



Digital Transformation: Navigating through the Clouds

Deepika Nathany
(Manager, Specialized Services)

Abstract

The ability to scale business is largely dependent on a clear digital strategy. Digitally advanced companies seek to unlock new levels of competitive advantage using technology. Customers aim to generate new value propositions in their operating models through fast changing landscape of technology. Organizations must adopt a well-defined digital strategy to integrate physical and digital components effectively (Kaidalova, Kurt, & Seigerroth, 2018). The article explains how companies with a cohesive plan for integrating the digital and physical components of operations can successfully transform their business models by enhancing operational efficiency, improving customer experience and drive innovation. many enterprises face challenges in aligning their digital initiatives with their business goals due to fragmented data sources, resistance to change, and lack of cohesive leadership. Digital transformation begins with restructuring the Enterprise Architecture (EA) which encompasses organizational structure, business processes and IT infrastructure. The cultural transformation from decision making using human experience to the incorporation of real time data and cutting-edge analytics to process and analyze data is critical. Fostering an environment of innovation that is possible by establishing collaborative cloud-based systems to develop drive idea generation and bring down costs.

Digital maturity models help assess an organization's readiness for transformation by categorizing businesses based on digital intensity and transformation management intensity. Frameworks such as TOGAF provide structured approaches to integrating business, data, and technology architectures. This paper presents the foundation and the first steps aiming at the development of a method for the holistic planning of the digital transformation into small and medium-sized mechanical engineering enterprises.

Keywords: digital transformation, enterprise architecture, innovation, digital maturity, business strategy.

I. Introduction

Today even small startup companies can grow from zero to new market leaders at tremendous speed leveraging technology. The various aspects of an enterprise possibly affected by digital transformation include organizational structure, business processes, information systems, and infrastructure, which together form an Enterprise Architecture (EA). The top layers of architecture models usually contain more complete and up-to-date information.

For lower levels information about concrete IT services and applications is often difficult to collect and keep up to date. All IT solutions and applications that are used at the enterprise to support its functioning and operation are what we refer to as enterprise-IT (E-IT). This part is sometimes addressed as Enterprise Information Systems (EIS) and can include various ERP components.

In particular, enterprises in manufacturing industry, and in sectors where a lot of value creation is represented by IT components built into the products, find a lot of new opportunities created by seamless and real time integration of physical systems and IT. Use of real-time data for enterprise architecture analytics has been a challenge due to shortcomings of IT possibilities (limits in volume, variety and speed of data collection). Advancement in the area of Big Data helped to overcome this challenge. Similar deficiencies can also be found in the area of enterprise modeling techniques that are used to represent various aspects of EA and support EA Management (EAM).

II. Literature Review

The level of digitization in an organization is measured by its digital maturity model. The model developed by MIT's Center for Digital Business and Capgemini Consulting considers two dimensions: ****Digital Intensity**** and ****Transformation Management Intensity**** (Hanelt et al., 2015). Companies fall into categories such as Digital Beginners, Fashionistas, or Digital Masters.

TOGAF, widely considered an industry standard, defines three architectural levels that are: Business Architecture, Information Architecture, and Technology Architecture. The business layer includes customer value and key processes, while the Information Architecture consists of Data and Application Architecture. The Technology Architecture defines the hardware and software infrastructure necessary for deployment (The Open Group, 2018).

Digital Enterprise Transformation emphasizes leveraging innovative IT to drive business transformation (Digital Enterprise Transformation, 2015). Companies with integrated digital strategies have achieved improved operational efficiency, customer satisfaction, and competitive advantage.

III. Methodology

The article uses a qualitative research approach to perform an in-depth analysis on digital transformation strategies. A systematic literature review has been conducted using sources from industry reports, case studies, academic databases about companies and organizations that have successfully implemented digital transformation strategies. The focus is primarily on:

- Case studies detailing the impact of digital transformation.
- Organization's readiness assessment using digital maturity models.
- Enterprise architecture frameworks and their role in digital transformation.

Data was collected from peer reviewed journals and research papers published between 2015 and 2019. Thematic analysis was applied to identify challenges faced and strategies used for digital transformation.

IV. Results and Discussion

4.1. Create a culture and structure for innovation- So how can you strategically drive new product development to better ensure top-line revenue and profitability growth? By fostering a culture of innovation. But this can be difficult when your teams are working in silos with separate data sources and processes. This opens the door for the "loudest voices" to take charge of the culture and development process, while the best ideas may go unnoticed. The solution is to unify your organization around a common goal enabled by everyone working from the same collaborative system. That will simplify the collection of ideas and quickly push the best ones through development cycles. With everyone working towards the same objective on the same platform, your teams will feel like they're part of a collaborative process and culture. That means the best ideas can be selected based on the data, not simply on who has the loudest voice or the most organizational influence. When you create a cohesive culture within a well-managed and holistic process, you can establish repeatable practices to help incubate your ideas and align innovation with your company's strategic goals.

4.2. Strategy before technology- Organizations need to integrate these digital technologies and their capabilities to transform processes, engage talent and drive new business models to compete and thrive in the digital world. Organizational change occurs when a company makes a transition from its current state to some desired future state. Managing organizational change is the process of planning and implementing change in organizations in such a way as to minimize employee resistance and cost to the organization while simultaneously maximizing the effectiveness of the change effort. Digital business transformation is the integration of new digital technologies into all business areas, leading to a fundamental change in the way the organization works. Successful digital transformation goes hand in hand with reengineering and optimization of business processes in the most appropriate way for the strategy. The digital transformation of the business seems different for different companies, and it is difficult to give a strategy that is valid for everyone. According to a study by the Massachusetts Institute of Technology, digital-transformed businesses are 26 percent more profitable than norms. Successful organizations must leverage strategy, culture, and leadership to harness the potential of digital transformation of business. Organization's digital strategy goals are: improve customer experience, increase efficiency, improve innovation, improve decision making, transform the business.

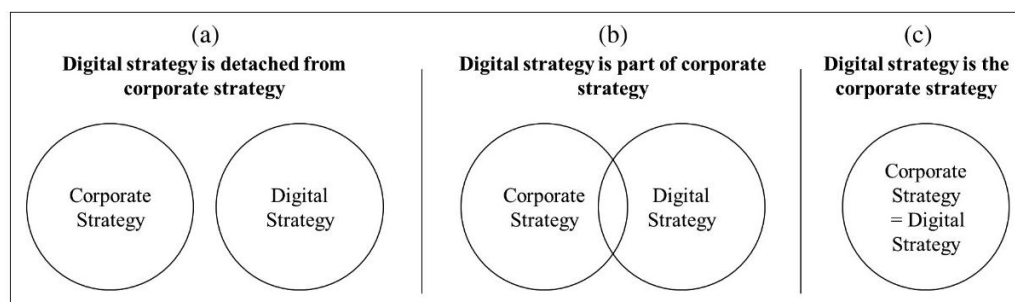


Fig. 1. Connection between digital strategy and corporate strategy.

Digital business transformation can only be successful if there is a well-founded strategy and leadership. Transformational changes are required to implement the digital transformation, which is related to strategy, leadership, and organizational culture. Business practice research has shown that businesses with a successful digital-based business have a clear strategy, commitment to senior management with change, motivated employee involvement in the process, and focusing on changes to customer needs and interests. One of the approaches to exploring digital transformation is the grouping of changes in three areas: consumer behavior, business processes and business models.

4.3. Business Maturity Model- A digital maturity model measures the maturity of the digitalization process of an organization. Several digital maturity models were proposed in the past. For instance, the digital maturity model developed by MIT's Center for Digital Business and Capgemini Consulting considers digital maturity as a combination of Digital Intensity (the level of technology investment directed towards changing how a company operates) and Transformation Management Intensity. Both dimensions are considered as x and y coordinates that span a quadrant. Depending on the intensity of both dimensions, companies are characterized high digital and transformation management intensity, low digital and transformation management intensity (Digital Beginners) or a mix of two (Fashionistas or Conservatives). The maturity model is classified on a scale from 1 to 5. Each level evaluates criteria in terms of an evolutionary path from ad-hoc chaotic processes to mature, disciplined processes as displayed in Fig 2 below.

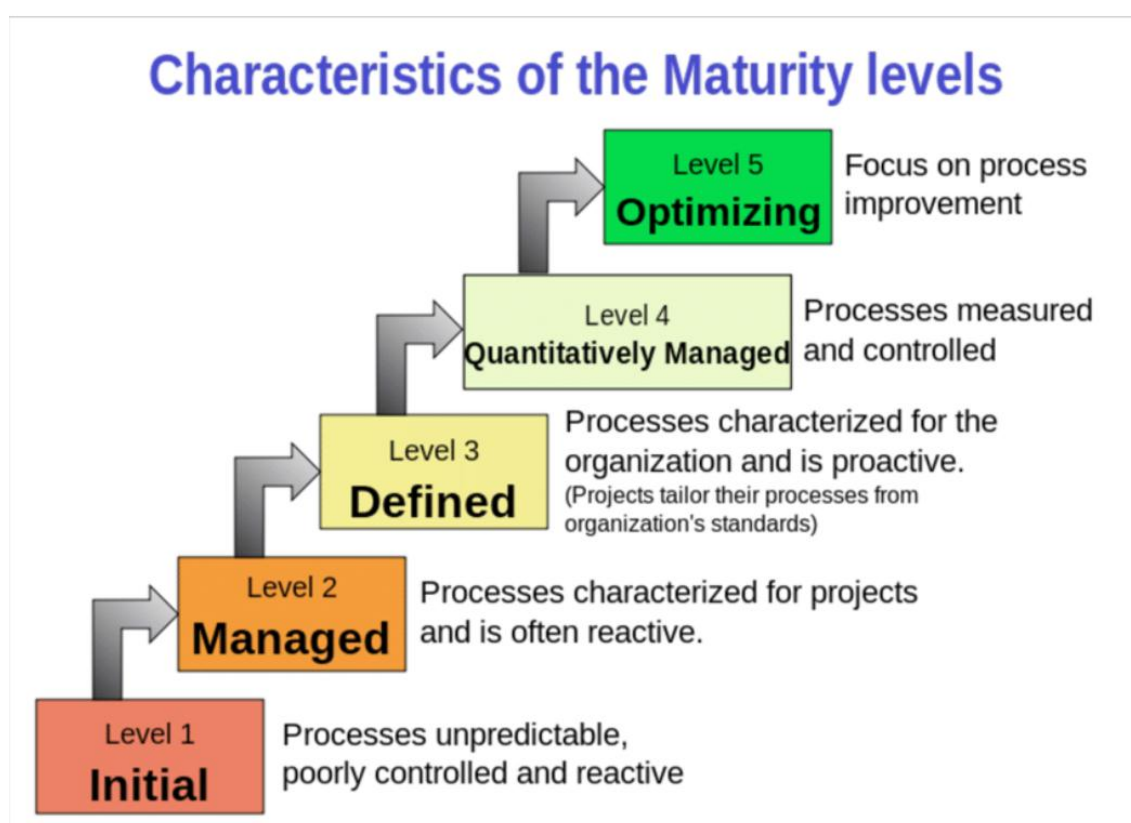


Fig 2

TOGAF is considered by many researchers as an industry standard and defines three different architectural levels which are visible in many other frameworks: Business Architecture defines the business strategy, governance, organization, and key business processes. The Information Architecture often is divided into two sub-layers: Data Architecture and Application Architecture. The Data Architecture describes the structure of an organization's logical and physical data assets and data management resources. The Application Architecture provides a blueprint for the individual application systems to be deployed, for their interactions and their relationships to the core business processes of an organization. The Technology Architecture describes the physical realization of an architectural solution. The logical software and hardware capabilities, which are required to support the deployment of business, data, and application services, are also defined in this dimension. The business architecture basically is defined as soon as the customer value and the use cases that have been designed and implemented to deliver the customer solutions. These values and use cases have been documented and are maintained.

The application architecture showed a separation between external services made for customers, the back-end services for the physical products and the services built-into the physical products. While external services are quite unified across the different product categories (ownership and warranty registration, archive for manuals and technical documentation, statistics, and alerts), the back-end and built-in services are dependent on product categories. An example is to lock/unlock the physical product using an app on the smartphone or smartwatch. This requires a corresponding backend and built-in services, which are not appropriate for all types of products. On the data architecture level, we found different data structures present in usage scenarios of PIT, but not all of them are fully stored in the product. The most prominent data structures are configuration and license information for the actual product in use, usage data collected during operations (operation time, operator ID, temperature, power consumption and other usage information of the device) and data structures for representing evaluation results of the operations data (indicator development statistics, triggered alarms and notifications, rules, etc.). Parts of the data are captured in the physical product or base stations made for forwarding the data. Other parts are stored in the cloud. Future scenarios also include streaming of real-time data via the base station to the cloud. On the technology architecture level, we found different hardware/software architectures which define platforms and reuse concepts for electrical/electronic control units in the products, sensors and actuators connecting to them and communication or networking components. Furthermore, the communication networks connecting the products to the backend network or the Internet could also be considered as part of the technology architecture.

4.4. Architecture Layer Content

Business architecture Not explicitly defined as architecture; made up of customer value and supporting IT solutions as displayed in Fig 3.

Architecture Layer	Content
Business architecture	Not explicitly defined as architecture; made up by customer value and supporting IT solutions
Application architecture	External customer services, backend services, services built into the physical products
Data architecture	Operations data, evaluation and statistics, configuration data
Technology architecture	Embedded systems architecture, communication components, infrastructure components

Fig 3

V. Conclusion

Digital Enterprises appropriately exploit new technological trends and can quickly adapt their business to them. Besides business and IT issues, IT governance has to cope with the needs and requirements of stakeholders, such as customers and employees in order to establish competitive advantages through Information Technology. The change of business models is already well seen, and it is imminent that the drivers will continue to impact the way organizations strategically structure their future morphology.

The changes to business models result from:

- a) the evolution of certain previous concepts (classical mainstream or Wave 1), mainly thanks to technological advancements,
- b) achieving social/user acceptance for previous concepts, generating economies of scale or the snowball effect,
- c) disruptive and breakthrough innovations. In order to facilitate the assessment of digital maturity, the proposed business model canvas can be used to evaluate the necessity for adaptation to the constantly developing new digital economy.

VI. Future Research

Further research on the needs of practitioners would be worthwhile. For example, it would be interesting to create a knowledge building community where researchers and practitioners can exchange needs and experiences across several countries and industries. Another possible area of future research would be to test our approach to digital strategy with practitioners. Lastly, future studies need to demonstrate quantifiable benefits of digital strategy.

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