Liability of robots: legal responsibility in cases of errors or malfunctioning

LLM Paper
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Cindy Van Rossum
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# ABBREVIATION LIST

The exhaustive abbreviations used in this thesis and their meanings are explained in the table hereafter.

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<thead>
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<th>Abbreviation</th>
<th>Meaning</th>
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<tr>
<td>AI</td>
<td>Artificial Intelligence</td>
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<tr>
<td>AV</td>
<td>Autonomous Vehicles</td>
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<tr>
<td>ECJ</td>
<td>European Court of Justice</td>
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<td>EPRS</td>
<td>European Parliamentary Research Service</td>
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<td>EU</td>
<td>European Union</td>
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<td>IFR</td>
<td>International Federation of Robotics</td>
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<td>IoT</td>
<td>Internet of the Things</td>
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<tr>
<td>MS</td>
<td>Member State(s) of the EU</td>
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<td>USA</td>
<td>United States of America</td>
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INTRODUCTION

« The major issue when discussing civil law rules on robotics is that of liability (for damages). »¹ - A. Bertolini

“Self-driving Uber car hits, kills pedestrian in Tempe” that is the title of an American news website this Monday 19 March 2018². Who is going to be held responsible for this dramatic event? Is the driver still responsible or is the manufacturer liable? Could the self-piloted car be held responsible itself? Those are the kinds of questions that appeared exponentially in the past years and will happen even more in a near future.

Robots are the technology of the future and many of them are already involved in our daily life. From leisure drones to humanoid robots as Atlas³, including bionic prostheses, they are now part of everyone’s daily life and help in day-to-day tasks. Yet, the picture is not all bright. Indeed, even good things have downsides and, as all (non-)technological products, robots can dysfunction. A robo-financial-adviser can make you lose money, a self-driving car can hit someone or something and the Da Vinci can have some bugs during an operation⁴.

In Europe, the PLD (“Product Liability Directive”) is a key directive to be proud of. It could be the directive applied in case of error or malfunctioning of a robot as of today⁵. Nevertheless, concerns are raised about its ability to deal with the complex issues of liability of robots. Since there are no case law known in Europe and very few outside, it is a difficult and prospective task to assess the quality and complexity of the Directive to resolve such matters.

Therefore, in this thesis, the research question is whether the current EU legislative framework is sufficient and adaptive enough to deal with liability issues in cases or errors or malfunctioning of a robot. If not, what would be possible solutions or alternatives at the EU level?

The hypothesis is that a no totally new legislation on liability of robots is needed. The actual framework is – at least partially – applicable and that will be demonstrated. Some difficulties

³ Atlas is a humanoid robot developed by Boston Dynamics to do research and rescue tasks.
⁴ Those different types of robots or issues will be explained infra.
⁵ See: infra.
may nevertheless arise, therefore it should maybe be partly redrafted and supplemented. Hence, some authors stated that the “crash test” of the current framework to the resistance test of the robotic failed. In other words, current legislation needs reform, but only to a certain extent and that is what will be demonstrated.

To try to give possible answers, several key terms will be defined (Chapter I). The very notion of “robots” is difficult to encompass because there are too many sorts of robots with a wide range of applications that have little in common (Section I). Then, the concept of “autonomy” will be addressed (Section II). Afterwards, the current legislation will be analysed in order to pinpoint the lacuna/ambiguities/problems as well as the part of the directive that could be applicable to the robot’s liability issues and how (Chapter II). Next chapter will deal with old and new possible applicable regimes (Chapter III). A personal assessment will finally be provided (Chapter IV) before concluding.

**Interest of the research and the question**

The interest of the question is due to the fact that there are very few research and papers about the subject. Robots provoke a lot of reactions and articles that stay in the philosophical, phantasmagorical and superficial analysis of the topic, whereas legal and in-depth analyses of the liability of robots are scarce. The issue is too recent and there are actually not enough robot liability cases occurred for lawyers to focus on it. Moreover, very few scholars reviewed all the different theories available. Instead, they focused on one or two and concealed the others.

Specific legislation is also almost inexistent. Some say that it is by fear of slowing down innovation by putting a framework that would influence the changes made by companies. Others say that the actual legislative framework is broad and adaptive enough to encompass these new issues. Some countries nonetheless dared to elaborate peculiar legal framework but this usually encompasses only ethical codes and considerations as, for instance, in Korea.

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6 This imaginary concept is given by Alain Bensoussan in the introduction of the book: A. BENSOUSSAN and J. BENSOUSSAN, *Droit des robots*, Bruxelles, Larcier, 2015, p. 2.


Denmark or the USA (“United States of America”). Moreover, the purpose of regulating it would be to foster innovation, provide an incentive to the market and to match it with values enshrined in the EU legal order. Therefore, an appropriate framework is needed.

The second interest of the research lies in the very topicality of the matter. As laid down in the EP Report (“Draft report with recommendations to the Commission on Civil Law Rules on Robotics from the Committee on Legal Affairs of the European Parliament of May 31 2016”), the average increase in sales of robots was of 29% in 2014 and the worldwide robotic industry is estimated to 100 billion euros in 2020. AI (“Artificial Intelligence”) and robots have the potential to transform lives and work practises at every level. The future of work in the EU will change dramatically and is an example of primary concern in the EU. There are even 50% of chances that in 45 years, AI will outperform humans in almost all the tasks they do. Therefore, a deep analysis of the liability regime is needed. According to some people on the market, robotic as a disruptive technology could be the next great industrial revolution, similar to the internet.

Moreover, as it is mentioned in the very first lines of this thesis, accidents (especially car accidents of autonomous cars) happen more and more frequently. Other well-documented

11 A. BERTOLINI, « Robots as Products... », op. cit., p. 216.
12 A. BERTOLINI, « Robots as Products... », ibidem, p. 216. The legal challenges of robotics are multiple (see: Annex, diagram 1).
14 COMMITTEE ON LEGAL AFFAIRS OF THE EUROPEAN PARLIAMENT, Report..., 2015/2103(INL), ibidem, p. 3.
18 Besides the Uber self-driving car that killed a pedestrian in Arizona in March (supra), a Tesla killed the driver of a car four days later in California while in autonomous mode. A crash already occurred in 2016 making the first fatal collision while autopilot was engaged (V. TANGERMANN, « Tesla Model X in Autopilot Killed a Driver. Officials Aren’t Pleased With How Tesla Handled It », Futurism.com, 2 April 2018, https://futurism.com/officials-tesla-model-x-autopilot-killed-driver/, accessed April 2018). Indeed, in more than 20 USA states there are self-driving legislation either approved by legislators or via executive order by governor (see: Annex, diagram 2).
incidents occurred with the Da Vinci or with drones. A good framework is needed, one that is flexible enough to allow innovation but clear enough to allow legal certainty. Now that robots are starting to take part in the public life and in private homes, the protection associated to it must be more comprehensive: EU citizens need a protection that is satisfactory.

The third and final interest of the research is that, from a legal point of view, the concept of liability is very old but evolved and always managed to resolve all liability issues until now. Nowadays, the world is changing and facing a real “revolution” that is putting the well-known and established legal concepts into question. All the areas of law are likely to be affected by this new “robotisation wave” and liability is surely one of the first.

In addition to these important reasons to deepen the knowledge on robotic and liability of robots, the legal profession itself will be affected by robots. Indeed, legaltech start-ups emerge to propose dematerialised legal services that are cheaper. They could do some lawyers tasks and give fast and cheap legal answers especially for simple and repetitive infractions thanks to the blockchain technology. So liability of robots is of interest for the legal world as much as for the legal profession itself.

Limits of the research

The scope of the subject matter being very broad several limits need to be set in the research to have an in-depth analyse of well-defined questions.

First of all, not all the so-called “robots” will be analysed. This limit will be further explained in the first chapter where the definition of robot is set. Due to the complexity of the matter and

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20 Consumer protection is an important goal of the EU and often considered as a « higher objective » or a « mandatory requirement ». Indeed, EU citizens are very concerned by the topic of liability of robots (see: Annex, diagram 3).

21 For example, Article 1382 of the Belgian civil code comes from the Napoleonic French civil code of 1804.


24 As, for instance, haulage offences.


26 Liability of robots could therefore one day maybe include professional liability. The question will probably appear in the near future.
the size of the thesis, smart devices will not be analysed. AI, on the other hand, will be touched upon.

Second, war robots will not be analysed. Indeed, war robots raise different problematic. To resolve these issues, the law of the war is needed, which is totally different from the civil law, as well as the maintenance of the public order concept. Besides, the hypothesis on how to deal with war weapons/robots liability is usually resolved by distributing responsibility based on the military chain of command.

Third, non-European sources and points of view will be discussed in the thesis. Indeed, comparative analysis is useful in an area that is still in its early stages. Moreover, other countries already have experienced liability cases or have a different analysis than the EU. South Korea, Japan and the USA are pioneers in the robotic sectors.

Nevertheless, the reader must keep in mind that the goal of this paper is to provide an emerging answer to the liability of robots problem in the EU. This choice has been made because this falls under an EU competence. That is why legislation has to be made at the EU level and it will also allow a comparison with the EP Report. Moreover, there are many advantages to it. MS ("Member States of the EU") legislation is nevertheless useful and will be used. International regulations, on the reverse, would be too vague to analyte and to propose.

Fourth, although moral, philosophical and ethical aspects will be mentioned, the paper will focus on the legal aspects. Indeed, even if some EU working groups are drafting Ethic Codes on robotic, an accident can still occur with “ethical” rules and robots. With a view to conciseness – and because this paper is a legal one – mainly liability issues will be dealt with.

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27 A smart device is an electronic gadget that is able to connect, share and interact with its users and other smart devices (TECHOPEDIA, https://www.techopedia.com/definition/31463/smart-device, accessed April 2018).
30 In the EU, except Germany, no country has specific legislation on the topic.
32 Such as: avoid race to the bottom, faster and efficient regulation, and so on. See: Annex, diagrams 5 and 5’.
33 A Charter on Robotics is to be written. It consists of a Code of Ethical Conduct for Robotics Engineers, a code for Research Ethics Committees and Licenses for Designers and Users. This framework will be in compliance with the EU Charter of Fundamental Rights. The creation of a European Agency for robotics is also suggested (see: COMMITTEE ON LEGAL AFFAIRS OF THE EUROPEAN PARLIAMENT, Report..., 2015/2103(INL), op. cit., p. 21).
34 Interview of Mady Delvaux, op. cit.
To close this introduction, this paper will analyse the liability regimes that would apply to robots and see if the current rules can be adapted to robots or if new one a really needed.

CHAPTER I – DEFINITIONS

« There was a time when humanity faced the universe alone and without a friend. Now he has creatures to help him; stronger creatures than himself, more faithful, more useful, and absolutely devoted to him. Mankind is no longer alone. »

In this chapter, key concepts will be defined. Indeed, before going in the heart of the matter, it is important to be confident on clear and well-defined concepts. It is only the day a consensus on the definition of robot will emerge that a real “robot law” shall have a chance to emerge. That is why a whole chapter is devoted to it. The concepts of robots (and AI) (Section I) and of autonomy (Section II) will be examined. They are still open to debate and are sometimes found under other names in the literature: “open robots”, “systems”, “learning machines” and so on. For the sake of clarity, the only concepts used in this thesis will be “robots” and “AI” and will have to be understood as defined in the following section. Liability, on the other hand, will not be defined as it is a clear concept known by all practitioners but specific liability concepts will be dealt with in the relevant parts of the thesis.

SECTION I – ROBOTS AND AI

The word “robot” was first mentioned in a Czech play from the 1920s: R.U.R. In this play, robots are artificial humans used as slave labour in a factory. No definition was given but the robot was seen as a tool useful for the work too dull or dangerous for humans.

In this section, different types of robots will be mentioned demonstrating the wide variety that exist. Then, the different proposals of definition will be analysed and the most appropriate one, according to the author, will be picked to have a clear and strong basis in this thesis.

36 Rossum’s Universal Robots play by Karel Capek.
§1 — A WIDE VARIETY OF ROBOTS

As Bill Gates said several years ago, there soon will be “A robot in every home”\(^{38}\). From the well-known vacuum robot to very complex software, AI and robots will soon be in every civil society spheres.

First and foremost, the most “common” and well-known robot: the self-piloted car. It is so urgent to regulate it that Germany passed a law to know who should be held responsible in cases of AV (“Autonomous Vehicles”) accidents\(^{39}\) and that the EPRS (“European Parliamentary Research Service”) did a separate study on it\(^{40}\). A particular attention will be paid to self-piloted cars in this paper due to its popular understanding and deeper reflection and advancement available on the topic.

A second area where robots are very important is medicine and health care. Some legal complaints dealt with the Da Vinci robot in the USA\(^{41}\). Exoskeleton\(^{42}\), nanotech medical robots and smart prostheses are other examples of this type of robot. Watson is another well-known AI used in the medical field that helps to take decisions and diagnosis\(^{43}\). Care robots are also a “sub-section” of this type of robots that will be very convenient with the ageing population.

As we mentioned in the introduction, the legal profession will not be spared. Robo-lawyers\(^{44}\) already exist and robo-judges might appear in the future.

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\(^{41}\) This will be explained *infra*.

\(^{42}\) For example, the HAL exoskeleton from the Japanese company Cyberdyne, the HULC exoskeleton of the American company Lockheed Martin, the Hercule exoskeleton from the French company RB3D... For an interesting article on it: E. DATTERI, « Predicting the Long-Term Effects of Human-Robot Interaction: A Reflection on Responsibility in Medical Robotics », *Sci Eng Ethics*, 2103, Vol. 19, pp. 143-151.


Last but not least, robo-financial advisers enter the finance world. These algorithms have more precise information but some bugs can appear when two algorithms conflict. Some of them are even part of certain boards of directors to help in the decision-making process.

Not to mention civil drones, robo-journalists, warehouse robots and so on. This list of types or examples of robots and AI is not exhaustive but is sufficient to demonstrate the wide variety of robots already existing nowadays.

§2 – VARIOUS DEFINITIONS PROPOSED

Problematique

It is therefore clear from the first paragraph of this section that there is not a single type of robot. This notion is protean and different robots can be found under this definition that are specified by different shapes (humanoid, animaloid), materials, functions (industrial, services, emotional…), sizes, environment, level of interaction with humans and so on.

This means that it is not an easy task to find a suitable and inclusive definition from a legal perspective and it also raises another problem being: is it possible to have only one piece of legislation to address all the problems robotic raises?

First, it should be noted that the difference between AI and robots is that robots are a form of embodied AI. Nonetheless, there is no need to insist on the very sharp distinction between robotic and AI because it could be misleading since nobody knows yet how the technologies will be developed and deployed. So this distinction is minimal. AI (Watson for example) and robots (autonomous vacuum cleaner for example) will be studied in this thesis.

45 Interview of Mady Delvaux, op. cit.
47 For example, « Quill » is a software that creates some economic articles. Thanks to the Big data, it searches for pertinent information and write at text (N. Tatu, « Et maintenant, des robots journalistes ! », Le Nouvel Observateur, 22 aout 2014).
48 They help humans to fulfil orders for online retailers such as Amazon. They have their own mental agency because they reconfigure the storage locations of items in the warehouse based on customer demand (N. March and W. Smart, op. cit., p. 8).
50 H. Eidemueller, op. cit., p. 4.
52 Besides being a medical expert, Watson is being used as fashion coach, culinary consultant, or assistant to patent lawyers in their work (J. Millar and I. Kerr, « Delegation, relinquishment, and responsibility: The prospect of expert robots », Robot Law, Cheltenham, Edward Elgar Publishing, 2016, p. 105).
The definition of robot is also unclear because it is influenced by the literary depiction of robots, being incomplete\(^{53}\). People mainly think about examples from movies as Wall-E or Terminator. They are almost all seen “tools” used by humans to do a task they do not want and are all anthropomorphise. There is at the same time fascination and fear for robots, but it is phantasmagorical and does not encompass the real near-future problematic\(^{54}\).

For Andrea Bertolini, there will even never be a satisfactory definition of the term, both from engineering and legal point of view. This is because robots have a technical nature\(^ {55}\). He proposes instead a classification where various criteria are considered such as the embodiment or nature, the level of autonomy, the function, the environment and the human-robot interaction and individual applications\(^ {56}\).

However, other authors designed specific definitions. That is nevertheless lawyers and scholars’ job to (try to) define even difficult and protean concepts. The EP Report points out the importance of “common Union definitions” for robots\(^ {57}\). From the dozens of definitions seen, several of them seemed interesting from a legal point of view.

**Definitions proposed**

First, the IFR has several definitions of robots in the ISO 8373:2012 norm\(^ {58}\). It defines a robot as an “actuated mechanism programmable in two or more axes with a degree of autonomy, moving within its environment, to perform intended tasks”\(^ {59}\). The definitions of industrial robot\(^ {60}\), service robot\(^ {61}\) or intelligent robot\(^ {62}\) are also found in this ISO norm.

Bensoussan, a French lawyer, defines a robot as “une machine: intelligente, c’est-à-dire dotée d’un module d’intelligence artificielle ; dotée d’une capacité à prendre des décisions en ne se

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\(^{53}\) For example, the definition of the *Merriam Webster* dictionary cited by Bertolini: “1a: a machine that looks like a human being and performs various complex acts (as walking or talking) of a human being; also: a similar but fictional machine whose lack of capacity for human emotions if often emphasized… 2: a device that automatically performs complicated often repetitive tasks; 3: a mechanism guided by automatic controls” (https://www.merriam-webster.com/dictionary/robot ; A. BERTOLINI, « Robots as Products... », op. cit., p. 218).

\(^{54}\) The near problems are those who will be set as an example in the following chapter (accident of self-piloted cars, loss of money due to a robo-financial adviser, problems during a surgical operation by a Da Vinci…). The idea that robots will dominate the world for example is more a fictional idea than a future problem.

\(^{55}\) A. BERTOLINI, « Robots as Products... », op. cit., p. 219.

\(^{56}\) For the complete (very long) definition of Bertolini: A. BERTOLINI, « Robots as Products... », ibidem, p. 219.


\(^{59}\) Article 2.6, ISO 8373:2012. The notions of axes and autonomy are also defined in the ISO articles 4.3 and 2.2.

\(^{60}\) Article 2.9, ISO 8373:2012.

\(^{61}\) Article 2.10, ISO 8373:2012.

\(^{62}\) Article 2.28, ISO 8373:2012.
réduisant pas à obéir à des automatismes ; capable d’apprendre ; en situation de mobilité dans des environnements privés et publics ; pouvant agir de manière coordonnée avec des êtres humains”

The definition of Calo is another very interesting one. For him, it is “a man-made object capable of responding to external stimuli and acting on the world without requiring direct (…) human control” and this definition has three key elements: some sort of sensor/input mechanism to react to stimuli, some controlling algorithm that govern responses and some ability to respond in a way that affect the world outside the robot. These features constitute the “Sense-Think-Act Paradigm” of robots/AI.

EPRS states that research led to the conclusion that a robot is a “physical machine which is aware of and able to act upon its surroundings and which can make decisions”. Only some robots are autonomous and have the ability to learn (subgroup of robots). The EP Report, on the reverse, only gives characteristics of “smart” robots.

Richard and Smart, on the other hand, refer to this definition: “A robot is a constructed system that displays both physical and mental agency but is not alive in the biological sense”. Therefore, it is something manufactured, moving, that seems to take rational decisions about what to do and is a machine. In this definition, the system must only appear to have agency to the external observer (subjective agency). Thus, this definition leaves open mechanism causing apparent agencies such as systems controlled by clever computer software or tele-operated by a remote human operator. This definition excludes AI having no agency in the physical world.

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66 H. EIDENMUELLER, op. cit., p. 5.
69 Defined as being: “acquires autonomy through sensors and/or by exchanging data with its environment (…)”, is “self-learning”, has “physical support” and “adapts is behaviours and actions to its environment (COMMITTEE ON LEGAL AFFAIRS OF THE EUROPEAN PARLIAMENT, Report…, 2015/2103(INL), op. cit., pp. 6 and 7).
70 N. M. RICHARD and W. D. SMART, op. cit., p. 6.
71 N. M. RICHARD and W. D. SMART, ibidem, p. 6.
72 N. M. RICHARD and W. D. SMART, ibidem, p. 6.
73 N. M. RICHARD and W. D. SMART, ibidem, p. 6.
§3 — THE CHOSEN DEFINITION

For this paper, the definition chosen is the one from Richard and Smart. This definition is broad – even the broadest –, simple and clear. For this thesis, AI is included in the definition of “A robot is a constructed system that displays both physical and mental agency but is not alive in the biological sense”\(^74\).

The very concept of agency means that there is a subject (an agent) that acts towards an end set by another (a principal), producing direct effects in his patrimonial sphere, as long as it is acting within its powers or as it appears that way to a third person in good faith\(^75\). The choice of an agent is to some extent free because he can choose how to perform the task between different alternatives\(^76\). Of course, not all authors interpret this notion in the same way concerning robots. Bertolini thinks that only machines having strong autonomy have moral agency\(^77\) but the interpretation of Richard and Smart seems more adapted to robots: only apparent agency is needed\(^78\). Hence, almost all so-called robot can dispose of it, even those having weak autonomy or being remotely controlled\(^79\).

The choice of a broad definition is explained by the fact that it allows a broader analyse and permits to imagine all the possible scenarios of civil liability. A large number of authors are in favour of a wide definition\(^80\). Palmerini and the EP Report insist on the need for “a generally accepted definition of robot and AI” that is “flexible” enough to encompass the great variety of applications without hindering innovation\(^81\). Nevertheless, some authors nevertheless think that it is a mistake as the interesting legal issues only pertains to a small set of robots\(^82\) but for the sake of completeness, and because legal issues about “simpler” robots (as the Da Vinci) are not resolved yet, the very broad definition is more appropriated. Moreover, authors giving

\(^{74}\) N. M. RICHARD and W. D. SMART, op. cit., p. 6.
\(^{75}\) A. BERTOLINI, « Robots as Products... », op. cit., pp. 226.
\(^{76}\) A. BERTOLINI, « Robots as Products... », ibidem, pp. 226.
\(^{77}\) A. BERTOLINI, « Robots as Products... », ibidem, pp. 227.
\(^{78}\) Moreover, almost no robot has a strong agency so that would lead to a very – too – narrow definition.
\(^{79}\) (Emphasis added). Indeed, this external ascription of agency is similar to the Turing test where an external observer tries to define if its conversational partner on an Instant Messaging system is a human or a robot. The computer passes this test if the observer thinks he is talking to a human (N. M. RICHARD and W. D. SMART, op. cit., p. 6). On the notions of weak and strong autonomy: infra.
\(^{80}\) For example: E. PALMERINI, « Towards a Robotics law at the EU level? », L’intelligence artificielle et le droit, Bruxelles, Larcier, 2017, p. 75.
\(^{81}\) E. PALMERINI, « Towards... », ibidem, p. 75 ; Interview of Mady Delvaux, op. cit.
a narrow definition admit themselves that their definition can be under-inclusive\textsuperscript{83}. AI is comprised in the definition since the only real difference is that robot is embodied AI.

This leads to exclude some so-called “robots” such as the industrial automaton that assemble cars, move heavy parts and so on because they have physical agency but not a mental one. Nonetheless, a lot of them will be included, for example: iRobot Roomba (vacuum cleaner), even if the algorithms that control it are simple, they appear to make rational decisions. Da Vinci\textsuperscript{84} or ground-based tele-operated robots\textsuperscript{85} also enter that definition as even though they are completely controlled by humans and have no autonomous capabilities, they look intelligent to external observers\textsuperscript{86}.

Nevertheless, it is not because a broad definition will be used that no specific application can be analysed. That is the reason why in order to exemplify the theoretical aspects of this thesis, the self-piloted car and the Da Vinci robot will often be referred to. This will allow the reader to better understand what the application of different liability regimes on robot errors/malfunctioning would give as an answer.

An important element to add is that the chosen definition is technologically neutral. Without that, the designated technology in the legislation will be quickly obsolete, especially because scientific and technical progress in the field is fast. So, to avoid changing legislation all the time and ensure a useful definition, this guideline should be followed\textsuperscript{87}.

Therefore, it is possible to identify a single definition for robots. This definition still can be divided into different sub-sections, and those subsections will have consequences on the discussion on liability issues. That will be discussed partially in the second section.

\textsuperscript{83} Calo itself states that his definition is maybe under-inclusive as it does not encompass machines that are fully controlled by remote human being (eg: Da Vinci) or military drones because they lack the independent ability to answer stimuli (A. M. FROOMKIN, « Introduction », \textit{op. cit.}, p. xii).

\textsuperscript{84} The EPRS is of the same advice (DIRECTORATE-GENERAL FOR INTERNAL POLICIES – EP, \textit{European Civil Law Rules...}, \textit{op. cit.}, p. 9).

\textsuperscript{85} For example: Packbot (iRobot) and the Talon (Foster-Mile).

\textsuperscript{86} N. M. RICHARD and W. D. SMART, \textit{op. cit.}, p. 6. For example, Da Vinci can make a surgical operation in India while being remotely used by a French surgeon. Moreover, these kinds of robots will become more and more autonomous. For example, NASA is developing \textit{« Robonaut 2 »}, a humanoid robot (A. BENSOUSSAN and J. BENSOUSSAN, « 1. L’approche générale », \textit{op. cit.}, p. 32).

\textsuperscript{87} This principle is established in the United Nations Convention on the Use of Electronic Communications in International Contracts, New York, November 2005.
When discussing issues of liability, a notion and a distinction will often arise: (non-) autonomous robots. When we speak about this notion what comes into mind are the levels of driving automation for on-road vehicles. Depending on the level and on the task to execute, the human driver is less needed and the “system” executes the task. The very concept of autonomy first has to be understood.

The autonomy can be understood as the “ability to perform intended tasks based on current state and sensing, without human intervention”. So, this means that when the method selected by the robot to accomplish the human-generate goal is not predictable by the human.

What is essential is to divide robots between those having a “real” autonomy (strong autonomy) and those that are actually remotely controlled by humans or that cannot take decisions as humans (weak autonomy).

The latter englobes everything up to the so-called “free will” that all humans have. So even if the robot decides in a way how to perform the task, he actually responds to a situation it was programmed for. It is free because there is a choice from the robot but that choice was primarily programmed by the producer/programmer. “To the extent that an agent relies on the prior knowledge of its designer rather than on its own perceptions, we say that the agent lacks autonomy”. Hence, everything that is not under human supervision as driverless cars, autonomous drones and vacuum cleaners as well as remotely controlled robots as Da Vinci fall under this definition.

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89 This concept means: a « group, set, or aggregate of things, natural or artificial, forming a connected or complex whole » (B. WALKER SMITH, « Lawyers …, op. cit., p. 79).
90 Article 2.2, ISO 8373:2012.
91 C.E.A. KARNOW, op. cit., p. 53.
92 A. BERTOLINI, « Robots as Products... », op. cit., p. 217.
96 Those are the two limits in which this category of robots starts and ends.
On the contrary, the strong autonomy would mean that the robot can set goals and decide totally freely. This means that true autonomy or “higher grade” autonomy at least involves self-learning, meaning that the program does not apply the human-made heuristic but generates its own. Also, a robot would have strong autonomy if it could develop rational explanations for its actions, showing “intention”.

An important caveat to bear in mind is that there is no correspondence between autonomy and unpredictability of the outcome because an autonomous behaviour can be predictable if it is posed following the program. On the reverse, robots controlled by a human can have unpredictable actions. Moreover, it should already be noted that hundred percent autonomous robots still do not exist.

To conclude this chapter, and now that the true meaning of robots, AI and autonomy are known, several questions arise. Since there are different levels of automation, do they have to be taken into account to assess the liability, and how? If some robots are really “free” in the sense of the “strong autonomy” concept, shouldn’t we give them a e-personality or are humans always responsible? Where should the line be drawn? On the contrary, if the programmer or the producer is still responsible, where should the foreseeability be set? A comprehensive answer to these questions shall be given in the following chapters.

**CHAPTER II – STATE OF THE ART**

« (1) A robot may not injure a human being or, through inaction, allow a human being to come to harm. (2) A robot must obey the orders given it by human beings except where such orders would conflict with the First law. (3) A robot must protect its own existence as long as such protection does not conflict with the First or the Second Laws. (0) A robot may not harm humanity, or, by inaction, allow humanity to come to harm. »

The first so-called « laws » applying to robots where the Asimov’s Three Laws of Robotics (and another one added later: the zeroth law). They were created to negotiate the dangers

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97 A. BERTOLINI, « Robots as Products... », op. cit., p. 221.
99 A. BERTOLINI, « Robots as Products... », op. cit., p. 223.
100 A. BERTOLINI, « Robots as Products... », ibidem, p. 221. For example, a lot of so-called « autonomous » cars, no matter how complex its functioning, only perform the various tasks it was originally programmed to carry about.
101 A. BERTOLINI, « Robots as Products... », ibidem, p. 221 ; US Court of Appeals, 3rd Cir., Mracek v Bryn Mawr Hospital, 28 January 2010.
102 I. ASIMOV, op.cit.
associated with the introduction of robots into society properly\textsuperscript{103}. Strictly legally speaking, there has been conflicting suggestions on the application of traditional tort law to the acts or robot and AI\textsuperscript{104}. Therefore, a quick but accurate state of the art is needed.

In this section, the most plausible liability rules already existing to use in case of error or malfunctioning will be analysed. As legal objects, robots fall into certain legal regimes. The principle legislation, the PLD, and more largely the strict liability regime will be analysed (Section I). Then, the potential problems and potential advantages of applying the PLD alone will be set (Section II).

Before that, it should be kept in mind that the liability regimes to apply will depend on several variations. It will depend on the cause of the damage: an error (by the producer, by the driver, the user… and the kind of error) or a malfunctioning of the robot (due to the producer, due to the new skills the robot acquired through learning…)\textsuperscript{105}, on the level of automation of the robot\textsuperscript{106}, the kind of robot (especially: open or closed robots\textsuperscript{107}) and so on. This is the reason why, different scenarios will be reviewed and why there are so many theories possible.

\textbf{SECTION I – THE CURRENT APPLICABLE LEGAL FRAMEWORK}

Even though liability of damages caused by robots is often told not to be totally covered by the current framework, some specific norms could be used as well as safety standards that could supplement and help to determine the existence of a defect (§4). As explained and confirmed by the EP and the EPRS, conventionally damages caused by robots may arise from a machine defect, which would mean that the PLD could be applied if its conditions are fulfilled\textsuperscript{108} (§3). Damages may also be tracked back to the user error and therefore strict liability would apply (or fault-based liability, depending on the circumstances)\textsuperscript{109} (§2). Prior

\textsuperscript{103} D. M. COOPER, « The application of a “sufficiently and selectively open license” to limit liability and ethical concerns associated with open robotics », Robot law, Cheltenham, Edward Elgar Publishing, 2016, p. 173.
\textsuperscript{104} C.E.A. KARNOW, op. cit., p. 51.
\textsuperscript{105} DIRECTORATE-GENERAL FOR INTERNAL POLICIES – EP, European Civil Law Rules…, op. cit., p. 16. Conventionally, damage caused by robots could arise from a machine defect, so malfunctioning or to the user error.
\textsuperscript{106} See: supra.
\textsuperscript{107} D. M. COOPER, op. cit., p. 166. A closed robot is designed with (a) specific functionality/ies in mind and is not intended for modification. Its functions are limited to the purpose selected by its manufacturer. On the reverse, open robots are not limited and are intended to be modified.
\textsuperscript{109} DIRECTORATE-GENERAL FOR INTERNAL POLICIES – EP, European Civil Law Rules…, ibidem, p. 16.
to this, a quick definition and explanation of the (un)foreseeability of robots actions will be set because it lies at the heart of tort liability\(^{110}\) (§1).

\section*{§1 – The Unforeseeability of Robots and its Consequences}

As will be stated several times, the fact that robots could make unpredictable actions or choices is a fear for the users, the society as a whole and the manufacturers. At the same time, an argument often invoked by the latter and scholars to explain that liability cannot be established for the manufacturer or other stakeholders.

The foreseeability notion is hard to define but refers to the kind of events that we think it is reasonable to have people guard against\(^{111}\). It is a very important notion because liability cannot be allocated if the damage is not foreseeable, the problem is, however, to set to line between what is and what should be foreseeable. Foreseeability “is not to be measured by what is more probable than not, but includes whatever is likely enough in the setting of modern life that a reasonably thoughtful person would take account of it in guiding practical conduct”. One may be held accountable for creating even “the risk of a slight possibility of injury if a reasonably prudent person would not do so”\(^{112}\).

Indeed, traditional theories (for instance: negligence and strict liability) of tort law predicate liability on foreseeability\(^{113}\). Except, the problem is that autonomous robot, especially the strong one being self-learning, are often seen to be too unforeseeable and that could mean the non-possibility to use those theories\(^{114}\).

Of course, this problem is not a general one for robots because most of them are not self-learning or do not have strong autonomy. They do “what they are told to do, in the way they are told to do it, or the variation of the means is itself programmed and utterly predictable”\(^{115}\).

In the end, injuries are the result of human error or more often poor workplace design. Otherwise stated, robots are “short of that kind of full-fledged autonomy” and are completing the tasks they were designed to do no matter what sort of emergent behaviour they display the robots “still not defy their classification as mere objects”, determined in their actions “by the

\(^{110}\) C.E.A. KARNOW, \textit{op. cit.}, p. 52.

\(^{111}\) C.E.A. KARNOW, \textit{ibidem}, p. 72.

\(^{112}\) C.E.A. KARNOW, \textit{ibidem}, p. 63.

\(^{113}\) Not in the general sense, but : predictable harm to a predictable group of potential victims (C.E.A. KARNOW, \textit{ibidem}, p. 52).

\(^{114}\) C.E.A. KARNOW, \textit{ibidem}, p. 74.

\(^{115}\) C.E.A. KARNOW, \textit{ibidem}, p. 74.
real agent, a human being, who alone might be held responsible”. A human is always responsible since for example, it is his decision in providing a robot that led to harm.

Nevertheless, some robots are more “unpredictable by design” such as Watson-like robots. Watson’s inherent unpredictability derives in part from the fact that its inputs are, in principle, the complete set of information “out there” on the internet. That set of data is constantly changing as a function of the behaviour of millions of individuals who constantly contribute new bits of information to it, the content of which is also unpredictable. When sets of algorithms act on such a vast set of ever-shifting input, the outputs become unpredictable. Watson is designed to surprise. Though software is written in comprehensible line code, software functions that parse and operate on massive constantly changing data sets, deliver results that no programmer can fully anticipate according to Millar and Kerr. Unpredictability is even amplified in newer “machine learning” computer chips that are designed to mimic the plasticity of the human brain. Like human brain learning from environmental stimuli delivered via nerves, next-generation robot brains will change over time and will not be programmed in the traditional sense of the term, making them even less predictable than today’s most sophisticated and unpredictable robots.

The current models to assess responsibility are not easily applicable in the case of sophisticated robot decision makers.

§2 – The Strict Liability Regime

It can simply be defined as liability “no matter what”. It is liability without negligence or other fault and usually applies only to products. Liability without fault is based on the theory of risk, based on the fact that a person carries out activities that he or she cannot fully

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118 J. MILLAR and I. KERR, ibidem, p. 108.
121 J. MILLAR and I. KERR, ibidem, p. 127.
122 Cars, pills and so on.
control. Therefore, there is need to comply with safety regulations but to be liable even if there is compliance because the risk remains\textsuperscript{123}.

There are four theories of strict liability known: ultra-hazardous activity and three bans of product liability (failure to warn, design defect and manufacturing defect)\textsuperscript{124}. The manufacturing defect happens when a product departs from its intended design. This means that if there is an error in factory and someone is hurt then this theory will provide relief\textsuperscript{125}. There is a design defect when a foreseeable harm could have been avoided by an alternative design. Finally, there is a failure to warn the consumer when this one is not adequately warned on the uses or risk of the product\textsuperscript{126}. Therefore, the distribution chain would be liable.

It does not matter if the defect was intentionally or negligently built. In all these cases, the victim only needs to prove that the damage has occurred and that there is a causal link between the harmful behaviour of the robot and the damage suffered by the victim\textsuperscript{127}.

An important distinction needs to be made between general strict liability and product liability. Indeed, while there is “nothing to prove” in strict liability, the PLD still request the proof of defect. It is still “strict” but there is an additional element to prove and that makes it more complicated. It makes it more complicated to prove for the consumer and that is why the EP prefers strict liability to the PLD.

To determine whether an activity may be subject to strict liability for being too dangerous, several factors have to be taken into consideration such as: high degree of risk of some harm, likelihood that the harm will be great, inability to eliminate the risk by exercise of reasonable care, and so on\textsuperscript{128}. All these factors do not need to be met. For instance, even if the self-piloted cars could not meet the test of dangerous instrumentalities because they are supposed to make the roads safer, they are still perceived, in the US at least, as hazardous and thus,

\textsuperscript{124} C.E.A. KARNOW, \textit{op. cit.}, p. 65 ; K. C. WEBB, « Products liability and autonomous vehicles: who’s driving whom? », \textit{Richmond journal of law & Technology}, Issue 4, 2017, p. 19. (Manufacturer defect or failure to warn consumers about a danger or hazard or design defective but this could be the market role to decide what design is defective, not judges (K. COLONNA, « Autonomous Cars and Tort Liability », \textit{Case Western Reserve Journal of Law, Technology and the Internet}, Vol. 4 No. 4, 2012, p. 107).\textsuperscript{125}
\textsuperscript{126} C.E.A. KARNOW, \textit{ibidem}, p. 66.
\textsuperscript{127} C.E.A. KARNOW, \textit{ibidem}, p. 67.
should be held to a higher liability standard\textsuperscript{129}. Therefore, as a “buffer” against the unknowns around AV, strict liability in general is an appropriate and logical solution\textsuperscript{130}. Some European systems introduced liability regimes for traffic accident triggered by the occurrence of an accident (French law) or the fact that the harm was caused by the operation (German law) and most of them will apply to harm caused by AV\textsuperscript{131}. In strict liability cases, either the user – if they make a mistake – either the producer will be held responsible. It will be argued that the PLD stands better in cases of manufacturer errors, whereas liability for fault stands better in cases of human error, both supplemented by insurance.

\textbf{§3 – THE PRODUCT LIABILITY DIRECTIVE}

The PLD is the current legal framework in the EU to promote the compensation of victims of defective products. It was adopted thanks to the initiative for a consumer protection politic\textsuperscript{132}. Legally speaking, this is the natural paradigm within which to frame issues of liability involving robotic\textsuperscript{133}. Since we are looking at the EU level, this is also the only set of rules available at the EU level that could apply to robots\textsuperscript{134}. Products liability law can be tracked back to the sixth century A.D. and is a specialised area of law that imposes liability upon manufacturers or suppliers of goods\textsuperscript{135}. It operates \textit{ex post}\textsuperscript{136} and the rationale comes from the economic benefit that manufacturers derive from the sale they make\textsuperscript{137}. The strict liability mechanism is at work in the field of liability for defective products and will apply here\textsuperscript{138}. It means that victims do not have to prove that there is a fault

\begin{thebibliography}{99}
\bibitem{ROSENBERG} A. ROSENBERG, \textit{op. cit.}, pp. 216-217.
\bibitem{ROSENBERG} A. ROSENBERG, \textit{ibidem}, p. 218.
\bibitem{BORGHETTI} J. P. BORGHETTI, \textit{Is defectiveness an appropriate notion to deal with damage associated with the IoT or artificial intelligence?}, Munster – slides of the lecture, 12 April 2018, slide 14.
\bibitem{BERTOLINI} A. BERTOLINI, « Robots as Products... », \textit{op. cit.}, p. 236. Indeed, if they are not 100% autonomous they are objects and therefore products;
\bibitem{COLONNA} The present tense is not used as there has been any cases where the PLD was used in the EU in robot liability cases. Therefore, all the propositions made in this thesis as well as the personal assessment are mainly prospective.
\bibitem{COLONNA} K. COLONNA, \textit{op. cit.}, p. 105.
\bibitem{PAGALLO} Because it compensates victims, this will be important \textit{infra} when the issue of insurance and risk management comes into play.
\bibitem{COLONNA} K. COLONNA, \textit{op. cit.}, p. 105.
\end{thebibliography}
done by the producer\textsuperscript{139} while balancing the consumers and producers’ interests. “For product liability to attach, it is not sufficient that a product caused harm; rather, it is required that the product was defective”\textsuperscript{140}.

The question of its applicability to software was put into question by the EU Commission that said that, because it applies to every chattel, it applies to software too\textsuperscript{141}. Even though it was controversial at the time\textsuperscript{142}, there is no real discussion on the topic anymore because it is a normal evolution to follow the social evolution where it is logical that defective software needs to be repaired\textsuperscript{143}. The question of the application of PLD to “robots” and “algorithms” as products can be controversial but is desired\textsuperscript{144}. It seems even logical to extend the application of the PLD to robots to ensure victims compensation\textsuperscript{145}. Several authors consider that the PLD undoubtedly applies to the robot in which an algorithm is embedded. However, considering the directive’s rationale, robots where the algorithms are not embedded are also affected by the PLD\textsuperscript{146}.

Before examining the directive, some key features of the PLD need to be kept in mind. First, this directive is based on the concept of “producer” (or manufacturer). It was held that the responsibility of all the participants in the production process could be engaged\textsuperscript{147}. There is also a subsidiary responsibility regime for suppliers when the producer cannot be identified\textsuperscript{148}. Secondly, a product is defective in the sense of the PLD when “it does not provide the safety which a person is entitled to expect (…)”\textsuperscript{149}. Defect is therefore linked to the security of the product that exposes users to an abnormal risk for their security and takes into account the legitimate expectations of the public, \textit{in abstracto}\textsuperscript{150}. Therefore, a lack of information or

\textsuperscript{140} G. WAGNER, \textit{Robot liability}, Munster – slides of the lecture, 12 April 2018, slide 6.
\textsuperscript{141} See: Answer given by LORD COCKFIELD on behalf of the Commission: “(…) the term ‘product’ is defined as "all movables (…). Consequently, the directive applies to software in the same way (…)” (Answer given by LORD COCKFIELD on behalf of the Commission the 15 November 1988, \textit{O.J.E.C.}, 8 May 1989, C-114/42). At least the one with a material output (K. ALHEIT, « The applicability of the EU Product Liability Directive to software », \textit{Comparative and International Law Journal of Southern Africa}, Issue 2, 2001, pp. 201 and 205).
\textsuperscript{142} It was controversial in Belgium for example (H. JACQUEMENT and J.-B. HUBIN, \textit{op. cit.}, p. 130).
\textsuperscript{143} Doctrine assimilate software and the material support so that it is understood as a good.
\textsuperscript{144} Interview of Mady Delvaux, \textit{op. cit.}
\textsuperscript{145} H. JACQUEMENT and J.-B. HUBIN, \textit{op. cit.}, p. 130.
\textsuperscript{146} J. P. BORGHETTI, \textit{op. cit.}, slide 4.
\textsuperscript{147} Preamble 4 of the PLD.
\textsuperscript{148} Art. 3 of the PLD.
\textsuperscript{149} Art. 6 of the PLD. “Defectiveness” is understood as an intrinsically excessive risk arising from the use – and to some extent misuse – of the product (A. BERTOLINI, « Robots as Products… », \textit{op. cit.}, p. 239).
\textsuperscript{150} H. JACQUEMENT and J.-B. HUBIN, \textit{op. cit.}, p. 132. A product is defective if it is unreasonably or abnormally dangerous (J. P. BORGHETTI, \textit{op. cit.}, slide 6).
warning can lead to qualify defective a non-dangerous product. A contrario, a product having potential dangers is not necessarily defective. The presentation of the product, information and warnings have to be taken into account.

The injured person has to prove the damage, defect and causal relationship. There are a lot of critics about the burden of proof being on the victim. But there is a balance because the ECJ (“European Court of Justice”) held that “where it is found that products belonging to the same group or forming part of the same production series (...) have a potential defect, such a product may be classified as defective without there being any need to establish that the product has such a defect”.

Nonetheless, there are exemption clauses in article 7 of the PLD. Of course, since they are exceptions their interpretation is restrictive and the producer has to prove it. Exemptions of the art.7 (b) and (e) are the most possible ones that would be invoked in the cases of AI.

The action also has to be introduced in certain time limit, set by article 10 of the PLD. The damages covered by the directive are damages to people, moral damages and damages caused to private goods.

§4 – OTHER LEGISLATION (FOR THE RECORD)

Other legislation can also be applied to robots in different fields. First of all, safety standards, then in specific fields of robotic.

In the first place, directives about safety. Robots are mechanical objects and fall under the definition of machinery set by the Machinery Directive. Therefore, they have to be designed and assemble in compliance with the standards and safety measures provided

151 H. JACQUEMENT and J.-B. HUBIN, op. cit., p. 132.
152 H. JACQUEMENT and J.-B. HUBIN, ibidem, p. 132.
153 Art. 4 of the PLD. A product’s defect is normally established through: the proof that the product malfunctioned or violated safety standards, comparison with other products or balancing the risks and benefits of the product (J. P. BORGHETTI, op. cit., slide 6).
154 Indeed, prove the malfunctioning or the violation of standards is not that easy, comparison might therefore be interesting. Comparison of the behaviour of the robot or AI with a reasonable human being or with a robot in the same situation is not appropriate. Therefore compare the overall outcomes of the algorithm to that of other algorithm (through a system of percentage) might be possible (J. P. BORGHETTI, ibidem, slides 7-12).
155 E.C.J., Boston Scientific, 5 March 2015, C-503/13, §43. In this case, it was also held that « The safety which the public at large is entitled to expect… must therefore be assessed by taking into account, inter alia, the intended purpose, the objective characteristics and properties of the product in question and the specific requirements of the group of users for whom the product is intended » (§38).
157 The limitation period to proceedings for the recovery of damages will be of three years. Art. 11 of the PLD states that the maximum limitation period would be 10 years from the date on which the producer put into circulation the actual product which caused the damaged.
158 Art. 9 of the PLD.
159 Art. 2.a of the Directive 2006/42 on machinery.
Moreover, robots that qualify as products intended for the consumer market are also subject to the requirement of the GPSD. Those safety standards generally are not considered enough by the EU and the national courts but play an important role. For example, they come into play in the compliance defence of art. 7.d of the PLD.

Authorities are obliged to recognise that products manufactured in conformity with mandatory standards are presumed conform and having harmonised standards could help producers, users and judges to objectively assess safety. While assessing safety would help assess the defectiveness of products. Indeed, it could be good to adopt a system for including product safety analysis in developing the design of the robotic machines and the warnings and instructions concerning the machine and to have more private and governmental standards. Though compliance these standards does not automatically avoid liability, it will reduce the risk of liability.

Secondly, a field to point out is the medical field. For example, surgical robots, advanced robotic prostheses and exoskeleton are covered by the MDD and the AIMDD as amended by the Directive 2007/47. Other fields have safety and standards regulations such as the automobile field, the drone field, and so on.

For the sake of accuracy and to be able to provide a clear analysis, only the PLD, the main existent instrument that could be used for the current problem, will be assessed in the following section.

160 E. PALMERINI, « Towards…», op. cit., p. 56.
161 Directive 2001/95 on general product safety. This directive does not apply when more specific rules governing the safety of certain products exist.
163 C. AMATO, ibidem, slide 7. The compliance defence of art. 7.d of the PLD could only exclude liability if the damage occurred because of the specific feature set forth by the legal rule and not simply because of the (mal)functioning of the good (A. Bertolini, « Robots as Products… », op. cit., p. 241).
164 C. AMATO, ibidem, slides 7 and 17.
SECTION II – ASSESSMENT OF THE CURRENT LEGISLATION

While some scholars assume that the PLD could be adaptive enough to cover the main situations of liability caused by robots, others infer too quickly that a huge change is needed and elaborate creative and innovative solutions. Before questioning the current framework, a general assessment of its possible limitations and its disadvantages will be carried (§2). Moreover, whether and how it should be applied to robot liability or not will be assessed (§1).

§1 – LACUNA, AMBIGUITIES AND PROBLEMS OF THE PLD

First of all, a general problem can be pointed out. There is a limited number of cases decided by national courts in the EU through the application of the PLD and so that raises doubts about the effectiveness of this sub-system in granting quick and adequate compensation.

Secondly, the PLD is based on a fundamental and static distinction between producers and suppliers from one part and victims on the other. But AI applications, at least those having a learning capacity, are in a production process that is dynamic. More and more people are involved in this process, especially those involved in their cognitive intelligence development. If those people participate to the elaboration of the robot, they could escape the PLD application. Moreover, if they are open robots, the users themselves could be part of the “learning” process and therefore partly responsible for the dysfunction of the robot.

Third, since producers of dangerous products giving good information can avoid liability, robots and AI producers could escape liability if they give enough information on the dangerousness of the robot. Therefore, if there is not abnormal conduct in giving the information by the producer, his liability could not be engaged. That is not normal and should be avoided. Good information should, of course, exist and limit to some extent the producer liability but cannot be a loophole for all errors or malfunctioning.

\[\text{A. BERTOLINI, « Insurance … », op. cit., pp. 301 and 302. Of course, that criticism only stands at the applicability and effectiveness level and has little to do with the suitability of the regime to robots.}\]

\[\text{170 H. JACQUEMENT and J.-B. HUBIN, op. cit., p. 131.}\]

\[\text{171 H. JACQUEMENT and J.-B. HUBIN, ibidem, p. 131.}\]

\[\text{172 H. JACQUEMENT and J.-B. HUBIN, ibidem, p. 131.}\]

\[\text{173 H. JACQUEMENT and J.-B. HUBIN, ibidem, p. 131.}\]

\[\text{174 Indeed, open robots may be more problematic than their closed counterparts from a legal and ethical perspective. as Calo suggests, “open robotics may expose manufacturers and distributors to legal liability for accidents in a far wider set of scenarios than closed robotics” (D. M. COOPER, op. cit., p. 164 ; R. CALO, « Open Robotics », Maryland Law Review, Vol. 70, No. 3, 2011, p. 123).}\]

\[\text{175 H. JACQUEMENT and J.-B. HUBIN, ibidem, p. 133.}\]
Fourth, the first exemption clause analysed (art. 7.1.b of the PLD) could cause problems for learning robots. If the defect of the robot comes from its learning, the producer could try to totally escape liability saying that the default was not existent when the robot was put into circulation. The question would be whether the default is latent or totally unpredictable. Some authors argue that the producer should assume unpredictable modifications of the robot/AI behaviour which he did not prevent by programming. The other problem is when there are updates, therefore the new functionality could be considered as added up after update and not before it was put into circulation. So, the third and fourth problem shows that there could be a general problem because producers would avoid liability too easily. It could be considered as a good thing also but therefore someone else should be held responsible. The same could apply for the second exemption of art. 7.1.e of the PLD that could weaken the balance between consumers and producers because the latter could avoid liability of learning robots gaining defect after creation.

Fifth, the time limit of ten years above mentioned might be too short since robots, at least learning and autonomous ones, are supposed to become better and have more abilities so ten years could be too short to cover accidents caused by robots.

Sixth, one of the most well-known caveats which is the scope of the PLD would not be sufficient to cover the damage cause by the new generation of robots with adaptive and learning abilities that permit them to have a certain degree of unpredictability in their behaviour. As some authors stated: the PLD works well where robots are designed as mere tools, and when those tool-like robots do not do what they are supposed to, due to some kind of defect or malfunction. With Watson-like robots, there is neither defect nor malfunction in the usual sense because their “choices” look more like behaviour than defects. Moreover, these situations of sort are not what one might imagine with near-term semi-autonomous

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177 H. JACQUEMENT and J.-B. HUBIN, ibidem, p. 135.
180 That could be compensated by users (drivers or keepers of robots) taking a facultative insurance (see: infra).
181 But this exemption was not transposed by every MS. Finland and Luxembourg did not for example, Belgium did (H. JACQUEMENT and J.-B. HUBIN, op. cit., p. 136).
183 COMMITTEE ON LEGAL AFFAIRS OF THE EUROPEAN PARLIAMENT, Report..., 2015/2103(INL), op. cit., p. 6. Indeed, robots could autonomously learn things and interact in their environment in a unforeseeable manner.
184 See: supra.
software bots such as those that might search, procure, negotiate, and enter into contracts on one’s behalf but, in doing so, exceed authority. This apparently “huge” problem is nevertheless overruled by other arguments infra. Moreover, robots can have ordinary material defects where it is easy to say that ordinary rules of the PLD apply and other easy to handle and demonstrate.

Seventh, the PLD might not be accurate enough. Judges who are little-versed in emerging technologies might have trouble comprehending the subtleties. Other problematic could be dealt with such as how to deal with the quality and safety of the algorithms or how to interpret the directive in light of those new technologies, for example.

§2 — POSSIBLE APPLICATION TO ROBOTS AND AI

Even though there are some disadvantages to the PLD, it could remain a suitable framework for robot liability. Indeed, some main points of the PLD are very good or could be interpreted in a way that would resolve a lot of problems.

Advantages of the PLD

Indeed, firstly, there would have no problem concerning the default proof because robots and AI have and would have a black-box that will permit to identify the cause of damage and say if the product was defective or not at the time of the accident. Therefore, the PLD could be a good framework on this point.

Secondly, it would be easy to apply the PLD especially in certain circumstances. If the producer had given insufficient information to the customer of the dangers associated with autonomous robots, or if the robot’s safety system was deficient. Damages related to robots’ new abilities could be seen as a defect within the meaning of the directive according to a lot of authors and the EPRS.

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187 A defective brake in an automated vehicle, a defective sensor...
188 J. P. BORGHETTI, op. cit., slide 3.
189 Code line with an error, abnormal vulnerability to viruses...
191 Interview of Mady Delvaux, op. cit.
193 The example of the self-piloted car and the black-box contained in it is explained infra.
Thirdly, this option is preferred because the PLD is a good directive known for being beneficial for consumers. For the moment, it is the one preferred by the Commission that does not want to change things for the moment. It should be noted that the Commission is assessing the PLD nowadays to see whether it could totally apply to robots and AI.

Fourthly, the apportionment of liability between the producer and the programmer usually is trivial because the two subjects usually coincide. Otherwise their relationship may be regulated pursuant to a contract and the car manufacturer could seek an indemnity from the software programmer on this basis. Moreover, the manufacturer of the car is best positioned than the program designer to control risks and balance the benefits and costs of the technologies. He uses the AI and has intimate knowledge of the relevant technologies. In the car accident of 2016 referred to in the introduction, Google was directly able to identify the cause of the problem. Moreover, the car manufacturer “controls” the system, including all component parts. He is also the one to avert the expected accident costs at the lowest cost, so it is even economically good. Of course, as it was stated, he can after seeking an indemnity from the software programmer on the basis of contractual liability.

Practical applications

To try to have a better understanding of what could happen on the ground, the example of the self-driving car can be taken. Different scenarios might arise. First of all, if it is the driver error, the normal rules on liability would apply. Second, it the driver relies on the automated system and there is a failure of the system, a black box integrated in the system might explain it and the manufacturer might be responsible. This is the situation that falls directly into the scope of the PLD. The third situation is the most complicated: if the driver realises that due to the conditions the situation exceeds the cognition and conditions of the

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196 Interview of Mady Delvaux, op. cit.

198 A. BERTOLINI, « Robots as Products... », op. cit., p. 236.
199 In the case of autonomous cars: H. EIDENMUELLER, op. cit., p. 8.
201 H. EIDENMUELLER, ibidem, p. 9.
203 Negligence would apply at MS level, meaning that if the driver fails to exercise due care he could be liable.
204 J. ELLROTT et al., op. cit.
205 The car owner/driver will therefore look to others (manufacturer of the car or any component part) for recovery of losses.
automated system and require manual control, he should also be responsible according to a new German law \(^{206}\) but that is not what the EP wants \(^{207}\). If the black box system works well, it will help to allocate fault and liability telling whether the driver or the system was in charge of the driving, whether the system prompted the driver to take back control and whether any technical malfunctions occurred \(^{208}\). In Germany, the driver will anyway be liable towards the victim, which is criticised \(^{209}\). The PLD could be sufficient. In these cases, even if the driver should have taken the manual control of the car, the manufacturer would be liable under the PLD. Therefore, in absence of a new legislation, it should be evaluated whether the accident is due to the carelessness of the driver or because of an error or a shortcoming in the system \(^{210}\). Rules will overlap to cover that particular kind of robot since it is still demanded for every car to have a driver in it \(^{211}\) and because grey zones still exist.

What is more, to prove that a product is defective as written in art. 6 of the PLD for AV will mean very intense expectations since safe design is of utmost importance in this case \(^{212}\). Indeed, even a careful design of automated driving systems cannot fully eliminate the unreliability of the software. However, regardless of this inherent problem an owner and driver of a car is entitled to expect a safe product and can consequently hold the vehicle's manufacturer responsible for an accident caused due to a software malfunction or bug in the system \(^{213}\). The information given is also important because the user must know precisely what is expected of him. However, the manufacturer cannot anticipate all possible scenarios the self-driving vehicle will encounter and instruct the user accordingly, especially for a technology as complex. Uncertainty is added if cars are self-learning. So, while the manufacturer will try to design the car and instruct the user in a way that minimises the risk of an accident, a high risk of liability will remain \(^{214}\).

\(^{206}\) J. ELLROTT et al., op. cit.
\(^{207}\) Interview of Mady Delvaux, op. cit. It could also be considered to be a design defect if the warning for the driver to take his wheel back is considered not sufficiently timely (A. BERTOLINI, « Insurance … », op. cit., p. 305)!
\(^{208}\) J. ELLROTT et al., op. cit.
\(^{209}\) Interview of Mady Delvaux, op. cit.
\(^{213}\) M. F. LOHMANN, ibidem, p. 337. The manufacturer can minimise his liability by satisfying state of the art when designing his product and monitoring it by regular software updates and bug fixes.
\(^{214}\) M. F. LOHMANN, ibidem, p. 338.
It should be noted that for current tests (that are happening in the US, but also in Asian and even European countries\textsuperscript{215}), liability relies only on manufacturers\textsuperscript{216}. Of course, it is more difficult to assess who will be liable when self-driving cars will be allowed to circulate on public roads\textsuperscript{217} and no reported decisions involving self-piloted cars were found as of May 2017\textsuperscript{218}. Nevertheless, Volvo declared that it will take full responsibility for accidents caused by its self-driving cars\textsuperscript{219}. Full self-piloted could facilitate the answer since the responsibility on the manufacturer would seem normal. Therefore, there is a come back to a well-established idea: the higher the level of automation, the higher the expected shift in liability from users/drivers to manufacturers is\textsuperscript{220} since the (mis)conduct of the driver will no longer be a relevant accident cause\textsuperscript{221}.

The current PLD, while imperfect, is probably totally compatible with AV as they will be safer than human-driven vehicles. Therefore, decisions will shift from drivers to automated systems and so, almost all the crashes that will occur will implicate the PLD\textsuperscript{222}. The producers “will bear a bigger slice of a smaller pie of total crash costs”\textsuperscript{223}. The latest case of possible defect can be found in the Tempe crash of March. It was revealed that the cause of the accident could be caused by a “false positive”. AV software has the ability to ignore those false positives or object in its path that would not actually be a problem for the vehicle such as plastic bags floating over a road\textsuperscript{224}.

\begin{quote}
\textsuperscript{215} DIRECTORATE-GENERAL FOR INTERNAL POLICIES – EP, Research for TRAN Committee – Self-piloted cars ..., op. cit., pp. 56-59. Even in Belgium some tests were conducted!
\textsuperscript{216} DIRECTORATE-GENERAL FOR INTERNAL POLICIES – EP, Research for TRAN Committee – Self-piloted cars ..., ibidem, p. 81.
\textsuperscript{217} DIRECTORATE-GENERAL FOR INTERNAL POLICIES – EP, Research for TRAN Committee – Self-piloted cars ..., ibidem, p. 81
\textsuperscript{218} Even in the USA: A. ROSENBERG, op. cit., p. 222.
\textsuperscript{219} DIRECTORATE-GENERAL FOR INTERNAL POLICIES – EP, Research for TRAN Committee – Self-piloted cars ..., op. cit., p. 81. On the reverse, Tesla said that the driver should maintain responsibility.
\textsuperscript{220} DIRECTORATE-GENERAL FOR INTERNAL POLICIES – EP, Research for TRAN Committee – Self-piloted cars ..., ibidem, p. 81 ; Interview of Mady Delvaux, op. cit.
\textsuperscript{221} M. F. LOHMANN, op. cit., p. 337.
\textsuperscript{223} B. W. SMITH, « Automated… », ibidem, pp. 2, 31 and 32 ; K. COLONNA, op. cit., p. 130 ; D. G. GIFFORD, « Technological Triggers to Tort Revolutions: Steam Locomotives, Autonomous Vehicles, and Accident Compensation », Journal of Tort Law, 2017, p. 67. Nonetheless, the severity of injuries is likely to be greater especially for cars because they will drive faster and closer to each other’s). For a simple picture of this concept of “bigger slice of a smaller pie”, see: Annex, diagrams 8 and 8’.
\end{quote}
For the Da Vinci, the basis to assess the PLD are the cases on the subject\(^\text{225}\). It has proven very difficult to make products liability claims stick in these cases. A case that comes back in a lot of contributions is the infamous US case: *Mracek v. Bryn Mawr Hospital*\(^\text{226}\). In this case, a patient had his prostate removed by a Da Vinci but suffered several harsh complications after because the system experience technical problems during the surgery. Indeed, Da Vinci displayed error messages during the operation and stopped taking commands from the human operator. Mracek sued the hospital and Intuitive Surgical\(^\text{227}\). Summary judgement was granted in favour of the defendant because there was no sufficient evidence saying that Da Vinci was to blame. The court said that the plaintiff had to establish more than just a causal link between the robot’s unplanned behaviour and the harm suffered. In light of Da Vinci error message and disobedience, the plaintiff said that it was obvious but the court disagreed, even though the plaintiff gave evidence that the product was defective, that the defect caused the injury and existed at the time the product left the manufacturer’s control\(^\text{228}\). This case here highlights that the robot is still considered as a product; it is not an autonomous agent\(^\text{229}\). It also proves that courts are open to use product liability regime in cases of liability of robots due to malfunctioning. However, this example is not relevant to hold that all cases would lead to the same outcome as the Da Vinci is a particular kind of robot, even not considered by a lot of scholars as a robot, and because the final outcome results in no compensation for the victim. Though, if we were to apply this regime in the EU, it would be possible to find a good balance by developing techniques and tools for tracking liabilities through complex causal chains involving intelligent systems to identify the real human agency behind AI\(^\text{230}\). Establishing the boundaries of liability for the different levels of automation is not expected to be a black and white process and the EU should provide clear guidance on it\(^\text{231}\).

Moreover, it was held that healthcare is one of the areas in which robotic technology and the issues of liability linked to it exist are already sufficiently dealt with by the existing legal

\(^{225}\) By 2012, more than 3000 claims had been submitted against the Da Vinci in the USA (S. Dyrkolbotn, *op. cit.*, p. 120).


\(^{227}\) The company producing Da Vinci.

\(^{228}\) E. Datteri, *op. cit.*, p. 156.

\(^{229}\) S. Dyrkolbotn, *op. cit.*, p. 121.

\(^{230}\) S. Dyrkolbotn, *ibidem*, p. 132. By the way, the claim about surgical team negligence was also rejected (E. Datteri, *op. cit.*, p. 156).

\(^{231}\) DIRECTORATE-GENERAL FOR INTERNAL POLICIES – EP, Research for TRAN Committee – Self-piloted cars ..., *op. cit.*, p. 81. In my opinion, to ensure legal certainty and facilitate everyone work, the liability should still lie on the driver as explained *supra* but not for the last level of automation because it is still the driver’s choice to activate the autonomous mode. For other robots, it is different since it is the producer’s or designer’s choice to allow the robot its freedoms and abilities and therefore they should always be liable, not the users (even when they have abilities to learn).
framework being the PLD\textsuperscript{232}. So, in this area, PLD is used but the criticism goes against the outcome the PLD will give for the consumers\textsuperscript{233}.

§3 – \textit{Intermediate Conclusion}

Robotic applications fall within the boundaries of diverse law regimes that qualify them as products, machinery, medical devices and so on and thus, regulate them\textsuperscript{234}. The analysis done \textit{supra} as well as the legal and personal opinion of numerous scholars leads to the conclusion that the PLD is maybe not the ideal framework to solve all the robot liability problems but could still be applicable in a large number of cases\textsuperscript{235}. The ECJ might have to interpret some provisions in the light of the new technologies, but this framework could be sufficient. Anyway, totally autonomous robots do not exist yet therefore this only last claim can be swept away.

The PLD could have enough elasticity that could accommodate most of the problems arising from the introduction of robots in our society\textsuperscript{236}. At the EU level, this solution still seems coherent. It seems that keeping the PLD that compensates all harm is more important than the possible influence on the harmful outcome that users could have.

The foreseeability\textsuperscript{237} is not a sufficient argument to abandon the PLD since, except almost totally autonomous robots, behaviours are never truly unforeseeable since a robot performs a program, even when it leaves a wide variety of choices and alternatives and is therefore still following the instruction it was given\textsuperscript{238}. Consequently, potential harm would always be foreseeable and designers or robots have to internalise the costs of their business choices. The producer will be bound to conceive a safety device to prevent or reduce the risks\textsuperscript{239}.

However, theses regimes may not be exhaustive and not be able to cover or properly solve new legal issues robots will bring about\textsuperscript{240}. The malfunctioning problems due to defects can be handled with it as well as some producers’ errors qualified as defects leading to a

\textsuperscript{233} See: \textit{infra}.
\textsuperscript{234} E. PALMERINI, « Towards… », \textit{op. cit.}, p. 58.
\textsuperscript{235} H. EIDENMUELLER, \textit{op. cit.}, p. 8.
\textsuperscript{236} A. BERTOLINI, « Robots as Products… », \textit{op. cit.}, p. 238.
\textsuperscript{237} See: \textit{infra}.
\textsuperscript{238} A. BERTOLINI, « Robots as Products… », \textit{op. cit.}, p. 240.
\textsuperscript{239} A. BERTOLINI, « Robots as Products… », \textit{ibidem}, p. 240; ibidem, p. 240.
\textsuperscript{240} E. PALMERINI, « Towards… », \textit{op. cit.}, p. 58.
malfunctioning. Nevertheless, several problems were pointed out. In the Mracek case for example, the plaintiff alleged that the hospital negligently performed the surgery. Even if by suing the manufacturer, he implies that a functioning robot would have performed the surgery better than the human doctors. The problem is that humans may still have a duty of care to avoid accidents, even after delegating some of the operation to a robot. Therefore, not all the problems can be handled by the directive. That is why we can already say that there will have an overlapping of legislation.

This is the reason why the next chapter analyses possible alternatives to the current legal framework. A first insight is that it will be difficult to apply some of those legal theories to truly autonomous robots. Another insight is that some innovative theories seem totally appropriate and will concur with the PLD such as the compulsory insurance to cover product liability.

**CHAPTER III – ALTERNATIVE AND INNOVATIVE THEORIES**

« Insurance is a fundamental tool to enable technology transfer from research to the market and the creation of a new industry. » - A. Bertolini et al.

Vivacious discussions about the need for other rules emerged and are still ongoing. While some authors may be inclined to use traditional tort theories to robots, other authors create new theories – some going outside the tort law sphere – or mix different theories. Interestingly, the new EP Report (“Report with recommendations to the Commission on Civil Law Rules on Robotics from the Committee on Legal Affairs of the European Parliament of January 27 2017”) juxtaposes strict liability and risk management approaches. In this chapter, traditional tort theories will be quickly reminded and assessed (Section I). Then, the new risk-management approach will be described, as well as the insurance mechanism (Section II). Subsequently, the very controversial idea of an e-personality for robots will be
discussed (Section III). Lastly, other interesting theories will be mentioned (Section IV). This overview will allow the author to make a personal assessment and common to a conclusion\textsuperscript{246}.

**SECTION I – TRADITIONAL TORT THEORIES**

As stated in the introduction, tort law exists since the beginning of the 19\textsuperscript{th} century in Europe but changed to adapt itself to socio-economic news such as cars, mass distribution and so on. Therefore, a scalable interpretation of the basic laws were developed as well as the appearance of new laws\textsuperscript{247}. Primarily based on the concept of “fault”, tort law departed from it. Robots and AI are a new challenge for tort law and the following section deals with this, reviewing quickly: liability for fault or negligence (§1), vicarious liability and its derivatives (§2). The PLD and the general strict liability regime will not be recalled.

**§1 – NEGLIGENCE AND LIABILITY FOR FAULT**

In this regime, fault is the generating element of the compensation rights. In Belgium and in France, fault finds its origin in any fact of the man. It can result from the violation of a standard of conduct, an act, an omission and this standard of conduct can come from a legal rule or the general requirement for prudence\textsuperscript{248}.

The problem with that regime is that it is linked too much with the human behaviour\textsuperscript{249}. It applies to the “fact of man” as there is a subjective component to the fault needing a subject with discernment. The general requirement for prudence is also based on the “*bonus pater familia*”, directly linked to the human person\textsuperscript{250}. So, even if robots and AI have to some extent autonomy, autonomy does not equal conscience\textsuperscript{251}. The autonomy of robots is purely technical and makes them take decisions on the basis of algorithms. Therefore, it is not the same as a human\textsuperscript{252}.

\textsuperscript{246} See: *infra*.
\textsuperscript{247} H. JACQUEMENT and J.-B. HUBIN, *op. cit.*, pp. 112 and 113.
\textsuperscript{250} A person is negligent if he or she does something that a reasonably careful person would not do in the same situation or fails to do something that a reasonably careful person would do in the same situation (C.E.A. KARNOW, *op. cit.*, p. 62).
\textsuperscript{251} See: section on e-personality *infra*.
Nevertheless, even if this theory cannot apply to the robot itself, it could expose the user of the robot if he uses the machine in a wrong way. First, if the user intentionally makes a wrongful act. Second, robot users will follow licit goal but an error or malfunctioning could occur. To evaluate if a fault appeared, the most important thing is to determinate to which extent technology supplemented the intervention capacity of the user. In any cases, user can only see his responsibility engaged if he breaches the general requirement for prudence by not being vigilant enough or by not stopping the use of the robot. Even there, it still cannot be asked to users to control their robots all the time.

The damage must also be predictable. Prediction is central here. It can be said that use a robot is a fault, but that would totally prevent innovation. The central legal fight over the scope of negligence liability concerns whether the actual bad results were foreseeable or whether having done something that foreseeably could result in some sort of harm, one might be liable for any and all harm that resulted. For some authors this liability regime is not good enough for the victims and not good enough for the user/consumer of the robot.

§2 – Vicarious Liability

Some scholars tried to attribute the robot/AI liability to the driver and/or the producer thanks to this theory. It should be noted that this theory can be seen as a general one and/or one overseeing different subcategories of it. Indeed, in France, vicarious liability is a general principle, whereas in Belgium vicarious liability only applies to specific cases established in the Belgian civil code.

The believers of this theory think that this is a conservative alternative until real autonomous robots emerge. First, it could be possible to apply the second scenario of art. 1384 to AI

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253 H. JACQUEMENT and J.-B. HUBIN, op. cit., p. 117.
254 For example, if the driver of a self-driving car programs it to drive too fast or if the Da Vinci is used to hurt someone.
255 H. JACQUEMENT and J.-B. HUBIN, op. cit., p. 117.
256 H. JACQUEMENT and J.-B. HUBIN, ibidem, p. 117.
257 C.E.A. KARNOW, op. cit., p. 63.
259 C.E.A. KARNOW, op. cit., p. 64.
264 Art. 1384 al. 3 Belgian civil code.
and robots, especially to humanoid robots. In this article, there is an irrefutable presumption of responsibility for masters and principles for faults committed by their subordinate or agent.

Here again the notion of fault plays an important role because it is the agent fault that justifies the principle liability. Moreover, the same downward apply being the fact that the notion of fault is linked too to the human activity/behaviour. In conclusion, in Belgian law at least, this regime cannot apply. A solution could maybe be found if the notion of fault is replaced by the notion of an act objectively illicit but there are still too many doubts to say it would apply to robot acts.

A vicarious theory applied more often is the liability for damages caused by animals. Based on art. 1385 of the Belgian civil code, there is an irrefutable presumption that the owner of an animal is responsible for the damages caused by him. It is not asked that the animal has an abnormal or unpredictable behaviour. The control over the animal can be in fact or legal but there is a need for a concrete and direct surveillance over the animal.

In Belgian law, this article only applies to animals in their essence and so, not to robots that take the form of animals. Nevertheless, it is interesting because the owner liability can be engaged no matter what. For example, if the behaviour is abnormal or not, unpredictable or not (which will generally be the case for learning robots). This also opens the debate to know whether robots could be assimilated to animals. Indeed, robots are often compared to domesticated animals but it is often said that the reasons for such a claim are not convincing.

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266 H. JACQUEMENT and J.-B. HUBIN, ibidem, p. 120.
267 See: supra.
268 H. JACQUEMENT and J.-B. HUBIN, op. cit., p. 120.
269 In French law, this is part of liability for the actions of things but not in Belgium.
270 H. JACQUEMENT and J.-B. HUBIN, op. cit., p. 121.
274 A. Bertolini, « Robots as Products... », op. cit., p. 227. Even if both act autonomously, to some extent, are dangerous, also to some extent, and cannot (yet) hold property, the unpredictability is not the same. As explained supra, the so-called unpredictability of the robot comes from the software and executes the programs incorporated in it, whereas animals have their own character (A. Bertolini, « Robots as Products... », ibidem, pp. 227-231).
Finally, the liability of art. 1384 al.1 of the French and Belgian civil code is a strict liability regime for the guardian of something. In this regime, if the victim proves the existence of damage linked to the defect of something under someone’s custody, the latter will irrefutably be responsible without a fault even if he didn’t know the defect. This article applies to all tangible objects, so to robots and not AI as it is intangible. Nevertheless, this is debated as some argue that it could be applied to intangible objects.

Two defects could affect the robot: a material defect or an immaterial one, affecting the algorithms influencing the robot. This regime is better than the two others because a robot is something that does not need to be assimilated to an animal or a human, with which he does not have enough similarities.

In this regime, the defect is now analysed under a functional point of view and the object becomes vicious when it does not answer the safety requirements to which the prudent and diligent man would expect. This notion resembles to the defect of the product liability regime. For some authors, it is even more adapted than PLD and makes it easier to conclude in liability for the keeper of the object.

Again here, the same question about the unpredictability of the robot may apply as well as the difficulty to prove the defect. The counter-argument is the same as for the PLD: robots, having a black box, could permit lawyers to rely on reliable information to explain the origin of the dysfunction.

**SECTION II – RISK-MANAGEMENT AND INSURANCE**

The second “innovative” solution to the liability of robots proposed by the New EP Report is the risk management (§1), mainly achieved by insurance (§2).

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276 H. JACQUEMENT and J.-B. HUBIN, ibidem, p. 123.
277 Except if, the interpretation supra on the applicability of the PLD to software could be applied here.
281 H. JACQUEMENT and J.-B. HUBIN, ibidem, p. 126.
283 H. JACQUEMENT and J.-B. HUBIN, ibidem, p. 126.
§1 – MANAGE RISKS

The notion mentioned here is the risk-generating or risk-management approach, meaning that parties are held liable if they either generate a major risk of harm for others or they are best placed to minimise or avoid such risks. It does not require to find negligence but only the ability “to minimise risks and deal with the negative impacts”. It does not focus on the person “who acted negligently” as individually liable but on the person able to minimise risks and deal with negative impacts.

The major problem is that there is no case law on the topic. Moreover, there are no statistics neither data that could help create a good management or insurance framework.

An interesting point to make here is that if there is a switch from identifying the subject of the fault to place the burden on the party best suited to manage risks and pay for the costs, it also entails that “no-fault plans and absolute liability rules” should be used, as well as “duties to insure against first or third party risks”. In light of all the considerations already mentioned, the best place person is the robot manufacturer.

§2 – HOW TO MANAGE RISKS: THE (COMPULSORY) INSURANCE

The legal risk of being called to compensate damages is typically dealt by insurance contracts. Insurance is “a contract aimed at shielding the insured party from the adverse economic consequences of a future and possible risk, should that risk materialise. The risk can be of any type, depending on a negligent behaviour of the insured, or of third parties, causing harm to the same party entering the contract (…) or to others (…)”. The insurer pays the insured against a premium which is a function of the risk and varies according to different variants. Of course, this will be a difficult task that some insurance companies will start to

285 G. Wagner, op. cit., slide 3.
286 G. Wagner, op. cit., slide 3.
289 A. Bertolini, « Insurance … », op. cit., p. 293; Interview of Mady Delvaux, op. cit.
293 According to the likelihood of occurrence of the risk and the severity of the consequences that may arise (A. Bertolini, « Insurance … », ibidem, p. 294).
do294. However, the more varied the task and the more interactions with the men, the harder it is to identify the risks of it295. The chosen liability law should therefore be supplemented by a concept of insurance. To allow it to exist, registration and classification of autonomous systems according to their risk potential are also needed296. Indeed, they help identify risky systems297.

The purpose of compulsory insurance is already an established instrument in many different areas: users of machines, keepers of animals, lawyers and architects, but not yet manufacturers of machines298. These insurances aim at safeguarding the compensation for the benefit of injured parties and deal with the problem of insufficient solvency of the party causing the damage299. Since there are solvency risks in the case of operators of autonomous systems, it seems that this simple syllogism can be resolved by implementing a new compulsory insurance for robot manufacturers.

The choice of the manufacturer as the central person to take an insurance seems the most appropriate. It is also what is proposed by the EP Report300. Indeed, according to us, if the manufacturer is the one that is liable and does not have the financial resources to compensate the victims, the insurer will take over the responsibility. It would be fairer for the victims. This is even a goal clearly stated in the EP Report that “the future legislative instrument should in no way restrict the type or the extent of the damages which may be recovered, nor should it limit the forms of compensation which may be offered (…)”301. Users, or at least frequent users, of robots should also have the choice to take a facultative insurance.

Consequently, voluntary or mandatory insurance scheme could overlap with a liability regime above mentioned or cited infra. Indeed, the EP Report and the New EP Report ask the

294 In Greece, for example, CityMobil2 car is insured by a private Greek insurance company for civil liability (G.-A. BALLAS and T.-J. KONSTANTAKOPOULOS, « 7. Greece Chapter », Comparative handbook: robotic technologies law, Brussels, Larcier, 2016, p. 166).
297 G. BORGES, New liability..., ibidem, slide 24 ; see: infra.
298 G. BORGES, New liability..., ibidem, slide 21.
299 G. BORGES, New liability..., ibidem, slide 22.
300 COMMITTEE ON LEGAL AFFAIRS OF THE EUROPEAN PARLIAMENT, Report..., 2015/2103(INL), op. cit., p. 11.
Commission to consider establishing “a compulsory insurance scheme” as it is already the case with cars but it should take all potential responsibilities in the chain into account.\textsuperscript{302}

\textbf{SECTION III – THE E-PERSONALITY OF ROBOTS}

The most innovative alternative to the PLD or traditional tort theories is the creation of new \textit{ad hoc} rules and of an e-personality for robots. This solution will only be quickly explained since it is harshly criticised and, while it was mentioned in the EP Report\textsuperscript{303}, the New EP Report abandoned it one year after. Nevertheless, some authors believe in it.\textsuperscript{304}

This “revolutionary” idea that caused rivers of ink to flow in a multitude of legal papers consists on giving a legal personhood to (certain) robots and AI.\textsuperscript{305} Therefore, robots might own assets, from which damages could then be sought.

First of all, it is criticised because it is creating a new category of individuals and an electronic person contains too many incongruities. As already said, there is no reason and no need to assimilate robots with humans. Moreover, robots have no conscience\textsuperscript{306} and this new category would only be conducted by a need for pragmatism and certainty.\textsuperscript{307} Even if the legal personhood, legal fiction, was given to corporations, it is because humans are still behind it. Moreover, if we give legal personality to robots but that in the end we give responsibility to the humans behind the technology when it comes to blame, it does not make sense.\textsuperscript{308} Even if there could be a liability capping, it is not even the most effective compensation mechanism.\textsuperscript{309} Moreover, too many ethical discussions would appear.\textsuperscript{310}

\textsuperscript{302} COMMITTEE ON LEGAL AFFAIRS OF THE EUROPEAN PARLIAMENT, Report..., A8-0005/2017, op. cit., p. 17.

\textsuperscript{303} COMMITTEE ON LEGAL AFFAIRS OF THE EUROPEAN PARLIAMENT, Report..., 2015/2103(INL), op.cit., p. 12.


\textsuperscript{305} S. DYRKOLBOTN, op. cit., p. 125.

\textsuperscript{306} DIRECTORATE-GENERAL FOR INTERNAL POLICIES – EP, European Civil Law Rules..., op. cit., pp. 14 and 15. Indeed, Next to the distinction between strong and weak autonomy, another distinction seems to exist: weak and strong “conscience”.\textsuperscript{306} A strong conscience would allow the machine to be aware of its own intelligence and this machine could “feel” authentic feelings (A. BENSOUSSAN and J. BENSOUSSAN, Droit des robots, Bruxelles, Larcier, 2015, p. 2).


\textsuperscript{308} DIRECTORATE-GENERAL FOR INTERNAL POLICIES – EP, European Civil Law Rules..., op. cit., p. 15.

\textsuperscript{309} DIRECTORATE-GENERAL FOR INTERNAL POLICIES – EP, European Civil Law Rules..., ibidem, p. 15 ; A. BERTOLINI, « Robots as Products... », op. cit., p. 242. But it would not really change who bear the costs and when liability must be borne.

\textsuperscript{310} DIRECTORATE-GENERAL FOR INTERNAL POLICIES – EP, European Civil Law Rules..., ibidem, p. 15. Indeed, (too) many papers the e-personality focus on the so-called problem of giving not only duties but rights to robots.
The majority of scholars agree that EP must resist calls to establish a legal personality based on science fiction\(^{311}\). However, that could be the next natural step if robots acquire the real strong autonomy as defined by Bertolini and start having free will\(^{312}\).

**SECTION IV – OTHER THEORIES**

Other theories are interesting to mention, either because they are new such as the immunity of all stakeholders (§2) and the licensing of robots (§3) or because they could overlap and supplement other liability regimes (§1).

**§1 – THE CREATION OF A FUND**

The creation of a fund guarantees the compensation of damage where there is no insurance cover and the possible advantages of this would be that every gap in liability could be avoided, that this system can be made up of many different sources and that it would no longer be necessary to prove the requirements needed to establish liability\(^{313}\). This would answer the criticism that it is not normal to put almost all liability on the manufacturer and that risks of autonomous robots are risks to society as a whole by a communitisation of the risks\(^{314}\). Indeed, damages are costs of the transformation process towards a Digital Society and since everybody will “enjoy” it, these funds are ethical and philosophically suitable.

Nevertheless, the New Report calls for the creation of a fund that would supplement the insurances and not for the creation of a fund alone that would centralise all the liability problems\(^{315}\). Indeed, this fund should only be a means of last resort and should only apply in cases of problems with insurances, people having no insurance but holding a robot (as it unfortunately exists for cars) and so on\(^{316}\). As Borges said, it cannot be a “convincing solution” that is over or displaces civil law liability\(^{317}\). Indeed, it could diminish the steering effect of liability. Moreover, administering a fund is difficult (the more money and effectiveness you need, the more it will be) and the rules to govern it are hard.


\(^{312}\) See: Annex, diagram 9.

\(^{313}\) G. BORGES, *New liability…*, op. cit., slides 29 and 30.


\(^{316}\) Contrary to what has been suggested in the (first) EP Report where it was proposed to create a fund that would also allow various financial operations in the interests of robots.

\(^{317}\) G. BORGES, *New liability…*, op. cit., slide 32.
Of course, many advantages come from it: it avoids chilling effects, reward society through the development/use of autonomous systems, and does not burden injured parties with the cost of the transformation process and closes gaps in liability\textsuperscript{318}.

\section*{§2 – THE IMMUNITY OF THE MANUFACTURER}

In the first and second chapters, we referred to the distinction between open and closed robots as well as to the fact that open robots may be more problematic. Indeed, closed systems manufacturers are able to better foresee the risks associated with their technologies and to provide product warnings in order to limit their liability\textsuperscript{319}. This is not the case for open-robot manufacturers\textsuperscript{320}.

Calo argues in favour of providing selective immunity to manufacturers and distributors of open robots\textsuperscript{321}. Such immunity would prevent end users and others injured parties from obtaining redress from open-robots manufacturers and distributors where “it is clear that the robot was under the control of a consumer, a third-party software, or otherwise the result of end-user modification”\textsuperscript{322}. An insurance market for owners of robots, similar to those available to automobile drivers should be needed. Hence, the idea of the insurance comes back.

The architecture of closed robots limits the scope and scale of the harmful application because, for example, it is not uneasy to foresee that left alone a vacuum cleaner iRobot can injure pets and thus, there is a warning in the safety manual. So while foreseeability is a relatively straightforward matter in the case of closed robotics, it is not possible given the architecture of open robotics, the defining feature of which is open functionality. Closed-robot manufacturers are exposed to lower liability risks than those who develop open systems. Finally, because closed robot manufacturers can foresee potential harms associated with the use of their robots, they are better able to limit liability by providing warnings to end users. However, this risk-management tool is not available to makers of open robots, as the architecture of these systems does not restrict the applications or operating environments in which the robots may be used.

\begin{thebibliography}{9}
\bibitem{318} G. BORGES, New liability..., \textit{op. cit.}, slide 33.
\bibitem{319} R. CALO, « Open Robotics », \textit{op. cit.}, p. 103.
\bibitem{320} R. CALO, « Open Robotics », \textit{ibidem}, p. 103.
\bibitem{321} D. M. COOPER, \textit{op. cit.}, p. 165.
\bibitem{322} R. CALO, « Open Robotics », \textit{op. cit.}, p. 136.
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Thus, to overcome this barrier of the liability risks associated with open robots, Calo proposes to grant selective immunity to manufacturers of open robots and creating an insurance market for robot owners. He does not want a drastic approach by avoiding all immunity since blanket immunity removes the incentive to manufacture safe systems. So immunity would only apply in those instances where it is clear that the robot was under the control of the consumer, a third-party software, or otherwise the result of end-user modification.

Moreover, Calo proposes incentivising users of open robots to obtain insurance to compensate victims for the harms that manufacturers are immunised from. He says that level of insurance depends on the nature of the robot being insured. Second, it is important to consider what the consumer intends to use the robot for. If it is for dangerous activities, users should purchase substantial insurance coverage while those taking it for companionship, don’t.

§3 – LICENSING ROBOTS

This chapter makes the case for adopting a licensing approach to allocate liability between manufacturers and users and to promote ethical and no harmful use of open robots.

The proposed licence prescribes obligations and restrictions on downstream use of the technology and allocates liability between upstream and downstream parties, and it incorporates the requirement for robot owners to obtain insurance. Violation of licence terms renders downstream parties liable to upstream channels for breach of contract and IP infringement. The licence includes two things: conditions (things the licence must do to be permitted to use the robot) and covenants (things the licence promises it will not do in relation to the robot).

The licence will expressly prohibit end users from using or modifying the underlying technology to function as a weapon. There is also a restriction on the development of robot

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325 D. M. COOPER, op. cit., p. 169.
326 R. CALO, « Open Robotics », op. cit., pp. 138 and 139. Calo also says that for example small entertainment robots need minimal insurance while large robot with autonomous functioning (security robots that patrol a parking lot need greater coverage).
327 D. M. COOPER, op. cit., p. 168.
328 D. M. COOPER, ibidem, p. 170.
self-defence capabilities\textsuperscript{331}. The licence also takes a cautionary approach by prohibiting the use or modification of robots in a manner that conceals their machine-like nature\textsuperscript{332}.

In conclusion, it is obvious that there are plenty of different theories that could be applied to liability of robots. First of all, more traditional ones but that are challenged by an insurmountable objection: liability rules are based on the human persons but robots “too” autonomous. On the other hand, very new and innovative ideas but some are coming totally out of the blue, they could be not that efficient and need more reflexion. A final long personal assessment will be made in the last chapter of this thesis.

**CHAPTER IV – PERSONAL ASSESSMENT**

« (...) it should be the manufacturer who is liable, because he is best placed to limit the damage and deal with providers. »\textsuperscript{333} - M. Delvaux

In this chapter, I will give my own assessment after having analysed the main features of the present and future possible legal framework to adequately assess liability of robots in cases of error or malfunctioning. First some non-legal considerations must be mentioned and taken into account (Section I). Then a brief overview and summary of the main theories will be given (Section II). Finally, I will give my point of view (Section III).

**SECTION I – ECONOMIC AND ETHICAL CONSIDERATIONS**

While the legal logic is an integral component of the reasons to adopt a specific theory, other considerations play a role in the decision-making process of the EU legislator.

The most important one is (un)fortunately the economic (and political) consideration. Indeed, some say that there are no rules that govern robot actions, at least under EU law\textsuperscript{334}. On the other hand, many others say that there are already too many laws hampering the development of robotics that « we can and should similarly immunise robotics manufacturers for many of

\begin{footnotesize}
\begin{itemize}
\item[332] D. M. COOPER, *ibidem*, pp. 175 and 176. That could cause problems when the robot is too much anthropomorphised.
\item[334] C. LEROUX et al., *op. cit.*, p. 7.
\end{itemize}
\end{footnotesize}
the uses for which their products are put. The Commission is also scared to make businesses less innovative by drafting more severe legislation. It was mentioned several times that most of the liability regimes would have a “chilling effect” on innovation and that high damages award could reduce corporations’ willingness to develop new (and riskier) technologies. Ironically, even though automated cars are deemed safer overall than manually driven cars, the manufacturer's liability exposure will likely be greater and that might be detrimental to innovation.

Be that as it may, manufacturers would maybe a bigger part of a smaller pie, it does not mean that it would in the end result in more costs for them. Moreover, only excessive liability would have that outcome, in my opinion. My opinion is supported by a study in Economic Law where an illustrative model to assess the link between liability and innovation seems more complex than the simple “liability chills innovation” argument. Features on the liability system, such as the allocation of risk between producers and consumers and the level of centralisation in regulation might impact innovation, especially of robots. Other facts such as market structure also play a role to determine if liability stifles innovation.

Moreover, ethical (philosophical and, again, political) considerations can also be taken into account. A basic problem linked to the economic one is to know who should be protected the most. Consumer protection or innovation? In addition, applying the PLD to harms caused by complex technologies can result in between what the law delivers and what people regard as justice as in the Mracek case and can turn into a de facto defence against this liability regime.

Other numerous ethical concerns mainly arise in the e-personality debate. Indeed, if a legal personhood is given to robots, should they have only duties or also rights? What about their consent? Should they have a minimum capital such as corporations have minimum share

336 Interview of Mady Delvaux, op. cit.
337 M. F. Lohmann, op. cit., p. 338. Indeed, it projected that there will be fewer accidents with AV. Moreover, Watson robots are right nine times out of ten while humans only seven.
338 See : Annex, diagrams 10 and 10'.
341 S. Dyrrkolbotn, ibidem, p. 120. By 2012, more than 3000 claims had been submitted against the Da Vinci in the USA.
capital? Some questions are even going further such as to known whether people could have a right to marry their robot. So many unanswered questions that would have an impact on the potential e-person of the robot.

SECTION II – MAIN SCHOLAR CONCLUSIONS

Throughout the text, it is clear that prominent scholars and EU institutions have different points of view on what would be the best applicable liability regime. A quick summary would help the reader memory.

First of all, the opinion is very divided among scholars to decide what is better between a general and a sector-by-sector approach. Some say that the latter is more appropriate, depending on the type and intensity of risk that is associated with the use of AI\(^\text{343}\). There is already a fragmentation of certain regulations (Proposal for the drones, EPRS on AV and so on). Nevertheless, there are more authors taking a general approach for the liability issue. On the reverse (safety) standards are mainly sectorial\(^\text{344}\).

Traditional tort theories lead to very different conclusions depending on which one is focused on. A lot of authors agree that negligence is not a high enough standard\(^\text{345}\). Indeed, prove the fault of the manufacturer would be a very difficult exercise. Nonetheless, liability for fault and negligence can still be used in clear-cut situations where the user/driver clearly made a fault.

The view on the general strict liability regime is the most interesting one. Indeed, several persons – among which the EP – argue that this regime should be applied\(^\text{346}\). Indeed, Wagner feels that “to the extent that a finding of product defect runs into difficulties with a view to IoT devices, the obvious solution would be to move to true strict liability – for any damage caused by a product (subject to the contributory negligence defence)”\(^\text{347}\) doing away with the requirement of product defect and this difficult notion of defectiveness of the PLD. In my opinion, this regime would facilitate recovery of damages for the victim and avoid lengthy debates but could be seen as unfair for producers if they followed all safety standards and could not foresee the damage. In my opinion, again, it would not be a fair balance between all

\(^{343}\) J. P. BORGHETTI, op. cit., slide 13.
\(^{344}\) See : supra.
\(^{345}\) A. ROSENBERG, op. cit., p. 206.
\(^{346}\) A. ROSENBERG, ibidem, p. 206.
\(^{347}\) G. WAGNER, op. cit., slide 14.
stakeholders’ interests. Moreover, a new legislation would be needed to put write down clearly the strict liability that would apply with robot liability. For Borghetti, a general strict liability regime applying to all types of robots and AI, regardless of the dangers they created and not resting on defectiveness seems neither realistic nor desirable.\footnote{J. P. Borghetti, \textit{op. cit.}, slide 13.}

The PLD has its supporters and opponents as extensively demonstrated \textit{supra} but has the enormous advantage of being the only complete legal framework already existing at the EU level. There are still challenges and discussion to have. For example, in the USA, some States exempt from the responsibility the manufacturers of the cars except if they install the non-embedded technology or the defect comes from the car directly independently of this technology\footnote{A. Bensoussan and J. Bensoussan, \textit{« 3. La personnalité robot »}, \textit{op. cit.}, p. 48.}. Of course, this could also be understood as always leading to the car manufacturer because it is often him that will install the technology.

Among the new theories, the e-personality theory seems to come way too early. Although some scholars support it, many admit that it is too prospective and would not be applicable to the majority of robots (as understood in this thesis). Regarding the licensing of robots, this theory is not yet well developed, relies on another categorisation of robots (closed and open robots and would only apply to one specific category of it (open robots). Concerning immunity of producers, this theory would be the favourite one of the businesses. Supported by the “unforeseeability of robots’ behaviour” argument, this seems to be an extreme solution. Moreover, all the robot liability victims cannot rely only on insurance. It would take too much time to administer and to implement. The same drawback applies to the fund idea.

Risk management on the reverse is a newer theory but with a bright future. Indeed, it works \textit{ex ante} and not \textit{ex post} as all the other theories. It undoubtedly makes the manufacturer the central actor. In my opinion, this theory is not sustainable alone. It is also complicated to set up since the outcome is not guaranteed with this theory. Indeed, as long as you did what you needed to do, you are good. Second, there is not enough data to establish what should be the “state of the art”, to draw the limit of a good risk management.

Other authors consider mix of regimes or persons liable. Indeed, Koch proposes to adopt for all robots the current “co-existence liability regimes for (traditional) motor vehicles – strict
liability of the car’s keepers and of its producer” because of the good reasons of this duality. Others mix a liability regime and an insurance regime or a fund.

SECTION III – PERSONAL POINT OF VIEW

As far as I am concerned, a suitable legal framework should allow fairness, the guarantee that all victims will be sufficiently compensated, reducing injuries and incentivising innovation.

Therefore the solution that seems the most adapted is to keep the PLD but with some “fine-tuning” and updating. De lege ferenda, this system should be supplemented with some “risk management” being a compulsory insurance that each and every robot and AI producer should pay. Moreover, insurance should be supplemented by a fund as a means of last resort.

The PLD should only be fine-tuning and not forcefully stressed too far by forcefully adapting it to all needs of the age of robotics. There is no need to reshape the entire liability legal framework. The choice to keep applying this regulation is plural. First of all, I am from the opinion that we are still in a transitional period of robotic technology where some human supervision over the machine (leading to apply liability for fault in case of a mistake from the error) and lots of unknown factors (strict liability would be too harsh for producers). At the same time, robots are not yet totally autonomous (leading to the impossibility to conclude that producers should have immunity), most of them still are “tools” since their learning capacity and autonomy is very limited. Moreover, there is not yet case law neither the Commission assessment pointing out the salient problems of the PLD. Also, the pleading for no need of a new framework can be compared with the “law of the horse” critique. A law of the robots is as much needed as a law of the horse, meaning that they do not deserve special rules. They can still be handled by the current framework and there should not be any robot exceptionalism. On the other hand, to choose and interpret the current framework is not that easy.

Therefore this mix of product liability, insurance and fund is a balance between legal certainty and effectiveness, consumer protection and innovation, innovative theories and good old ones.

352 B. A. KOCH, *op. cit.*, slide 16.
The biggest fear of the PLD to be become a critical barrier to the market entry of new robots and innovation because it would disincentivise manufacturers and affect production decisions cannot be a loophole for allowing too extreme and lenient theories such as immunity of manufacturers.

In my opinion, the PLD should be clarified on certain points. When there is damage caused by a robot caused by a defect, there could be only one person liable. Indeed, it is important for the consumer to know against whom to take action. Almost all the time it is the manufacturer that will be responsible, meaning the one that put into circulation the good. There is a consensus to say that the “crucial actor” in the field of harm caused by robots is the manufacturer. Of course, after, this manufacturer could pursue remedies against the software manufacturer or the one (user usually) participating in its learning process. It could also possibly sue the user if he really made an error. So I join the idea of different scholars stating that there will be an overlapping of regimes and people liable. I disagree with the fact that people (so users, consumers and so on) exercising effectively and often theoretically control over the robot should be responsible if the dysfunction is linked to the functions for which the robot is employed. As for the proof, thanks to the “black-box” concept, the burden of the proof will be easier and could eventually be dealt by the manufacturer alone.

Then, all manufacturers should have a compulsory insurance (third-party insurance) to be sure to be able to cover all the costs because they are the pivotal actor from the perspective of deterrence and risk management. Indeed, insurance is a fundamental tool and will become an important tool to enable technology transfer from research to the market.

Moreover, a fund should be created. In my opinion, it could take the form of the Belgian common guarantee fund. It would therefore be used as a means of last resort and not as a primary solution to liability problems.

The liability operative event should be a deviation of behaviour from a security standard to which the public can legitimately rely. And this would be based on the level of

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357 H. JACQUEMENT and J.-B. HUBIN, op. cit., p. 140.
360 H. JACQUEMENT and J.-B. HUBIN, op. cit., p. 140.
information received by the consumer. Therefore, the notion of defect is very important and the safety standards should be developed! There is still too little importance given to it. Therefore, the notion of defect is very important and the safety standards should be developed! There is still too little importance given to it.  

Concerning other theories, I agree with the fact that the discussion on the legal personhood of robots does not have to disappear but the focus should be on the actual problems being that robots still are objects and not legal subject. Near future technologies could change it but it is still too prospective.

The theory giving immunity to manufacturers seems to me too extreme, not the most efficient and do not give an accurate picture of who is supposed to pay attention in the manufacturing process. Of course, it is not that fantasist to imagine that most of the robots will become more and more unpredictable and that it will be harder to foresee the damages they could cause.

Concerning the very interesting and loved strict liability idea, the problem with this argument is that even if the manufacturer controls driving behaviours and is the best placed to control the more parameters possible, it still only indirectly controls driving behaviour by programming and creating the car. It should be noted that for a clear example of misuse or abuse of the robots, negligence liability is sufficient. But usually the user will be powerless and it will not be its fault.

Finally, concerning the New EP Report, I think that it is to be praised because it rightfully puts into question the current framework. Nevertheless, I only partially agree with it. I think that the EP should resolve the internal dispute and choose for a solution. On the other hand, the idea of the insurance complemented by a fund seems perfect. Moreover, in my opinion, the statement that nothing should limit damage and compensation should be put in the preamble of the PLD and of different safety standard regulation to become an interpretative guide for the judge while deciding liability and allocating compensation. The so-called unpredictability of the robots’ behaviour should not allow the liable person to be exempted neither to pay the victims.

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361 As pointed out by C. Amato in her presentation: C. AMATO, op. cit.
364 G. WAGNER, op. cit., slide 16.
CONCLUSION

«The European Union must create an actionable framework for innovative and reliable AI and Robotics to spur even greater benefits for the European peoples and its common market.» 365 - 150 European signatories of the Open Letter to the European Commission

In conclusion, new technologies influence laws but what is even more important for lawyers is that new technologies will influence innovation. Moreover, the way they are dealt with will influence technology and their insertion in the EU market366. Therefore, a well-balanced regime should be found to be sure that victims will be properly compensated, that consumers will buy a lot of robots and that injuries – and the severity of injuries – will decrease, on the one hand, and, on the other hand, that businesses keep innovating and placing new products on the EU market.

The multiplicity of possible uses and scenarios in which robots could be deployed make it a difficult task to have a clear-cut solution and issues are not only legal but economic and scientific at the same time. To insure legal certainty, after a reviewing of an almost exhaustive part of the literature on the topic and with conviction, I think that the PLD supplemented by a compulsory insurance mechanism for producers – supplemented by a fund – is the best legal mix and the best solution.

The reasons for this choice were stated supra. Of course, other alternatives might have other advantages (but also other disadvantages) and not all the scholars agree but this solution seems to be most natural. Uncertainty is structural in all areas of law and I am sure the consequences of technology on liability law is still at a very early stage.

Future case law as well as new technologies and business lobbies will show us the path to the EU law to apply. Nevertheless, nowadays by staying realistic we can say that the PLD still has fine days ahead.

The insurance companies now will have a lot of work to do to create different kinds of robots’ categories and premiums. The EU also needs to create a new legislation to incentivise the MS to create new insurances and a fund at the EU level or MS level. These technical discussions will also emerge more and more in the future.

366 N. NEVEJANS, Traité de droit et d’éthique de la robotique civile, Bordeaux, LEH éditions, 2017, p. 15.
Nowadays, the so-called “Robolaw” might not exist and lawyers might be scared to be replaced by them, but the profession still have lots of opportunities and legal thinking in the (not yet) field of robotic law. There is no doubt that one day lawyers and robo-lawyers will work hand in hand to answer more and more complicated and technical (robots) liability issues and find more comprehensive solutions to it.
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III. INTERVIEW AND OTHERS

III. Interview of Mady Delvaux, Member of the S&D Group at the European Parliament and Rapporteur for the Draft Report above mentioned (015/2103(INL), achieved Wednesday 28 February 2018.

III. PowerPoints of the presentations at the Münster Colloquia on EU Law and the Digital Economy: Liability for Robotics and in the Internet of Things held the 12 and 13 April 2018 in Münster (see: https://www.jura.uni-muenster.de/de/fakultaet/fakultaetsnahe-einrichtungen/centrum-fuer-europaeisches-privatrecht/flyer-digital-iv/ for the outline) and kindly sent by Mrs Karen Schulenberg the 9 May 2018 (The mail containing the slides can be transferred to the promoter and the second reader).

The following PowerPoints presentations were consulted:

- BORGHETTI (J. P.), Is defectiveness an appropriate notion to deal with damage associated with the IoT or artificial intelligence?, Munster – slides of the lecture, 12 April 2018.
- SPINDLER (G.), User liability and strict liability in the Internet of Things and for robots, Munster – slides of the lecture, 12 April 2018.
- WAGNER (G.), Robot liability, Munster – slides of the lecture, 12 April 2018.
- ZECH (H.), Liability for autonomous systems: Tackling specific risks of modern IT, Munster – slides of the lecture, 13 April 2018.
ANNEX: DIAGRAMS AND CHARTS

Diagram 1

- The Nature of the Law
  - Legal Concepts
  - Legal Reasoning
- Philosophy of Law
- Law as Meta-Technology
  - Criminal Law
  - Contracts
  - Tort Law
  - (...)
- The Legal Challenges of Robotics

Fig. 1.2 A philosophy of law for lawyers and a work in positive law for philosophers

Diagram 2

Autonomous systems and damage as part of our daily lives

USA: States with Enacted Autonomous Vehicle Legislation

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368 G. Borges, New liability..., op. cit., slide 8.
**Diagram 3**

**ARGUMENTS IN SUPPORT FOR REGULATION IN LINE WITH CONCERNS OF RESPONDENTS**

*Please indicate to what extent you feel concerned about the following issues*

<table>
<thead>
<tr>
<th>Issue</th>
<th>Strongly concerned</th>
<th>I am neutral</th>
<th>Concerned</th>
<th>Not concerned at all</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Protection</td>
<td>51%</td>
<td>34%</td>
<td>8%</td>
<td>6%</td>
</tr>
<tr>
<td>Values and principles</td>
<td>51%</td>
<td>30%</td>
<td>9%</td>
<td>10%</td>
</tr>
<tr>
<td>Liability rules</td>
<td>35%</td>
<td>39%</td>
<td>19%</td>
<td>6%</td>
</tr>
<tr>
<td>EU competitiveness</td>
<td>29%</td>
<td>37%</td>
<td>22%</td>
<td>8%</td>
</tr>
<tr>
<td>Physical safety</td>
<td>26%</td>
<td>38%</td>
<td>22%</td>
<td>11%</td>
</tr>
<tr>
<td>Intellectual Property</td>
<td>17%</td>
<td>27%</td>
<td>27%</td>
<td>24%</td>
</tr>
</tbody>
</table>

| EPRS | 11 |

**Diagram 4**

**Figure 12 – Adaptation de la structure des cabinets d’avocats**

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**Diagrams 5 and 5**

**MAJORITY PREFERENCES SUPRA-NATIONAL REGULATION**

Generally speaking, do you think it is necessary to regulate developments in the robotics and AI area? – *yes answers only*

- 96%: "At least very soon at EU level. Of course it is also necessary at international level, but it will take more time and the moral standards will be lower."
  - Bulgarian, male (25-39 yr)
- 4%: "As AI has no residency or nationality, question cannot be solved using pure national or EU law, it’s a supra national issue"
  - French, female (15-24 yr)
- "EU level regulations will be the most effective way to standardize robotics at an international level."
  - Italian, male (25-39 yr)
- "Chaque peuple doit pouvoir souverainement choisir ce qui est éthiquement bon pour lui. En l'égardant de manière centrale, l'Europe outrepuisse les droits que lui ont conféré ces peuples"
  - French, female (40-54 yr)

**SEVERAL ARGUMENTS IN SUPPORT FOR REGULATION AT EU-LEVEL**

- Protection of EU values (especially data protection, privacy, ethics)
- Global competitiveness of EU
- EU should be standard setter, first mover at international level
- Avoid race to the bottom and promote fair competition within internal market
- EU faster and more efficient to regulate vs. individual Member States or vs. international level
- Better enforcement of regulation

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371 EPRS (EUROPEAN PARLIAMENTARY RESEARCH SERVICE), *Public consultation ...*, op. cit., slide 9 and 10.

Diagrams 8 and 8'\textsuperscript{374}

Figure 9

Crashes without automation \rightarrow \text{Product failure} \rightarrow \text{Crashes with automation?}

Figure 14

Product liability \rightarrow \text{Crash costs without automation} \rightarrow \text{Crash costs with automation?}

\textsuperscript{374} B. W. SMITH, « Automated... », op. cit., pp. 32 and 54.
Diagram 9

Figure 11. Combinaison des droits

Droit des humains
Référentiels éthiques et culturels
Liberté
Droit des biens

Diagrams 10 and 10

Figure 16

Lack of automation as the defect

Product liability without automation  Product liability with automation?

Figure 17

Product liability without automation  Product liability with automation?

Picture p. 76

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