

Integrated Intelligence

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Integrated Intelligence

Combining Human and Artificial Intelligence
for Competitive Advantage



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Preface

How can businesses profit from artificial intelligence? The book addresses this key strategic question by examining the possibilities for gaining and sustaining a competitive advantage in an intelligence-based competitive environment. As such, it goes considerably beyond viewing AI applications as isolated tools that may enhance the efficiency of established business processes. Rather, it considers the interplays of artificial and human intelligence that enable firms to develop completely new products, services, processes, and business models. Besides many opportunities, the growing importance of AI also brings major threats for the traditional business of companies and for the jobs of some employees. In addition, the recent advances in different fields of AI have led to the emergence of major ethical questions, whose importance cannot be overestimated. In this exciting and challenging context, this book focuses on the strategic and competitive rather than ethical implications of AI.

This book is aimed at managers and executives, and it does not require prior knowledge in information technology or engineering. Instead, it shows how firms may thrive in a digital future by achieving an intelligence-based competitive advantage. As such, the book is targeted at practitioners rather than researchers. Nonetheless, some concepts, such as the intelligence-based view of business performance, may also provide a contribution to management research. In fact, many parts of the book have been adapted from some of my previous journal articles, which ‘survived’ review processes before publication and which also include a more detailed literature overview. However, the focus of this book is on managerial implications. Therefore, it deemphasizes discussions of the academic

literature. For a more detailed literature review, please consult the published journal articles, to which I refer in several chapters.

The book offers some guidance and support to practitioners in the exciting journey towards intelligence-based future competition. My previous consulting expertise and ongoing collaborations with companies suggest that some of the insights of the book actually provide helpful starting points for managers. If readers are most interested in the relevance of AI and the situation at other companies, part A may be particularly interesting. If the focus is more on implementation challenges, part E and especially the I3 – Integrated Intelligence Incubator are worth reading. At the end of chapter 14 you will find an overview of the major characteristics of Integrated Intelligence. HR professionals may be particularly interested in part D and the beginning of part E, which address the role of employee attitudes, new leadership styles, and the future role of the HR department. For academics, part B with the conceptual framework for an intelligence-based view may be relevant. Overall, the largest part of the impact of AI is yet to come. I wish you best of luck with your AI initiatives and look forward to receiving your feedback and hopefully meeting you at some future event. Please do not hesitate to contact me:
www.integratedintelligence.de

Cologne, February 2020
Prof. Dr. Ulrich Lichtenthaler



Part A
Relevance

The competitive relevance of artificial intelligence

Can your business successfully compete without using artificial intelligence (AI) in the future? No. Can your company successfully compete without human expertise and human intelligence (HI) in the future? No. So far, these questions are no-brainers. But do you think that your company takes the necessary steps to benefit from AI and HI in the future? Well ... honestly no. If these could be your own answers, you are quite representative for many companies at present. These are very typical responses that you will get from the executives and managers in many established companies when asking some quick questions about the relevance of AI. Many companies have acknowledged the relevance of AI. Beyond merely realizing the importance, many of them actively utilize AI, and this is true for large companies as well as small and medium-sized enterprises across a large variety of different sectors, including product-based as well as service-driven industries. Thus, is everything fine with the competitiveness of those established companies in an intelligence-based future? Most unfortunately, the answer again is ... no.

Many companies have accepted the growing importance of AI in terms of advanced data analytics and intelligent algorithms. You can hardly avoid regular news updates about the latest developments and accomplishments of AI in the news, press, social media, and many other channels. Despite the clear understanding of both AI and human expertise being essential in the future, however, most companies do not act accordingly. If you answer 'no' to the question of whether your firm takes the necessary steps for profiting from AI and HI, this is a strong initial signal that your organization may be in trouble, at least in the

medium to long run. However, your insight is an important first step towards strategic transformation. Paradoxically, the situation is often even more difficult at companies where executives are fully convinced that they are on the right path with regard to AI. These companies have usually started some strategic initiatives towards implementing selected smart algorithms and the latest technology for data analytics, but most of these companies only claim to be well-prepared for intelligence-based competition.

In fact, these companies only seem to be well-prepared at first glance. When you take a closer look, the leading position of these companies is only a superficial perception, and this wrong perception may be dangerous. So do you personally take the necessary steps to benefit from AI and HI in your everyday business activities? Maybe yes ... and maybe you have initiated some fascinating strategic initiatives for implementing AI, which work well and which are quite successful from an operational and financial perspective. These success stories may be important, and they may constitute major steps towards proficiently competing in the future. Nonetheless, you most likely are not among the very small minority of companies that are in fact leading the intelligence revolution. Rather, the likelihood is over 90 percent that you and your company have a wrong perception of being well prepared for the digital future – at least to some degree. So what is the situation with regard to AI in the vast majority of companies, really?

Many firms from a variety of sectors – such as automotive, chemicals, electronics, machinery, and pharmaceuticals – are reluctant to fully leverage the benefits of AI, willingly or unwillingly. Even those companies that are actively pursuing strategic AI initiatives usually focus on replacing some human work by AI in selected business processes. However, merely using AI to substitute for human work will usually be insufficient. This logic of replacing humans may be an important first step in using AI. In many situations, it may be implemented quite easily because the underlying business processes do not change. Therefore, it is indeed a good start for leveraging AI. Nonetheless, it is only a suitable first step and nothing more. In particular, replacing human work typically helps companies to enhance their efficiency. The cost savings that are associated with this

substitution are a natural next step in the automation of business activities. However, these smart automation processes will become standard procedures in the future. Consequently, a company's competitors will also master these AI applications, whose competitive benefits will fall short of most executives' expectations.

This is not to say that the efficiency gains from AI are not relevant with regard to a firm's financial performance. The optimization processes may very well have important financial consequences. However, they will not enable companies to gain and to sustain an intelligence-based competitive advantage in the future. In this respect, companies rather need to integrate their AI applications with specific human expertise. While it may be challenging for competitors to imitate particular human competencies, it will be even more challenging to copy specific combinations of human and artificial intelligence. This is what integrated intelligence is all about. It focuses on the interfaces of human and artificial intelligence. For many isolated applications of AI, standardized solutions are being developed at the moment. A large part of these solutions will be quite interchangeable and will further be commoditized over time. Therefore, they do not constitute a suitable basis for a sustainable competitive advantage.

Rather, the consequences of the evolution towards AI will substantially exceed an isolated use of AI. Instead, companies will significantly alter their entire intelligence architecture, which affects key business processes, established organizational designs, and typical forms of collaboration. In this regard, AI will also have a major impact on humans' everyday activities. Consequently, businesses need to actively manage multiple types of intelligence, including AI, HI as well as a meta-intelligence for transforming their human and artificial intelligence in line with their long-term strategies and dominant managerial approaches. Thus, businesses need Intelligence^x – encompassing various types of AI and HI as well as meta-intelligence. Along with the combination of AI and HI, the dynamic transformation and renewal of a company's intelligence architecture provides the basis for achieving an intelligence-based competitive advantage that may be sustained over longer or even unlimited periods. Only those companies that are aiming at a sustainable competitive advantage are well-prepared for future competition. The vast majority of

businesses, in contrast, neglect developing integrated intelligence, and they only have a wrong perception of being well prepared for intelligence-based competition.

AI has come a long way

The application of AI is more ubiquitous than you may believe. What was your last touchpoint with AI? Most probably, you do not remember it. Most certainly, it was today. Nonetheless, you do not remember it because you did not recognize it. AI is everywhere around us, making our lives easier – or at least parts of our lives. We hardly notice it because companies integrate it so seamlessly in software applications, hardware devices, and many processes that we already take for granted. Examples are auto corrections by your smartphone, which improve over time because the algorithm learns which words you want to use. Another smartphone application of AI are face recognition technologies. Beyond mere smartphone applications, many people regularly interact with customer service bots that are based on AI. You may also think of Google's Duplex solution, which integrates several AI technologies to enable an AI assistant to make calls with a close-to-human voice.

Beyond these applications for customers, AI transforms the production processes, data handling and channel management of companies. Moreover, self-driving cars are only one well-known solution among many more fascinating applications of AI. In light of the growing proficiency of AI applications, many people now fear that AI at some point may replace their own jobs. Yes, AI will create new jobs, but it will also replace human work. Still, AI's impact on human work remains controversial. This is largely due to the fact that we have only seen the beginning, the application of AI so far being limited relative to its potential. Therefore, the competitive effect is already noticeable, but the largest part of the impact is still to come. Sometimes, it is surprising to what degree many small and medium-sized companies have already adopted particular AI applications

that you would rather have expected to see in dedicated departments of large multinational companies. Despite the surprisingly broad use of AI, however, the focus of most companies is on a few selected applications.

In this regard, AI may be considered a logical strategic move in an evolutionary process that started at least several decades ago.¹ AI has come a long way, and it is not a trend that only started a few years ago. In fact, the roots of AI are often traced back to 1956, when the term ‘Artificial Intelligence’ was coined for the two-month Dartmouth Summer Research Project. The project proposal included ambitious goals for the short research period, and some of these goals have not been fully achieved today despite the significant advances of AI. Beyond the term AI, we can even go further back in time referring to 1679 when Gottfried Wilhelm Leibniz developed the binary number system, following an example set in ancient China. In 1936, Alan Turing proposed the concept for the Turing machine, which provided an important foundation for computer technology.

On this basis, the 1960s and 1970s brought the first wave of IT impact in Western companies. Here, the focus of IT primarily was on automating relatively isolated activities in the value chain. During this time, Intel also developed the first commercially available microprocessor. The second wave of IT impact occurred during the 1980s and 1990s. The particular strategic emphasis during this time was enabling coordination and integration across multiple different activities. During this period, in 1989, the World Wide Web was invented by the English scientist Tim Berners-Lee. In 1997, IBM’s Deep Blue defeated Garry Kasparov at chess. Subsequently, in 1999, the British entrepreneur Kevin Ashton proposed the term ‘Internet of Things’. We now experience the third wave of IT impact in companies, roughly since the year 2000. In 2012, Apple introduced the intelligent personal assistant Siri. By means of sensors, big data, and smart algorithms, products increasingly feature computer components to enable all parts to network with all other parts.

With particular emphasis on production processes, AI is a next step in the evolution that started with ‘industry 1.0’ in terms of using steam power for production based on James Watt’s patent for a steam engine in 1781. Typically, 1913 is considered as the start of mass production and

‘industry 2.0’ because Henry Ford manufactured the Model T on an assembly line. With a growing use of computer technology in production processes, the next step in terms of ‘industry 3.0’ included the IT-based automation of manufacturing activities. Today, we experience ‘industry 4.0’, which focuses on digital connectivity and AI. The terms digitization, digitalization, and digital transformation have been increasingly used since 2010, and the following years also led to an explosion in the use of the term artificial intelligence. With regard to production processes, companies increasingly use AI to leverage the data that they started to collect with the digitalization of their manufacturing processes in the previous years.

From a strategic perspective, it is essential to view AI as a next wave of IT impact in business activities and as a logical further step of automating production processes. Here, it is particularly important to acknowledge the dynamic understanding of the scope of AI. Some advanced applications were regarded as AI in previous times, but they are largely considered standard routines today. Thus, the understanding of AI substantially develops over time, and it now includes the latest technology in the fields of advanced data analytics and intelligent algorithms. In some years, today’s most advanced applications will be considered relatively standard procedures, which are mastered by the majority of companies, thus limiting the potential to achieve a competitive advantage on that basis. For example, you may think about the robot-based automation of production processes in the automotive industry, which started several decades ago. Partly, this automation was considered AI in the past, but it is merely standard routine now due to the dynamic understanding of the scope of AI.²

Why are we experiencing such hype about AI just right now? This is an excellent question if we consider the long evolution of AI until today. Of course, this evolution has not occurred continuously. Instead, there have been periods of major advances, which were followed by periods of limited further developments, leading to a reduction of funding in the development of AI. These periods are typically termed ‘AI winters’, and we witnessed several of them over the past decades. In contrast, there is a huge hype about AI right now. In fact, Gartner put two key fields of AI,

machine learning and deep learning, at the top of its hype cycle analysis in 2018. Some other fields, such as artificial general intelligence and deep reinforcement learning, are still far from reaching this inflection point. With regard to machine learning and deep learning, however, we may have reached a peak of somewhat inflated expectations with regard to their potential opportunities. Thus, there may be some disillusionment over the next years until a sustainable level of productivity based on these key fields of AI will have been achieved.

Nonetheless, there are good reasons why the competitive impact of AI will continue beyond the hype that we experience at present. There have been major improvements in various technology fields in recent years, which jointly drive the business impact of AI. Examples are advanced analytics and voice recognition, which may be leveraged by means of enhanced connectivity and cloud solutions. These developments help to exploit the technological infrastructure and pools of big data which are increasingly collected due to the growing digitalization of business processes. Thus, the danger of experiencing yet another ‘AI winter’ is relatively limited in the next years. While the hype cycle may have reached the inflection point at least for some of the key fields of AI, the vast part of the competitive impact of AI is yet to come. Without a stronger use of AI, most companies’ investments in digital transformation would not pay off because firms will be unable to leverage all the data that they collect as a part of their digitalization initiatives exclusively based on human work.

With the most substantial business changes of AI still ahead, it is particularly important to examine the strategic implications for your firm right now. It is key to adopt a strategic perspective, which examines the impact of AI on your business in the medium to long run. There is no alternative to developing a thorough understanding of the changes for your industry, for your business model, and for competitive advantage. There are some excellent previous publications of the impact of AI. For example, Ajay Agrawal, Joshua Gans, and Avi Goldfarb describe the economics of AI in their 2018 book entitled *Prediction Machines*. In addition, Paul R. Daugherty and H. James Wilson discuss the implications of AI for the human-machine interface in their 2018 book entitled *Human + Machine*. If

we take for granted the underlying economic logic of AI and the need for a closer collaboration of humans and machines, executives still face the challenge of developing appropriate proactive and reactive strategic initiatives to stay ahead of competition in an intelligence-based future business arena. Here, many key questions from a strategic and competitive point of view remain open in most companies.

There is a long road ahead

AI has come a long way so far, but for most companies the largest part of the AI transformation is still ahead. In this regard, there is no need for viewing the growing use of AI primarily as a threat to a company's established competitive position. For most companies, there are just as many opportunities as there are threats due to AI. In particular, understanding AI as a next step in a long evolution of business activities towards automation and IT helps to get a more realistic perspective on the potential benefits and risks of AI. Yes, there are severe challenges ahead. However, just doing nothing is not an option in light of the fundamental nature of the transformations. Many AI applications are quite complex from a technology point of view. What is even more critical for executives and general managers, however, is the impact on their firms' business models and business processes. General managers do not have to become experts in the underlying technologies. Instead, it will be the application of the solutions and their impact on the established businesses and competitors which will separate winners from losers.

Above all, there will be major shifts with regard to the value chain and the business ecosystems of many companies. Executives need to acknowledge that many of these shifts cannot fully be foreseen today. Thus, some level of experimentation and simultaneously pursuing multiple strategic options will be inevitable. Nonetheless, there is no immediate need to be nervous immediately and to embark on a course of aimless activism. At the same time, however, wait-and-see is not a suitable strategic option ei-