Robotik und Recht 14

Eric Hilgendorf/Uwe Seidel (eds.)

Robotics, Autonomics, and the Law

Legal issues arising from the AUTONOMICS for Industry 4.0 Technology Programme of the German Federal Ministry for Economic Affairs and Energy

Nomos

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Introduction

AUTONOMICS for Industry 4.0 is a technology programme initiated by the German Federal Ministry for Economic Affairs and Energy (BMWi). As part of a technology competition, 14 projects with collaborators from academia and industry have qualified for funding from the Ministry for Economic Affairs and Energy. The "AUTONOMICS for *Industry 4.0*" technology programme is designed to merge state-of-the-art information and communication technology with industrial production by exploiting the potential offered by innovation in order to accelerate the development of innovative products. The aim is to strengthen Germany's leading position as a world-class production site and as a supplier of innovative production technologies. The Ministry's technology programme hence marks an important step towards the implementation of *Industry 4.0*, the Federal Government's project for the future.

In anticipation of "AUTONOMICS for *Industry 4.0*", important spadework was carried out in 2010 under the predecessor programme entitled "AUTONOMICS – autonomous and simulation-based systems for medium-sized businesses" by the Federal Ministry for Economic Affairs and Energy. The results and findings of the R&D projects in production, logistics and assembly backed by AUTONOMICS are the perfect fit for *Industry 4.0* and will serve as a basis for the "AUTONOMICS for *Industry 4.0*" programme.

The AUTONOMICS for *Industry 4.0* concept includes a host of technical, organisational and economic innovations which have been almost impossible to assess up to now in terms of their reach and impact. Although revolutions like these affect legislation, resulting in more or less quick change, the legal framework is extremely important for the development and implementation of innovation. This is particularly true in a country like Germany with its highly developed legal system based on the rule of law and very active legal policy. Laws can hinder innovation, but they can also promote it.

The legal challenges facing *Industry 4.0* are closely linked to legal issues regarding autonomous systems and, in some cases, go far beyond them. The most important difference, from a legal perspective, between the predecessor project "AUTONOMICS – autonomous and simulation-based systems for medium-sized businesses" and "AUTONOMICS for *Industry 4.0*" is the comprehensive networking that is part of the design for *Industry 4.0*. The resultant legal questions have mostly been discussed up to now in the field of Internet law, a field which has attained new and in some areas crucial importance.

Many of the legal issues brought up are closely linked to the new quality of machine networking. That is why the first step in examining the relevant legal issues understandably begins with Internet law (including provider liability law and complex cross-cutting issues involving elements of civil, criminal and public law). As in the predecessor programme, the AUTONOMICS programme throws up significant questions regarding liability for damage to machines, products and other assets as well as personal injury. From a civil law perspective, tort law and product liability law are important, however, criminal law is also relevant. It should be remembered that injured parties will often seek recourse to criminal law simply for reasons of securing evidence. In order to avoid liability (also in growing machine-to-machine communications), it is imperative that the machines and devices used within the scope of *Industry 4.0* be equipped with a host of sensors that can capture and process large quantities of ambient data and trigger suitable safety responses. The vast quantity of data captured, however, leads to considerable problems with data protection law.

With a view to liability (under civil and criminal law), the right balance between technical rules and the legal criteria for negligence must be found. Considering the high level of many technical rules, it is regrettable that up to now both worlds, i.e. technical regulation and legal regulation, have largely existed independently of each other. It is now time to transform competition into synergy. Certain sensitive data are also protected by intellectual property rights and this must also be examined. In the event of injury, applicable supplementary criminal law provisions will also become relevant.

Man-machine co-operation is extremely important within the context of *Industry 4.0*. This poses a huge challenge for labour law and especially for occupational health and safety law. All employees working within the scope of *Industry 4.0* can come into contact with smart machines. Special attention should be paid here to the considerable public relevance of the issues mentioned which can determine whether or not innovative, technically organised concepts are accepted by society. This is the reason why the relevant issues must be identified as early as possible and proposals for solutions developed. Following the first phase of analysis, these proposals can then be introduced into the societal and political debate.

The anthology „Robotics, Autonomics, and the Law“ is the result of an international workshop, held in summer 2016 in Munich, where international experts analysed the legal situation of autonomous systems and robotics in Germany, and Europe as a whole, Japan, Korea, China and the USA. The main findings are summarised in this book.

We would like to thank all participating authors for their co-operation and the Federal Ministry for Economic Affairs and Energy for their support of this project. Special thanks go to Dr. Tettenborn and Dr. Glasmacher. Moreover, we would like to thank Jochen Feldle, who helped a lot in the publication of this book, and Roger Fabry, who translated most of the texts collected.

Würzburg, 8 February 2017

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Industry 4.0 and Law – Experiences from AUTONOMICS

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A. Introduction

In its concentrated efforts to pave the way for the continued roll-out of *Industry 4.0*, the German Federal Government is setting a new focus in technology policy. In the AUTONOMICS for *Industry 4.0* technology programme backed by the Federal Ministry for Economic Affairs and Energy, more than 100 partners from industry and science are conducting research into new technologies and systems for industrial production. In addition, accompanying scientific research measures are addressing important cross-cutting issues related to IT security, the future world of work in *Industry 4.0*, standardisation, business models and legal frameworks. Comprehensive networking and autonomy, as part of the *Industry 4.0* concept, are posing completely new questions relating to the legal framework for interaction between smart machines, systems and workers. Data protection and IT security are just as important here as issues of liability, such as in the case of accident scenarios.

B. Industry 4.0 – New Legal Challenges in Value Chain Networks

Digitisation is a growing trend. It is rapidly transforming our industry and the services sector, creating new challenges, not only for our economy, but also for our legal system. Smart interaction between human beings and machines means that traditional production processes and business models are undergoing major transformations, as are the complex, global and often cross-sectoral value networks that are based upon them. The ideal vision of digital production involves a high level of automation, short response times and processes that run in the most effective ways possible. This ‘brave new world of creating added value’ offers many new opportunities for raising productivity and improving performance, but also presents a number of challenges that need to be taken into account in order to successfully implement novel types of business models.

Whenever there is a new period of innovation, legislation has difficulties keeping up with the rapid development of new technology and its possible implications; however, existing legal provisions usually suffice to limit legal risks to a reasonable degree. Both legal experts and engineers must familiarise themselves with each other's disciplines. Only if legal experts have basic knowledge of what technically controlled, autonomous processes involve can they determine in what fields new legal provisions may be required. Only if engineers have a basic level of sensitivity for detecting legal pitfalls can they turn engineered systems into successful business models. Once professionals in both of these worlds start communicating with one another, a number of grave risks can be prevented. The vague idea that there might be potential risks must not lead to innovation being slowed down. If companies were to stop optimising their production and value creation processes because they were unsure of the legal implications, this could severely impair their potential to compete on the international market. This is why the present paper also looks at how international risk assessment can be fed into existing legal provisions.

In order to be able to assess the legal impact that potential risks will have, the process scenarios and the role of individual stakeholders need to be clearly determined. Many of the reference parameters to be used for *Industry 4.0* applications still need to be defined. Traditional labour law rules continue to apply even in an age where smart machines, systems components and employees work together ever more closely. However, applying these rules in the field of innovative production – where products are constantly being enhanced – will continue to become more difficult. Machines that have been programmed in a particular way cease to be mere tools; they can make their own decisions, and select the right course of action from a wide range of different options. Smart production processes are available for use. They are controlled via sensor and actuator systems that allow for the highest possible degree of optimisation, but are insufficiently covered by current technology law. Fundamental issues such as answering the question of who will be liable for errors, material damage or physical harm need to be resolved by looking at real-life cases. After it has been determined which legal provisions are applicable, human-machine interactions can be organised in a way that ensures legal compliance. *Industry 4.0* is generating many new puzzles to be solved by the law – from civil liability, to the right to data protection, to criminal law.

In order to take account of smart factories, which are based on technically controlled, automated processes, we will need to revise our existing legal framework in a wide range of different areas. Concepts like causation and legal protection will often need to be fundamentally rethought. As in previous periods of innovation, the prevailing legislation has difficulties keeping up with the rapid development of new technology and its possible implications. The use of robots to help run production processes is taking human-machine interaction to a completely new level.

C. Supporting the Development of Compliance Rules for Technology

Industrial companies, and all persons who are in positions of responsibility within these companies, need to always strive to conduct their commercial activities in a way that is in accordance with applicable provisions and legal assessments. In order to minimise the risk of criminal or civil liability of persons who are in positions of responsibility within *Industry 4.0*, companies can set up compliance rules. First and foremost, this means compliance with the laws and agreed rules, which helps minimise a company's risk of incurring liability. The digital transformation of production and value chains creates entirely new challenges for the way smart machinery, systems and workers interact with one another. As none of these are fully covered by the existing legal framework, companies need to be as cautious as possible when assessing the risks they face.

Data protection and IT security play a key role here, as does the question of who will be liable, for example, if an accident occurs. The vague idea that there might be potential risks must not lead companies to delay innovations. If companies were to stop optimising their production and value creation processes because they are unsure of the legal implications they will have to face, this could reduce their potential to compete on the international market. Thus, non-lawyers, not least developers of technology, ought to familiarise themselves with the legal framework that applies to their work and look at how to implement their findings in order to minimise potential risks. Consequently, *Industry 4.0* requires suitable compliance rules to be put in place.

D. Examples from the AUTONOMICS Projects

Technology projects that focus on research and development often touch upon areas of technology in which no explicit solution or guidelines exist on how potential risks are to be avoided. These projects involve innovative development processes and implementation scenarios that are completely new. The AUTONOMICS for *Industry 4.0* technology programme covers a multitude of different projects and areas that reflect a wide range of technological but also legal challenges that are yet to be resolved. Companies planning to launch a new product or service need to start dealing with the legal side of things early on. This helps ensure that innovations can be turned into business models that are in accordance with the law. As has been confirmed time and again, we do not need to change the foundations of our legal system or introduce anything akin to 'legislation 4.0'. Taking into account the applicable legal framework and the laws that exist at all stages of the production process is sufficient to stay clear of any major legal pitfalls. As there still is a lack of case law on many specific issues, there is currently no clear legal framework. However, companies can interpret the existing law and apply it to their specific challenges in order to minimise risks.

In the following section, this paper will focus on a number of specific subjects in order to provide an overview of the legal challenges that have been brought to light by the projects undertaken as part of the AUTONOMICS for *Industry 4.0* technology programme.

E. Engineering Networked Production Facilities

One of the defining characteristics of *Industry 4.0* is the digital networking of production facilities. The planning, design and operation of these facilities confronts automation technicians and production engineers with completely new challenges. Flows of data – which allow for all of the development-related information and experience gained along the product life cycle to be available – are the key factor that drives the creation of value added. In order to handle the data that is obtained, new methods of dissemination and protection are needed. All of the data that is used for the optimisation of networked production facilities needs to be transmitted and processed in a legally certain manner. This means that we need to deal with data protection issues and the question of who will be liable for any damage or harm that is caused by the use of products that come out of digital production workflows.

F. Autonomous Systems in Intralogistics

Industry 4.0 also involves intralogistics – the logistics processes that take place within production facilities. The AUTONOMICS projects aim to considerably raise the level of automation of equipment used at construction sites, forklifts used on the shop floor and work pieces and machinery used in production systems. Automated intralogistics makes it possible to pinpoint the exact location of an object, identify it and prepare it for further processing. In the course of this identification process, flows of data are generated, which has legal implications.

G. Industrial Service Robotics

Service robots that can move around freely have become widely used in many areas of our everyday lives. In the context of 'industrial service robotics', a service robot is defined most often as a mobile robot that provides a service either in direct cooperation with the user or completely autonomously. In the digital factory, these robots increasingly carry out tasks that involve the controlling of production processes. Robots are becoming ever smarter (through sensors, actuators and smart systems components). They can sense when changes occur in production workflows and what needs to be changed. They can interpret events and select the right course of action from a set of different options. They can communicate with their surroundings and interact with people working in production and logistics. By using novel types of control algorithms and sensor-actuator systems to optimise machinery, production processes will be made safer and more secure, thereby reducing the number of claims that result in litigation.

H. Human Workers in Manufacturing

Although manufacturing is becoming ever more automated, *Industry 4.0* does not mean that human workers will disappear from factories altogether. As the level of automation in *Industry 4.0* increases, and interaction between humans and technology grows, employees will take on new roles and responsibilities. Rather than working side by side, humans and machines will increasingly interact with one another. As human workers become part of a system that is constantly being monitored, they will face new challenges to their labour rights. Much of the outcome of a legal assessment of potential risks or claims will depend on whether humans operating ICT-controlled production technologies are considered to be mere users of this technology or to have a substantial impact on the equipment they use.

I. Areas of Law that Relate to Autonomous Systems

German law contains an almost unimaginable number of provisions that may be relevant for *Industry 4.0.* In the following sections, the most important areas of law and the most important provisions within these areas will be described, as will be a number of relevant court decisions.

J. Civil Law

There are a number of questions that need to be answered and that will determine to a large degree how (semi-) automatic systems are to be treated under civil law. We need to distinguish between liability for a wrongful act pursuant to Section 823 *et seq.* of the German Civil Code (tortious liability) and liability for breach of contract (contractual liability). In either case, the person who is liable will be 'held to account' for the damage, provided it can be proven that the person was "at fault".

At fault (in German law), which is required for liability to be incurred, means that a person wilfully or negligently causes injury to another. A person acts wilfully if he acts deliberately, knowing or intending his action will cause damage. This type of conduct is typically expected to exist within a criminal context. As far as 'regular' business activities are concerned, it is more likely for a company to be found liable for causing damage due to negligence. A person acts negligently if he fails to fulfil his reasonable care and skills obligations, cf. Section 276 of the German Civil Code.

There are currently few statutory provisions that clearly address the issue of duty of care. *Industry 4.0* still needs to research this in the case law and relevant legal treatises and to discuss its implications. As a result, there may be situations where we face legal questions to which we can give no clear answer. In these situations, manufacturers and developers need to inform themselves about potential risks and situations where they may face liability, and to document these in order to be able to prove, in the event of a dispute, that they have adequately taken into consideration the state of the art of their technology, potential dangers and preventive measures, and that they have done so prior to any claims being brought.

As *Industry 4.0* is an area that has not yet been regulated, where (almost) no case law has been developed by the courts, the level of care to be used needs to be defined by weighing competing interests. This creates a situation of great uncertainty, as companies are faced with the possibility that the courts may later take different views on important issues. This has to do with the fact that dangerous situations can be more easily detected once the damage has been done.

Particularly in technology law, conduct that may have been considered to be acceptable at one point in time may later be considered as negligent, for example, when technological progress provides companies with completely new opportunities to prevent risks or gives rise to new types of risks previously unknown to them. As technology continues to rapidly advance, it may become even more difficult to lay down the right level of care that is required. And in the area of new technologies, the threats that companies may have to face are completely unforeseeable as the extent to which these technologies have been used in practice is rather limited.

We also need to consider the fact that the level of duty of care that is required also depends on the extent to which the users for whom a particular product is intended are familiar with that product. For example, if an autonomous system is operated only by skilled staff, a lower level of care will be required.

The civil law of negligence is not designed for dynamic, learning devices. We will still need to figure out in what cases the users, producers or even developers of a device will be held accountable for the ‘actions’ their devices carry out. Until there is more case law on liability, producers can only protect themselves by documenting all of their development and manufacturing processes, which will allow them to prove that they have examined all of the risk scenarios that can reasonably be expected. In this context, the question as to what monitoring obligations need to be fulfilled – for example the installation of a black box – will also need to be addressed. In addition to this, there are also a number of product liability-related issues (Act on Liability for Defective Products). For example, a product is typically defined as a tangible thing. This raises the question of whether intangible things can be considered products within the meaning of product liability rules. We also need to discuss whether the definition of the term 'defect' needs to be narrowed for software and whether we are entitled to expect a piece of software to meet the same requirements as other products. We also need to examine whether the types of defects set out in both product and producer liability rules can be applied to automated systems.

And there are still more civil law-related questions that need to be addressed: these include the controversial question of whether software can be considered a physical thing (and not only a carrier medium). Depending on how this question is answered, software may be subject to different warranty rules. And this question becomes all the more relevant as software is increasingly distributed online, for example via the Cloud. In autonomics, devices can learn by themselves and software is intended to evolve. Therefore we will need to discuss how the term 'defect' should be defined in this context.

Contractual liability means that a person will be 'held to account' for damage resulting from a breach of contract. What is particularly important about contractual liability is that if a person breaches his (contractual) obligations, the person who has suffered the damage has a right to seek compensation for the damage caused (Section 280 (1) German Civil Code). Nevertheless, the person who has caused injury does not have to pay compensation if he is not at fault (responsible for the breach of obligations that has occurred). Thus where it cannot be proved that he is at fault, having acted in a wilful or negligent manner, he escapes liability. There are only a limited number of relevant cases where liability is not fault-based in this way.

Under German civil law, there are currently no specific provisions governing the conclusion of contracts by (highly) autonomous devices or software agents. This is a problem that is already relevant in the field of financial transactions and it is very likely that it will become even more relevant as the level of automation rises (for example spare parts ordered by autonomous machinery). In order to solve this problem, new statute-making will be needed.

K. General Provisions of Civil Law

I. Section 437 German Civil Code

Section 437 of the German Civil Code is the provision that governs the rights of persons who buy defective products. It lists the rights of the buyer in case of defects: the buyer may demand rectification, revoke the agreement, reduce the purchase price, and demand compensation for damages or reimbursement of expenses. In order for a buyer to bring claims, there needs to be a contract of sale in place (Section 433 German Civil Code) and a breach needs to have occurred (Sections 434 and 435 German Civil Code). A product does not conform to the contract if it does not provide the features that one is entitled to expect.

II. Section 280 German Civil Code

Section 280 of the German Civil Code is the most important legal basis upon which claims for compensation can be made when a person breaches his duties resulting from an obligation. These can be either contractual obligations (e.g. a sales contract) or statutory care obligations (e.g. a claim for compensation in negligence). If a party breaches a duty arising from an obligation, and if the party is found to be responsible for the breach (i.e. if fault is proved), the party in breach must compensate the aggrieved party for the damage suffered. Section 280 (1) sentence 1 establishes an (objective) breach of duty as the key concept for the rights of persons to demand damages in lieu of performance. Section 280 (1) sentence 2 sets out that liability under civil law must be fault-based by referring to Section 276 of the German Civil Code. This means that a party is only responsible for the damage he has caused if he is found to have breached his obligations.

III. Section 823 German Civil Code

Section 823 of the German Civil Code is the most important legal basis upon which claims for compensation can be made in tort law. Section 823 (1) of the German Civil Code focuses on the fact that a particular legal interest has been violated (e.g. life or property). If this has been done wilfully or negligently, the guilty party will be held liable for the damage caused. In contrast to this, Section 823 (2) of the German Civil Code focuses on breach of a statutory duty intended to protect another person. The provision of Section 823 (1) of the German Civil Code states that liability is limited in that a party can only be held liable for injuring the life, body, health, freedom, property or another right of another party and for committing or failing to commit a particular act.

An act is 'unlawful' if it is contrary to the law. An act is not 'unlawful' if there are reasons that justify the act, for example if an act is committed by one party and acquiesced in by the other.

To demonstrate fault (acting wilfully = knowing and intending that an act will cause damage, negligence = failing to meet one's duty of care obligations, i.e. not being careful enough), it must be proved that a particular party has caused a particular result. This provision is not only applicable to situations where a third party suffers damage at the hands of a user of an autonomous device, but also to situations where a user or a third party suffers damage at the hands of a producer (producer liability).

IV. Section 1 Product Liability Act

Pursuant to Section 1 of the Product Liability Act, a producer of a product will be held liable if the defectiveness of his products causes a person's death, bodily harm, damage to health, or damage to an item of property. This German law, which implements Council Directive 85/374/EEC, is designed to prevent distortions of competition that arise due to diverging liability rules that exist across the various European Member States. The law is intended to promote the free movement of goods at European level. In addition to this, the law is meant to ensure that consumers will be better protected from defective products than in the past.

Under the Product Liability Act, companies may be held liable not only by consumers, but also by other companies. Although there may be cases where a party is found liable under both Section 823 of the German Civil Code and Section 1 of the Product Liability Act, the provisions on liability set out in the Product Liability Act do not go as far as those provided for in Section 823 of the German Civil Code.

V. Section 3 Product Liability Act

Section 3 of the Product Liability Act picks up upon the term 'defect' used in Section 1 of the Act, and provides a clear definition of this term. The definition uses similar criteria for defining producer liability as are used in Section 823 of the German Civil Code: producers will be held liable for defects in production, development and design, for failing to provide adequate information about the use of their products (e.g. defective guidelines, instructions, manuals etc.), as well as for products that are found to be ineffective.

In order to determine whether a product is defective, it will be taken into account what an average user is entitled to expect from the product.

L. Criminal Law

Under criminal law, anyone whose acts have caused damage or harm can be held to account, provided that these acts constitute a criminal offence. The manufacture, bringing onto the market and use of products in the context of *Industry 4.0* can also result in conduct that amounts to a criminal offence, for example bodily harm or manslaughter. Often, it is difficult to determine or establish causation, i.e. to prove whether a particular action is a factual cause of the result.

In addition to this, it needs to be determined whether a person has acted 'wilfully' (with intent) or 'inadvertently' (by negligence), provided that this negligent conduct is punishable by law (e.g. Section 222, 229 German Criminal Code). This last point is particularly relevant, as this means that by meeting their documentation and monitoring obligations, companies can avoid being charged with criminal negligence. Where a company can show that, in light of the state of scientific and technical knowledge at the time it put the product into circulation, it did everything possible to prevent the defect, it will, as a general rule, not be liable under criminal law. Based on the fact that in criminal law, 'causation' is defined broadly, criminal liability may be established on the part of both developers and manufacturers of defective autonomous systems, as well as on the part of programmers and sellers.

Whether a party has committed an offence that is punishable under criminal law will be determined based largely on the standard level of care to be applied under civil law. The standard level of care to be applied under civil law will always be higher than the standard level of care to be applied under criminal law. If a person's actions do not incur liability under civil law, then these actions will (most certainly) not incur liability under criminal law.

The level of care that is required will be determined based on the conduct that a reasonable, average person would engage in, were he in the situation of the wrongdoer ('objective test'). In order to prove that a person is indeed at fault, this person also needs to have failed to meet his subjective duty of care obligations. This means that, considering his individual capabilities, skills, experience and knowledge, the person could have prevented the harm that occurred. The extent to which a harmful result is foreseeable also needs to be determined both objectively and subjectively. Objectively, a result is foreseeable if an average person could have reasonably expected it to occur; subjectively, a result is foreseeable if a particular person's individual capabilities, skills, experience and knowledge should have enabled him to foresee it.

M. Fundamental Issues Relating to Liability for Defective Products

Manufacturers can be held liable for defective products. This also applies to *Industry 4.0* – which is based on networked production. Manufacturers may be held liable both under civil law (e.g. they are liable to pay compensation for the damage caused) and criminal law (e.g. they are liable for bodily injury caused by negligence). But also other persons, such as researchers and developers or in some cases even users may be at risk of being held liable for a defective product.

These persons will be held liable provided that they have caused damage to another person (e.g. the user of the product) by committing an act or by failing to act, and provided that they have acted in a way that breaches their duty. So it needs to be determined whether a certain type of conduct is unlawful. In the following sections, we will take a closer look at liability and what this means for the group of people that we are most interested in, namely for producers.

In both case law and legal doctrine, a number of duties have been developed that play a key role for products and the risks they pose. The sections below have been structured around a number of categories that are based on the categories of duties used to determine producer liability under civil law pursuant to Section 823 of the German Civil Code.

N. Duties Regarding the Design of Products

The producer of a product needs to meet particular duty of care obligations. This starts with design. The producer must not expose any third parties to risks. However, a producer is not required to ensure the maximum level of safety possible. The level of care that is required for the production of a particular product depends on the level of safety that a consumer expects the product to have. If a customer expects a product to only have an average level of safety, the producer cannot be required to provide an optimal or even maximum level of safety.

Specific requirements for product design can often be found in technical specifications and legislation. Depending on the type of product, a number of rules need to be taken into account in its design, for example DIN or ISO standards or accident prevention requirements. These can also be used to determine the state of the art of the product. If the product does not meet these requirements, this can be an indication of a breach of duty.

As far as these rules and standards that do not amount to a legal obligation are concerned, two aspects deserve special attention: even though these rules represent only minimum standards, the interest groups that design standards can set them so that they will have a direct impact on the accountability of the producer. The development of technical standards is therefore also very much relevant for the field of law. In some areas, these technical rules and standards become outdated quite quickly. And sometimes, there will be no standards yet available at the time a product is produced. This makes it difficult for producers to assess their potential liability.

Legislation such as the Product Safety Act can also contain provisions on product design. The problem here, too, is that some of this legislation sets out requirements that are not very specific and does not cover all of the details. If no specific rules or standards exist, the state of the art of a product is the guiding factor. Producers can check whether a product is designed safely by comparing it to similar products that are available on the market.

From the design stage onwards, producers should consider what groups of persons might be exposed to risks. By using a product, customers accept that they will be exposed to a certain level of risk. If, through the customer's use of the product, a third party could also be exposed to a potential risk, the producer must exercise a greater level of care. This is because the extent to which third parties can protect themselves against a defective product is limited.

Designers of a product should also take into account that users may not use the product the way it was intended. Designing a product that leaves no room for misuse of any kind does not make economic sense as it would make the product impossible to sell. Only foreseeable misuse needs to be taken into account when determining the level of care that is required of the producer. A producer bears no liability in cases where it can be proved that a product has been misused in a way that could not have been foreseen.

O. Duties Regarding Production

A production error has occurred if a product does not provide the safety that it would normally have provided had production been error-free. Here again, the level of safety that production needs to provide depends on consumers' expectations. If a producer can be expected to monitor his production process, then quality assurance is one of the most important duties that the producer must fulfil. Production errors can be caused by human error or carelessness; they can also be caused by material fatigue in production equipment. As far as networked machinery is concerned, cyber-security plays a key role. In order to combat production errors, producers may set up a monitoring system; they may, depending on the product, carry out visual inspections, measurements, or mechanical tests. In addition to this, they must check their testing equipment.

It has to be taken into account that not every error that occurs in the production environment means that a producer has failed to meet his duty of care obligations. When determining whether a producer has acted negligently, the level of acceptable risk also needs to be factored in. We live in a high-tech society and if we do not want to give up technology altogether, it will not be possible to completely prevent all risks that may arise. This is something that criminal law needs to take into account as well. Consequently, producers will not be liable for isolated cases of defective products that could not been have prevented even though all production-related requirements had been met. So if the requirement is to carry out random checks and producers comply with this requirement, then they cannot be held criminally liable for isolated cases of defective products.

P. Duties Relating to the Use of Products (Requirement for User Information)

As a general rule, producers are required to make consumers aware of and provide adequate information about the risks of their products. This is because users need to be able to protect themselves against the risks of that product. Again, consumers' expectations are the most important factor to be taken into consideration. In addition, the level of risk that a particular product poses needs to be taken into account.

By requiring producers to provide information about their products, it is to be ensured that, first of all, users will not misuse the product or use it in a way that was not intended; and secondly that users understand the risks that a particular product has even when it is used the way it was intended. In order to define the duties that producers have with regard to providing information about their products, the responsibility of producers and sellers for their products needs to be weighed against the responsibility of consumers to protect themselves.

Q. Duties that Producers have after a Product has been brought into Circulation

Producers need to fulfil a number of duties even after the product has been put into circulation. They are required to take action in order to mitigate potential risks.

If a producer discovers that a product which he has put into circulation may pose risks, there is a wide range of measures he can employ. According to case law, these measures are not limited to issuing warnings, this being namely so in cases where issuing warnings is insufficient for helping users to assess the full extent of the risk they are exposed to and to adapt their behaviour accordingly. So, in addition to issuing a warning, producers may be required to issue specific safety instructions or even recall an entire batch of a particular product. This depends on the potential severity of the harm, the likelihood of that harm occurring, and the extent to which individual users of the product can be contacted by the producer. In addition to this, the producer needs to be given some scope to specify which of his products are actually affected, with the extent to which a producer is required to take measures based on the individual case.

If the producer fails to adopt appropriate measures to prevent potential risks, he may be liable under criminal law for failure to act. He is also required to change the production of the defective product in a way that ensures that it will no longer pose a risk.

It should also be noted that producers can choose from a wide range of different options to fulfil their duties with regard to the surveillance of their products. For example, they can actively monitor the market in order to find out whether the products they put into circulation pose potential risks; they can also be asked to analyse information that is passed on to them.

R. Data Protection Law

In addition to complying with the provisions described above, companies also need to make sure they know what legislation on data protection needs to be taken into account in cases where autonomous systems are used for handling data. There are no specific provisions governing autonomous systems. The main points set out in the relevant German legislation governing data protection are virtually identical throughout. This is because the European Data Protection Directive (95/46/EC) provides that a minimum standard of data protection be maintained in all areas that are subject to regulation. The EU has adopted a new General Data Protection Regulation, which is expected to take effect in 2018.

As a general rule, personal data may only be collected, processed or stored if the data subject has consented to it or if a law permits it. For example, this means that an employer needs to seek consent from his employees before collecting and using their personal data. This can also be done by including a provision regarding consent to the use of data in the employment contract.

In *Industry 4.0*, employers collect and store huge amounts of employee data; just think of human-machine interaction where a machine needs to be precisely adapted to the needs of the employee who operates it. In this area, there are still a large number of legal questions that need to be answered.

Autonomous Systems and the Law: Why Intelligence Matters

A European Perspective

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A. Robotics and the Law Today: What is Changing

Talking about robots and the law in Europe requires a preliminary clarification of what we mean by the word 'robot'. The reason is that the scope of the definition, and the objects (and their features) we include in it, have direct effects on the legal regulation of robotics.

Defining what is a robot, is less banal than it might appear at first glance. Traditionally, embodiment was considered an essential feature of a robot: it means a machine which physically interacts with the environment. However, things are changing (and we would also say have changed) for many reasons, and, among them, mostly because of the increasing use of artificial intelligence (AI) in robotics. In other words, when we use the word 'robot', we refer to a family of entities that is dramatically growing, and today goes from systems with poor cognitive and learning capacities to systems with extremely high cognitive and learning abilities, which are able to process huge quantities of information, make decisions, and act in ways that may exceed human capacities. This is the reason why, in this paper, we maintain that stress should shift from the robot's physical body to its intelligence. This shift requires clarification of the meaning of some concepts normally used in the field, such as action, autonomy and intelligence.

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