

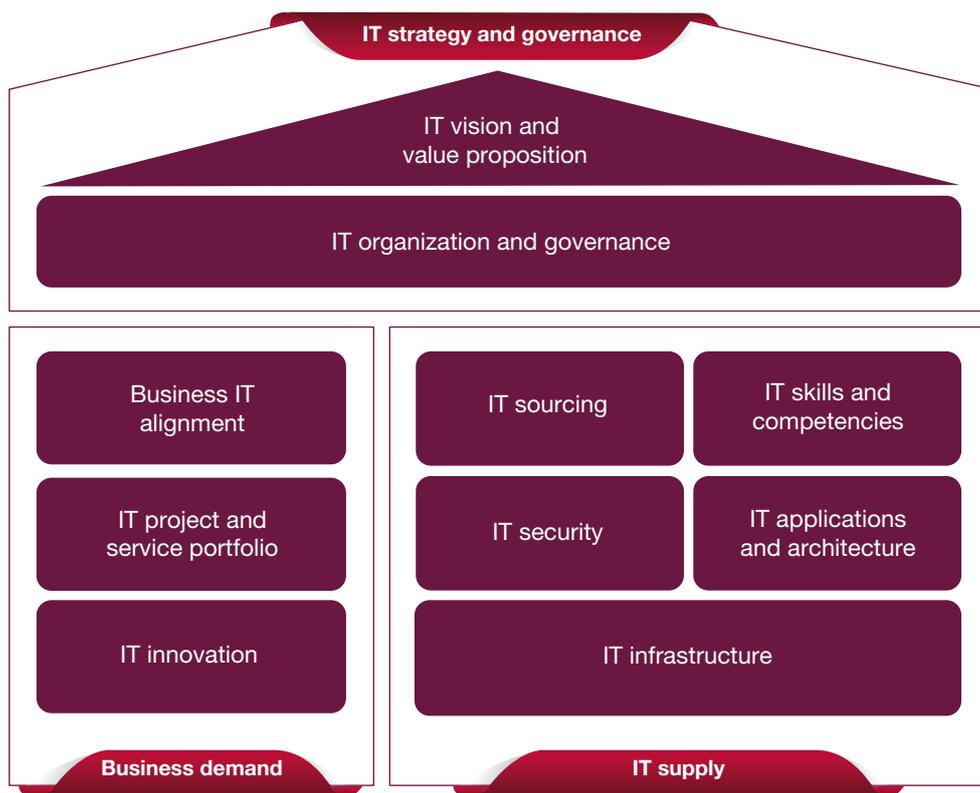
When we talk with our clients about the implications of Industry 4.0 and the respective role of IT, we regularly arrive at a key question: What are the levers for our IT to tackle the arising Industry 4.0 challenges?

To guide our clients in this question and the IT-related opportunities

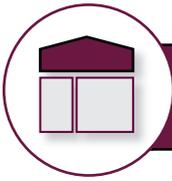
and challenges of Industry 4.0, we have developed a holistic framework specifically for CIOs and IT managers (cf. Figure 3). It captures three perspectives: The overall IT strategy and governance perspective, the business demand perspective and lastly the IT supply perspective. Each perspective helps to

analyze the individual building blocks of the organization's IT and to identify opportunities, challenges and possible levers for the IT. Using three Industry 4.0 real-life use cases, we illustrate individual IT challenges from each perspective in the following sections.

**Figure 3: Capgemini's IT framework for Industry 4.0**







## IT strategy and governance perspective

### Case study



A manufacturer of outdoor lighting solutions wants to enrich its products by integrating sensors to record road conditions. The collected data and analysis of traffic would then be marketed to companies and public authorities. This approach enables an entirely new business model and value streams but creates several challenges from an IT strategy and governance point of view.

### Challenges



#### IT vision and value proposition

The current vision and value proposition of the manufacturer's IT does not cover the tools and capabilities needed to gather and analyze the large amount of data resulting from the sensors. The predominant role of IT has to shift to realize the endeavor and support the new business strategy. Consequently, the IT organization is missing a clear future vision and value proposition, making it unclear which initiatives to prioritize.



#### IT organization and governance

From an organizational perspective, it is unclear if roles and responsibilities for sensor data analytics should be built up internally or outsourced. This is because inefficient coordination mechanisms can inhibit the cost-efficient and fast realization of the new business model. Furthermore, the question arises as to which extent elements of the IT should be centralized and decentralized and which governance mechanisms should be established.

### Levers

Successful companies address challenges in the IT strategy and governance domain by selecting from a well-suited set of initiatives. Depending on their individual point of departure, these initiatives can include:

- Creation of a clear overarching IT vision and roadmap to distinguish which digital initiatives to pursue
- Formation of top-down governance and clear organizational principles
- Establishment of dedicated digital committees and new organizational roles such as the Chief Digital Officer (CDO) in order to make the ambition for the transformation visible and assist in the clarification of roles and responsibilities in digital initiatives

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“*Digital Transformation is highly dependent on clear top-down governance. An uncoordinated array of bottom-up initiatives will block the path towards Industry 4.0<sup>8</sup>.*”





## Business demand perspective

### Case study



An automotive manufacturer intends to offer new value-added services enabled by data collected from sensors and network devices installed into cars. These services range from increased car safety features, infotainment systems up to the connection of the car to smart phones and smart watches to monitor and control the car. From the business demand perspective, the delivery of these new data-driven business models and services impacts the manufacturer's IT in several ways and creates challenges.

### Challenges



#### Business IT alignment

The business units of the manufacturer have always seen the IT unit as a supplier of standardized IT services to support their processes. However, the development of new data-driven services for connected cars makes a closer collaboration between business and IT necessary and requires them to become true partners.



#### IT project and service portfolio

The vast amount of potential new IT services to support connected cars makes it difficult for the manufacturer to prioritize its IT project and service portfolio. Both outcome-based and cost-based investment decisions have to be considered.



#### IT innovation

On the one hand, the manufacturer's product development unit expects IT to deliver connected car software prototypes for fast time to market. On the other hand, cost-efficient IT operation is required by the other business units. This dualistic role to provide IT commodities as well as innovative IT services with high-value contributions is extremely challenging for IT.

### Levers

Several levers are available to address the challenges from the business demand perspective. Major levers include:

- Reduction of organizational boundaries between business and IT, utilizing organizational transformation mechanisms
- Establishment of a thorough project and service portfolio in close collaboration between business and IT as well as design of flexible IT budgets to accelerate the creation of innovative IT services
- Creation of an IT innovation management process and culture in parallel to the cost-efficient IT operation through transformation initiatives

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“Especially the separation of business and IT functions we often witness today will prove to be a true show stopper for Industry 4.0<sup>9</sup>.”





## IT supply perspective

### Case study



A multinational logistics company aims to offer its clients superior transparency in their supply chain. Using RFID and modern telecommunication technologies, cargo data such as location, temperature, humidity and acceleration are to be monitored in real-time. Using an alert system, the logistics company will be informed about irregularities and can initiate countermeasures in real-time. In order to realize the Industry 4.0 service, entire new processes are needed from an IT supply perspective and have to be supported by information and data streams.

### Challenges



#### IT sourcing

To enable real-time supply chain transparency, the IT organization of the logistics company has to rethink its sourcing mix to account for the efficiency, effectiveness, quality and flexibility needed to provide traditional and innovative IT services. There is also a need for new partners, as traditional partner management strategies no longer apply.



#### IT skills and competencies

The logistics company does not have in-depth skills and competencies in key areas, such as data analytics, to deliver real-time supply chain transparency services. As the resource market is strongly competitive, it is difficult to obtain access to talent and to build up and secure the skills to deliver and develop the novel Industry 4.0-related IT services.



#### IT security

In order to enhance supply chain transparency, the breadth and volume of communication devices, network connections and data sharing is increasing. This enlarges the IT security attack surface. Furthermore, in the context of increasing quantity and severity of cyber attacks, it is especially notable that 80% of companies consider current and former employees as the main source of security incidents<sup>10</sup>.



#### IT applications and architecture

From an IT application and architecture perspective, digital platforms that span different business entities are a key element to utilize data generated in a smart supply chain. This requires the logistics company to rethink its IT application landscape. This is because the accelerating change of products, services, and business processes within and in the environment of the logistics company is reducing the life span of IT applications.



#### IT infrastructure

Scalable and high-capacity storage systems and highly reliable networks to create the infrastructure for handling real-time data streams in a smart supply chain are a big challenge for the logistics company.

### Levers

In order to meet the challenges from the IT supply perspective, several levers can be applied, which include:

- Generation of both long-term strategic partnerships and short-term relationships in the area of IT sourcing, centered on agility and innovation and combined with suitable governance mechanisms
- Analysis and reframing of existing IT competency models and skill management systems, including career paths for subject matter experts to attract high potentials from the labor market
- Establishment of an appropriate degree of information security by securing data, networks, devices and applications and forming a security awareness culture in the entire organization
- Creation of an Industry 4.0 IT architecture which considers connectivity, data management, service orchestration and cloud governance to address IT application and IT infrastructure challenges

# 4. How can the IT better support future Industry 4.0 based business models?

Considering the many implications for IT shown in the last chapter, one might wonder what the best solution for one's own company is. Experience shows that solutions which might be good for one company are not necessarily good for another – there is no “one size fits all” solution.

However, we have identified a set of recommendations that help companies avoid common pitfalls in each step of their transformation. In general, the transformation consists of three steps: analyze the current situation, define the target picture, and create a roadmap with initiatives needed to reach the target picture (cf. Figure 4). The grey boxes on the bottom of the picture show steps

which should be carried out by the business and which serve as an input for the definition of the IT target picture.

### 4.1 What is the current status of IT in my organization?

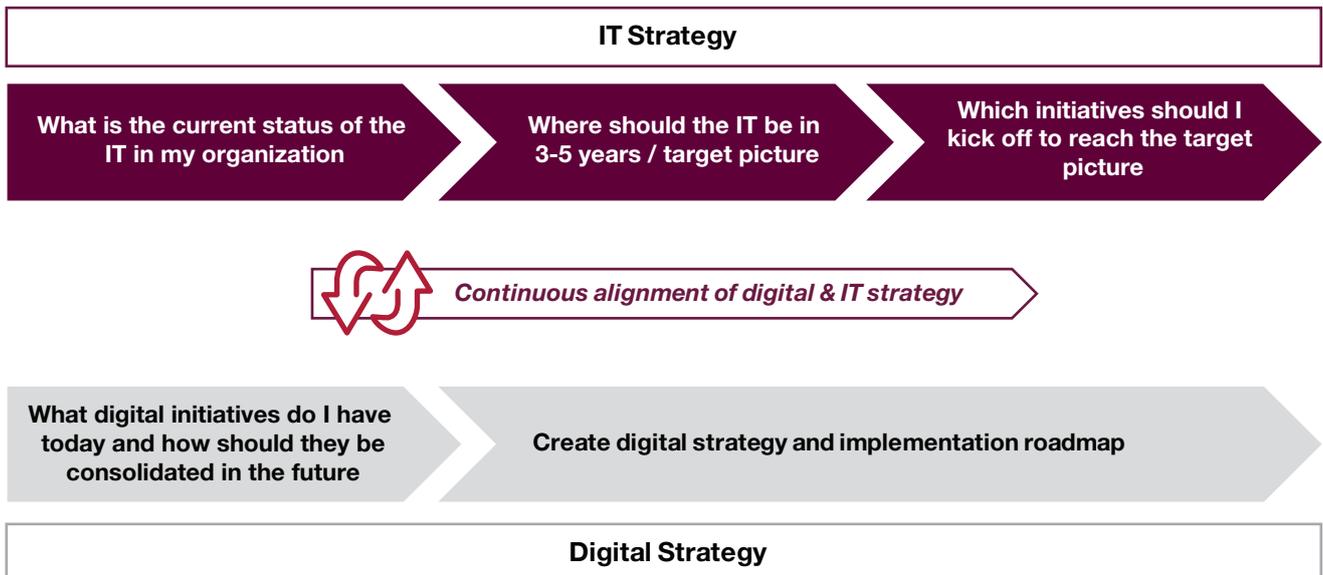
In this step, the current status of IT is analyzed and documented.

To properly set the focus of the analysis, we recommend **defining top-down guiding principles** for the transformation by both business and IT. In other words, the focus of the analysis should be derived from strategic goals. These guiding principles will also be helpful in later steps when defining the target picture and prioritizing initiatives.

For all steps of the transformation, it is crucial to **get top management sponsoring combined with a bottom-up approach** to ensure high acceptance. This needs to be set up at the beginning of the transformation and operationalized during the subsequent steps.

In parallel to the first step, we recommend **creating a target picture for consolidating digital initiatives**. Even though this is a business and not an IT topic, it is an important input for the definition of the IT target picture in the subsequent step.

**Figure 4: Basic steps for enabling the IT to support future Industry 4.0-based business models**



## 4.2 Where should the IT be in 3-5 years / target picture?

In this step the target picture of the IT is defined, i.e. where should the IT be in 3 to 5 years.

Since many requirements and priorities come from the business, it is crucial to involve **both business and IT in the definition of the target picture**. Furthermore, this ensures acceptance of the target picture by the business and lays the foundation for acceptance of the initiatives in the subsequent step.

When defining the target picture, it should be borne in mind that the IT will need to **serve both “traditional” requirements as well as “new” ones**. For instance, the IT organization needs to cope with novel and innovative technologies while reliably providing commodity services (bimodal IT).

Reaching the right balance between fulfillment of “traditional” and “new” requirements is crucial to **position IT as an enabler with high strategic value** while ensuring business continuity.

## 4.3 Which initiatives should I kick off to reach the target picture?

In this step, initiatives are identified to realize the transformation from the current status to the target picture. The initiatives are prioritized and organized in a roadmap. After this step, first initiatives can be kicked off.

We recommend starting with “low-hanging fruit”, i.e. **starting with initiatives that create immediate benefits or that mitigate risks**. To be able to identify the low-hanging fruit, a **detailed roadmap with prioritized initiatives including investment and time planning** is needed.

Proper involvement and buy-in of different stakeholders from business and IT is a prerequisite for a successful transformation. Therefore, **change management needs to be an integral part of the transformation journey** and needs to be started together with low-hanging fruit initiatives.



## Summary

Industry 4.0 is changing how companies do business and thus is placing new demands on IT departments. By transforming their IT departments, CIOs can enable them to better cope with current and future requirements. This avoids the shift of budgets and competencies from IT to businesses, and it can position IT as a key enabler for organizations.



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