PILOT REPORT

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Executive Summary/Management Summary

The VDC is a prosperous network that brings together companies from the hardware and software sectors, technology service providers, users, universities and research institutions. They work together in the Hub along the entire value chain of Virtual Engineering- namely in 3D simulation, 3D visualization, product lifecycle management (PLM), Augmented Reality (AR) and Virtual Reality (VR). Cooperation with thematically equivalent Hubs and an active membership in the competence center initiative of the Stuttgart Region Economic Development Agency and the competence network Germany initiative of the Federal Ministry of Economics and Technology complete the content and institutional orientation of the VDC Fellbach.

The fourth industrial revolution, called Industry 4.0, with the goal of more comprehensive digitization of various sectors, is already underway. The focus is on connected cyber-physical systems and networking of machines and processes with the help of information and communication technologies in industry. Within the framework of this networking, there are many opportunities for companies to generate advantages over previous approaches with the help of new technologies. In addition to the digitization of production facilities, systems and their communication or networking with each other, we should not ignore the human factor. The rapid development of digitization and the constant miniaturization of smart sensors and wearable devices has created the opportunity to develop intelligent tools and workspaces for operators and thus let them participate in the development.

Therefore, further topics related to Industry 4.0 were included in the Hub. We focused on the operator 4.0 typology according to Romero. The main focus was not on the future vision itself but on the current implementations that are already possible today and the available hardware and software solutions. As part of the 4STEPS project, different event formats and implementations were tested as well to see which can best conveyed the topic of Operator 4.0 and the needed hardware and software. The knowledge gained then flowed into the Hub in the form of demonstrators and event formats.

1. Introduction

This report is about the tasks that were carried out in this work package and their implementation in the existing VDC Hub during the 4STEPS project. By using a SWOT analysis this report reports on the strengths, weaknesses, opportunities and threats of the Operator 4.0 typology. The resulting measures and implementations that have been incorporated into the existing Hub are also addressed. Internal employees took part in the SWOT analysis to evaluate the typology, its current status or potential and the pilot implementation.

2. Digital Innovation Hub and its services

It has been shown that many approaches of Industry 4.0 and Operator 4.0 are already partially in use, especially in bigger companies. But even in bigger companies, these are only partially implemented and a holistic approach is still missing. Lean production elements have found their way into a lot of sectors during the past few years and have been continuously optimized. With that in mind new technologies are only implemented hesitantly and new processes and ideas are only introduced if there are clear advantages and improvements. The hurdle is even greater for small and medium-sized companies. Due to a lack of or scarce resources, current and new trends cannot be followed in some cases, so there is a risk of losing touch with digitalisation and new technologies. In addition, it is difficult to directly recognize the benefits of the Operator 4.0 approach and the new XR technologies. It is therefore often necessary to try out and experience these new technologies in order to recognize their potential.

We have tried to address these points through our activities and to work out solutions for them.

2.1. The Hub

The Virtual Dimension Center (VDC) is Germany's leading competence network for Virtual Engineering. Technology and service providers, users, research institutions and multipliers work together in the VDC network along the entire value chain of Virtual Engineering- namely in 3D- simulation, 3D-visualization, product lifecycle management (PLM), and Virtual Reality (VR. Special attention is paid to the imbedding of SMEs so as to increase their innovation and competition abilities through technology and knowledge transfer within the network. Additionally, the range of services was expanded to include Operator 4.0 topics, so that consulting can also be given on this topic together with the associated or necessary technologies. The Hub now includes possibilities to try out XR technologies together with software solutions from industrial use cases.

2.2. Products & services

Demo Center:

The demo center not only contains the hardware but also free software demos for the devices. However, there is also custom-made software that is used in industry and that acts as a use case demonstrator and was developed by our members. It was expanded to cover Operator 4.0 topics to be able to demonstrate some uses cases. Everything can be tested in detail on site and, if necessary, advice and consulting on the own application and use case can be done. As a member it is also possible to rent the hardware for several days.

XR Consulting:

The consultation can be booked online with a 30-minute time slot each. The first meeting takes place online in a video call in which the expectations and possible applications and use case of XR technologies are queried. After the expectations are clear, the questions and needs of the company or organisation can be discussed in detail in a further meeting. If desired, the appointment can also take place on site at the VDC. The consulting was expanded with the knowledge acquired during the 4 Steps project to cover the Operator 4.0 approche. In combination with other VDC services, there are also opportunities to try out hardware and software and to find the one that suits best to the own needs. When it comes to particularly difficult and special use cases, we also offer our consulting atlas which can be used to find further specialized consulting and experts throughout Germany for further advice.

Events:

It has been shown that it is difficult to convey the benefits of new technologies and approaches. New XR technologies such as AR and VR in particular are difficult to convey using traditional formats. Demonstration through online formats and videos can also show the potential, but it does not replace the experience and understanding that comes from trying it. These are technologies that must be experienced to fully understand them and see the potentials they offer. In addition to the Demo Center demonstration Events for public and industry with a mixture of online demonstrators with examples of use cases and physical demonstrations of use cases were implemented. These formats tested during the 4STEPS project have proven to be effective. By maintaining these formats in a regular basis further advantages and sustainability of the results can be ensured.

2.3. Processes

All Hub activities and services are aimed at promoting the development of a digital manufacturing environment in the region with Industrial 4.0 aspects in mind. By consulting on digitalisation and a wide variety of new technologies and their integration into existing processes the Hub offers services that gives SMEs the knowledge and ideas to start their digital transformation. The service itself does not implement these solutions for the company but helps SMEs to understand existing and new solutions that are specially tailored to them and gives examples of uses cases from similar SMEs in the region. Further consulting and the implementation of discussed measures are ensured by connecting to competent partners and providers.

2.4. Networks

In order to connect the different actors, the Hub hosts various events, meetings and boards of stakeholder groups to ensure the exchange of information and technology between companies, universities and organizations. With the large network of members and partners of the Hub the region can be optimally supported and the involvement of the most important actors is ensured. Regular stakeholder meetings and working groups bring current needs and new insights into the Hub and ensures that all services are subject to constant improvement and continue to meet the needs of the region.

2.5. Business models

Since the Hub is a non-profit organization and association, its financial viability depends on membership fees. There is no business model around the use, demonstration of XR-technologies or provided services around the industrial 4.0 approach. Our members benefit from the expertise and technology transfer of the Hub. In addition, they can network with each other in the Hub and get consulting and help in areas in which they are not so well positioned. Many small and medium-sized companies find it difficult to find the right service or product for the problems they are facing. The Hub provides consulting and services so that the companies looking for a possible solution and potential software providers are brought together. The membership fee incurs additional costs for companies but it also means that they have access to additional services of the Hub and that internal resources of these companies can be saved in these areas.

3. SWOT analysis

The term SWOT analysis is a synonymous and stands for "Strengths, Weaknesses, Opportunities and Threats" (see figure 01). It is a technique to identify strengths and weaknesses as well as opportunities and threats. This tool is used to present the implementation of the Hub and the activities in the 4STEPS project.

The SWOT analysis was applied to the Operator 4.0 approach.

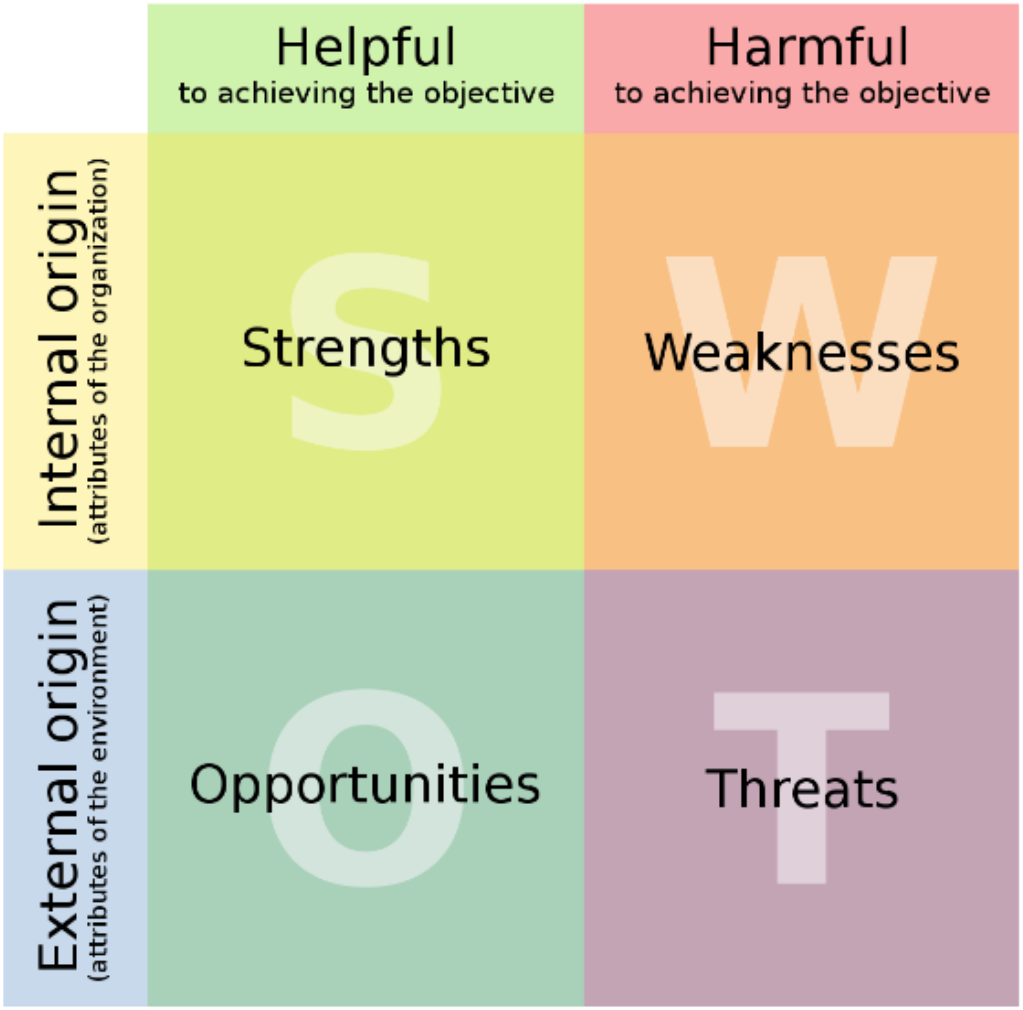

Figure 01: The four components of the SWOT Analysis

Table 01: Operator 4.0 typology SWOT Analysis

internal factors	
Strenghts - Multi-machine concepts - Improves cognitive perception - Saves material and spatial resources - Increased data base of the staff - Improves the quality - Reduces Service Times - Enables communication with colleagues - Enables communication with devices (IoT) - Increases efficiency - Reduces the reaction time for decisions - Increases flexibility for high number of variants - Allows interaction with connected devices - Increase efficiency in many areas - Savings in energy, raw materials and costs - Remote control and visualisation - Staff savings	**Weakness** - Increased IT security requirements - Can unnecessarily complicate work processes (keep it Lean & simple) - Increased qualification requirements for the worker - Increases workers salary claims - Restrict location selection (internet connection) - Technologies partially not sufficiently developed/available
Opportunities - Opportunities to reduce product costs - Shorter throughput times due to better connectivity and information flow - Contributes to waste and energy consumption reduction. - New design options for work processes, batch sizes and processing of variant diversity - Increased attractiveness for employees (recruiting) - Competitive advantages through know-how superiority	**Threats** - Increased dependency on external services for IT security and software algorithms - Generational acceptance of new technologies and digitization efforts - Further softening of data protection - Reducing job opportunities for the low-skilled - Increase in long-term unemployment among low-skilled workers - In many places it does not correspond to lean thinking and creates barriers instead of eliminating them - Higher vulnerability to data leaks and data espionage
external factors	

With this knowledge and by including Operator 4.0 approach and derived measures and strategies from it the Hub, members and region benefits from various advantages.

- Access to knowledge for providers and users
- Easy access to selected Industry 4.0 / Operator 4.0 technologies and methods
- Hardware and market overview of existing solutions
- Linking of selected technologies and uses case examples
- Expertise for knowledge transfer, technology transfer, event formats available
- Working groups on identified Weakness/Threats and selected topics
- Use of other resources and access to stakeholders from different areas (service providers, software providers, research institutions, associations)
- Test-before-invest opportunities for companies
- Allowing test-before-invest
- Help finding Investments
- Further observation and analysis of the Operator 4.0 approach
- Bringing together existing connections with new needs, skills and training requirements

4. (Expected) Impacts for your tackled business/industry, region, country & Interreg

The Hubs connects different actors with each other to help the development of the region. Where there is a need identified the gap will also be closed through consulting and support. The Operator 4.0 approach and the knowledge gained from the implementation of events helps the Hub to cover new areas and provide targeted support in the implementation of Industry 4.0 relevant approaches. With our analysis of the Operator 4.0 approach, we were able to determine the current status in terms of hardware availability and suitability of use and can now use this to support the companies with the implementation. This way the implementation of solutions that are not yet fully developed can be avoided and meaningful implementations can be named, promoted and prioritized. The companies and the region can therefore concentrate on what has already been proofed and save time, money and resources. With the overview of the marked and existing solutions companies can be connected with the provider to get additional consulting, support and the right Hardware for the implementation.

Experiences gained from the events with the best practice examples can be used to inform the companies about the possible advantages by using the ideal formats for the best possible transfer. With the demo center Hardware, Software and use cases of new XR-Technologies for Operator 4.0 approaches are available to the region to be tried out. And with the hardware rental actors outside of the region can be reached as well. Our Hub already has various partnerships in Europe and is open for new partnerships and cooperation's. Knowledge and experience of the Hub is available to everyone and can be exchanged.