

Maintenance Digital Maturity Assessment

A Roadmap to Maintenance
Digital Continuity

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He is a PMP®, ITIL® expert for the Digital Industry sector. Throughout his career, he has always been working for ICT driven innovation, in terms of processes and technical solutions, enjoying challenges to the business-as-usual. He developed skills in conceiving, planning, and managing complex digital transformation programs at large national and international customers, spanning from telecommunication to public administration, from transportation to manufacturing, in positions involving various levels of responsibility. With a strong technical background in computer engineering, he learnt the human factor of information technologies and how to mediate between technology and organizations. He trained his interpersonal and communication skills by interacting with customers' representatives, both executives and operatives, working on ICT departments, engineering, operations and maintenance. He successfully managed relationships with partners and suppliers, and handled commercial negotiations and agreements. Always aware of evolutions in ICT market, both in terms of solutions and customer expectations. His enthusiastic approach to work and the challenges to be solved with customers has driven him time and again in contexts where identifying innovative and creative solutions, being able to listen and negotiate, making use of interpersonal skills and ensuring a quality execution are critical to success.

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1 THE NEED

Digital revolution is redefining how business is done particularly in asset-intensive industries. Virtually every asset today may have data production and communication capabilities.

Whether continuously fed to a Data Lake or via batch upload, collected data is supposedly being used for taking better decisions, facing uncertainty and achieving competitive advantage. Predictive algorithms, IoT, Big Data and Artificial Intelligence are just a few of the most repeated buzzwords in Maintenance papers and congresses.



The optimal balance among corrective and preventive maintenance is dramatically impacted by the advent of modern technologies. To human beings, it may seem that machines suddenly fail, but actually a measurable process of degradation may be identified before failure. Reduction of prices in sensors, CPU's, memory and telecommunications has made available cost-effective sensors and edge components capable of delivering timely precious data about the machine's status and performance. Nevertheless, a lot of maintenance today is either reactive, i.e. fixing or replacing equipment after it fails, or blindly proactive, i.e. assuming a certain level of performance degradation, with no input from the machinery itself, and servicing equipment on a routine schedule no matter whether service is actually needed or not. Both scenarios are extremely wasteful.



The appalling truth is that little or no practical use is made of most of data in many organisations. Sometimes this is because the available data are not collected in appropriate ways, enriched with necessary metadata and correlated to context data which make them useable. More often, no adequate processes exist for systematically circulating and exploiting the available data.

MAINTENANCE DIGITAL MATURITY ASSESSMENT



Confronted by the hype around Industry 4.0, enterprises recognize the need to innovate quickly and to leverage data to improve performances and reduce waste. Be it by reducing excessive preventive maintenance, fine tuning inventory levels, avoiding unnecessary down times, the maintenance engineer is required to achieve more with less. However, they have to do this while simultaneously running the business and hitting regular performance goals.

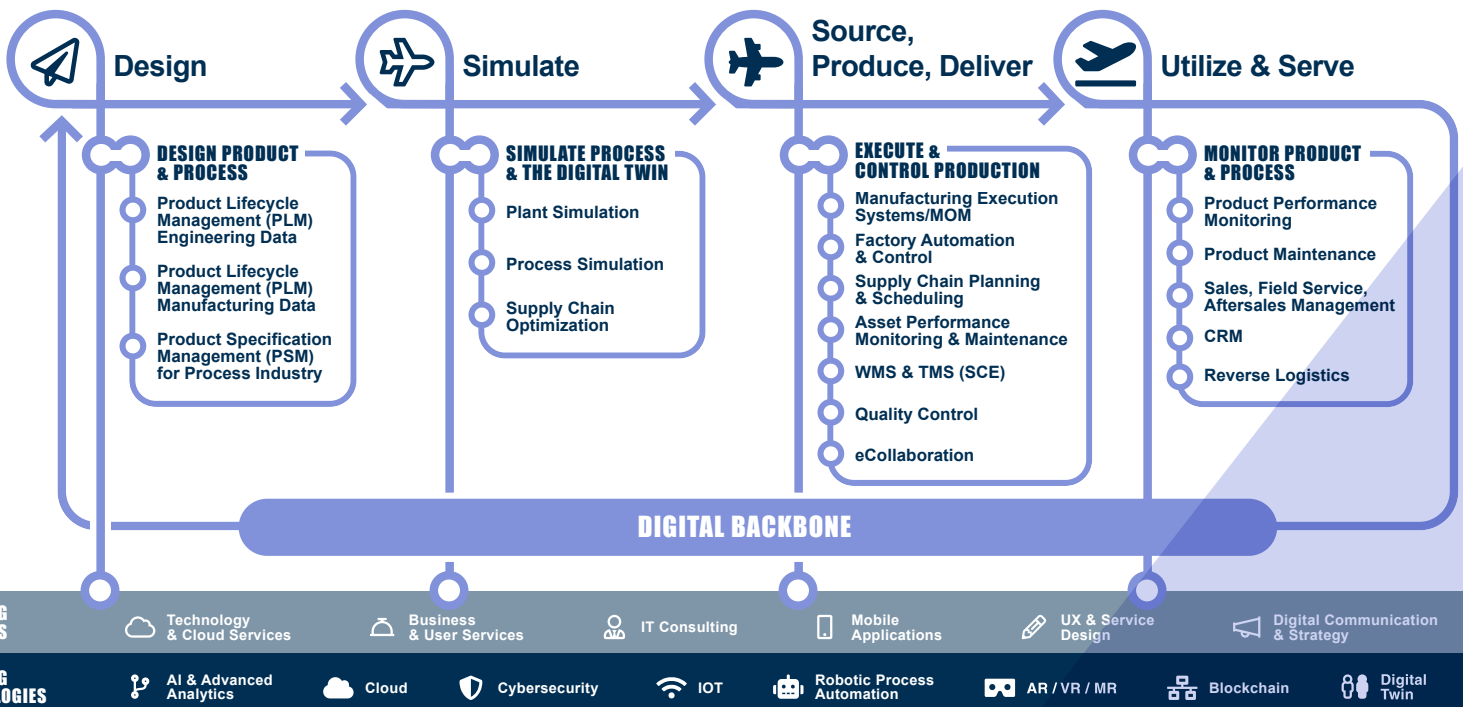


For these reasons, many enterprises are full of Digital Transformation initiatives, often unrelated, with competing goals and overlapping technologies. Most of those initiatives are short-termed, just trials of specific products and their impacts. That is the reason for, to many, Industry 4.0 is now a synonym of Proof of Concept. An organic strategic vision is often missing.

Maintenance is crucial for the Digital Industry Thread. In any phase, from design to use, the Digital Thread allows the data flow necessary to ensure asset efficiency and economic return, inside and outside the plant. By measuring our customer's digital continuum (i.e. their digital maturity), we can understand where to intervene and design a coherent and structured path towards Maintenance Digital Transformation.

DIGITAL THREAD

Digital Industry



2 OUR APPROACH

Time and again, technology alone has never been enough. Organizations can find real benefits starting from their business needs and understanding where their current Business Processes fall short of serving them.

WHAT CAN ENGINEERING BRING TO HELP?



Our extensive and deep knowledge of maintenance business processes and best practices. Our expertise in how digital technologies best support those very processes. We can help our customers in identifying where they are not up to their business needs and how those gaps can best be bridged.

Too many times the design department is regarded as working behind a high wall, throwing above it CADs, designs, documentation and ignoring what happens next.

THE DESIGN PROCESS IS WHERE DECISIONS ARE TAKEN ON HOW TO ACCOMMODATE MAINTAINABILITY AND TO SUPPORT INTEGRATION OF ASSETS INTO OPERATIONS.

OUR APPROACH AND EXPERTISE FOCUS ON THE ORGANISATION'S CAPABILITY END TO END.

FROM MAINTENANCE DESIGN TO DELIVERY we systematically evaluate our customer's processes in order to assess their maturity and rank it on a digital maturity scale.

WE CALL MAINTENANCE DIGITAL CONTINUITY the seamless communication among departments involved in any stage of the Maintenance processes; the availability of data where, when and whom they are needed to; the usage of digital traces to collect data on processes' performances and to implement a continual service improvement program.

Electronically available and pertinent BoMs, maintenance plans, operating instructions, visual guides, technical documentation are essential elements of mature maintenance design and operations, but not enough.

Suppliers, purchasing departments, operating contexts, and business objectives generally set constraints and may even be very different from what planned at design stage. At least because they usually change over the course of the asset life, while asset condition deteriorates. It is therefore important that a healthy flow of information is always kept alive and working between operations and design department in order to route upstream the returns of experience.



Maintenance processes must include the necessary information management tools to keep arrangements, documentation and operating instructions up-to-date and to assess the optimal maintenance strategy at each stage. Algorithms for “opportunistic” maintenance should support maintenance planner in evaluating which is the best set of maintenance activities to perform each time, taking into consideration current asset and service status, the applicable resource constraints and the impacts on internal and external customers.

ASSET PERFORMANCE MANAGEMENT SERVICES

must be in place and integrated with maintenance operations and other processes in order to continuously evaluate asset reliability trends and predictors.

STRATEGIC PLANNING OF MAINTENANCE

must enable organisations to maximise the value that they can extract from their assets. We assess how the organization performs tasks such as: the evaluation of the economic return of maintenance services, the choice of the optimal combination of costs, risks, performance and sustainability, decisions about insourcing vs outsourcing, supply chain network planning, and so on. Ultimately, we assess how organisations prove that they are managing their assets optimally, in the interest of their stakeholders, i.e. owners, customers, regulators, neighbours or the general public.

Support processes, third parties management, logistic and warehouses, and reporting are also carefully analysed and evaluated.

WHAT BENEFITS DO OUR ASSESSMENTS BRING TO OUR CUSTOMERS?

Thanks to our activities, our customers can devise how far they are from their optimal position in a quantitative radar chart, and use the same tool to implement, monitor and control successful digital transformation steps (see Figure 1).

An integrated program of initiatives, driven and controlled towards predefined goals by means of our radar chart, is what we call a successful Digital Transformation Roadmap.

It is worth noting that the chosen desired stage is not definitively going to have all the processes at the top level of Digital Maturity scale. The optimal stage actually depends on the Asset Management Strategy of the organization which, in turn, derives from the organization's Business Strategy.



Figure 1 – Sample As-Is vs To-Be Processes Maturity radar chart

2.1 ENTERPRISE ASSET MANAGEMENT

Maintenance Processes evaluation cannot be just carried out only to maintain individual assets in service, but it must take into consideration the whole asset system that includes interrelationships and dependencies between assets and their stakeholders, Operations and IT.

While a Plant System Engineer may focus on the performance of a single robot, the Plant Manager typically wants to know how to reduce Maintenance Opex or how to best allocate Maintenance Capex. On the other hand, a CIO might be interested in consolidating IoT technologies into a single platform and in finding out best of breed big data analytics in cloud. Culture of engineers values reliability and safety, fault tolerance, determinism, consistency and longevity. Culture of IT people is comfortable with agility, trying early and failing early, killing and restarting, virtualisation, security. It is mandatory and we are ready to discuss Maintenance issues with business and functional units, starting from their point of view.

Engineering approach to Enterprise Asset Management goals is in line to ISO 55000:2014 definition as “the coordinated activity of an organization to realise value from assets” where an asset is an “item, thing or entity that has potential or actual value to an organization.”¹

OUR GOAL IS TO HELP OUR CUSTOMER TO EXTRACT VALUE FROM THEIR ASSETS BY SUPPORTING THEIR PROCESSES WITH ENABLING DIGITAL TECHNOLOGY.

In the wider context of Asset Management, the overall objective of maintenance is to ensure that the assets continue to meet their service and performance requirements including safety, environmental and output parameters. Selection of the appropriate maintenance and inspection regimes to achieve this objective is as important as efficient coordination of

the resources and the timely availability of information needed to deliver the chosen regime.

The operation and maintenance phase of the Life Cycle can last a significant time and account for a significant proportion of an organisation’s annual budget. Appropriate tools for Life Cycle Costing estimations and value depreciation enable our customers to perform facts and figures based decisions and decide the optimal mix of Capex and Opex expenditures.

Maintenance is itself a broad term with many specialist disciplines and professional bodies. In the context of Asset Management, the maintenance strategy / plans for an asset or system need to be determined and documented in line with the Asset Management Strategy & Objectives and Asset Management Planning activities.

¹ While these are general definitions, encompassing the needs of most heterogeneous organisations, ISO falls short of specifying how to reach the stated goal and moreover it leaves to each organisation the responsibility to define the meaning of “value” in their context, for example – but not only, the minimisation of risks, liabilities and operating costs.

3 ROADMAP DEFINITION AND IMPLEMENTATION

The goal of our Roadmaps is to help our customers reach the desired digital maturity stage for their maintenance processes.

WE DON'T JUST DELIVER SLIDES, WE DELIVER SOLUTIONS.

We achieve this by designing, delivering and operating the right technologies to fill the gaps in their maintenance processes' Digital Continuity. By doing so, we enable our customers to define, implement, monitor and control processes which support their data-driven Asset Management Strategies.



Our Roadmaps include services and solutions covering all the data-related sides of Enterprise Asset Management:

STRATEGY, in terms of scenario analysis tools to evaluate how to best align Capex and Opex with the required performances and measure its achievement by means of quantitative and actionable KPI's

INTEGRATION, we design and deliver silos-breaking information infrastructures, in order to collect and correlate all data concerning assets, components, systems, decision, resources related to Asset Management. We make the total puzzle work as a whole - and be more than just the "sum of the parts"

OPTIMISATION, through our decision support tools, artificially intelligence empowered, enable appropriate balance of costs, risks and performance on different timescales, ranging from day-by-day activities to multi-year life cycle planning.

MULTI-DISCIPLINARY, our network of expertise ranges from PLM to CRM, from supplier

relationship management to IoT, from predictive algorithms, to reliability growth analysis, from networking to big data, from ERP to Warehouse management, from supply chain design to PLC and SCADA, from user experience to EAM products, from wearables to cloud. We are able to cross departmental and disciplinary boundaries and are focused on creating or increasing "value" – tangible or intangible, financial or nonfinancial.

RISK-MANAGEMENT, from risk assessments to risk based maintenance tools and service to enable evaluations of risks and liabilities and to use them as part of all decision-making. Not just average estimations, but detailed evaluations by means of modern simulation modelling tools.

KNOWLEDGE MANAGEMENT AND COLLABORATION, to elicit the most valuable implicit knowledge on asset management (such as troubleshooting and fixing) from expert maintenance operator and make it part of the organisation's explicit know-how.

OPERATIONS AND WORK FORCE MANAGEMENT, for managing work orders, notifications, schedules, shifts, resources, equipment, spare parts.

VIRTUAL AND AUGMENTED REALITY, solutions, for virtual communication, collaboration, sharing of real-time data, documentation and advice in a peer-to-peer and/or in a centralized scenario.

3.1 DATA DRIVEN MAINTENANCE

We can support our customers in the early phases of placing the right sensor onto the right asset in the appropriate operating conditions, defining data collection, sampling and storage rules to minimize storage and bandwidth consumption while saving the descriptive power of the collected data.

When assets are not connected we can design and implement the appropriate network and monitoring facility. We then can help support building the right **DIGITAL TWIN** of the asset, and make it evolve based on collected data.

WE HAVE THE EXPERTISE AND THE ALGORITHMS TO SUPPORT OUR CUSTOMERS IN SELECTING THE APPROPRIATE FEATURES FOR HEALTH STATUS IDENTIFICATION AND IN SETTING UP CONDITION BASED MAINTENANCE THRESHOLDS AND EARLY WARNINGS.

Our competencies and machine learning solutions enable the **IDENTIFICATION OF PATTERNS** in appropriate features to monitor and predict health degradation, setting thresholds, extrapolating temporal behaviour of health indicators to predict risks of unacceptable behaviour over time as well as pinpointing exactly which components of a machine are likely to fail by performing prognostic estimations of Remaining Useful Life. Maintenance actions can then be synchronized with the overall operation of the system as well as with the necessary maintenance resources and spare parts. Such

synchronization of maintenance actions and information flow infrastructure can enable autonomously triggering of services and ordering of spare parts, yielding reduction to downtimes and spare parts inventory levels.

WE CAN BUILD DIGITAL TWINS OF OUR CUSTOMERS' ASSETS AND PROCESSES,

ranging from a single component to a whole Plant or a worldwide Supply Chain Network. We are experts in giving to our customer tools to analyse impacts from a component's scale to the organisation's scale.

ASSETS ARE NOT JUST PHYSICAL ASSETS: THEY ARE ALSO ECONOMICAL ASSETS.

MAINTENANCE DIGITAL MATURITY ASSESSMENT



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