

Dear Reader,

We live in turbulent times. Amidst of the numerous lockdowns of the COVID-19 pandemic, the rapid increase in digitalisation and the change in our consumer behaviour, it is becoming clear how versatile we can be as people, entrepreneurs and employees.

As has often been the case in the history of mankind and also in the history of logistics, we are in a constant state of change. But if we become consciously aware of the current situation, one thing becomes clear: this time something is different.

While the development from the steam engine to the first computers was slow, technologies, innovations and trends now evolve faster than ever. Technologies follow a digital and exponential development path. Just think about how speedily new smartphones, laptops or tools come to market. The pace of innovation rapidly speeding up, innovation cycles become shorter and shorter.

These exponential developments do not correspond to how we as humans mostly experience natural developments as linear. Initially, change happens slowly; almost unnoticeably. Then, at a certain point, the curve steeply increases and we become aware. Only when this point, this "point-of-no-return" is passed, do we notice a development – but from this point on, progress is already so fast that we are almost overrun.

This book is therefore intended to inform at an early stage and to help all logisticians, entrepreneurs and employees. Together we describe the "new" exponential technologies, future trends and developments in logistics. Combining the expertise from logistics and future strategists, we describe what needs to be done, with a practical link to hand on work and adaptable for every company, no matter if start-up, SME or major corporation.

So whether you want to learn about artificial intelligence, robotics or the next steps to implement it in your warehouses – you will find the solution here. Our goal with this book is that once you have worked your way through the entire paper – or even just revised individual chapters – you will have gained a comprehensive understanding of the most relevant technologies in logistics and enabling you to approach the various aspects with a more open mind and clear vision.

In our view of the future, we do not restrict ourselves to the factory of the future and its associated logistics processes, but also address the entire supply chain, from suppliers to the factory to the route to the customer. Our practical implementation plans have been tried and tested in years of practice. >>

Foreword by the Authors

Marco Prüglmeier is an expert in the field of supply chain, lean production and logistics innovations. He built and managed the innovation lab and the company start-up idealworks at BMW AG. Today he is the founder and consultant of the management consultancy i2market. Alexander Pinker is an innovation profiler, future strategist and new media expert. He helps companies not only to look into the next two years, but to understand the trends in technology and society for the next five to ten years. To do this, the innovation profiler and his companies "Alexander Pinker – Innovation Profiling", "Medialist Innovation" and "innovate! communication", embark with their clients on a search to trace the change and find the appropriate communication channels and technologies.

This experience is the leading thread through the entire book. This is why we don't just look at the technologies and their use and effectiveness, but always bear the human being in mind as well. How will occupations change in the logistics of the future? What does management already have to consider today so that implementation succeeds together with the people? How can I, as an employee in logistics, adjust to this change and deal with it?

As authors, we are driven by the deep conviction that the future of logistics can be shaped to benefit the people and to benefit shareholders and entrepreneurs alike at the same time. However, this requires thoughtful, foresighted change, and we must not wait until the technologies are ready to be deployed at companies' doorsteps. We must act today and help shape the change responsibly!

From our point of view, and this is what we experience when planning and implementing innovation projects with leading companies, the changes in logistics will be dramatic in the coming years. With this book, we want to prepare for this and contribute to the success of this revolutionary change in logistics as an industry of such outstanding importance for Germany.

Therefore, we invite you to actively shape the future of logistics! Get involved in a personal and entrepreneurial change and embark on an interesting and fast-paced journey of learning and implementation. Together we will go into the future, shape it and bring the hashtag **#LogisticsGoesHightech** to life.

We look forward to journey together with you dear reader into the world of logistics of tomorrow!

Marco Prüglmeier and Alexander Pinker

For the sake of a better flow in reading the following text, dear readers, we will use the generic masculine. Of course, this always includes the female form.



Prof. Dr. Thomas
Wimmer

The Trends and Strategies Study published by the German Logistics Association in summer of 2020 identifies three top challenges for the next few years: digitalisation of business processes, transparency in the value chains and omnipresent cost pressure. Closely linked to digitalisation and transparency are technical and organisational aspects such as the willingness to trustfully exchange data, intensive networking of people and systems, but also the use of sensor technology, artificial intelligence and robotics besides business analytics. The top trends also include the sustainability of logistical processes and the shortage of skilled workers. Those who

want to be successful or stay on the cutting edge must actively address all these topics. The future always begins now.

Those who wait will fall behind. However, those who consistently overcome old thinking and traditional structures to engage in new, possibly digital processes can save high costs. Organisational agility, rapid decision-making and leadership closely connected to the employees are also of great value.

These are precisely the ideas addressed by this publication. In their present book, Marco Prüglmeier and Alexander Pinker provide tangible support in competing for logistical excellence. They write about a broad canon of topics that concern the far-sighted logistician.

They comprehensively explain the technologies that will have a significant impact on logistics: From individual components in modern Autonomous Mobile Robots (AMRs) to LIDAR scanners, camera technology and SLAM algorithms, to augmented and virtual reality and artificial intelligence. They describe how ways of working will change with or by 3D printing, network technologies and IT trends, like cloud or edge. In doing so, they also keep an eye on the effect this will have on people. They make clear what role new technologies play for sustainability in logistics – a field of action in which this industry must and will assume more and more responsibility in the future.

They take the reader to detailed insights into the future of the various logistics processes, be it in production, in warehouses, or beyond that throughout the entire supply chain to distributing goods to the consumer. But one thing is very important: it is not a mere description of a coming logistics world, but also a very practical guide on how to >>

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get there. Marco Prügmeier, project manager of an innovation team at BMW, whose concept was awarded the BVL's German Logistics Prize in 2019, provides valuable practical advice to implement future-oriented logistics and the future logistics' developments towards high-tech and effectiveness. Future strategist Alexander Pinker, as an international innovation expert, lecturer and author, completes this practical perspective with a futuristic look at the trends that drive our corporate world, our everyday life and our logistics today.

As a "trained" production logistics expert and also as chairman of BVL, I am pleased with the commitment of the team of authors, who combine practical experience with strategic orientation. The systematics developed for the Technology Radar by BVL, Huss-Verlag and Capgemini have been reflected in the present elaborations. The book encourages the reader to develop their own vision, to open up new business fields and to dare to innovate.

Prof. Dr.-Ing. Thomas Wimmer

Chairman of the Board, German Logistics Association (BVL) e.V.



Prof. Dr.-Ing.
Johannes Fottner

For a few years now, one has had the impression that the world is about to be flooded with autonomously driving passenger cars. Another year or two, and then – or so one might think – and they will be everywhere. Travel, watching a movie in peace or work through your emails without feeling guilty. Back in 2015, it was believed that it would only take another 2 to 5 years, for the technology and the market to be ready. To date, some driver assistance systems are available, even far-reaching and well-functioning ones, but there is still some way to autonomy.

With the use of artificial intelligence, augmented or virtual reality the situation is quite similar. Although there are use cases, the technologies remain largely unapplied in everyday life. However, there is one area that has been using new technologies as a pilot application for many years: Logistics; foremost: intralogistics!

Since the 1970s, “autonomous” (technically correct, of course, “automated”) transport vehicles, long known as automated guided vehicles (AGVs) or in large, entirely automated systems referred to as automated guided systems (AGSs), have been in use since the 1970s. Hyped over and over and in the beginning they were unfortunately relegated to the test track due to initial problems but have now set onto a triumphant march forward over the past 20 years.

Today, virtual reality is another reliable companion in the planning process of new factories and distribution centres, helping project teams to work intuitively across different disciplines and remotely off-site.

Augmented reality, such as pick-by-vision, is a method to facilitate order picking, making the process more intuitive and more reliable.

Digital twins are an integral part of complex warehouse systems in order to be able to successfully implement optimisations and entire product changeovers during ongoing operations.

Digitalisation has been implemented almost across the board in many logistics facilities, and the Internet of Things (IoT) is certainly no longer an abstract future concept.

Notice how in logistics, science does not cover in a white coat in front of a microscope but goes hand in hand with practice. Relevance is a must. The quick and successful practical test is more important than the theoretical publication. Industry 4.0 is largely driven by logistics – a precondition for individualised, efficient production.

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Over many years in his professional life Marco Prüglmeier has directly followed and driven such processes. He was part of the ever faster implementation of innovative technologies in the context of modern intralogistics. Few can explain and describe more impressively how to identify, analyse, test and, above all, successfully implement technology with relevance and future significance in practical industrial environments.

As a future strategist, start-up expert and lecturer, Alexander Pinker always draws the greatest added value from the future. His focus on current innovation technologies, trends and the associated communication with employees, as well as with partners and customers, clearly emerges when reading this book. He takes us practically through the process of innovation to the world of tomorrow.

In this book, Marco Prüglmeier and Alexander Pinker impressively show the new technologies deployed and what effect they have. It explains impressively clear and comprehensively how mechanical processes and machines are no longer conceivable without state-of-the-art IT and computer technology. Additive manufacturing and cloud computing are just as much a part of modern logistics systems as autonomous mobile robots are. Just like in a perfect construction kit, modern industrial systems are built from the most suitable technologies – interfaces are smooth seams and no longer insurmountable boundaries, neither on the software side nor on the mechanical hardware side. This book also sheds excellent light on the role that project partners play in the implementation of such systems, in addition to the technologies.

This is precisely the appeal of the book:

High practical relevance, an impressive and comprehensible overview over the portfolio of new technologies and their respective fields of application, clear advice for a targeted, solution-oriented implementation, and finally a vision of where it can still go – hypothetical and “visionary” in the truest sense, but also quite rationally a vision for one’s own company.

Especially for me, as a long-time employee of small and medium-sized businesses: a clear path, not only for large corporations, but also specifically for small and medium-sized businesses. SMEs in particular are often very open to innovation and predestined to drive the pilots of new technologies in logistics. Enjoy the reading!

Congratulations on this fine book, dear Marco, dear Mr Pinker.

Garching, April 2021

Prof. Dr.-Ing. Johannes Fottner
TU Munich

Marco Prüglmeier

After studying mechanical engineering with a focus on production at the Technical University of Munich he spent a year abroad in the field of industrial engineering. Marco Prüglmeier completed his studies with a practical diploma thesis in the field of automation technology in Barcelona.

In more than twenty years of working in the automotive industry, he gained experience in assembly and logistics and developed into an expert in supply chain management, lean production systems and innovations in logistics.

He built up the logistics innovation department, including a “Logistics innovation lab” for BMW AG and founded the company’s own start-up “idealworks”. Since then, BMW has not only sold cars and motorbikes, but also autonomous mobile logistics robots (AMRs).

In 2019, BMW AG received the German Logistics Award from the German Logistics Association (BVL) for the “Logistics NEXT” project.



Afterwards, Marco Prüglmeier founded his own innovation consultancy i2market and a start-up for robot-operated urban fulfilment centres.

His personal mission is to support others on their way towards the logistics of the future. To this end, he frequently hosts his own podcast episodes on the international channel The Logistics Tribe.

Marco Prüglmeier is married, has two sons and lives in Munich.

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The Authors

Alexander Pinker

Alexander Pinker is an innovation profiler, future strategist, new media specialist and start-up expert.

Born in 1989, he is an entrepreneur and futurist who has been working in innovation and future consulting, as well as cross-media communication. He founded the company "Medialist Innovation" in 2011 during his "Bachelor of Arts" studies in media management at the University of Applied Sciences Würzburg-Schweinfurt. In 2020, the companies "AP Innovation-Profiling" and "innovate! communication" were added.

The group of companies for innovation consulting, trend research and innovation marketing deals with digital change by means of innovation profiling. Alexander Pinker supplemented his academic education with a part-time Master of Science in Corporate Communication at the University of Applied Sciences for Economics and Management (FOM) in Munich.

Since 2015, Alexander Pinker has been a board member of the start-up



network SUN e.V., which volunteers to help active and future founders, entrepreneurs, investors and mentors from various industries and at different stages of the start-up process, acting as a business enabler to help them on their way through the corporate world.

In 2020, he received the Isarnetz Creator Award Corporate for his work in innovation communication.

Alexander Pinker is a lecturer at the University of Applied Sciences Würzburg-Schweinfurt in "Innovation and Trend Management", author, blogger and podcaster.