Industry 4.0 – Trends & Challenges

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Exponential change as the new challenge

"We are living in a VUCA world" is a saying that you might already have heard. Even if not, there´s no way to avoid it any longer. VUCA is an artificial word that's derived from the terms volatility, uncertainty, complexity and ambiguity. Together these four terms characterize the challenge that we all face - people, states, industries and companies.

One of the main drivers for this VUCA situation is the ever increasing, accelerating speed of technological development. Looking ten years into the future, we'll see as much change as we've seen over the past two decades with the invention of notebooks, smartphones, tablets, robots, 3D-printing and all other kind of disruptive technologies. In other words: we´ll have to cope with exponential change, and bad news is, that we´re not very good in coping with that. Yes, thanks to "Moore´s law" we know that computer speed and power is doubled each one and a half to two years. And we have already seen over the past few years, that data volume, data traffic, the spread and the amount of knowledge are increased at the same time and pace. If, for instance, I´ll make 30 steps forward, it will roughly take me 30 meters forward. But if, compared to that, I would make 30 steps in an exponential logic that would take me 25 times around the globe! This might serve as an example for the core problem of exponential growth: as nearly everything around us is linear, we are just not used to think in exponential logics. And the longer companies stick to their regular linear thinking and logics for improving their business by 2, 5 or 10 percent, the bigger the gap to exponential scaling and growth will get, providing the opportunity for new competitors with disruptive business models to use this gap to set up new business logics and scale them up very fast. This is the main challenge that industries and companies face today. And this is probably one of the most important things, you should be aware of.

Against this background, it was quite astonishing and should be alarming, that in a recent McKinsey study with 300 industrial decision-makers in the US, Japan and Germany, one of the core findings was the assessment that "digitization is important, but we are not prepared enough". Especially in a slow-growth environment as we see it for industrial manufacturers on a worldwide scale, productivity gains are paramount. There should be no doubt that digitization is one of the main drivers for that. We had another astonishing result in our TrendIndex that we publish twice a year. In the first edition 2017, we asked innovation managers, whether they had already deliberately prevented innovation in their own company. Each third innovation manager actually admitted that, because they feared that they would fail to deal with the consequences. This is really something we should be

very aware of. And we should try to find solutions to help them out of that situation as soon as possible.

My first recommendation is that we must be aware that we won't stop the development. Even if we don't like digitization, disruption or the term industry 4.0, we won't stop it! There are numerous examples in history where states, organizations or companies actually tried to stop innovation. Almost always they failed. One of my favourite examples is the so called "Red Flag Act", adopted in the UK in 1865. According to that act, at least three persons had to be employed to drive a car. One of them had to precede the car on foot, carry a red flag and warn all bypassers of the approaching vehicle. Until 1896 this act remained unchanged. As we all know, it couldn't prevent the motorization in the UK. And just as an interesting side note: there were more than 1,500 casualties reported over those 31 years, albeit the cars were usually not allow to drive faster than 2 miles per hour. My personal assumption is, that most of the road casualties were those poor guys with the red flags, falling asleep and run over.

We have to keep in mind that digital disruption has already changed many industries. So we're not talking about future developments or the year 2025, but we are talking about something that has already happened in a lot of different industries. For example the world's biggest taxi company doesn't own taxis, the world's biggest accommodation provider doesn't own flats, the world's biggest retailer doesn't have any inventory, the world's most prominent media owner doesn't produce any content, the world's fastest growing bank doesn't operate with traditional money but with cyber currencies, the world's biggest movie house doesn't have any cinemas and the world's biggest software providers don't program any apps. It´s always the same logic that we see here: the business models are separated from the infrastructure, instead they are based on data and scalable platforms. Even if you think you can´t copy that it's worth to prioritize digital transformation initiatives. According to the World Economic Forum, there are trillion dollars of value at stake as a result of digital transformation up until 2025. That should be a sufficient incentive, go for it!

My second recommendation is, that if you strive to achieve a digital change, please make sure that you´re really talking about the same things, the same logics and the same common goals in your company. Otherwise you might run into a problem of comprehension like little Kevin does, when he writes on his wishlist for Santa Claus that he would like to have a "THQ Wii Smackdown, Dragonball Budokai and War Republic Heroes" and Santa Claus´ answer is: "Dear Kevin, I've got no idea, what you're talking about. You'll get a book." This is how we are actually seeing a lot of discussions about disruption, digitalization, innovation, Industry 4.0 and this is obviously no basis for a successful change.

Good news is, you can almost start from scratch. Because "nearly everything you think to know about strategy and innovation is wrong." This is what Paul F. Nunes and Larry Downes already stated four years ago and I think they're (still) right. Because all those basic logics have changed so

much, because you have to deal with exponential development. All those linear logics that we've used in the past to define our strategies or to cope with innovation, they won't help us out. It´s just the other way round: we have to learn to unlearn, challenge everything and find new solutions to deal with this unprecedented situation. And if we do so, we might even have a very good chance to translate VUCA a bit different than I did before. We might use VUCA to set up a really good, digital <u>V</u>ision for our companies for the next five to ten years. We might find a good <u>U</u>nderstanding of what's happening around us with regard to social, technological, economical, ecological and political aspects. We might increase <u>C</u>larity in communications throughout our companies and with all stakeholders. And we might rely on <u>A</u>gility as an answer, how to deal with an uncertain situation and at the same time reduce the risk to take far-reaching decisions.

Living in a connected world

The future will be a mobile future. The web is more and more determined by social applications, social networks. Users become producers. This is very important, because it changes the experience and the expectations of all of us. We become active participants, used to being asked, used to being incorporated and used to having the opportunity to comment on things. In the majority of cases, social networks are already assessed via mobile devices and mobile does no longer mean an uncomfortable situation on the go. Smartphone screens are getting bigger and bigger and a lot of people have some kind of tablets they use for a wide range of applications, as long as the user experience is better than average. That means, you have to deal with more digitally conversant, connected and empowered consumers. And these consumers may at the same time be buyers or even professional buyers in the b2b-context. The next generations don't go online anymore, they are online. And they won´t even know the difference between the online and offline world. These generations are online from birth on, supported by a network of an estimated 70 billion connected devices already by the year 2020. This is, by the way, in merely 2 years.

How will it feel to live in a world with 70 billion connected devices? I´d like to give you some impressions on that, based on our thinktank´s future scenario. First, talking about smart homes, the estimate for Germany is that we´ll have around one million smart homes by the year 2020. Homes with an automatic adaption and control of connected devices, taking into account all kind of environmental data and preferences of the owners. In a study we published some months ago on "The safe house of the future", two of the core findings were that smart homes will enhance health and will become an integral part of everyday living. How will that work? Here's a part of the answer: let's have a look at a degression that we've seen over a couple of years now for the cost of an individual DNA sequencing for the full genome. Starting with an inconceivable amount of 2.7 $ bn in 1999, reduced to $ 1,000 in 2014 and to a promised "less than $ 100 by the year 2020", as stated by Jack Wang, at that time CEO at BGI, the world's biggest gene sequencing institute, two years ago on our future congress. Together with the genome, he plans to analyse the individual mix of bacteria

in a body. And based on these two information, he will offer you functional food, especially designed for you, that will prolonge your lifetime to 150 to 170 years. As this is just representative for what's happening over the next couple of years, your morning toilet will get a completely different meaning: there won't be just ten litres of water flushing, but the toilet will tell us how we feel, whether we are sick or healthy and what we can do to improve our health. This is the kind of the responsibility that buildings will assume for our health. And people are very open to quantify themselves to get a better understanding of their state of health. Just as an indication: there are more than 1.3 million fitness and health apps, separate apps, in Apple´s app store and in Google´s play store. So there is a huge demand to get a better understanding of how we feel and how we can improve that. And for a majority of us, even the optimization of our brain power is seen as an attractive offer, at least from time to time.

When it comes to smart cities, the main focus is on information and communications technologies and the interconnectivity of infrastructure and data, that's needed to increase economic and ecological efficiency and to enhance a sustainable development. I think there are two cities that stand out, because they both follow open innovation approaches to gain speed while striving to become a smart city. Bristol has declared itself an "open programmable city" and Boston has done something quite similar with an open innovation approach and a dedicated "smart city playbook". Basically, both cities offer a powerful and scalable infrastructure with wired and mobile networks to service providers and / or start-up companies that can use this infrastructure instead of sandbox environments to test-run their applications in a real city with real people, real traffic and real problems. We've seen that before. Just imagine Apple would have tried to program all apps on his own, it wouldn't have scaled up that fast and successful. So here we have a similar approach. Both cities open their platforms for all developers that are interested or capable to develop applications for a better environment, for better solutions, for better decisions, for better data analysis, for better platforms and they don't to digitization for the saint of digitization and they don't worship efficiency. They want to solve real problems for real people.

Another example that shows, how the knowledge that we've gained through experience over decades will become irrelevant in an environment with 70 bn sensors, is Amsterdam. Amsterdam has set up smart lighting pilots in some districts. To define the necessary intensity of lighting, they do something that you wouldn't expect. They combine the intensity of lighting with the crime rates in those districts. This leads to a logic that wherever the crime rate is high, they increase the intensity of lighting and vice versa. So the brightly lit districts are in fact the dangerous districts with high crime rates. And the skid roads, the dark areas are the safe areas in these districts. Who would expect that? Usually we would try to keep away from these places, we would try to keep in the brightly lit areas. This is just one example of this tiny little internet of things network with 70 billion sensors by the year 2020 that will change a lot of logics. And wherever we will no longer be able to understand these logics and act accordingly, we will strive to find new experts that can help

us out. I think it´s a big opportunity for companies to adopt that role and to help their clients and customers making sense of what's happening around them.

Another logic that you'll see in those smart cities is what we call adaptive: an individualization of (public) services and logics, provided exactly at the right time. Big data and artificial intelligence are the prerequisites for real time analytics that enable cities, companies and others to offer this kind of adaptive products and services. And for sure mobility will change over the next years, with e-mobility and autonomous driving as centerpieces of smart cities.

New logics in production, Industry 4.0

Disruptive technologies drive productivity gains and new business models into the manufacturing industry, fueled by a bit more than 125 start-ups that are financed with a billion dollar venture capital, right now. So albeit change will probably be a bit slower than what we have seen and actually see in the mobility sector, the disruptive potential is quite obvious: here too, start-ups are focussing on nearly every aspect of the business like sensors, edge devices, connected devices, universal platforms, applied sensors, advanced analytics etc.

Data, computer power and connectivity

Let´s take a look at the different disruptive technologies that will drive the change, starting with data, computer power and connectivity. The data volume in 2025 will reach approximately 163 zettabytes. That equals, in comparison, as if you would look at the complete Netflix catalogue 500 million times. Today we have a data volume around 16 zettabytes, so it's ten times increased over the next seven to eight years. 60 % of that data will be business data, compared to 30 % business data that we have today. An increase that is of course driven by the internet of things, the industrial internet of things and all related sensor networks. Each of us will have close to 5.000 transactions with those sensors, networks and computer systems. 5000 transactions per day, that is. So we will be living in a really connected and analysed world by 2025.

D-Wave´s and Rigetti Quantum Computing´s CEOs spoke on our last future congress and they said inter alia, quantum computing will be like "Moore's law on top of Moore's law." So the exponential development doubling the computer power each one and a half to two years will be doubled another time, will become even more exponential, even steeper than that, if they get things done. 75 % of all people on this planet will be connected by the year 2025 and 90 % of all data will require some kind of data security. Cyber security is obviously a real big issue when it comes to sensor networks. Blockchain data distribution might be one answer to tackle those security challenges, but there remains a lot of work to be done.

Analytics and artificial intelligence

Already back in 2013, Oxford researchers Frey and Osborne stated in a study that up to 50 % of our jobs could be automated in the coming years. It didn´t say that it will necessarily be done, but that it could be done from a technological point of view. 1.4 zettabytes of data will be analysed by cognitive systems in 2025, meaning one percent of all data that runs through all systems will already be connected, analysed, interpreted and transferred into processes by the year 2025. This is a hundred times more compared to the current situation.

Man to machine interface

We expect to see important improvements of the man to machine interface and to get rid of keyboards by 2025. Speech recognition and voice control take over. Slowly, but that's a bit inherent to the logics of artificial intelligence: things need time, you have to accept a learning curve before you really see positive results. Mixed reality is seen as a promising, supplementary development to augmented and virtual reality with companies like Microsoft or Magic Leap at the forefront of that development. Mind control might be very interesting wherever you need to use both hands while working. Emotiv is one of the companies that have already developed some very promising headsets. And when it comes to robotics, researchers try to achieve a context understanding that will allow an even better co-working between men and robots.

Digital to physical conversion

Additive manufacturing will become considerably cheaper and faster by 2025. Soft robots with artificial muscles can lift a thousand times their own weight, and there are first examples for so called "lights out factories." Fanuc in Japan is one of those companies that produce goods in a fully automated environment, in that case industry robots building industry robots in their factory, up to 200.000 robots per year. Philips has a similar factory in Europe, where just nine people are working together with robots, and Tesla is working on a concept that they call "Gigafactory."

So what?

We are exactly at one of these tipping points in exponential logics. Up to now you might have the impression that all those disruptive technologies like blockchain, 3D printing, robotics, the internet of things, virtual and augmented reality and so on are overstated. You're right, but as soon as these technologies cross the tipping point, and if you don't have an idea how to handle that by then, it gets really challenging and difficult to speed up, scale up and participate from this development. Basically, there are three different options how you can handle that: you can either make things happen, you can watch things happen, but hopefully you don't go for the third option, that is sit and wait, then complain "oh what happened".

- To improve your foresight, Gartner´s hype cycles for emerging technologies have been and still are a good and reliably source for estimating, which technologies will when reach the plateau of productivity.
- You should be aware of the logics of disruption that are well documented by Clayton Christensen, dating back as far as 1997.
- For a couple of years now, Strategy& analyses the strategies of the 1.000 companies worldwide with the highest R&D spendings.
- You´ll find some interesting patterns there. You should also document your business model and be capable to adapt and enhance it as needed to exploit your core business and explore new business.
- From our own experience, derived in different industries and companies of all sizes with our "Digital Readiness Assessment" and support for digital transformation, an assessment of your digital readiness and a roadmap, how to support your digital change, is essential for that.
- And last, but not least: be visionary and ambitious. In Peter Diamandis words: "the ratio of something to nothing is infinite. So just do something."