

# Chapter 1

## Caught Between Technophilia and Technophobia: Culture, Technology and the Law

New technologies change the world and make people react. When a new technology<sup>1</sup> emerges and starts to spread – if you look at cultural history – it is both welcomed as visionary and feared as a threat to culture.<sup>2</sup> Is this justified? Does technology really shape culture and society? Or is it actually the other way around: does technological development depend on the culture, politics and economics of a society? This either/or controversy has now more or less been settled. There are close mutual influences between technological and cultural developments within society.<sup>3</sup> It is only once a certain level of cultural development has been reached, that certain technological processes which lead to innovations are enabled. And vice versa: developments in technology influence the politics, economics and culture of a society. What does this recognition mean for the law? As an important part of culture, the law is involved in this mutual influencing – simultaneously as both a subject and an object. It influences technological developments and at the same time is itself shaped by them.

### 1.1 Interaction – Technology and Culture

There are multiple inter-dependencies between technology and culture. Technology occurs in a cultural context and is shaped by the culture. And vice versa: culture develops within a specific technological environment. Of course technology also has an impact on the culture of a society.

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<sup>1</sup> On the concept of technology from a sociological point of view Rammert (2006), P. 15 ff.; 47 ff. inter alia and from a philosophical perspective Rapp (1994), P. 19 ff.

<sup>2</sup> Schefe (2000), P. 234 f., and Ropohl (2003), P. 12 ff., who warns against both exaggerated *technophilia* as well as unfounded *technophobia*. Detailed and thorough on assessment and acceptance of technology Ropohl (2003), P. 59 ff., and Eigner/Kruse (2001), P. 101 ff.

<sup>3</sup> At length also Thompson/Selle (2000), P. 155 ff. inter alia.

### 1.1.1 *Technology: The Product of Culture?*

One frontier that technological advance fundamentally cannot cross is the laws of nature.<sup>4</sup> But that is not the only boundary faced by technology. Technology does not exist in a vacuum. Technological and technical progress are embedded in political, social and cultural contexts.<sup>5</sup> Because technology is created by creative social activity.<sup>6</sup> Scientific and technological developments are promoted or held back by certain cultural, economic and political parameters. That is one of the reasons why innovative technologies are able to develop sooner and better in certain regions of the world than in other.<sup>7</sup> *Silicon Valley* is the best-known example of this. The technical state of development of a society – its technology – is largely a result of its culture.<sup>8</sup>

The influence of the state, culture and society on technical development can be frequently observed in cultural and technical history. A striking example: around 1400 China was the most technically advanced civilisation in the world.<sup>9</sup> This development, however, did not – as in Europe – lead to industrialisation. Roughly from the start of the Renaissance onwards technical progress slowed down and finally came to a halt.<sup>10</sup> Why? The only plausible explanation is to look at the interaction of society and technology. In the final analysis the decisive factor was the over-bureaucratic state, which stifled scientific and technological progress.<sup>11</sup> A similar phenomenon can be observed in Japan in the sixteenth and seventeenth centuries. In 1543 firearms reached Japan and revolutionised military technology.<sup>12</sup> From about 1607 Japan began, for cultural and political reasons,<sup>13</sup> to deliberately reject this advanced military technology.<sup>14</sup> The Japanese military returned to using their traditional weapons – swords and lances – and to the old battle strategies. It was only in the mid-nineteenth century that fire-arms made a comeback in Japan thanks to the military influence of the British. This shows the (potential) strength of a culture: for centuries, culture and law were able to not only block (military) technical progress, but even to turn back the clock. The huge technological development in Japan since the end of the nineteenth century has also been the result of political and cultural influences. It was a deliberate and strategic national policy that made

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<sup>4</sup> Rapp (1994), P. 72. Somewhat differently Ropohl (1999a), P. 58 f. inter alia, who stresses that technology also means overcoming the constraints of natural laws.

<sup>5</sup> Dicken (1998), P. 146.

<sup>6</sup> Rammert (2006), P. 11 inter alia.

<sup>7</sup> On this Dicken (1998), P. 172 ff. inter alia.

<sup>8</sup> Argued very strongly by *social constructivism*. At length on this Rammert (2006), P. 24 ff. inter alia.

<sup>9</sup> Mokyr (1990), P. 209 ff. outlines China's extremely advanced technology at that time.

<sup>10</sup> Mokyr (1990), P. 218 f.

<sup>11</sup> This is the seminal statement by Mokyr (1990), P. 232 ff.

<sup>12</sup> Perrin (1996), P. 20 ff.

<sup>13</sup> On the reasons in detail Perrin (1996), P. 60 ff.

<sup>14</sup> In detail on this development Perrin (1996), P. 96 ff.

Japan one of the leading industrial states in the world.<sup>15</sup> Equally, in the development of Germany as an industrial state since the late eighteenth century the state's influence in encouraging innovation played a major role.<sup>16</sup> The state created new industries and accelerated technical development, not least through an educational policy which promoted technical skills.<sup>17</sup> Nuclear energy was another state initiative and was developed and pushed forward using considerable state funding.<sup>18</sup>

To put it in a nutshell: state intervention has had a formative influence, visible today, on the development of engineering and technology.<sup>19</sup> On the one hand, the state supports specific technical development using various instruments and strategies, quite often at great cost.<sup>20</sup> An equally impressive but problematic example of this is military technology, which is often subsidised by states in the early stages of technical development for reasons of national security.<sup>21</sup> As cynical as it may sound: security policy very often equals support for research and technology. At the same time, however, the state can hold back technological progress for a wide variety of political motives. In recent times the subsidy policy has moved up from national level to the European level: supporting or holding back technological development is an important policy area of the European Community.<sup>22</sup>

Not just the state and the law, but the economy also helps to shape technology. Economic parameters play a major role in technological advance and technical developments. This is something that both *Karl Marx* and *Max Weber* agreed on.<sup>23</sup> Technical development also depends on market demand for goods and services.<sup>24</sup> Industrial research in particular, which is an important driver for technical development, is subject to the logic of economics and is therefore very sensitive to economic influences. And finally, a further factor which can scarcely be over-estimated in the development of technology is the dominant philosophy of a society.<sup>25</sup> Just one forceful example of this: *And you shall have dominion over the Earth*<sup>26</sup> – This Judeo-Christian maxim engenders a particular attitude towards nature and encourages the development of specialist technologies.<sup>27</sup>

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<sup>15</sup> Castells (2001), P. 11 ff.

<sup>16</sup> Radkau (2008), P. 113 ff.

<sup>17</sup> Details on this from Radkau (2008), P. 117 f.

<sup>18</sup> At length on this Radkau (2008), P. 355 ff.

<sup>19</sup> Mayntz (2001), P. 13 ff. inter alia; Rammert (2006), P. 25 f.

<sup>20</sup> In detail on the opportunities and boundaries of state promotion of technologies Hilpert (2001), P. 74 ff. With empirical material.

<sup>21</sup> On the detail Rammert disagrees (2006), P. 26, believing that the influence of the state and the military on technological development is over-stated. Empirical examples to support this theory are, however, not provided.

<sup>22</sup> In detail on European research and technology policies Grande (2001), P. 368 ff.

<sup>23</sup> Very tendentiously on this Rammert (2006), P. 25.

<sup>24</sup> At length and sophisticatedly Mayntz (2001), P. 11 ff.

<sup>25</sup> Rammert (2006), P. 26 f.

<sup>26</sup> Genesis 1, 28.

<sup>27</sup> Very critically White (1967), P. 1203 ff. However justified the basic criticism may be: its global nature and single causality are definitely exaggerated.

So social, political, economic and cultural parameters all have a major influence on the development of technology. But this does not mean that technological advance is *solely* exogenously induced.<sup>28</sup> Endogenous factors play an equally major role – factors which arise out of technology itself and its own (development) logic.<sup>29</sup> New technologies also arise – more or less broadly – due to autonomous conditions, which are barely influenced by society.<sup>30</sup> Cognition and invention are primarily driven endogenously and are scarcely influenced by exogenous factors.<sup>31</sup> What scientists, engineers and technicians think in universities and research laboratories is on the whole not very dependent on cultural and social factors. But that changes in the later stages of technical development: innovation, diffusion and application of a new technology are more sensitive to exogenous influences.<sup>32</sup>

### 1.1.2 *Culture: The Product of Technology?*

Saying that the State and culture both influence technology is, however, still not the whole story. The relationship between technology and culture is not one-sided, but a two-way affair.<sup>33</sup> Technology is a core component of culture.<sup>34</sup> The two are linked by a web of causes and effects.<sup>35</sup> Because the technological and scientific circumstances of an age also shape its social structure and culture.<sup>36</sup> These interactions are, however, very complex so that it is often unclear who influenced whom and how.<sup>37</sup>

Technology as such – it is often said – is neutral. It is not the technology, but people who decide whether a knife is a key domestic tool – or a dangerous

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<sup>28</sup> But Heilbroner sees it differently (1994a), P. 71 f., seeing technical progress as primarily exogenous, driven by the economy.

<sup>29</sup> At length on the complex origins of technology Ropohl (1999), P. 296 ff.

<sup>30</sup> Roßnagel (1993), P. 67.

<sup>31</sup> Roßnagel (1993), P. 68 f., who does concede that even in these phases of technology external influences (can) exist.

<sup>32</sup> Roßnagel (1993), P. 70 ff.

<sup>33</sup> Thompson/Selle are very emphatic (2000), P. 156, talking of a “mesh of society and technology”. Unlike technological determinism, which stresses – too – one-sidedly the dependence of culture on technological advance. One spokesman for this is Ellul (1965), P. 79 ff. Norris is critical (2001), P. 106.

<sup>34</sup> Rammert (2006), P. 12 ff. Shows how naturally – and often largely unnoticed – technology forms a part of (everyday) culture.

<sup>35</sup> Roßnagel (1993), P. 75. And also Rosa (2005), P. 243 ff., who explains this using the example of acceleration.

<sup>36</sup> Strange (1996), P. 7 ff.; Nye (2001), P. 1 f.; Spur (2001), P. 45; Rosa (2005), P. 247.

<sup>37</sup> Rosa illustrates this (2005), P. 243 ff. This complexity is not found in strict technological determinism, which stresses the one-sided influence of technology on culture. A prominent defender of this approach is Ellul (1965), P. 133 f. and *passim*.

weapon. Is this assumption really true? Of course not. Technology is not neutral.<sup>38</sup> Even an approach which looks only at the technology shows how incorrect this assumption is. At most, only technically simple tools are neutral. The more the technology is specialised, the less neutral it becomes. The clearest examples of this are highly specialised weapon systems or sophisticated medical technologies, which are tailored exclusively to a very specific – so not the least bit neutral – function.<sup>39</sup> If you view technology in a wider context, that clearly refutes the theory of neutrality. Technology both influences and changes infrastructures and logistics systems.<sup>40</sup> Nor can social neutrality be asserted. Technology plays an important role in modern daily life, which it also (helps to) shape significantly.<sup>41</sup> Society is extensively technified.<sup>42</sup> But technology's influence is even greater than this and reaches further than just the present: technological innovations are also significant drivers for social change.<sup>43</sup> They create permanent change in the world we live in and reshape how people lead their lives in a lasting way.<sup>44</sup> New technologies enable or simplify new, often unpredictable,<sup>45</sup> social activities, products<sup>46</sup>, processes and organisations in all areas of society.<sup>47</sup> Technology influences social behaviour and social processes, although with varying intensity and to different degrees.<sup>48</sup>

But the impact of engineering and technology on culture goes deeper still: technical innovations influence the way of thinking and the collective view of the world

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<sup>38</sup> Roßnagel (1993), P. 78. For criticism of the neutrality theory of technology in detail see Rapp (1994), P. 68 ff.

<sup>39</sup> Rapp (1994), P. 68.

<sup>40</sup> Rapp (1994), P. 68 f. Thoroughly on the influence of technology on the economy and economic order see Ellul (1965), P. 149 ff.

<sup>41</sup> Stehr (2000), P. 85.

<sup>42</sup> For a thorough and detailed view of the technification of society see Ropohl (1999), P. 183 ff.

<sup>43</sup> Roßnagel (1993), P. 75; Mainzer (1995), P. 511, using the example of computers. Rapp (1994), P. 69, stresses correctly that you cannot talk about the social neutrality of technology. Eriksen (2001), P. 38 ff., notably illustrates this with the example of the mechanical clock, whose invention not only introduced time *measurement* but also time *awareness*, and changed the structures of society, thought and actions.

<sup>44</sup> Spur (2001), P. 45. In detail about the impact of technology on lifestyle Eigner/Kruse (2001), P. 98 ff.

<sup>45</sup> Eriksen (2001), P. 22, 74 ff., and Dommering (2006), P. 5 f. *inter alia*, who discusses concretely in this context the unexpected “revenge effects” of innovative technology.

<sup>46</sup> In detail on the effects of technological advance on products and their lifecycle, Dicken (1998), P. 161 ff.

<sup>47</sup> Similarly Dicken (1998), P. 145, although specifically related to economics. The impact of new technology on social organisation is shown by White (1968), P. 32 ff. using a small but telling example: The invention of the stirrup in the 7<sup>th</sup> Century revolutionised war techniques, organisation of fighting units and the social strata of society. Similarly wide-ranging impacts came from developments to the plough in the early Middle Ages. See White (1968), P. 39 ff.

<sup>48</sup> Rammert (2006), P. 23 f.

of an age, as well as individuals' feelings and thoughts.<sup>49</sup> Telephones, automobiles, airplanes, antibiotics and contraceptives to name but a few, have initiated far-reaching processes of change in our culture and have clearly changed both social structures and societal behaviour.<sup>50</sup> That is equally true of the stock-market ticker, which made the modern financial markets possible and which tore up and reshaped economic thought in many areas.<sup>51</sup> Current examples through which we can trace the power of technology to change cultures are the new information and communication technologies<sup>52</sup> and increasingly, bio-technology. The modified role of the nation state within the international system is barely comprehensible unless you take into account the cross-border nature of digital IC-Technologies.<sup>53</sup>

The power of technology to shape society can be seen clearly through the example of media technologies. Cultural anthropology and media theory can demonstrate that the media influence society, and quite often shape it. The pithy saying: "The Medium is the Message" from the Canadian media researcher Marshall McLuhan<sup>54</sup> has become famous: it is not the content of the media which matters, what is far more important is the existence and form of the medium itself. The very existence of the medium causes widespread cultural, social and personal repercussions. Starting from this – empirically proven – assumption, you can divide cultural history into different cultural eras, each decisively shaped by their dominant communication media.<sup>55</sup> To show this using a banal, but obvious example: the medium of television has, by its very existence, changed social behaviour, social relations and communications – quite independent of whatever the content of an individual television programme might happen to be.

So should we conclude: technology drives everything; there are no other alternatives?<sup>56</sup> Is technology the "prime mover", which all other developments in society,

<sup>49</sup> Mainzer (1995), P. 514 f. inter alia. On the social and cultural effects of new communication media in detail see Grunwald and others (2006), P. 47 ff.

<sup>50</sup> Friedman (2002), P. 501. Dicken (1998), P. 145, describes technology clearly as the "great growling engine of change". Similarly Roßnagel (1993), P. 75, who sees technical innovations as "perhaps the most important drivers of social change". A very illuminating example of this is given by Eriksen (2001), P. 23: The later, very aphoristic and very terse style of *Friedrich Nietzsche* is often said to derive from the fact that in his later days Nietzsche used the newly invented "writing machine" (typewriter).

<sup>51</sup> Preda (2006), P. 110 ff.

<sup>52</sup> A notable example of the unexpected repercussions of IC-Technology is given by Dommering (2006), P. 6. On the cultural effects of computers see Mainzer (1995), P. 511 ff. inter alia. On the political effects of the "Information revolution" see Nye (2001), P. 8 ff. inter alia. Early on Weizenbaum (1976), P. 337 ff., was warning about the "imperialism of machine understanding", whose driver is the advances in computer technology.

<sup>53</sup> In detail see Boehme-Neßler (2009), P. 175 ff.

<sup>54</sup> McLuhan (1992), P. 17.

<sup>55</sup> Seminal and extensive on this is Innis (1951), P. 3 ff. A clear example is given by Mainzer (1995), P. 513. How new technologies influence culture is outlined by Grunwald and others (2006), P. 47 ff. inter alia.

<sup>56</sup> Ellul argues strongly in this direction (1965), P. 133 f., and derives technical determinism from the autonomy of technology.

politics and economics have to follow?<sup>57</sup> Certainly not that either. The strong influence of technology on culture is not an argument for technological determinism.<sup>58</sup> Of course technology does not *determine* society.<sup>59</sup> Despite its very real power, technical progress does not automatically and inevitably change society. Despite all the technical factual constraints: there is room for manoeuvre by societal and political influences in the effect of new technologies.<sup>60</sup> For whatever – increasingly unpredictable<sup>61</sup> – effects technology may cause, will depend to a great extent on the usage that is made of it. Technology outcomes come – at least in part – from the ways in which technologies are implemented within the social and cultural environment.<sup>62</sup>

## 1.2 Technological Imperative or Transformational Power of Law?

It is not only between technology and culture that there are mutual influences. Because the law is an important part of any culture, there are of course also influences in both directions between technology and the law. Technology obviously has an impact on the law. Technical advances frequently bring considerable pressure to bear on the law to adjust. But this also applies the other way around. Of course the law influences technology and technological advance. The law is simultaneously an enabler and a limiting factor for technology. But can the law really steer technical developments in a certain direction or even with any accuracy? That is fairly doubtful.

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<sup>57</sup> Stated clearly by Ellul (1965), P. 133

<sup>58</sup> Roßnagel (1993), P. 75. Roßnagel (2005b), P. 27, refers to the fact that not every new technical advance actually has to be used. This is not totally unchallenged. Schelsky (1965), P. 453 ff. stresses the factual constraints of technology, to which everything else must yield. Eriksen (2001), P. 25 represents a moderate determinism. Similarly and earlier Heilbroner (1994), P. 54 ff. *inter alia*. On the phenomenon of factual constraints as such, Haar (2004), P. 139 ff.

<sup>59</sup> Castells (2001), P. 5, who regards the problem of technological determinism as a false problem.

<sup>60</sup> Very fundamentally on this see Roßnagel (1993), P. 267 ff., who correctly talks of the *reshaping capability* and *reshaping necessity* of technology via the law. But Schelsky sees it differently (1965), P. 455 ff., seeing the State as being compelled by technological factual constraints. He sees human actions playing only a minor role in technical-social developments. Ellul puts it even more strongly (1965), P. 133 ff. He regards technology as an autonomous power, which no human activity can now escape. Technology therefore determines everything, including the developments of society and culture.

<sup>61</sup> On the limited predictability of technical impacts using the example of media technology see Leib (1998), P. 88 *inter alia*.

<sup>62</sup> Beautifully concisely see Roßnagel (1993), P. 75 *inter alia*.

### 1.2.1 *The Standard-Setting Power of Technology. How Technology Changes the Law*

Technology is a major modernising factor. Technical innovations have a major *ability to change the world*.<sup>63</sup> Obviously technical progress also impacts the legal system, which is an important part of the culture.<sup>64</sup> Every major technical innovation leaves traces in the legal system of a society.<sup>65</sup> Direct and indirect effects can be distinguished here.<sup>66</sup> The *direct* effects are obvious: new technologies throw up new legal issues and create a need – real or assumed – for new regulation.<sup>67</sup> Often completely new areas of law may be created. Technical safety law started to develop around 1831 in Prussia – as a reaction to the use of steam engines and the beginnings of industrialisation.<sup>68</sup> A highly developed set of traffic laws only came into existence with the advent of the automobile.<sup>69</sup> And data protection laws have grown up as a reaction to the development and rapid advances in new technologies – information and communication technology.<sup>70</sup> How the ever smarter neuro-imaging technologies<sup>71</sup> will modify the law is so far only a subject of (justifiable) speculation.<sup>72</sup> Assuming that the possibilities it offers of visualising thoughts will not have any impact on the law is scarcely a tenable thesis.<sup>73</sup>

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<sup>63</sup> Roßnagel (2007a), P. 18.

<sup>64</sup> Friedman (2002), P. 501. On the close interplay between law, culture and economy even in earlier times from an anthropological viewpoint Trimborn (1950), P. 135 ff. and Schott (1970), P. 114 ff.

<sup>65</sup> Summers (1996), P. 66. Thoroughly on the technical consequences for society and law Roßnagel (1993), P. 74 ff. What consequences technology has on the organisation and form of the state is shown by Ellul (1965), P. 229 ff. with striking historical examples. This alone shows the theory of the neutrality of technology is wrong. On this thoroughly Rapp (1994), P. 68 ff.

<sup>66</sup> Friedman (2002), P. 502, introduces this distinction.

<sup>67</sup> A current burning issue is neuro-imaging which creates new legal issues, which are only just beginning to become evident today. On this Hüsing/Jäncke/Tag (2006), P. 195 ff. Other instructive examples from recent and current legal history are quoted by Summers (1996), P. 66 and Berg (1985), P. 401 f.

<sup>68</sup> Berg (1985), P. 403, traces the beginning of technical safety laws back to a Prussian Cabinet Decree in January 1831, which dealt with the safety of steam machines. Details on this from Kloepper (2002), P. 19 f.

<sup>69</sup> Friedman (2002), P. 502. Instructive in this context is how the whole environment has adapted to the automobile. An expression of this activity is the phrase *a car-friendly city*. At length on this Radkau (2008), P. 343 ff.

<sup>70</sup> Abel (2003), margin number 1 f. inter alia. The new imaging processes which enable brain scanning throw up critical data protection legal issues. At length on the whole problem area of data protection and neuro-imaging Hüsing/Jäncke/Tag (2006), P. 229 ff.

<sup>71</sup> A systematic overview of the state of research from Hüsing/Jäncke/Tag (2006), P. 27 ff. inter alia

<sup>72</sup> Seminal on this Mishler (2007), P. 26 ff. inter alia and Hüsing/Jäncke/Tag (2006), P. 195 ff.

<sup>73</sup> Although Mishler stresses (2007), P. 36 that in the near future it will not yet be possible to make people's thoughts and feelings visible using neuro-imaging.



Even more far-reaching and also more subtle are the *indirect* effects that technical innovations have on the law. Technical progress changes the way of thinking, the cultural references and social behaviour. That in turn impacts the legal approach<sup>74</sup> and totally disparate, apparently unlinked, parts of the legal system. A good basic example of this: written law throughout its long history has always been recorded on solid media: clay tablets, stone, bronze, wood, papyrus, parchment or paper. Changes in the “technology of the medium” have always also had an influence on the writing and therefore on the form of legal thinking.<sup>75</sup> Legal texts, for example, written in cuneiform on clay tablets, were of necessity short and to the point. The heavy and cumbersome tablets were not suitable for lengthy texts. The technological switch to papyrus made it possible to have longer texts – and so more complex laws.

A modern example: the invention of anti-biotics directly brought about changes in pharmaceutical law. In addition, the very existence of this group of medicines also changed the law on compensation for injuries and the concept of the social state.<sup>76</sup> Because medical advance had fundamentally changed the attitude of people towards their personal health and their expectations of the health system.<sup>77</sup> To demonstrate this using a case which caused a furore: to see a child as harm<sup>78</sup> resulting from ineffective contraception, is of course only possible if the use of contraception is normal, everyday practice. The invention of modern contraceptives has had equally wide-ranging effects in other areas. It has led to far-reaching changes in sexual morality in Western societies. That has eventually changed not just family law but also criminal law.<sup>79</sup>

The existence of a risk cannot be denied: technical power can represent a threat to the basic provisions and fundamental rights of the constitution. The development and application of technical systems can create pressure for change to which the law has to cede.<sup>80</sup> In a democracy that is highly problematic: because important decisions in this area should not be taken by technical imperatives, but by democratically legitimised parliaments.<sup>81</sup> Law and politics both need to be aware of the

<sup>74</sup> Highly critical on the impact of technology-oriented thinking on legal thinking Summers (1996), P. 72 f.

<sup>75</sup> At length on this Roßnagel (o. J.), P. 3 ff. with instructive examples.

<sup>76</sup> Friedman (2002), P. 503.

<sup>77</sup> Friedman (1989), P. 1584. Completely new, so far unresolved questions of law are currently being thrown up by advances in medical technology and gene technology. On this Roßnagel (2001), P. 197.

<sup>78</sup> On this group of problems BGHZ (German Court of Appeal Civil Division) 124, 128 ff.; BVerfGE (Federal Constitutional Court Rulings) 88, 203 (295 f., 358); Federal Constitutional Court, NJW 1998, 519 ff.

<sup>79</sup> Friedman (2002), P. 503.

<sup>80</sup> Roßnagel (1989), P. 10. Similarly and earlier Schelsky (1965), P. 453 ff., who speaks of the *Technological Imperative and Imperatives of a scientific-technical Civilisation*.

<sup>81</sup> BVerfGE (Federal Constitutional Court Rulings) 34, 165, 192 f.; 45, 400, 417 f.; 47, 46, 79 f.; standing jurisdiction. Roßnagel (1989), P. 14 stresses, that in practice this requires better information processes and an effective judgement of the consequences of technology.

problems of technical imperatives and not forget their respective roles in providing guidance and control. Because if law and politics do not provide control and guidance, then technology will rule itself.<sup>82</sup> But can the law and politics control and guide technology anyway?

### ***1.2.2 The Technical Force of Standard-Setting. How Laws Change Technology***

The relationship between the law and (technical) progress is ambivalent and never free of tension. On the one hand, the law is a great promoter of technical progress. Technical innovation is barely feasible without a legal framework and legal support. On the other hand, the law is often felt by engineers and technicians to be a barrier.<sup>83</sup> Correctly so: standards not infrequently attempt to control the technical process of innovation or even to prevent some innovations. In short: technical laws have two main purposes: enabling technology and limiting technology.<sup>84</sup>

The law is there to serve technical progress. It also has a function of *enabling* technology and technological progress.<sup>85</sup> The law frequently creates the conditions for technical progress. That is, of course, not a new aspect of the law. In about the nineteenth century the law unleashed social and economic forces on an unprecedented scale.<sup>86</sup> In 1810 Prussia introduced freedom of trade.<sup>87</sup> The old trade and guild privileges had gradually been removed since the late eighteenth century and replaced by official authorisations.<sup>88</sup> This revolution in technical law bore fruit:<sup>89</sup> fewer random decisions by administrations and more legal protection of rights. That made economic activity easier and drove fledgling industrialisation forwards. In this way the *legal enfranchisement* of the economy was an important pre-requisite for the amazingly rapid development of technology in Germany at that time.<sup>90</sup> Overall, the second half of the nineteenth century was characterised by legal liberalisation throughout Central Europe, which met the needs of their

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<sup>82</sup> Spinner (2002), P. 41 creates for this the useful phrase *defining force of technology*.

<sup>83</sup> Impressive examples from the early 20th century are given by Vec (2002), P. 117 ff.

<sup>84</sup> At length on this Kloepper (2002), P. 86 ff.

<sup>85</sup> Schmidt-Preuß (2002), P. 177 inter alia; Roßnagel (2001), P. 198; Summers (1996), P. 66 f.

<sup>86</sup> This development is outlined by Kloepper (2002), P. 57 ff. inter alia. And earlier, seminally and at length Landes (1969), P. 197 ff. inter alia.

<sup>87</sup> Kloepper (2002), P. 57 inter alia. On the meaning of this measure Landes (1969), P. 197.

<sup>88</sup> Kloepper (2002), P. 18 f. inter alia.

<sup>89</sup> So Kloepper believes (2002), P. 18.

<sup>90</sup> Kloepper (2002), P. 17.

rapidly developing industries.<sup>91</sup> In brief: the law opened up the way for industrialisation to occur.

But technology promotion by the law is not limited to liberalisation and breaking down bureaucratic barriers. Just as importantly: the law provides a reliable framework and ensures certainty for forward planning.<sup>92</sup> It protects technology and helps it to win social acceptance.<sup>93</sup> Liability legislation and legal safety requirements also work to enable technology – although they can potentially also work in the opposite direction, to limit it.<sup>94</sup> The same is true of patent law. It protects the inventor and provides certainty.<sup>95</sup> Overall the right to intellectual property is an important element controlling the speed of development or prevention of – technical and other – innovation. That can be stated in slogan form in the statement: no legal stability means no investment, no investment means no technology.<sup>96</sup>

But modern law can – and must – go much further. Modern industrial societies are subject to a permanent drive to modernise, and rely desperately on technical innovation.<sup>97</sup> This increases the demands on the law in its role as a *promoter of technology*. For the law, therefore, promoting technology also means actively putting in place incentives for creative and innovative behaviour. A whole slew of legal instruments exists for this, which are already being used – if hesitantly at first. Two fundamental strategies can be observed here. On the one hand, the law creates space for creativity and research initiatives. Expressions of this are fundamental rights such as freedom of research, freedom of choice of profession or job, and freedom to own goods.<sup>98</sup> Another example: the actual organisational form of the scientific establishment is a factor which can promote – or can hamper innovation and progress.<sup>99</sup> Quite frequently the law also actually creates a market which then economically drives the development of innovations. Current examples of this are telecommunications laws and environmental laws.<sup>100</sup> Simultaneously, it rewards innovation and protects technical innovations from legal risks.<sup>101</sup> That is done partly through patent law and product liability laws.

<sup>91</sup> Details on this Landes (1969), P. 197 ff., and *ibid*, P. 199, where he talks in summary of “reciprocal adaptation of the law and industrial capitalism”.

<sup>92</sup> Schmidt-Preuß (2002), P. 178.

<sup>93</sup> Schmidt-Preuß (2002), P. 180.

<sup>94</sup> Kloepper (2002), P. 83 *inter alia*.

<sup>95</sup> Hoffmann-Riem (2007), P. 389, who points out that patent law not only promotes innovation but also limits it.

<sup>96</sup> Schmidt-Preuß (2002), P. 180.

<sup>97</sup> Hoffmann-Riem (2007), P. 392.

<sup>98</sup> Roßnagel (2007a), P. 13.

<sup>99</sup> At length on the legal organisation with relation to innovation of the German scientific system Trute (1998), P. 216 ff. *inter alia*.

<sup>100</sup> Roßnagel (2007a), P. 14, who talks of “Market shaping by administration”.

<sup>101</sup> Roßnagel (2007a), P. 13 f.

The law as promoter of technology and innovation – does that describe its role fully? Definitely not. In a modern constitutional state, technology does not exist in a legal vacuum. It has to conform to constitutional principles<sup>102</sup> and it has to be socially acceptable. The law is required to control technology along these lines. It has to help to manage the risks and results of technical innovations.<sup>103</sup> That also includes, in specific cases, restricting technology. But is the law actually in a position to do so?

In the realm of controlling technology the law has to wrestle with two main obstacles. A law is created in the present. But it has to work not just in the present, but also in the future.<sup>104</sup> It has to be able to deal with uncertainty and unknowns. Because technology developments and their consequences are very difficult to forecast. The law is called upon to regulate technologies which do not even exist yet.<sup>105</sup> So some uncertainty always remains, on the basis of which the law has to develop regulations.<sup>106</sup> The second problem is the speed of technical innovation.<sup>107</sup> Technical innovation happens a lot more quickly than new legal rules.<sup>108</sup> The legislator (almost)<sup>109</sup> always is limping along behind the technical inventor and developer.<sup>110</sup> So they have to develop methods and instruments which enable them to keep pace with technical development.<sup>111</sup>

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<sup>102</sup> The concept of the constitutionality of technology was coined by Roßnagel (1984), P. 14 and he defined it more closely in numerous publications. On the necessity and the possibilities of shaping technology to fit with the constitution Roßnagel (1989a), P. 177 ff.

<sup>103</sup> Roßnagel (2007a), P. 16.

<sup>104</sup> On this problem area Appel (2004), P. 329 inter alia, who, ibid, P. 352 f. talks ominously of a *Futurisation of the law*.

<sup>105</sup> Roßnagel (2001), P. 206. Appel (2004), P. 330 ff. Shows that the key legal concept which the law uses to tackle this problem is that of prevention.

<sup>106</sup> Thoroughly on various methods for avoiding uncertainty, Appel (2004), P. 336 ff.

<sup>107</sup> Berg (1985), P. 401 inter alia.

<sup>108</sup> Spinner (2002), P. 15, stresses the “highly dynamic, accelerating development, which seems to be unstoppable.”

<sup>109</sup> The cause of this lies with the inner logic of technical creation. The first phases of technical development – cognition and invention – are scarcely or not at all – influenced by external factors, such as the law. At length on this Roßnagel (1993), P. 68 ff.

<sup>110</sup> Scherzberg (2002), P. 122 reduces this to the statement: the law is fundamentally always “catching up”. This problem is heightened by a recent development. Basic scientific concepts and issues and technological/practical applications are ever more tightly intertwined. The rate of technical innovation is increasing quite considerably – yet again - in the area of “technoscience”. On this Bora (2006), P. 32 inter alia. Vec (2002), P. 1133 talks in this context of a “cultural lag” in the theory of law, but explicitly excludes practice of law from his diagnosis of a time-lag.

<sup>111</sup> How difficult this is is explained by Bora (2006), P. 34 ff. Using the example of recent, participative procedures in technical assessment. Generally on this, how the law deals with unknowns, imprecision and uncertainty, Scherzberg (2002), P. 124 ff. inter alia.

That the law is not able to determine technological development in the classic cybernetic sense, is obvious.<sup>112</sup> Technology is created through a highly complex process, which involves not just science and commerce, but also political forces and a mix of other disparate social groups. Such developments are far too eclectic and complex to be able to be steered in a particular direction, or fully controlled and managed, by such a limited mechanism as the law.<sup>113</sup> So should the law just shrug and walk away resignedly?

Whatever is technically possible will be done, sooner or later.<sup>114</sup> That is the *technological imperative* in today's world. But is it really an imperative? Are humans really helpless in the face of the process of technical development, which marches on oblivious? Definitely not. The technological imperative is not – quasi scientifically – imperative. It takes effect when it is allowed to take effect. The law can fundamentally act against this. Because what is possible is for the law to choose technologies and shape technologies.<sup>115</sup> Which implies having controlling effects on technical development.

The law can make choices from among a number of alternative technologies and in so doing can shape future technical developments.<sup>116</sup> This can – and must – involve other criteria than purely technical ones – such as constitutional, political or economic issues.<sup>117</sup> Examples for this *control of technology by technology selection*<sup>118</sup> are, for example, the retreat from atomic energy in Germany<sup>119</sup> or a decision in favour of a climate-friendly energy supply.<sup>120</sup> A historic example is that of Japan in the seventeenth century, when the already-imported military technology of firearms was deliberately rejected and there was a return to the use of traditional weapons for several more centuries.<sup>121</sup>

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<sup>112</sup> Roßnagel (1993), P. 27 inter alia. Similarly also Spinner (2002), P. 40.

<sup>113</sup> Roßnagel (1993), P. 27 inter alia. In the 19<sup>th</sup> century there was still widespread belief in the cybernetic ability of the law to control technology. At length on this Kloepfer (2002), P. 82 inter alia. Although at that time both the technological structures and the social processes were clearly less complex than today.

<sup>114</sup> Similarly Ellul (1965), P. 79 ff., who talks about an “Automatism of Technical Choice”.

<sup>115</sup> Roßnagel (1993), P. 27, who in *ibid*, P. 256 ff. inter alia, explains in detail.

<sup>116</sup> Roßnagel (1993), P. 256.

<sup>117</sup> Not least public procurement rules can be used to shape technology. By pinpointing awards of contracts the state can promote specific technologies in a focussed way. At length on this Boehme-Neßler (2006), P. 1257 ff.

<sup>118</sup> Roßnagel coined both this phrase and this concept (1993), P. 27, 256 ff. inter alia

<sup>119</sup> Schmidt-Preuß (2002), P. 187. On the details of the “Nuclear power phase-out law” Roßnagel (2007), P. 156 ff. inter alia.

<sup>120</sup> On this much earlier Roßnagel (1993), P. 259 ff. inter alia.

<sup>121</sup> Details on this striking story from Perrin (1996), P. 96 ff., also *ibid*, P. 123 ff. where he describes a further example for a deliberate choice to influence technology by technology selection.

But the law has a second lever it can use to direct technology: the option of having a definitive say on the *form* of any given technology.<sup>122</sup> What does that mean in practice? Legal requirements are transcribed into detailed “safety philosophies” or “requirements”, which the technology has to apply in practice. There are plenty of examples of this.<sup>123</sup> The basic right to view your own data and the principle of strict need-to-know for data storage have left many traces in IC-technology.<sup>124</sup>

Alongside these direct influences on technical development, *indirect* influences of the law can be observed. An example from environmental law: the requirements that the waste disposal laws placed on the waste processing industry have shaped the development of waste disposal technologies. The idea of a recycling society<sup>125</sup> was injected by the law into the process of waste-related technical developments and has influenced the form of modern waste technologies. And liability law can push technical developments in a particular direction. The classic example of this is product liability law.<sup>126</sup> Because liability law creates, increases or reduces risks for both the developer and the user of technology, it influences behaviour. Because risk avoidance is an important aspect in the development and implementation of technical innovations.

The ultimate case of control of technology is the *ban*. The law can in fact substantially hinder the development of new technologies.<sup>127</sup> Bans are sometimes used when, for example, national security, public interest or the environment are under threat.<sup>128</sup> A current and very telling example is the ban on cloning in Europe.<sup>129</sup> In practice, complete bans of a given technology are very rare.<sup>130</sup> Whether new technologies can actually be suppressed by bans is open to doubt. The history of science – apart from some rare, temporary cases<sup>131</sup> – throws up no single example of a long-term and lasting prevention of technological progress.<sup>132</sup>

<sup>122</sup> Roßnagel (1993), P. 267, who goes into technology’s *need* of guidance and its *ability* to guide. Using the practical example of the data-protection law’s principle of relevance to purpose in Electronic Government Roßnagel/Laue (2007), P. 548 f., outline how technology could be guided by law, and how it should be.

<sup>123</sup> Examples from recent US IT-law are provided and analysed by Kesan/Shah (2005), P. 332 ff. *inter alia*

<sup>124</sup> Thus quite correctly Groß (2004), P. 416 f. *inter alia*.

<sup>125</sup> Kloepfer (2004), P. 1722, talks correctly of a change of paradigm to an effective and resource saving circulation and supply chain economy which the law has successfully accomplished.

<sup>126</sup> At length on this Kesan/Shah (2005), P. 351 ff. *inter alia*.

<sup>127</sup> Roßnagel (1993), P. 245 f. Talks in this context about *restrictive guidance of technology*. Kloepfer (2002), P. 86 believes that the limitation of technology – as well as enabling of technology – is a prime function of technical law. That the law can actually prevent technical development is something he vehemently doubts, however, *ibid*, P. 99 f.

<sup>128</sup> At length on this Kesan/Shah (2005), P. 328 *inter alia*.

<sup>129</sup> On the details Kloepfer (2004), P. 1590 *inter alia*. An example from American law is given by Summers (1996), P. 66.

<sup>130</sup> Kloepfer (2002), P. 96. A thorough critique of technology legal bans by Kesan/Shah (2005), P. 328 ff. *inter alia*.

<sup>131</sup> Perrin (1996), P. 96 ff. and P. 123 ff., sets out two striking examples.

<sup>132</sup> Similarly Roßnagel (1993), P. 245 and Kloepfer (2002), P. 99 f.

## Bibliography

- Abel, Ralf-Bernd (2003): 2.7. Geschichte des Datenschutzrechts, in: Alexander Roßnagel (Ed.): Handbuch Datenschutzrecht. Die neuen Grundlagen für Wirtschaft und Verwaltung. Munich.
- Appel, Ivo (2004): Methodik des Umgangs mit Ungewissheit, in: Wolfgang Hoffmann-Riem/Eberhard Schmidt-Aßmann (Ed.): Methoden der Verwaltungsrechtswissenschaft. Baden-Baden, P. 327 ff.
- Berg, Wilfried (1985): Vom Wettlauf zwischen Recht und Technik - Am Beispiel neuer Regelungsversuche im Bereich der Informationstechnologie -, in: Juristenzeitung, P. 401 ff.
- Boehme-Neßler, Volker (2006): Öffentliche Auftragsvergabe in Public-Private-Netzwerken, in: Deutsches Verwaltungsblatt, P. 1257 ff.
- Boehme-Neßler, Volker (2009): Das Ende des Staates? Zu den Auswirkungen der Digitalisierung auf den Staat, in: Zeitschrift für öffentliches Recht 64, P. 145 ff.
- Bora, Alfons (2006): Im Schatten von Normen und Fakten - Die Kolonisierung der Politik durch technowissenschaftliche Normativität, in: Zeitschrift für Rechtssoziologie 27/1, P. 31 ff.
- Castells, Manuel (2001): Der Aufstieg der Netzwerkgesellschaft. Das Informationszeitalter Teil 1. Opladen.
- Dicken, Peter (1998): Global shift: Transforming the world economy. 3<sup>rd</sup> Edition, New York.
- Dommering, Egbert (2006): Regulating Technology: Code is not Law, in: Egbert Dommering/Lodewijk Asscher (Ed.): Coding Regulation. Essays on the Normative Role of Information Technology. The Hague, P. 1 ff.
- Eigner, Swantje/Kruse, Lenelis (2001): Wahrnehmung und Bewertung von Technik - was ist psychologisch relevant?, in: Günter Ropohl (Ed.): Erträge der interdisziplinären Technikforschung. Eine Bilanz nach 20 Jahren. Berlin, P. 97 ff.
- Ellul, Jacques (1965): The Technological Society. London.
- Eriksen, Thomas Hylland (2001): Tyranny of the Moment. Fast and Slow Time in the Information Age. London/Sterling, Virginia.
- Friedman, Lawrence M. (1989): Law, Lawyers and Popular Culture, in: Yale Law Journal, 98, P. 1579 ff.
- Friedman, Lawrence M. (2002): Changing Times: Technology and Law in the modern Era, in: Jürgen Becker a.o., Commemorative publication for Manfred Rehbinder. Munich/Bern, P. 501 ff.
- Geißler, Karlheinz A. (1997): Die Orientierung am Rhythmus - Das rechte Zeitmaß in der Zeit der Flexibilisierung, in: Peter Rusterholz/Rupert Moser (Ed.): Zeit. Zeitverständnis in Wissenschaft und Lebenswelt. Bern, P. 111 ff.
- Grande, Edgar (2001): Von der Technologie- zur Innovationspolitik - Europäische Forschungs- und Technologiepolitik im Zeitalter der Globalisierung, in: Georg Simonis/Renate Martinsen/Thomas Saretzki (Ed.): Politik und Technik. Analysen zum Verhältnis von technologischem, politischem und staatlichem Wandel am Anfang des 21. Jahrhunderts. Wiesbaden, P. 368 ff.
- Groß, Thomas (2004): Die Informatisierung der Verwaltung. Eine Zwischenbilanz auf dem Weg von der Verwaltungsautomation zum E-Government, in: Verwaltungsarchiv 95, P. 400 ff.
- Grunwald, Armin/Banse, Gerhard/Coenen, Christopher/Hennen, Leonhard (2006): Netzöffentlichkeit und digitale Demokratie. Tendenzen politischer Kommunikation im Internet. Berlin.
- Haar, Tilmann (2004): Sachzwang. Technik zwischen natürlichen und institutionellen Tatsachen, in: Nicole C. Karafyllis/Tilmann Haar (Ed.): Technikphilosophie im Aufbruch. Commemorative Publication for Günter Ropohl. Berlin, P. 139 ff.
- Heckmann, Dirk (2006): Rechtliche Grenzen (quasi-) verbindlicher Technologievorgaben. Der Übergang von interner Beratung und Koordination zur Standardsetzung durch Empfehlungen für die IT-Beschaffung der öffentlichen Hand, in: Computer und Recht, P. 1 ff.
- Heilbroner, Robert L. (1994): Do Machines make History?, in: Merritt Roe Smith/Leo Marx (Ed.): Does Technology Drive History? The Dilemma of Technological Determinism. Cambridge, Massachusetts, P. 53 ff.
- Heilbroner, Robert L. (1994a): Technological Determinism Revisited, in: Merritt Roe Smith/Leo Marx (Ed.): Does Technology Drive History? The Dilemma of Technological Determinism. Cambridge, Massachusetts, P. 67 ff.

- Hilpert, Ulrich (2001): Zwischen Kompetenz und Umsetzung. Zu den Möglichkeiten und Grenzen befähigender staatlicher Politik. Das Beispiel Deutschlands nach der Wiedervereinigung, in: Georg Simonis/Renate Martinsen/Thomas Saretzki (Ed.): Politik und Technik. Analysen zum Verhältnis von technologischem, politischem und staatlichem Wandel am Anfang des 21. Jahrhunderts. Wiesbaden, P. 71 ff.
- Hoffmann-Riem, Wolfgang (2007): Recht als Instrument der Innovationsoffenheit und der Innovationsverantwortung, in: Hagen Hof/Ulrich Wengenroth (Ed.): Innovationsforschung. Ansätze, Methoden, Grenzen und Perspektiven. Hamburg, P. 387 ff.
- Hüsing, Bärbel/Jäncke, Lutz/Tag, Brigitte (2006): Impact Assessment of Neuro-Imaging. Zurich/Singen.
- Innis, Harold Adams (1951): The bias of communication. Toronto (quoted here from the 2003 reprint).
- Kesan, Jay P./Shah, Rajiv C. (2005): Shaping Code, in: Harvard Journal of Law & technology, Vol. 18, P. 319 ff.
- Kloepfer, Michael (2002): Technik und Recht im wechselseitigen Werden. Kommunikationsrecht in der Technikgeschichte. Berlin.
- Kloepfer, Michael (2004): Umweltrecht. 3<sup>rd</sup> Edition Munich.
- Landes, David P. (1969): The unbound Prometheus. Technological Change and Industrial Development in Western Europe from 1750 to the Present. Cambridge/Massachusetts.
- Leib, Volker (1998): Wissenschaftsnetze und Bürgernetze. Vom selbstgesteuerten Internet zur elektronischen Demokratie?, in: Wienand Gellner/Fritz von Korff (Ed.): Demokratie und Internet. Baden-Baden, P. 81 ff.
- Mainzer, Klaus (1995): Computer - Neue Flügel des Geistes? Die Evolution computergestützter Technik, Wissenschaft, Kultur und Philosophie. Berlin/New York.
- Mayntz, Renate (2001): Triebkräfte der Technikentwicklung und die Rolle des Staates, in: Georg Simonis/Renate Martinsen/Thomas Saretzki (Ed.): Politik und Technik. Analysen zum Verhältnis von technologischem, politischem und staatlichem Wandel am Anfang des 21. Jahrhunderts. Wiesbaden, P. 3 ff.
- McLuhan, Marshall (1992): Die magischen Kanäle: "Understanding Media". Duesseldorf, Vienna.
- Mishler, Carl F. (2007): How Functional Magnetic Resonance Imaging (fMRI) will change the Legal Profession - A View from the United States of America, in: European Journal of Law Reform, IX, P. 17 ff.
- Mokyr, Joel (1990): The Lever of Riches. Technological Creativity and Economic Progress. New York/Oxford.
- Norris, Pippa (2001): Digital divide. Cambridge/Mass.
- Nye, Joseph P. jr. (2001): Globalization's democratic deficit, in: Foreign Affairs Juli/August 2001, P. 2 ff.
- Perrin, Noel (1996): Keine Feuerwaffen mehr. Japans Rückkehr zum Schwert 1543-1879. Stuttgart.
- Preda, Alex (2006): Wie Techniken Finanzmärkte erschaffen: Der Fall des Börsentickers, in: Werner Rammert/Cornelius Schubert (Ed.): Technografie. Zur Mikrosoziologie der Technik. Frankfurt am Main, P. 101 ff.
- Radkau, Joachim (2008): Technik in Deutschland. Vom 18. Jahrhundert bis heute. Frankfurt/Main.
- Rammert, Werner (2006): Technik – Handeln – Wissen. Zu einer pragmatistischen Technik- und Sozialtheorie. Wiesbaden.
- Rapp, Friedrich (1994): Die Dynamik der modernen Welt. Eine Einführung in die Technikphilosophie. Hamburg.
- Ropohl, Günter (1999): Allgemeine Technologie. Eine Systemtheorie der Technik. 2<sup>nd</sup> Edition. Munich/Vienna.
- Ropohl, Günter (1999a): Technologische Aufklärung. Beiträge zur Technikphilosophie. 2<sup>nd</sup> Edition Frankfurt am Main.
- Ropohl, Günter (2003): Vom Wert der Technik. Stuttgart/Zurich.



- Rosa, Hartmut (2005): *Beschleunigung. Die Veränderung der Zeitstruktur in der Moderne*. Frankfurt am Main.
- Roßnagel, Alexander (1983): *Bedroht die Kernenergie unsere Freiheit?* 2<sup>nd</sup> Edition Munich.
- Roßnagel, Alexander (1984): *Radioaktiver Zerfall der Grundrechte?* Munich.
- Roßnagel, Alexander (1989): *Technik und Recht – Wer beeinflusst wen?*, in: Alexander Roßnagel (Ed.): *Freiheit im Griff. Informationsgesellschaft und Grundgesetz*. Stuttgart, P. 9 ff.
- Roßnagel, Alexander (1989a): *Möglichkeiten verfassungsverträglicher Technikgestaltung*, in: Alexander Roßnagel (Ed.): *Freiheit im Griff. Informationsgesellschaft und Grundgesetz*. Stuttgart, P. 177 ff.
- Roßnagel, Alexander (1993): *Rechtswissenschaftliche Technikfolgenforschung. Umriss einer Forschungsdisziplin*. Baden-Baden.
- Roßnagel, Alexander (2001): *Rechtswissenschaft*, in: Günter Ropohl (Ed.): *Erträge der interdisziplinären Technikforschung. Eine Bilanz nach 20 Jahren*. Berlin, P. 195 ff.
- Roßnagel, Alexander (2005b): *Modernisierung des Datenschutzrechts für eine Welt allgegenwärtiger Datenverarbeitung*, in: *Multimedia und Recht* 2, P. 71 ff.
- Roßnagel, Alexander (2007): *Atomausstieg und Restlaufzeiten*, in: Andreas Hänlein/Alexander Roßnagel (Ed.): *Wirtschaftsverfassung in Deutschland und Europa. Festschrift für Bernhard Nagel*. Kassel, P. 155 ff.
- Roßnagel, Alexander (2007a): *Innovation als Gegenstand der Rechtswissenschaft*, in: Hagen Hof/Ulrich Wengenroth (Ed.): *Innovationsforschung. Ansätze, Methoden, Grenzen und Perspektiven*. Hamburg, P. 9 ff.
- Roßnagel, Alexander (o.J.): *Papier - die unbekannte Grundlage unserer Rechtsordnung*. Unpublished manuscript.
- Roßnagel, Alexander/Laue, Philip (2007): *Zweckbindung im Electronic Government*, in: *Die Öffentliche Verwaltung*, P. 543 ff.
- Sandermann, Wilhelm (1997): *Papier. Eine Kulturgeschichte*. 3<sup>rd</sup> Edition Berlin/New York.
- Schefe, Peter (2000): *Kulturelle Wirkungen computergestützter Medien*, in: Kubicek, Herbert u.a. (Ed.): *Global @home*. Heidelberg, P. 234 ff.
- Schelsky, Helmut (1965): *Der Mensch in der wissenschaftlichen Zivilisation*, in: Helmut Schelsky: *Auf der Suche nach Wirklichkeit. Gesammelte Aufsätze*. Düsseldorf/Cologne, P. 439 ff.
- Scherzberg, Arno (2002): *Wissen, Nichtwissen und Ungewissheit im Recht*, in: Christoph Engel/Jost Halfmann/Martin Schulte (Ed.): *Wissen - Nichtwissen - Unsicheres Wissen*. Baden-Baden, P. 113 ff.
- Schmidt-Preuß, Matthias (2002): *Technikermöglichkeit durch Recht*, in: Michael Kloepfer (Ed.): *Kommunikation - Technik - Recht. Kommunikationsrecht in der Technikgeschichte*. Berlin, P. 175 ff.
- Schott, Rüdiger (1970): *Die Funktionen des Rechts in primitiven Gesellschaften*, in: *Jahrbuch für Rechtssoziologie* 1, P. 107-174.
- Schulze-Fielitz, Helmuth (1998): *Instrumente der Innovationssteuerung durch Öffentliches Recht - insbesondere im Umweltrecht*, in: Wolfgang Hoffmann-Riem/Jens-Peter Schneider (Ed.): *Rechtswissenschaftliche Innovationsforschung. Grundlagen, Forschungsansätze, Gegenstandsbe-reiche*. Baden-Baden, P. 291 ff.
- Spinner, Helmut F. (2002): *Von der wissensgeleiteten Techniksteuerung zum technologischen Wissensregime*, in: Michael Kloepfer (Ed.): *Kommunikation - Technik - Recht. Kommunikationsrecht in der Technikgeschichte*. Berlin, P. 11 ff.
- Spur, Günter (2001): *Zum Selbstverständnis der Technikwissenschaften*, in: Günter Ropohl (Ed.): *Erträge der interdisziplinären Technikforschung. Eine Bilanz nach 20 Jahren*. Berlin, P. 43 ff.
- Stehr, Nico (2000): *Deciphering Information Technologies. Modern Societies as Networks*, in: *European Journal of Social Theory* 3, P. 83 ff.
- Strange, Susan (1996): *The Retreat of the State. The Diffusion of Power in the World Economy*. Cambridge.
- Summers, Robert P. (1996): *Technology, Law and Values*, in: Frank Fleerackers/Evert van Leeuwen/Bert van Roermund (Ed.): *Law, Life and the Images of Man. Commemorative Publication for Jan M. Broekmann*. Berlin, P. 65 ff.

- Teubner, Gunther (1989): *Recht als autopoietisches System*. Frankfurt am Main.
- Thompson, Michael/Selle, Per (2000): *Doing Technology (and Democracy) the Pack-Donkey's Way: The Technomorphic Approach to ICT Policy*, in: Engel, Christoph/Keller, Kenneth H., *Understanding the impact of global networks on local social political and cultural values*. Baden-Baden, P. 155 ff.
- Trimborn, Hermann (1950): *Die Privatrache und der Eingriff des Staates*, in: *Deutsche Landesreferate zum III. Internationalen Kongress für Rechtsvergleichung in London*, P. 133 ff.
- Trute, Hans-Heinrich (1998): *Innovationssteuerung im Wissenschaftsrecht*, in: Wolfgang Hoffmann-Riem/Jens-Peter Schneider (Ed.): *Rechtswissenschaftliche Innovationsforschung. Grundlagen, Forschungsansätze, Gegenstandsbereiche*. Baden-Baden, P. 208 ff.
- Vec, Milos (2002): *Technik oder Recht? Steuerungsansprüche in der Zweiten Industriellen Revolution*, in: Michael Kloepper (Ed.): *Kommunikation – Technik – Recht. Kommunikationsrecht in der Technikgeschichte*. Berlin, P. 111 ff.
- Weizenbaum, Joseph (1976): *Computer Power and Human Reason. From Judgment to Calculation*. New York.
- White, Lynn (1967): *The Historical Roots of our Ecological Crisis*, in: *Science* 155, P. 1203 ff.
- White, Lynn (1968): *Die mittelalterliche Technik und der Wandel der Gesellschaft*. Munich.

Pictorial Law

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