Industrial Internet
is driving industrial transformation

Midagon Industrial Digitalization White Paper

Introduction

Digitalization is a strategic level game-changer and the first-mover advantage is considered very important. Thus, expectations for the Industrial Internet and IoT are also very high. For some reason, the approach to digitalization for many companies is rather technology-driven as opposed to business-driven. Therefore, as companies proceed with implementing their digitalization capability road-maps, there will be many disappointments. Success, or failure, will be determined by several factors combining strategy, business models, technology, competences, organizational learning, architecture, methods, etc. Regardless of the priority of these factors, focus on the customer is critical.

The key question is, where is the money? We claim that the precise answer depends on your company's role in the value chain and the corresponding ecosystem as well as on your current offering and future aspirations. Technology will provide only a partial answer to the main challenge. Therefore, companies must think it through carefully. Three main categories of added value can be distinguished:

- **Revenue** – companies can increase their sales through intelligent solutions, e.g. in the form of new services. We have seen it also in practice. Where one company was previously able to generate thousands of euros from their services, through smart solutions they could achieve customer contracts worth tens of millions of euros. At a minimum, companies must look at what their competitors are doing and act accordingly to stay in business. Competition in the new environment can come from surprising directions. Thus, there are opportunities and threats, both of which require attention.
- **Efficiency** – Industrial Internet provides a unique opportunity to improve efficiency and productivity. For example, moving from reactive error-fixing to predictive maintenance and optimized uptime will mean fewer unplanned maintenance breaks, a reduction in lost sales and a reduction in capital tied to spare parts and warehousing. 3D printing is now going mainstream. Asset optimization, such as fleet management, provides an opportunity to reduce gas consumption, which will have a direct impact on profitability. In labor-intensive services, such as maintenance work, smart maintenance enables productivity increases of 20 – 30 %.
- **Indirect benefits** – indirect benefits include higher customer and employee satisfaction, improved quality and a stronger brand name. We predict that customers, employees and other stakeholders, when choosing, will favor providers with well-functioning, user-centric digital solutions over others.

It is said that innovation is 1% inspiration and 99% perspiration. This statement is directly applicable to the Industrial Internet and IoT, too. Those who are looking for silver bullet answers, think again. Each company should find its own unique path to success. The only certain way to fail is by laying still and not getting started. All other options present an opportunity to be seized.

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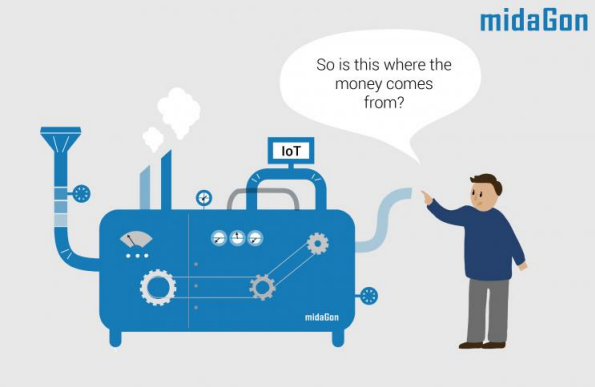
A tiger leap to the Finnish Silicon Valley



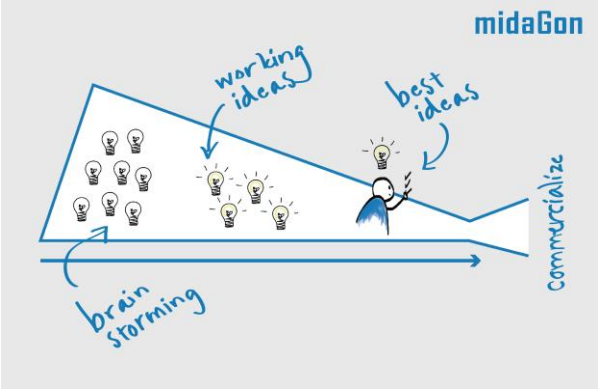
The Industrial Internet and IoT became hot topics in digitalization and technology discussions in 2015. This is also visible in the famous Gartner Hype Cycle for Emerging Technologies. The 2015 version positions the Internet of Things at the top of the curve. In 2016 IoT was separated from the Emerging Technologies Hype Cycle and a new IoT specific Hype Cycle was established. This underlines the importance of IoT in the digitalization scene.

Developing industrial services with the help of data and analytics is not a completely new idea. For example, Boeing started to build their Industrial Internet platform at the beginning of the 1990's to collect data from their new 777 fleet. Now, all Boeing services are based on data and advanced analytics. Another good example of Industrial Internet based services development with real-time data is Siemens, a global technology power house, who recently introduced their version of Industrial Internet cloud platform.

Why is the Industrial Internet such a hype right now? The main reason seems to be the huge value promise that several analysts have expressed. The risk of losing the Industrial Internet game to your competition is encouraging companies to do something. This has also been noticed in Finland. The Aalto University study "Suomi – Teollisen Internetin Piilaakso" estimates that the value Industrial Internet and the related opportunities bring to Finland can climb as high as 58 billion euros. But the value can also be negative if the Finnish government and companies are slow to act upon the opportunities that the Industrial Internet brings.

What are the main obstacles that stand in the way of fast success and value delivery? We believe that companies focus on investigating Industrial Internet related technologies rather than using business innovation to seek out the best and most potential business success areas under the companies' vision and strategic plans. It is easy to ramp-up small technology research initiatives – and the clear majority of IT suppliers are suggesting that companies should do this. In a typical case, these initiatives end quickly and the question about value generation emerges. The initiatives have focused on technology and business related questions have been ignored. There are no answers and the funding of Industrial Internet development vanishes.

On an Innovation Wagon



There is a huge value promise for Industrial Internet. Companies must move beyond Industrial Internet piloting, otherwise there is a growing risk of the competition achieving a digital competitive advantage. Even if the actual rewards are not crystal clear at the exact moment, action needs to be taken immediately.

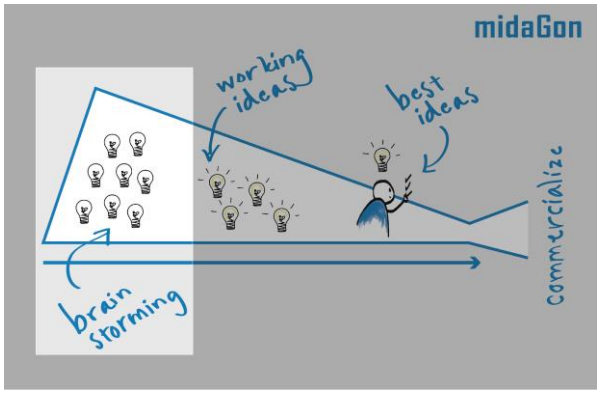
Where do you find those great ideas to develop Industrial Internet based services and products? How do you make sure that the ideas are aligned with the company's vision and strategy and not completely out of the company's current core business? How do you handle a potentially very large number of ideas – hundreds or even thousands? How do you find those with the most potential? How do you test the technical and commercial feasibility of the ideas quickly and cost efficiently, as companies don't have the time and resources to set up tens or hundreds of simultaneous pilot projects or Proofs-of-Concepts with limited resources?

As one might notice from the list of questions, only a few of them are related to technology. Strategy, value, costs and resources are much more visible than technology. Nevertheless, most companies focus on testing Industrial Internet technologies such as sensors to collect technical data from machines. We at Midagon believe that because the focus in Industrial Internet development initiatives is currently on technology, the logic of earning revenue from the new services is overlooked. Once technical solutions are tested and in place, there is no idea about how to monetize those services. This leads to disappointment and discontinuation of many Industrial Internet programs.

The good news is that there is a way to overcome these challenges by applying an agile approach to idea brainstorming, assessment, piloting and commercialization. We call this approach the Midagon Innovation WaGon or MIG. It starts from a company's vision and strategy under which potential business development areas are defined. Development ideas are generated for these areas in brainstorming workshops. The results are prioritized and the most promising ones are moved to feasibility assessment. Those that have clear business value and are implementable with a reasonable effort move on to piloting with key stakeholders such as customers. The created service prototypes are taken to productization only if the stakeholders think the new service or product is also valuable in practical use.

With the Midagon Innovation Wagon, companies can innovate, verify and validate Industrial Internet based services fast and cost efficiently.

Idea Generation



Companies can innovate, verify and validate Industrial Internet based services quickly and cost efficiently with the Midagon Innovation WaGon (MIG). The output from the idea generation phase of the MIG is a list of prioritized development actions that are aligned with the company's strategy. The idea generation is done in a workshop(s) by subject matter experts. Heterogeneous results are achieved by inviting people from different functions to the workshop session. For example, people from sales, service organization, finance and human resources teams could be present in one workshop.

The on-site workshop typically takes one day. The company's strategy is used as the baseline in the preparation work and the strategy sets guidelines for the workshop. During the workshop development ideas and related actions are collected and prioritized. Ideas not aligned with the strategy can also emerge. These ideas typically don't score high in the prioritization but if they are valuable otherwise, they can be handled separately as "disruptive" for a longer-term development.

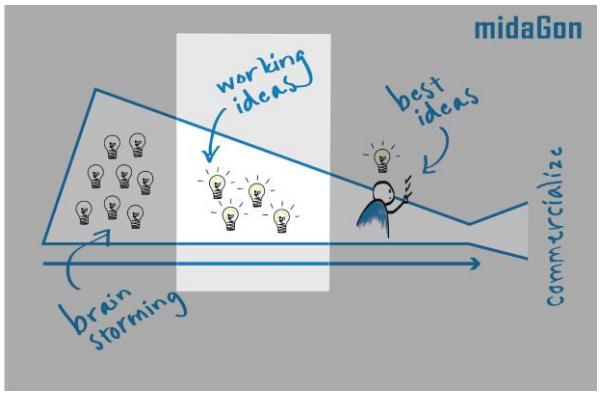
The workshop(s) uses team work methodology for brainstorming and idea prioritization. First, several ideas are generated individually and in teams. This is followed by prioritization by voting and through clarifying team discussions.

The generated action ideas need to be clarified so that everyone understands what their actual purpose is. Based on experience, adding clarifying questions to actions makes them more concrete and easy to handle. Refining action ideas with questions might seem strange at first but afterward their clarifying strength is usually crystal clear.

The final phase before summarizing the results of the workshop in a report format, is the idea prioritization. An example is the importance of adding remote monitoring capability to an industrial service process compared to providing more training to field service engineers.

The development areas and related actions can typically be put into three categories: new or increased revenue, better process and cost efficiency and other benefits such as customer satisfaction. These three categories help in the idea action assessment because companies normally have strategic objectives for these areas. The results of the workshop can be linked to the strategic objectives and aligned with the strategy.

Feasibility Assessment



After generating 100-150 prioritized development ideas based on Industrial Internet provided opportunities, it is necessary to move on to assessing the ideas in a feasibility study. The assessment is needed for fast and cost-efficient screening of prioritized ideas from the idea generation workshops. There are typically 10-20 high scoring ideas that are put under scrutiny. Those ideas that are impossible to implement or are too expensive, should not be taken to piloting.

The ideas are evaluated from several different viewpoints, technology being one of them. The other necessary viewpoints for overall feasibility estimation are business value, process and people.

The process viewpoint is considering changes needed to existing business processes when industrial internet capabilities are applied. It is seldom reasonable to just digitalize your existing processes but to consider also what is the best way to increase operational performance in general. Only by removing the constraints and boundaries of existing processes and practices, at least partially, the new digital capabilities can deliver the highest value.

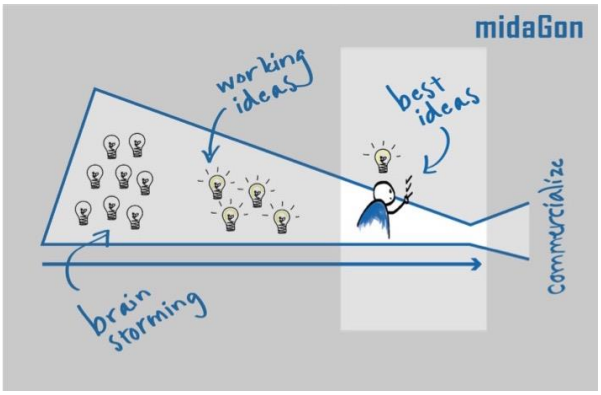
Organizations that are at the beginning of the Industrial Internet development typically also lack the necessary competencies for success. In many cases both training and new personnel are needed. It is good to recognize these gaps as early as possible and to calculate the related costs to an overall business case of the Industrial Internet development.

Finally, technology, process and people related gaps and costs are summarized in an Industrial Internet development business case. The business value side of the equation is estimated using reference cases and assumptions. The balance between costs and value is calculated and compared with organization's business benefits expectations. The highest scoring ideas from the assessed 10-20 are candidates for piloting.

Several tools and methods are available to be used in the feasibility study phase. Lean Canvas is a good framework for overall Industrial Internet development business case creation. Industrial Internet Consortiums' Reference Architecture works as a solid reference for technology and architecture related assessments. Other frameworks are available for process and people related assessments.

At Midagon we have packaged many of these viewpoints into a Midagon Industrial Internet Capability Assessment. It covers all cost side feasibility study aspects and feeds information to Lean Canvas on which the overall Industrial Internet business case is documented.

Piloting



The feasibility assessment phase of the Midagon Innovation Wagon answers the question “are generated digitalization ideas implementable, and are they delivering enough business benefits”. All ideas that pass this approval gate on the way to successful digital services, move on to the MIG’s phase called Piloting. In a typical case, the 10-20 top ideas that were moved to the feasibility assessment phase, have now turned into 3-5 that should be tested in real operating environment.

Piloting means that the remaining digitalization ideas need to be developed into prototypes that work and can be subject to stakeholder review. For people to understand the new digital services in the correct way, they need to see how the services work. Technical testing is not enough and the whole digital services delivery process needs to work properly.

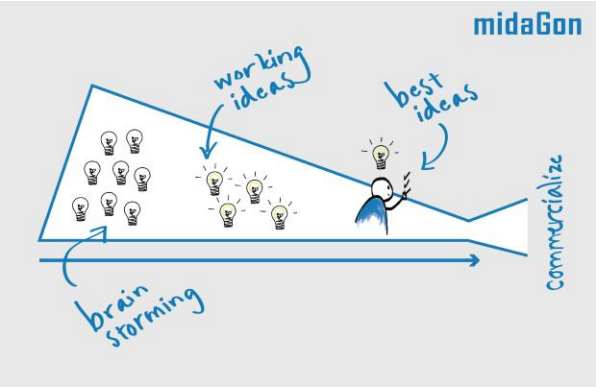
The prototypes don’t need to perform as well as the final production versions. For example, data feeds can be much slower or even manual for prototype evaluation purposes. But the data needs to flow through the whole data refining process and end up with analysis or business intelligence reports. If the process includes automatic decision making steps, then the decision-making capability needs to work.

The stakeholders are the people who will use, develop and benefit from the new digital services. They can be, for example, operational employees, developers or business decision makers. They are also customers who will use or benefit from the new services. Involving the customer is very important because it is the customer who eventually decides if the new digital services succeed or fail. The stakeholders will review the new service prototypes and provide feedback on how they see them. Based on the feedback, the new services will be modified to ensure effective adoption when they go into production. In some cases, the stakeholders don’t see the value of the new services. This means that those services should be removed from the priority list of the new digital services selected for productization.

The digital services that pass the stakeholder review move on to business modeling. This means that the results of the feasibility assessment will be reviewed and revised based on received stakeholder feedback. Business models and business cases are finalized.

The best technically working ideas that are considered beneficial by stakeholders and for which the business models and cases look very good, move to the final review. The purpose of the final review is to decide which new digital services move on to productization. A budget to launch the best new digital services is prepared for decision making. There should be 1-2 items on this list if the idea generation phase created 100-150 new digitalization ideas.

Commercialization



The feasibility assessment phase of the Midagon Innovation Wagon answers the question “are the best digital service ideas that work technically also working commercially from all stakeholders’ viewpoints”. The few ideas that pass this approval gate on the way to successful digital services, will be productized and taken to commercial use. The 3-5 top ideas that were moved to the commercial feasibility phase, have now turned into 1-2 that should be taken to production use to generate business and other benefits to the organization.

For a new digital service to be commercially successful, one needs to consider other than technical implementation as well. The new service typically requires at least some changes to the organization’s processes. Personnel skills and competencies most probably need to be updated as well. This means that the commercialization phase of the Midagon Innovation Wagon is very close to a business transformation program.

The industrial digitalization development initiative has turned into a transformation program that requires the use of change management principles. The facets of change can be described as a cube. The change cube has four sides that are interlinked. If one side is changed, it has an impact on the other sides as well. The facets are strategy, processes, people and systems. All the facets have been considered during the MIG journey but now a detailed plan needs to be created and implemented to make the new digital services work successfully.

The MIG started from organization strategy and objectives. Those were used as the base in the innovation workshops. They worked as the platform for idea generation and finally guided the prioritization of the new ideas. The prioritized ideas that were moved to the feasibility assessment, went through technical, process, people and business evaluation. During piloting stakeholders verified new digital services in real operating environment. Only few ideas from the original 100-150 remained but the remaining ones have high probability to succeed in commercial use.

As part of the new digital services go-to-market planning, one needs to consider marketing activities including pricing. This involves how to promote new services and the proper pricing models to maximize new digital services adoption. If the organization is operating globally and does not have experience in digital business, it needs to consider the global sales and support of the new services as well. Digital services are online 24/7 and when problems occur, they need to be resolved immediately.

Architecture Considerations

Perhaps the best generic reference architecture for Industrial Internet capability implementation is the one published by the Industrial Internet Consortium (IIC). The Industrial Internet Reference Architecture (IIRA) framework, published by the IIC, has four layers. The highest is the business viewpoint. IIRA underlines the importance of business strategy in the development. This is what we at Midagon have also built into our Midagon Innovation Wagon methodology to ensure that all Industrial Internet initiatives have a solid business reasoning before proceeding to the complex, and often expensive, technical implementation.

The second viewpoint of IIRA is the usage viewpoint. This means that the ways how people will use the new capability, must be considered before the technical implementation. If the people using the new industrial internet capability are not motivated to use the new tools and behave in a different way compared to the updated processes, the value delivery of the new capabilities will be zero or even negative.

The functional viewpoint of IIRA focuses on the Industrial Internet as a system and is more technical in nature. Factors such as functional components, their interrelation and interfaces are considered. The functional viewpoint has several domains that are inter-operational. The physical system is, for example, a cluster of operational machines. The sensing domain's role is to measure the performance of the machines while the actuation domain's role is to adjust the machines' parameters so that they operate in the correct way. The control domain is used to decide what the correct way is. The operations domain's role is to monitor and manage the systems of control domains. Its role is to manage, for example, a fleet of machines. The information domain's role is to collect, store and analyze data from the systems. The information domain supports the decision making of the control domain, for example, by improving the algorithms used in the control domain. The application domain's role is to realize specific business functionalities. The application domain doesn't participate in the continuing operations but enables, for example, information requests to control and information domains. The business domain integrates the Industrial Internet to other business functions such as ERP or CRM.

The fourth IIRA viewpoint is the implementation viewpoint. It is the technical representation of an Industrial Internet system. It also describes the needed technologies and system components required to implement defined Industrial Internet capabilities. The abstracted architecture level of the implementation viewpoint is the Three-tier IIS Architecture.

The Industrial Internet Consortium's Industrial Internet Reference Architecture is possibly the first attempt to describe the Industrial Internet as an interoperable system of components from different vendors to work seamlessly together. Could it work as the catalyzer for faster development in a similar way that the GSM standard did in the telecommunications industry?

A Success Story

This success story tells you how Efora initiated their Industrial Internet capability development based on a new strategy. It also tells you how Efora successfully implemented the digitalization part of the strategy in a few months instead of years, how Efora involved different stakeholders in the development and how adopting agile development methods and open source technologies allowed Efora to proceed quickly from concepts to implementation.

Efora maintains the machinery of StoraEnso's six largest factories. After creating a new strategy, Efora launched three pilot projects to create Smart Maintenance capabilities. There were selected partners working with Efora to design and deliver the pilots. The first created capability was a mobile platform for maintenance technicians to report maintenance notifications while conducting maintenance tasks for the paper machines, far away from the the control room. Before the new capability, the technicians had to use paper and pen to write the notification at the machine and then manually transfer the notifications to the maintenance system.

The technicians prioritized the mobile notification capability the highest on the development roadmap. The main reason for the high priority was that the manual notification task was considered slow and difficult by the technicians. A total of 140,000 maintenance notifications were created annually by Efora. Thus, there was a clear need for more efficient ways to do the work. The maintenance notification task was made more efficient by the new capability. It also helped to improve data quality. This was further supported by a capability to attach pictures to the notifications. The data was usable by others in real-time, immediately after a notification was made.

The agile development methodology was used in the pilot projects. Short, two week sprints delivered continuous incremental improvements for stakeholder review and commenting. The platform was built by using open source technologies with the functionality available on all devices including smart phones and tablet computers.

In addition to Efora and the developer partners, stakeholder companies such as Konecranes, Valmet and Metso were also involved in the pilot projects. These companies are the suppliers of machines, automation systems and other equipment to StoraEnso. Data from these connected systems were collected to the cloud platform that was created. The data collection was easy due to the excellent interfaces for data transfer from the systems and machines to the cloud.

The Efora Smart Maintenance initiative is an excellent example of a successful Industrial Internet capability implementation. The initiative was not driven by technology but rather by the new strategy and active involvement from the key stakeholders such as the maintenance technicians using the new capability.

Technology was only one of the factors that allowed the delivery of clear business benefits derived from the strategy. Business, people, processes and technology all played important roles in the success.

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