

The impact of digitalisation in asset-intensive organisations

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With the beginning of the breakthrough innovations of Industry 4.0, digitalisation is expected to enhance value realization from infrastructure assets in asset-intensive organizations. This article provides an outlook of the impacts of digitalisation in a large public organisation managing the Portuguese main road and rail networks.

Introduction

The aim of this article is to share the experience of a Portuguese asset-intensive organisation that manages the main road and rail networks while engaging in a digitalisation process by the asset management department.

The digitisation and automation have become widely available due to the fourth Industrial Revolution in terms of cyber-physical systems. Industry 4.0 is a confluence of trends and technologies that reshape processes, services, and products delivered by organisations of all types and sizes. But there are still challenges to overcome; for example, in order to combine “information technology” (IT) and “operational technology” (OT) (Woodhead et al., 2018).

Industry 4.0 may also be seen as a confluence of disruptive digital technologies driven by an astonishing increase of: i) readily available data, computational power, and connectivity; ii) the emergence of advanced analytics and business intelligence capabilities; iii) new forms of human-machine interaction, such as touch interfaces and augmented-reality systems; and iv) improvements in the transfer of digital instructions to the physical world (McKinsey & Company, 2016).

According to McKinsey & Company (2016), to capture emerging opportunities and keep pace with the rapidly advancing technological frontier, industrial players need to act in three dimensions: i) reach the next horizon of operational effectiveness; ii) adapt business models to capture shifting value pools, and; iii) build foundations for the organisation’s digital transformation by developing digital capabilities, enabling collaboration in the ecosystem, managing data as a valuable asset, and coming to grips with cybersecurity.

Organisations managing physical infrastructures face the challenging task of maintaining, preserving, and improving infrastructure assets for current and future generations, while grappling with limited funding. Because

assets such as pavements, railway track, and bridges have long, useful lives, sound asset management requires a long-term approach (FHWA, 2016). Adding to this challenging context, generically all transport infrastructure managers around the world are dealing with worn out assets that at the same time are required to deliver higher performance levels.

Industry 4.0 can add value to these types of organisations and there is the need to carefully monitor the coming changes and develop strategies to take advantage of associated opportunities (Baur & Wee, 2015).

Digital maturity of Portuguese organisations

EY & Nova SBE (2018) recently surveyed the levels of digital maturity of Portuguese companies and the expected levels of confidence in a world so greatly influenced by technology. A total of 102 participants took part in this survey, of which 80% hold management or top management positions.

The results of this study show that: (i) there is widespread optimism and reliance on digital transformation, and participants think they are well positioned in their processes; (ii) in the opinion of the participants, digital transformation has already begun; it is at an early stage, and only some believe they are behind competitors (Figure 1); (iii) there seem to be clues of ideas and leaders capable of thinking about the digital transformation in their businesses and their companies, but there is a significant gap between the strategy formulation and its implementation; (iv) the investment and adoption of technology seems to follow first an imitation of other actors, and only after adjustment of the technology to the specific organisational context; (v) the digital technologies most adopted by companies are social networks and digital marketing, big data and analytics, cloud computing and IoT (Internet of Things), with sectorial differences in the level of implementation.

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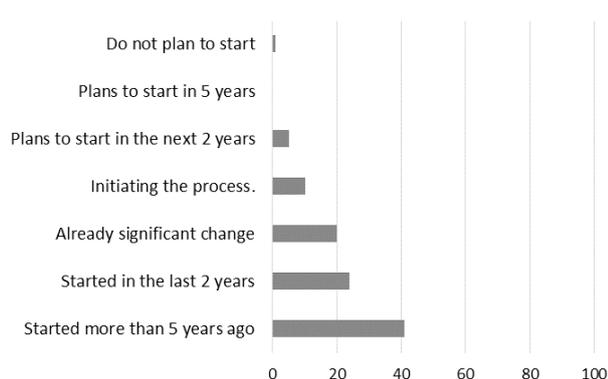


Figure 1. How long ago did digital transformation begin in your organisation?

Source: Adapted from EY & Nova SBE, 2018

Digital transformation is not new for Portuguese companies, but the impacts of change are still not clear (EY & NovaSBE, 2018).

Digital strategy for infrastructure asset management

Asset management in an asset-intensive organisation such as public infrastructure organisations are used to identify how an organisation deals with the management of its physical assets through their life cycle to achieve its strategy (El-Akruti & Dwight, 2010).

When used effectively, engineering asset infrastructure (EAI) can create benefits for both the asset-intensive organisation and their stakeholders/customers. However, the complexity of handling different types of budget-constrained EIA with varying capacity presents challenges for many asset-intensive organisations when planning, acquiring or constructing, operating and maintaining this EIA. Infrastructure asset managers must optimise the use of available resources within existing infrastructure and business constraints. A fully integrated technical, financial, and stakeholder/consumer-focused approach that leverages digital solutions is expected to enable asset managers to reach their benefit potential.

However, financial restrictions affect the availability of public sector funds, and subsequently this impacts asset-intensive organisations in different ways, namely by reducing the number of major capital projects and therefore hindering the disruptive effect of technology-based development projects.

Another critical issue to consider in asset-intensive organisations is the impacts of disruptive technologies in human resources, where adaptation and the risk of potential-

ly significant loss of expertise and experience needs to be planned and factored in.

In light of this, an important question to ask is: how can infrastructure asset managers develop digitalisation strategies to build a holistic, fully integrated, and flexible asset management (AM)? An answer to this question is proposed based on the current digitalisation strategy within the largest infrastructure organisations in Portugal. This asset-intensive organisation is Infraestruturas de Portugal, S.A. (IP-SA), a state-owned company resulting from the merger of Rede Ferroviária Nacional – REFER, E.P.E. (REFER), the former rail infrastructure manager, and EP - Estradas de Portugal, S.A. (EP, S.A.), the former national road network manager (IP-SA, 2016). The following Q&A offers the current view on digital transformation focused on asset management being carried by Infraestruturas de Portugal (IP). The authors appreciate the contributions in dealing with these questions by Rui Coutinho (IP's Director of Asset Management) and João Morgado (Information Modelling unit of IP's Asset Management Department).

1) Is the digital strategy of the organisation in line with the AM Strategy?

If you consider the fundamentals of asset management, the answer to this question will be for sure “it has to be.” The successful implementation of an asset management strategy must be fully coordinated with the digital strategy of the organisation, and both resulting from the strategic objectives of the company. Regarding the context of IP, it should be noted that it is a relatively young organisation, resulting from a merger process of two large organisations, REFER (rail) and EP (road). As an immediate result, the priorities within the digital development roadmap were focused on corporate systems such as accounting and document and process management. Currently, and after these initial efforts, relevant steps are being made to align the digital strategy and the asset management strategy, by mapping all systems, applications, and processes related to asset management, identifying gaps and priorities, and finally designing a mid-term plan to implement an asset management strategy fully supported in a corporate digital strategy.

2) How can asset managers develop digitalisation strategies to build a holistic, fully integrated, and flexible AM?

The first step shall be to understand that a digital strategy is not an IT strategy, the first focuses on automating processes and productivity and the last treats technology indi-

vidually. Successful digital strategies focus on specific business or processes and not on a global or unified strategy.

One of the key goals to bear in mind within the development of digitalisation strategies in the context of asset management of asset-intensive organisations such as an infrastructure manager is the proper alignment between the physical and technical management of an asset, and its financial dimension. As an infrastructure management organisation, IP provides mobility services based on the contracted performance of its infrastructure and each asset must be managed as a physical entity with all the challenges related to the effective management of its condition, but also as a source of revenue that must be managed in order to maximise its value to the organisation. That is why asset managers need to strive for coordinated strategies, enabling the organisation to assess the financial impact on its objectives, when a decision to postpone a specific investment is considered. Given the potential fast-changing decision contexts, regarding for instance budgetary frameworks, integrated and flexible asset management systems are key, and this can only be sustainably achieved through a business digitalisation approach.

3) The digital era will require quick responses to emerging challenges and opportunities – is IP-SA prepared for this?

As mentioned in the first question, IP is giving relevant steps so that it can be prepared and respond to those challenges and opportunities. However, for asset-intensive organisations and considering IP's specific context, it is difficult to act quickly in a practical way. IP's asset portfolio includes more than 15,000 km of roads, 2,600 km of railways, more than 7,500 bridges as well as many other sub-systems (such as earth retaining structures, road furniture, switches and crossings, signaling systems, catenary, power supply installations, communication systems, and telematics). This very complex and diverse asset portfolio constitutes necessarily a considerable management challenge, where only a well-discussed and supported digital strategy can prosper. We should add that aged assets include specific challenges such as condition and inventory issues, as opposed to newly built assets. In any case, transport infrastructure companies for roads and rails have been around for more than 150 years, dealing with social progress, technology evolution, and economic trends. How could a company with this background not be ready for the digital era?

4) We must be able to handle and process more data to efficiently make AM decisions. Have we a strategy for this?

One digital strategy of the organisation is currently addressing the data acquisition and management processes, identifying opportunities for a more efficient approach. While in some areas paper-based inspections still occur, these are being replaced by mobile equipment, allowing real-time data to be fed to corporate databases, immediately generating alerts whenever needed. In other areas, such as structural condition monitoring, real-time data transmission is also a reality. These joint efforts are trying to complete a puzzle where constantly available and reliable data for all asset types is the final objective. However, technologies as the IoT and big data can also play a relevant role to this end and may significantly accelerate it, as there is a huge potential for it in the monitoring of such a diverse group of physical assets.

We must understand that there is no one digital strategy to solve all issues related with data collection, information delivery, and decision-making. Asset management relies in coordinated digital strategies that maximise value extracted from assets.

5) Does IP's AM system include accurate performance metrics, deliver accurate data, and enable well-informed decisions?

As a result of the diversity of IP's asset portfolio, each technical area felt the need to develop dedicated systems, applications, and databases, supporting the technical management of each asset type. However, the communication between different platforms is not always possible, making it hard to compile, analyse and correlate data. Business intelligence started to be applied in some areas but is still limited by these types of constraints. The ongoing efforts on the alignment of the digital and asset management strategies are also dealing with these missing links and, in some cases, with potentially inadequate processes that may lead to nonefficient data handling and, in further extent, to decisions not supported in reliable data.

Of course, those missing links are filled by human actions, and progressively those actions will also become automated. Digital transformation is essential to human performance, creating a more productive path to value creation and well-informed decisions.

6) In your opinion, what will be the main future impacts and challenges of digitalisation for AM functions in an asset-intensive organisation like IP-SA?

In our opinion, three types of impacts or challenges can be mentioned. First, we believe that digitalisation will transform the organisation in its entire value chain, from data acquisition and management, supporting tools such as machine learning and business intelligence, and ultimately allowing the organisation to make better decisions. Second, it will be a key enabler of the long-term strategy of the organisation. Digitalisation will provide tools to support the definition of a sustainable asset management approach accurately, improving the assets' performance, not only in their physical dimension but mainly in their financial aspect as a source of revenue to the organisation and its shareholders, which in the case of IP is the Portuguese state. Last, digitalisation can also be the source for new business opportunities for the organisation. The existing systems and the ones being implemented shortly are providing big data that can be processed, becoming relevant and valuable information in the mobility business. This also means an opportunity for cooperation with other entities in the mobility industry, in order to provide better services to its users. In asset management, decisions are never taken in isolation but always aligned with the company's strategic objectives.

Conclusions

While it is hard to predict how the future will unfold, we can see that some trends and the fast-approaching digital transformation will involve an array of technologies that promise to reshape the way things are made today. Several evolutionary waves of strategic innovation had been seen many times before. What is happening today has happened before in other industrial revolutions. Asset-intensive organizations must understand the changing context and operate within it. They need to manage their transformational adaptation to better fit with emerging strategic priorities. It must consider: i) the emerge of new "smart" products that provide greater insight into uncertainties that link to long-term costs; ii) different services based on data from sensors through an innovative technology that links to real-time analytics engines, to tackle problems such as asset tracking, predictive maintenance, and new processes that change workflows and use information flows to create more value; and, iii) more expectations and demand of customers. However, in the other hand, it is also necessary to approach the sphere of technology considering the human factor, especially when we move on

to the business of deriving and implementing action plans, tracking progress, and changing the way people work.

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