TAF Journal of Advances in Technology and Engineering Resaerch JATER
2018, 4(2): 79-90

PRIMARY RESEARCH

Industry 4.0 implementation framework for the producing industry

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Keywords
Industry 4.0
Implementation
Business strategy
Operationalization process
Organization model
Innovation management
Change management

Received: 12 February 2018
Accepted: 5 March 2018
Published: 18 April 2018

Abstract
The competitive pressure induced by progressing globalization has forced companies to find new ways of differentiation. Industry 4.0, as the synonym for the next significant step in value creation advancement, offers new technologies and procedures to obtain further improvements in competitiveness. The real-time networking of people, machines, and objects is not only an opportunity to leverage productivity potentials; it also enables new data-driven business models to achieve an increase in revenues. Although the concept and enablers of industry 4.0 are widely known across the producing industry, companies struggle with its successful and sustainable implementation. Due to the often insufficient embedding of individual solutions in a coherent overall concept, implemented solutions cannot exploit potential synergies within the company. The presented paper introduces a framework to control and synchronize Industry 4.0 activities within a company centrally. By integrating bottom-up and top-down perceptions, the framework facilitates the early identification and assessment of potential industry 4.0 applications and efficient development of specific solutions up to the implementation in series production. Consisting of an operationalization process and an organizational model optimized for horizontal and vertical exchange within the company, the framework enables faster and more robust implementation of industry 4.0.

I. INTRODUCTION

Globalization has led to a great shift in economic power from the Western World towards uprising economies such as Eastern Europe and Asia. This trend has accelerated in speed due to further deregulation, increasing education levels and heavy investments in local infrastructure. The prolonged advantages in labor costs have subsequently led to a significant cost pressure on Western Economies. This competitive pressure has forced companies to find new ways of differentiation, for example by acquiring new customer segments, introducing innovative technologies and enhancing the time-to-market–in an attempt to skim monopoly profits in the early stages of product lifecycles [1]. A more dynamic business environment and a closer involvement of the customer during product development have further led to an increased amount of design and concept changes during development. This results in less predictability for the entire value creation chain, requiring companies to react more flexible to change requests. The declining average age of companies listed in the S&P 500 underlines their inability to adapt to changing and dynamic environments [2].
Although these aspects are issues of today's markets, the economies have always been in a constant change, not only induced by competitive pressure, but also technological advancement. While the technological advancement constitutes the necessary basis for the change, the competitive pressure ushers the implementation of those new technological achievements [3].
Global economies have already witnessed three industrial revolutions causing major shifts in the distribution of technology and power. Today, the world is on the verge of a beginning fourth industrial revolution, often described by the term "Industry 4.0". The term industry 4.0 was established during the Hannover Messe in 2013, when a report of the Industry-Science Research Alliance Working Group was presented to the German Chancellor, representing the

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transformation of "traditional" industries by the Internet of Things (IoT), data and services [4].

Industry 4.0 is currently seen and promoted as a potential solution to cope with the described and distinctive challenges. The real-time networking of people, machines and objects serves as an opportunity to enhance productivity as well as enable new data-driven business models. It can thus simultaneously achieve an increase in competitiveness and revenues. Via the connection of supply, manufacturing, maintenance, delivery and customer service, rigid value chains are transformed into highly flexible value networks [5].

Although industry 4.0 offers wide potentials among the industry, it also poses major challenges for businesses [6]. Existing manufacturing systems need to be horizontally integrated into value networks and vertically connected with companies' internal business processes [7]. Also the availability of new technological solutions such as artificial intelligence, robotics, data analytics, cloud computing, data networking or virtual reality needs to be addressed within the company and challenged for potential use-cases [8].

Due to its disruptive nature, companies are struggling to find viable ways to successfully implement these newly available technological solutions. On one hand, this is caused by a lack of knowledge and experience regarding these solutions; on the other hand, it is due to unclear and undefined implementation processes [9]. These common weaknesses often lead to an unsustainable implementation of solutions, the lack of integration of single solution into an overall concept or the lack of embedding into the corporate strategy. Altogether, technological solutions often do not expose their full theoretical potential and cause a low exploitation of synergies within companies [4] .

The presented paper introduces a genuine framework to successfully implement Industry 4.0 solutions into one's company. Therefore, it presents a necessary process and organization model for centered control and synchronization of industry 4.0 activities across different entities and locations. Not only can the provision of necessary knowledge be achieved, the framework also enables to identify potentials through Industry 4.0 as well as efficient development of specific solutions up to series production and implementation in production. Via the promotion of intra- and interorganizational exchange, necessary information and knowledge are permanently made available where needed.

To achieve these objectives, the topic of Industry 4.0 will initially be introduced. Once a common understanding is achieved, current challenges of its implementation as well as existing approaches will be presented. After all relevant requirements are established, the framework will be outlined.

II. INDUSTRY 4.0

The following chapter introduces the topic of industry 4.0 as well as its underlying challenges in regards to successful and holistic implementation in companies.

A. Definition

The term Industry 4.0 was established in 2011 and serves to anticipate and prepare for the fourth industrial revolution in reference to the prior stages of mechanization (Industry 1.0), mass production (Industry 2.0), and automation (Industry 3.0) [10]. Due to its German origin, the transition to a new industrial age is described differently in other linguistic areas. Additional terms describing parts of the same idea are "Industrial Internet of Things (IIoT)" or "Smart Factories". They all comprise real-time networking of products, processes and infrastructure via the internet for the sake of maximum flexibility and productivity [4]. The digital networking is achieved by applying the principles of Cyber-Physical Systems (CPS), internet and future-oriented technologies and smart systems with enhanced human-machine interaction paradigms[11]. Regular machines are converted into self-aware and self-learning machines to improve their overall performance and maintenance management [12].

The German Federal Government has made Industry 4.0 a core element of its High-tech Strategy to secure the competitiveness of the German economy [13].

B. Potentials

The potential of the fourth industrial revolution is closely linked to the development of the IoT. Convenient access to information technology allows the networking of a variety of systems. The digitization and automation of individual technologies, implemented as part of the third industrial revolution, is becoming increasingly intelligent through networked logic [14]. Self-controlling adaptive manufacturing systems also enable ever-smaller batch sizes down to the individual product [15]. Industry 4.0 further significantly influences the production environment with radical changes in the execution of operations. In contrast to conventional forecast based production planning, Industry 4.0 enables real-time planning of production plans, along with dynamic self-optimization [16].

The disruptive technologies of Industry 4.0, such as IT-enabled manufacturing and increased computing capacity hold the promise of smart factories that are highly efficient

ISSN: 2414-4592
DOI: 10.20474/jater-4.2.4

and increasingly data integrated. An integrated big data and advanced analytics approach can result in a 20% to 25% increase in production volume and up to a 45% reduction in downtime [17]. Other sources claim, that by using advanced analytics for predictive maintenance, manufacturing companies can avoid machine failures and cut downtime by an estimated 50%, while increasing production rate by 20% [18]. This facilitates fundamental improvements to the industrial processes involved in manufacturing, engineering, material usage, supply chain and lifecycle management. Major changes in industrial order processing are required which leads to new products and services [19].

C. Measurements and Maturity Indices

To describe the implementation depth of Industry 4.0 applications in companies, it is necessary to use standardized technology readiness and maturity indices. An example of Industry 4.0 readiness classification is the model created by the IMPULS-Foundation, which consists of six steps from outsider to top performer [20]. Other approaches can be found in the Acatech Maturity Index [21] or the KPMG Roadmap [22]. Consulting companies such as Accenture [23] and Capgemini [24] have developed their own models to assess the maturity and implementation degree of industry 4.0 solutions. One common aspect of most approaches is their base upon a rating system for factors such as strategy, leadership, culture and technology. Based on the rating in these different categories, the resulting maturity level is calculated. Differences between these models result mostly from the graphical presentation, the underlying factors and their evaluation.

A commonly used model for describing the maturity and benefits of Industry 4.0 has been developed by Acatech [25]. The four steps to achieve the full potential of Industry 4.0 include visualization, transparency, prediction and ultimately adaptability. While visualization is achieved through consistent digitization and intra-organizational integration, transparency goes beyond this level and helps to understand the cause of interdependencies. To achieve predictability, a system gains the ability to extrapolate its own behavior based on experience and virtual models. A system reaches the last step adaptability when it is capable of complete self-monitoring and self-controlling [26].

D. Challenges

Although the adoption of Industry 4.0 technologies has been deemed as a strategy to increase product quality and enhance process efficiency, the integration of related technologies into existing production systems and processes still poses major issues. In many cases, these issues can be ascribed to the required combination of different disciplines such as production, IT, management and logistics for the implementation of new solutions. Especially IT-structures and physical resources are often not coordinated, leading to various inefficiencies [27].

Further, company strategy and management goals in many cases do not resemble the needs of staff at the production locations. The outcome of that mismatch leads to unsustainable implementation of solutions, the lack of integration of single solutions into an overall concept and the lack of embedding into the corporate strategy. As a result, the single solutions cannot exploit their full theoretical potential within companies, leading to disenchantment among management and the involved staff.

E. Implementation Approaches

To conquer the issues and challenges described, theoretical and practical concepts have been developed for enhanced implementation success. Some implementation approaches such as the ones from Soder or Sanders et al. refer to Lean Manufacturing as a promising framework for the implementation of Industry 4.0 within companies. [16, 28, 29] it is stated, that the implementation of Lean Manufacturing and Industry 4.0 follow the same basic principles and thus can be achieved in a similar manner. Due to the required synchronization and coordination of Industry 4.0 solutions for a required interworking of solutions, this proposition cannot be fully supported. Other approaches focus on the implementation of automation solutions [30, 31, 32, 33, 34], which as a predecessor of Industry 4.0 most commonly does not cover the extent of data, interdisciplinarity and interlinkage of technological solutions involved. Further models describe strategies for implementing Industry 4.0 from a top-down perspective [28, 35]. These ladder approaches have especially been developed for their application from a management perspective, helping to establish necessary requirements for the successful implementation of new solutions.

These theoretical approaches lack a bottom-up perspective for the implementation of relevant use-cases and solution proposals from the shopfloor level. A sustainable and coordinated implementation of Industry 4.0 can thus not be achieved, as it requires the involvement and knowledge of shopfloor personnel. Regarding that issue, existing implementation approaches from literature cannot address required processes and organizational structures to enable the successful implementation.

On the practical side, several big companies have started to

ISSN: 2414-4592
DOI: 10.20474/jater-4.2.4

set-up platforms and laboratories for a systematic Industry 4.0 implementation. A designated Airbus "Protospace" can, for example, be used by employees to boost innovation and agility via the implementation of Industry 4.0 technology. The laboratory provides new technologies such as 3D-printers and VR-gear in combination with skilled innovation staff, supporting the ideation and implementation processes [36]. Other companies follow similar approaches, for example, Porsche by the means of its Digital Lab [37] or Daimler via its Technologiefabrik [38]. These innovative approaches usually exhibit start-up mentality and start-up structures requiring a position outside the classic company hierarchy.

F. Interim Conclusion

While companies start to realize the enormous potential of Industry 4.0 solutions, especially small and medium-sized businesses of the producing industry encounter difficulties with its successful implementation. Not only are the limited financial resources cause for the lack of set-up of implementation approaches, but also an insufficient expertise can be a huge burden on the way to Industry 4.0.

III. IMPLEMENTATION FRAMEWORK

This paper proposes the concept of an Industry 4.0 implementation framework to successfully integrate practical Industry 4.0 solutions into the company landscape. It is applicable for small-, medium- and big-sized companies of the producing industry.

At first, the requirements for a holistic implementation framework will be given. Secondly, the holistic framework as such will be presented. Subsequently, the framework's underlying strategic approach, the necessary organizational structure and the required change process will be explained in detail.

A. Requirements

For a holistic implementation, various objectives need to be fulfilled in order to achieve long-term and sustainable success of Industry 4.0 solutions. Generally, an overarching entity for controlling centralized and decentralized implementation of Industry 4.0 solutions needs to be established. This entity has to cover the following activities:

- Central control and synchronization of all Industry 4.0 activities within the company [39]
- Identification of potentials through Industry 4.0 as well as the efficient development of specific solutions to maturity and implementation in production [40]
- Provision of know-how for the development of specific problem solutions [41]
- Promotion of intra-and interorganizational exchanges, e.g., with colleges and industry [41]
- Impulses on current topics of science
- Provision and implementation of innovative working methods [42]

The given requirements enable to lay the basis for the successful handling and implementation of new technologies as well as the full exploitation of their potential.

B. Framework

The implementation framework is based on the given requirements and consists of four fields that need to be embellished in order to establish a holistic approach for the implementation of Industry 4.0.

As the first step, an individual strategy for the overall implementation of Industry 4.0 based on the companies' major potentials, targets and goals has to be set up. This includes the development of a viable vision and company-conforming strategy for the processes and resources required for the implementation. Services and outputs are to be defined as well as an ideal state with the underlying steps to achieve that state.

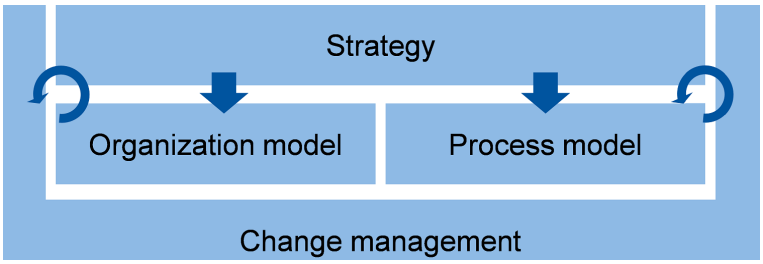

Fig. 1. Industry 4.0 implementation framework for the producing industry

Secondly, an organizational model needs to be put in place in connection with a detailed description of the underlying processes. Both allow an integrated top-down and bottom-up approach for the synchronization of targets from management as well as ideas and expertise from shopfloor level.

As the last step, the transformation towards the Industry

ISSN: 2414-4592
DOI: 10.20474/jater-4.2.4

4.0 revolution is a cross-functional effort that has to be handled and supported by the entire company. A new mindset of curiosity and openness towards new technologies throughout the company is key to identifying and integrating Industry 4.0 applications. This requires a change process to not only create awareness for the need of new technologies but also establish that digital mindset among the employees. The overall framework is illustrated in Figure 1 and explained in detail in the upcoming paragraphs.

C. Strategy

The goal of the implementation of Industry 4.0 is to address the company specific needs and action fields. This can either be achieved via traditional approaches such as a benchmarking or by analyzing one's industry 4.0 maturity by applying available indices [43]. The identified gaps then have to be taken as a basis for the development of a target picture, expressing what the optimal and future state of the company should look like [44].

The target picture should be developed interdisciplinary by comprising management and operational functions [44]. On the management side, aspects like future value proposition and differentiation from competitors via the provided product and service portfolio should be integrated into the development of a target picture for an Industry 4.0 production environment. From the operational side, upcoming products as well as necessary technology application should be considered for establishing a target picture.

Once finalized, the target picture does not only serve as the determining factor of necessary services, processes and resources for the implementation of Industry 4.0, it further defines necessary steps to be taken to achieve the target state. Figure 2 illustrates the identification of gaps in relation to a required target state as well as the subsequent development of a target picture with necessary steps.

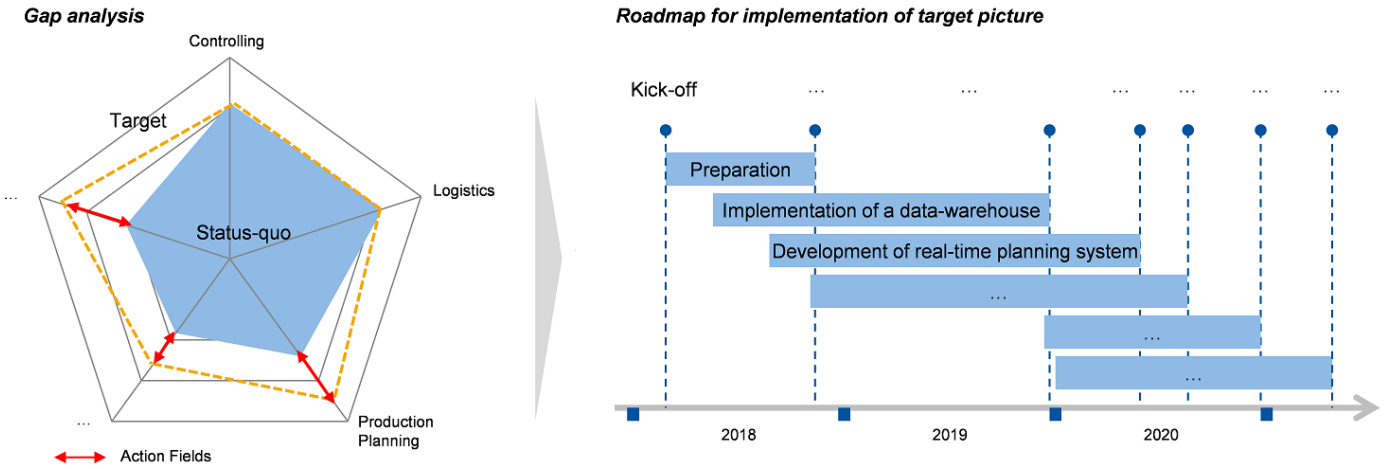

Fig. 2. Industry 4.0 strategy based on gap-analysis and roadmap

D. Organization Model

Regarding the set-up of an enabling organization, a universal organizational model is proposed. It conducts bottom up and top down relations with internal as well as external stakeholders. Its main task is to steer the implementation process of Industry 4.0 applications.

The center of the organization model is formed by a so-called steering committee. The steering committee is meant to control and synchronize all Industry 4.0 activities inside an organization. To achieve this objective, it needs to overview the different business units and match up ongoing activities with the companies' strategy. It should therefore be located outside the company's classic hierarchy as an independent unit.

The organization model in Figure 3 shows the ideal integration of the Industry 4.0 steering committee within an organization. The steering committee is connected to all relevant internal and external stakeholders via information and interaction streams. Strategy, targets and funding are the main inputs coming from management and are modeled through a top-down approach. They are updated on a regular basis (e.g., quarterly or yearly), depending on overall company goals and urgency of identified action fields. The determined financial resources can be used by the steering committee to fund its operations as well as the development of company-wide use-cases.

ISSN: 2414-4592
DOI: 10.20474/jater-4.2.4

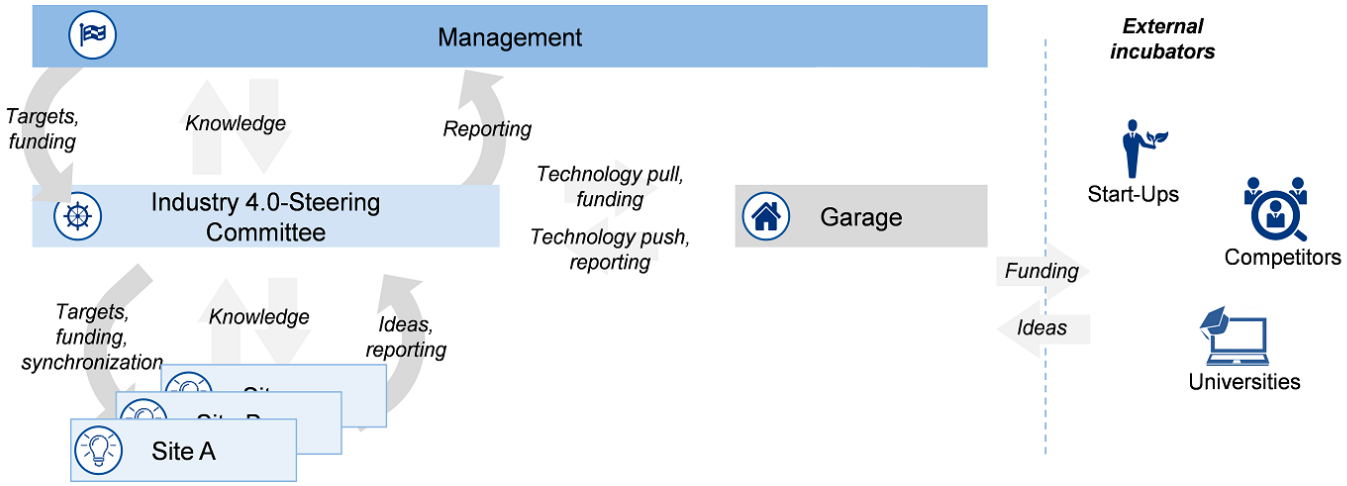

Fig. 3. Organization model for Industry 4.0 implementation

The bottom-up principle, on the other hand, describes the stream of innovative ideas coming from different business units and sites. Not only are use-cases identified via knowledge of processual and procedural weaknesses; the various sites are also responsible for the development and implementation use-cases once they have been assessed as meaningful and thus been approved for further elaboration. In combination, both input streams are used by the steering committee to evaluate possible use-cases for Industry 4.0 related solutions. The committee itself serves as a provider of Industry 4.0 know-how for the business units. It organizes funding, synchronizes and prioritizes the identified use-cases to match the company's strategy.

Via its position between management and business units and its high level of autonomy, the steering committee allows for a short response time. Ideas and use-cases can be developed and tested much faster compared to regular approval processes. Additionally, the committee functions as an information node, which manages to report about the success of implemented use-cases. In its role, it further defines organizational and financial resources for the development of use-cases, compiles the necessary teams and supplies relevant technological resources.

This committee comprises a core team of technology and methodology experts who offer mentoring and support to the business units. Additionally, the members of the steering committee supervise ideas coming from different sources.

One of these sources is the committees internal testing and developing unit called "garage". Inspired by start-up flexibility and innovative capacity, it serves as an environment that allows for easy and quick implementation of new technologies under controlled conditions and without disrupting daily operations at the different production sites. It further serves as a superordinate space, where overarching problems and solutions that are not use-case specific are developed. One task, for example, could be to define the requirements and establish a company-wide data-warehouse, where data from various proprietary systems are mirrored for system-independent data analytics.

Information exchange is bidirectional between the steering committee and the garage. If a technology is proven to function under garage conditions, the steering committee supports selection of implementation opportunities as well as the actual implementation at the different sites. Alternatively, reported issues or needs from the business units can result in an investigation request for the garage, which then starts to analyze potential technological or organizational solutions. As previously mentioned, the development and implementation of a superordinate data-warehouse could be an example for such a request.

The garage is further used to display various experimental technologies such as additive manufacturing or smart glasses. Employees will be given the opportunity to visit the garage and experiment with those technologies in order to develop ideas and innovation for the company.

Another source of ideas for the platform are so-called external incubators such as start-ups, universities and competitors. Cooperation projects can be launched and funded autonomously to generate new expertise for later use-case development. Due to the more difficult contractual agreements and the pursuit of internal skill development, this should only be considered in case of competence or resource constraints.

Figure 4 illustrates the embedment of the steering committee at the different production sites. As technological readi-

ISSN: 2414-4592
DOI: 10.20474/jater-4.2.4

ness, viable use-cases, optimization potentials and available knowledge is often site-specific, an Industry 4.0 manager is required for representation of each site. He not only has the oversight to supply important knowledge for prioritization of site-specific use-cases, he is further responsible to combine required knowledge within teams and supervise the elaboration of new technological solutions.
Besides his site-specific function, he is assigned to the steering committee and takes part in recurring meetings. These meetings not only aim at evaluating new technologies and possible use-cases, they also pursue the goal of synchronizing knowledge and activities within the company.

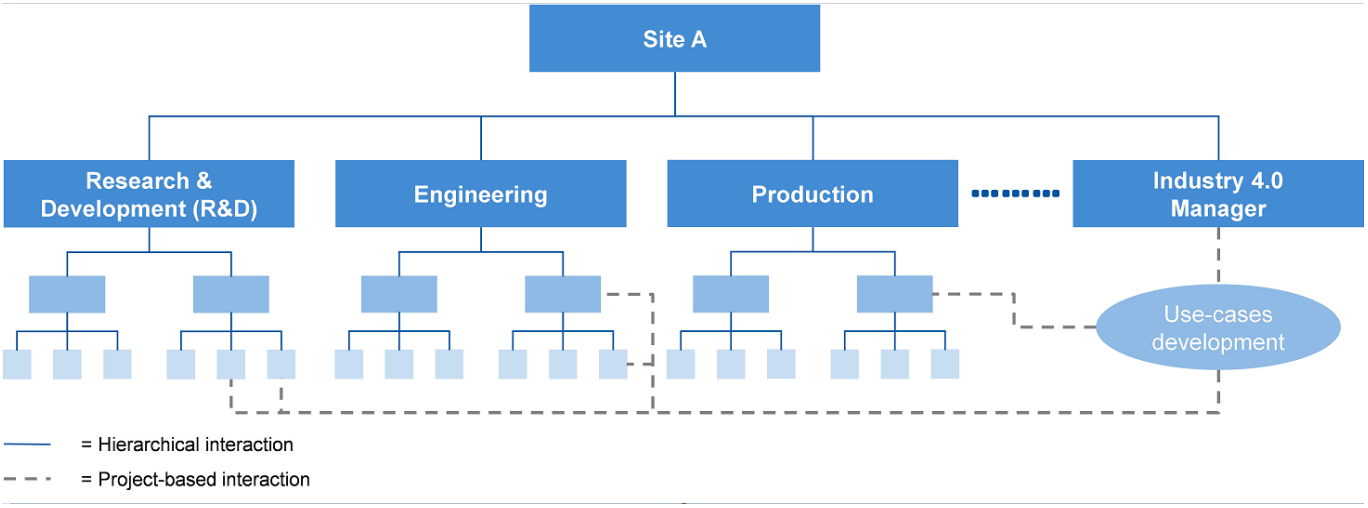

Fig. 4. Site-specific development of use-cases and interaction with industry 4.0 manager

E. Process Model

The process of implementing new Industry 4.0 applications and solutions into the company has been derived from product development ideation models [45] and is divided into two phases (see Figure 5). A conception phase, where possible use-cases ideas are evaluated and prioritized is followed by the implementation phase, during which prioritized use-cases will be developed to maturity and subsequently piloted. Similar to the organizational model, the presented process model is of universal nature and can either be applied as proposed or modified to the specific company needs.

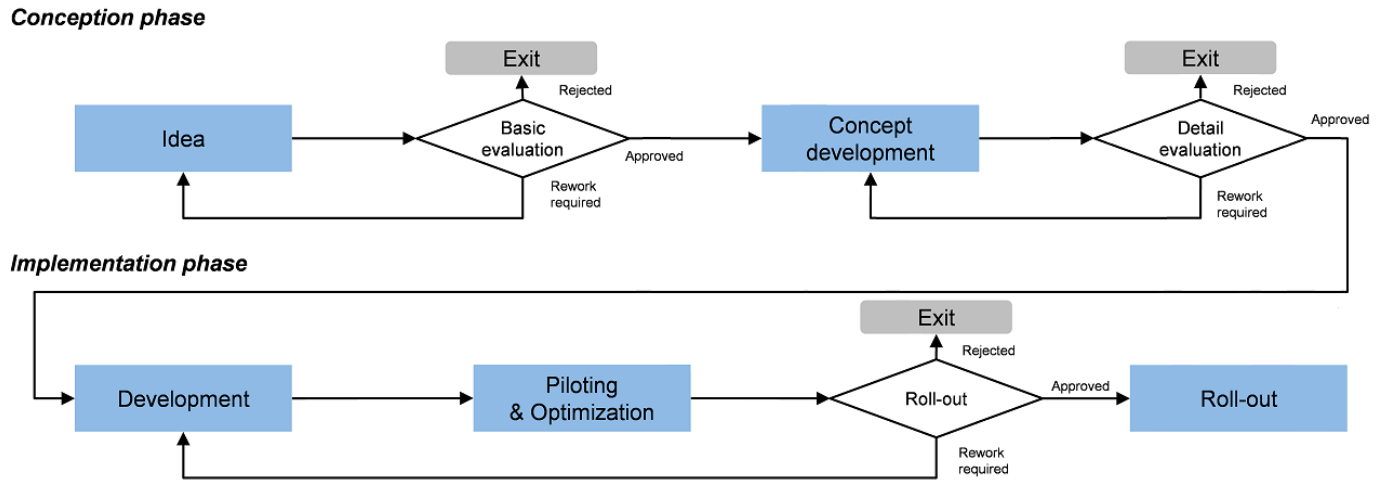

Fig. 5. Process model for Industry 4.0 implementation

The conception phase is initiated with a proposal given by any of the stakeholders shown in the organizational model. The proposal contains an idea of an application of Industry 4.0 that could potentially add value (e.g., reduced costs, shortened lead times, added process transparency, higher ergonomics) to the company. For instance, a proposal could

ISSN: 2414-4592
DOI: 10.20474/jater-4.2.4

contain the implementation of a real-time indoor material tracking system to enhance material flows and increase the resolution of production planning. The submitting can either be realized by standardized paper form or via the use of a digital proposal platform. The ladder should be prioritized, as it allows not only faster and digital processing of the request but further enables for an eventual detailed analysis of submitted proposals.

Once a proposal is submitted, it will be initially evaluated. The basic evaluation is executed by the steering committee in collaboration with local Industry 4.0 managers. Considering particularly strategic aspects, the first evaluation will either approve, reject or demand rework of the proposal. The evaluation should be based on the defined Industry 4.0 strategy and take a mostly qualitative assessment for quick decision-making into consideration. This, for example, could be the fit of the proposed idea with the identified action fields and defined roadmap. The evaluation should further consider urgency, transferability, required financial and organizational resources as well as the possible exploitation of synergies with other solutions. If steering committee and industry 4.0 managers lack the required knowledge, they have to draw back on internal or external experts. If a decision is made that rework is required, the aspects should be specified and supplied to the applicant.

If the proposal is approved, a concept will be developed for specification of the initial idea. In case of the example of the indoor location system, this could include a compilation of available technologies, solution providers and a short cost-benefit-analysis of various solutions. To obtain the relevant information and detail the idea, the submitter can get help from either experts within the steering committee, the Industry 4.0 manager or other experts within or outside the organization. In any case, the steering committee will accompany the concept development and supply necessary resources.

Once the solution concept is finalized, it will also be evaluated by the steering committee in collaboration with local Industry 4.0 managers. This evaluation will go into more detail compared to the previous one, as the subsequent development and piloting phase will be of higher financial impact. Due to the higher detail of the concept and the re
lated financial impact, the integration of experts is recommended.

During the detailed evaluation (see Figure 6), the concept is initially checked for completeness (A1). If all necessary information has been supplied for a detailed analysis, the concept can be evaluated. The evaluation consists of a combination of quantitative and qualitative factors (A2). The higher the financial impact (e.g., the higher the costs for implementation of the use case), the more quantitative the benefits of the use case should be assessed. The lower the financial impact, the more quantitative the evaluation of the benefits can be. For example, the investment of a pair of virtual reality glasses for learning purposes should be approved rather quickly if the concept is convincing, while the investment for an indoor positioning system has to be evaluated more crucially.

The benefits are evaluated on a two-step basis. As a first step, an overall benefit assessment is executed to evaluate general benefits of a use case. This, for example, could be technological maturity, integration into company landscape, improvement of process transparency, reduction of cycle-time, enhancement of due-date reliability, increase in quality, process stability, ergonomics, decision support or the enhancement of knowledge management. The second step is to evaluate parameters decisive to a certain action field. This could for example cover aspects such as the addressing of weaknesses in calculation systematics or planning. For a use-case countering weaknesses in calculation systematics, viable evaluation criteria could, for example, be the assessment of cost compliance, calculation effort or calculation cycle-time.

Both aspects are then integrated into a single benefit value and compared to the necessary expenses. The cost side of a use-case can be evaluated via common investment calculation tools. Not only should the initial investments be taken into account, but also the successive running costs (A3).

Once cost and benefits have been evaluated, they are transferred into a cost-benefit matrix (A4). Use-cases with high benefit to cost ratios should generally be prioritized. However, should there be any strategic considerations to prioritize use-cases with lower or even unfavorable cost-benefit ratios, they can still be conveyed into the implementation phase. This conclusion is taken during the decision (A5). A strategic decision could, for example, be the prioritization of development of a company-wide data-warehouse that might as such not pay off over a certain timeframe. As it is, however, necessary for future Industry 4.0 applications, a prioritized development could be beneficial for the overall company.

If the concept is approved, the implementation phase of the process begins. The solution concept will now be implemented. In order to do so, the steering committee in collaboration with the site-specific Industry 4.0 manager assigns an interdisciplinary team considering the required experts. The team can either be assigned on an application-basis, with the use-case being actively promoted within the

ISSN: 2414-4592
DOI: 10.20474/jater-4.2.4

company and be applied for by the personnel. Otherwise, the steering committee will assign experts based on competency profiles. Before the development is initiated, it is further decided whether the use-case can be developed at a specific site or if a transfer to the garage should be considered. This decision is not only dependent on the necessary resources available on-site; it is also dependent on the size of the use-case, the transferability and the required intensity of collaboration. The bigger the mentioned aspects, the more likely a use-case will be developed in the garage.

After development and piloting, a final evaluation regarding the roll-out has to be executed. If the expected benefits defined in the concept are met and the use-case displays a high process stability and acceptance among employees, it is rolled out. If not, the use-case can either be reworked or rejected.

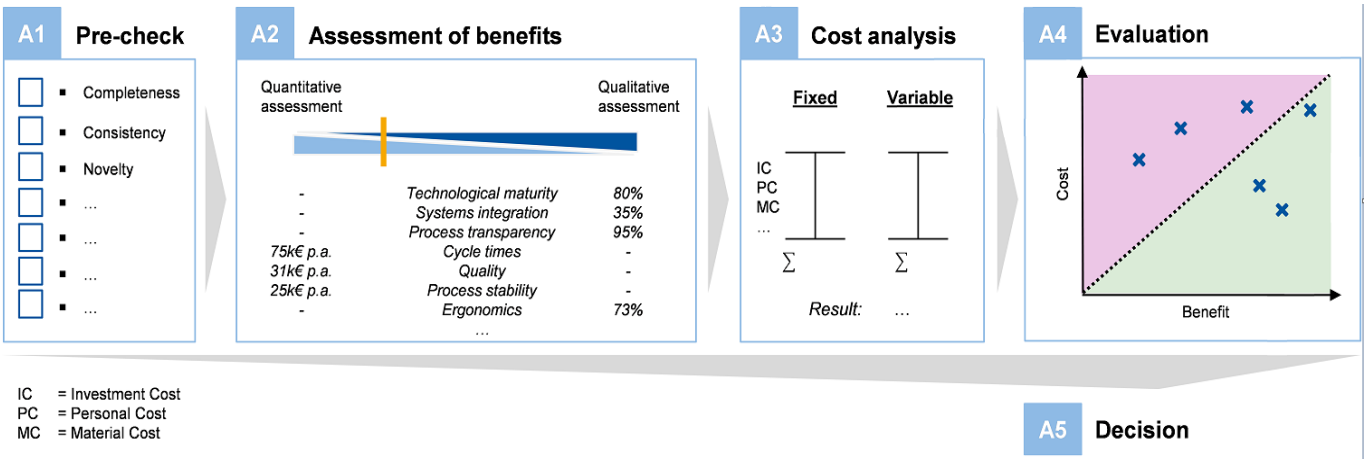

Fig. 6. Cost-benefit-assessment as part of the detailed evaluation

F. Change Management

In respect of the change model by Lewin, the operationalization of the implementation framework can be divided into three phases [46]. The communication phase, the implementation phase and the operationalization phase.

During the communication phase, employees need to understand both the competitive pressure created by the shift in economic power and the potentials which arise in the context of Industry 4.0. The upper management needs to clarify that in order to stay competitive, the company must change and adapt regarding Industry 4.0 and more concretely seize the potentials that the implementation and crosslinking of Industry 4.0 solutions can bring. Furthermore, it must address and manage the doubts and concerns that employees carry considering Industry 4.0. Ultimately, the concept of the implementation framework and its objectives are to be presented and promoted by the upper management. In the end, the employees should be convinced that the needed change can be executed via the implementation framework.

During the implementation phase, employees should be empowered and motivated to submit their ideas to the Industry 4.0 steering committee. To reach that goal, company-wide ideation workshops should be carried out by the steering committee and Industry 4.0 managers not only to promote the idea, but to further engage employees in the new processes. First use-cases will be chosen and prestigiously developed within teams at different locations. A newsletter supported by new media (e.g., video diary) will keep the staff informed about the progress of first use-case development and generate interest. Both employees successfully implementing as well as employees successfully adapting Industry 4.0 solutions should be internally rewarded. Further, processes are constantly reviewed and improved for better effectiveness and efficiency based on employees feedback. Lastly, during the operationalization phase, more and more employees will get involved in projects regarding the development and implementation of the Industry 4.0 solutions. For their support, the steering committee and the Industry 4.0 managers are well established as a constant mechanism within the company. They support the implementation of new technologies and crosslink fully implemented use-cases. Submitting ideas, helping to implement and crosslink Industry 4.0 solutions and coping with new technologies will be evaluated in the performance review of the employees. Although Industry 4.0 is becoming a daily business within the company, the target picture, processes and structures should be constantly reviewed for necessary adaptations and further improvements.

ISSN: 2414-4592
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IV. CONCLUSION AND OUTLOOK

The economic environment is changing at an ever-faster speed [47]. In order to keep up with the rapid technological advancement – especially in the context of Industry 4.0 – companies have to actively address and frame these advancements.

The implementation of Industry 4.0 is getting increasing attention from managers as the current mismatch between the availability of new technological enablers and the level of implementation becomes evermore obvious. Due to its big impact on future revenues and competitiveness, companies need to address that mismatch and enable their organization to effectively and efficiently implement new technological solutions. The provided paper introduces a new holistic framework to tackle the challenges arising from the implementation of Industry 4.0. To achieve this strategic goal, initial strategic considerations, an organizational as well as a process model and the necessary change management are given and explained.

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