



# **The Benefits and Challenges of Technology Neutral Regulation**

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Master's thesis  
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## Abstract

This master's thesis is based on a scientific article "*The Benefits and Challenges of a of Technology Neutral Regulation – A Scoping Review*" (Puhakainen & Väyrynen, 2021). The article was published in the PACIS conference during summer 2021. A scoping literature review was conducted to answer to the research question of the article: "*What are the benefits and challenges related to a technology neutral regulation of ICT?*". In total, 4 different categories of benefits were identified, while 7 different categories for challenges were identified.

This master's thesis further explains how the research and article writing process of said published article went on. It also continues the research on the principle of technology neutrality that was started with the article. The topic of technology neutrality was examined because it is still an undertheorized tool for legislation which also divides opinion of the researchers. The research questions examined in this thesis revolved around how the tone regarding technology neutrality has developed based on the research that was included in the article, and how some of the groundbreaking research was discussed in subsequent research. According to the results, the tone has shifted from mostly positive and accepting to questioning and critique. Also, some themes that were addressed in the research papers were examined more thoroughly. These themes were theory of the principle of technology neutrality, spectrums, and legal access to traffic data and privacy. Future research questions were suggested.

The general result of this master's thesis is the notion that the principle of technology neutrality and applying it to regulation are still in progress, as the scholars have major disagreement regarding whether technology neutrality is possible or worth pursuing, and whether these questions differ depending on the context of where the principle is to be applied.

### *Keywords*

Technology neutrality, future-proof regulation, scoping literature review

### *Supervisor*

PhD, University Lecturer Karin Väyrynen

## Foreword

I want to thank my supervisor and co-writer of the article PhD, University Lecturer Karin Väyrynen, for the extremely valuable guidance and discussions regarding this process of writing the article and later this master's thesis. Väyrynen's extensive experience and understanding of different research methods and ways to conduct research provided me value that cannot be gained by reading guidebooks. It is good that this experience can be also transferred to new research projects.

I also want to thank Dr. Mikko Rajanen for acting as the second reviewer of this thesis.

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## Abbreviations

ICT	Information and Communication Technology
INTERACT	Human-Computer Interaction, European Computer-Supported Cooperative Work, Participatory Design, and Activity Theory
PTN	Principle of Technology Neutrality
TN	Technology Neutral / Technology Neutrality

# 1. Introduction

This Thesis is based on an article “*The Benefits and Challenges of Technology Neutral Regulation – A Scoping Review*” (Puhakainen & Väyrynen, 2021), which I wrote together with my supervisor PhD, adjunct professor Karin Väyrynen. The article was published in the Pacific Asia Conference on Information Systems (PACIS) in July 2021, and it is referred to as “the PACIS article” in this thesis. The PACIS article is presented as an appendix B of this master’s thesis.

This article-based thesis was written based on the instructions for “Scientific publication as part of Information Processing Science Master’s thesis”. These instructions were issued by the Degree Program Committee of Information Processing Science on 13.8.2021 and are attached to this master’s thesis as Appendix A.

The purpose of this Thesis is to further explain how the research and article writing process went on. The purpose is also to examine the principle of technology neutrality further. The research for the PACIS article was a part of my 2-month internship at the INTERACT research unit in the University of Oulu.

The purpose of the internship was to participate in the ongoing research project on the digitalization of the Finnish taxi industry and the theme of technology neutrality regarding the taximeters. As I had a master’s degree from law, we decided to examine the legal aspects of said principle. In the beginning we had some preliminary questions, such as what exactly is the principle of technology neutrality, what elements does it consist of, does it affect legislation and if it does, how strongly and how much does the influence differ in different legislations? Or is the principle widely known and utilized to start with? What are the challenges and benefits of utilizing the principle? As our goal was to illuminate the principle of technology neutrality in the context of ICT and legislation, this led to our research question to be the following:

*“What are the benefits and challenges related to a technology neutral regulation of ICT?”*

It was found out that the viewpoints clearly differ, as when a total of 39 papers were examined, three categories could be formed: those who argued for benefits (13), those who argued for challenges (19), and those who argued for both (7).

Technology neutrality is a topic that is important especially in the context of legislation and regulation. To put it shortly, if a law is written in a technology neutral manner, it regulates the actions of the subjects, not the technology that is to be chosen, while technology-specific laws strictly regulate the manners how something is allowed or prohibited to be done. (Greenberg, 2015) The roots of the principle lie in the US. The US Government published its *Framework for Global Electronic Commerce* in July 1997 (United States, 1997). One principle that was set for governing global electronic commerce in this framework was that the “*rules should be technology neutral (i.e., the rules should neither require nor assume a particular technology) and forward looking (i.e., the rules should not hinder the use or development of technologies in the future)*”. In the next year the term of technology neutrality was used in EU legislative proposals for the first time, when the Economic and Social Committee stated that “*Regulation should be ‘technology-neutral’: as few as possible new regulations, policies and*

*procedures should be specific to the new services.*” (Opinion of the Economic and Social Committee, 1998)

However, even though moulding the principle of technology neutrality started in the late 90’s, there are still challenges regarding the nature and utilization of it. According to Reed (Reed, 2007), the abovementioned frameworks led to the principle being adopted to the most EU technology legislation eagerly, without proper questioning. Reed criticized how the principle has been accepted and adopted in a way which did not create common understanding of the deeper meaning of what the principle might actually mean. Reed pointed out that even though technology neutrality had been in discussion for at least a decade, as late as 2006 Professor Bert-Jaap Koops published his comprehensive essay (Koops, 2006) on how the principle could be used outside the telecommunications sector. Telecommunications sector was at first the main context in which the principle was examined. There still is not a clear mutual understanding of the applicability of the principle (Puhakainen & Väyrynen, 2021).

The main focus of this master’s thesis is to explain further the process of writing the PACIS article and to extend such parts of the PACIS article where the supervisor had taken a larger role. This master’s thesis has also two research questions that will be addressed:

1. *How has the tone regarding technology neutrality developed based on the research that was included in the PACIS article?*
2. *What kind of guidance and warnings on certain technologies have been presented in former research regarding theory, spectrums and legal access to traffic data and privacy in the context of technology neutrality?*
3. *How is the seemingly groundbreaking research by Koops (2006), Reed (2007) and Ohm (2010) referred to in subsequent research? In other words, are the thoughts just accepted, or is there discussion on the theorization and categorization?*

The previous work with the method of scoping literature review was continued regarding some of the most fruitful former research papers that did not receive the full attention they deserve in the PACIS article, as the publisher’s restrictions for the length of the article were strict.

The main findings of this master’s thesis include information on how the evolution of researchers’ tones on technology neutrality have changed during the years 1998-2020 (research question 1). This information is based on the 39 articles that were included in the PACIS article.

The second section of the main findings addressed what kind of guidance and warnings on certain technologies have been presented in former research regarding theory, spectrums and legal access to traffic data and privacy in the context of technology neutrality (research question 2). Suggestions for future research were also given and continuing the work of Koops (2006) was suggested due to its importance in developing the principle of technology neutrality further.

The third section of the main findings involves scrutinizing how some of the research (Koops, 2006; Reed, 2007; Ohm, 2010) that seemed rather groundbreaking during the process of writing the article were referred to in the other research that were included in the article (research question 2). For this the number of referencing was counted, and the content of the references was analyzed.

The discussion section of the PACIS article was expanded by further contemplating on the themes presented in the PACIS article. Also, the need for a framework for technology neutrality and the viewpoints regarding certain technologies and contexts are discussed in more detail than was possible in the PACIS article.



## 2. Theoretical background

The theoretical background presented in this chapter is further theorization of what was presented in the PACIS article that this master's thesis is based on. In the article we did not discuss different definitions of technology neutrality due to the restrictions for the page limit laid by the publisher. Theoretical background of the PACIS article can be found in its Introduction chapter. It focuses on the regulatory aspect and provides an example case of drones and technology neutral legislation.

Next, I will present some different definitions of technology neutrality to extend the theoretical background presented in the PACIS article.

Various scholars have defined the term “technology neutrality” or proposed characteristics to it (Puhakainen & Väyrynen, 2021). Below in the Table 1 are different definitions and views on the principle of technology neutrality. These are gathered from six papers: two argued mostly for benefits, two argued mostly for challenges and two argued for both benefits and challenges. They are presented in a descending order (publishing year).

One of the findings of the PACIS article was that while the definition of technology neutrality was quite coherent, there still is no consensus on whether the characteristics that are given to the principle actually are applicable, and if they are, do they apply for all situations. This seems to stem for the fact that the status and applicability of the principle are not clear yet, and the researchers have differing opinions on the matter.

In the definitions presented in Table 1 the positive attitudes towards technology neutrality are clearly seen. When it comes to the doubtful or negative attitudes, these are more subtle. It seems that doubtful or negative perceptions have more abstract wordings, such as “technology neutrality server as an aspiration to enact laws that could be sustainable over time” (Harasta, 2018) or “technology neutrality’s lodestar is intent to regulate behavior, not technology” (Greenberg, 2015), while the more convinced researchers use straighter language, such as “technology neutrality is essential” (Pritchard-Kelly, 2018), or “[I]f regulation is technology-neutral, then it will establish equivalence between the off-line and on-line worlds” (Koops, 2006).

**Table 1 Different definitions of technology neutrality**

<b>Paper</b>	<b>Definition</b>	<b>Paper argued for benefits</b>	<b>Paper argued for challenges</b>
Harasta 2018	“Technology neutrality serves as an aspiration to enact laws that could be sustainable over time and would not require frequent reviews. Similarly, it can be interpreted as a duty not to make technology choices by creating a restrictive legal framework, but contrarily to leave these choices to market actor.”		x
Pritchard-Kelly 2018	“Technology neutrality is essential: competitive prices for end users result from policies that allow deployment of the most efficient and affordable services, regardless of architecture model.”	x	
Greenberg 2015	“Technology neutrality’s lodestar is intent to regulate behavior, not technology; to worry about what occurs, not how it occurs. Whereas technology-specific provisions refer to technological classes (e.g., the fountain pen), technology-neutral laws use “general, vague, open-textured terms that specify purposes, effects, functions, and other general characteristics” (e.g., any device or process that produces a perceptible writing).”  “Additionally, technology neutrality often is adopted as an institutional arrangement, pushing questions arising from new technologies away from legislatures, to courts and administrative agencies.”		x
Ohm 2010	“Tech-neutral provisions refer to technology in general, vague, open-textured terms that specify purposes, effects, functions, and other general characteristics.”	x	x
Falch et al. 2009	“Similar services should be treated equally also if they are provided by the use of different technology platforms.  Any service provider or network operator should be free in their choice of technology.”	x	
Koops 2006	“[I]f regulation is technology-neutral, then it will establish equivalence between the off-line and on-line worlds.”	x	x

For example, Harasta (2018) describes technology neutrality as an aspiration to draft regulation that would stand the test of time, without needing frequent reviews. On the other hand, Harasta also finds the side of duty to leave the technological choices to the market actors instead of creating a restrictive regulative framework. I understand this as a choice that the legislators must make; either they can (or at least should) ensure that they understand the technology they are going to regulate, or they should allow the market actors to make the choices based on economic and innovative factors.

Based on the Table 1, technology neutrality is considered to have the following characteristics and purposes: The aim of technology neutral regulation is to allow the actors in the market to choose their way to reach a goal that is stated in a regulation. This can lead to competitive prices, as the market actors can find out the most efficient and affordable options. The language of this kind of regulation is general that mainly specifies purposes, effects and functions, not the ways to achieve the goals. One looked-for characteristic for a technology neutral law is that it should stand the test of time and to not to need frequent revisions. Technology neutral regulation creates equivalence between the offline and online worlds as the same regulation applies for both.

### 3. Research methods and process

In the following subchapters the method for this master's thesis and the PACIS article is explained, and the process of writing the article is gone through.

#### 3.1 The method for the master's thesis and the PACIS article: a scoping literature review

The research questions of this master's thesis were the following:

1. *How has the tone regarding technology neutrality developed based on the research that was included in the PACIS article?*
2. *What kind of guidance and warnings on certain technologies have been presented in former research regarding theory, spectrums and legal access to traffic data and privacy in the context of technology neutrality?*
3. *How is the seemingly groundbreaking research by Koops (2006), Reed (2007) and Ohm (2010) referred to in subsequent research? In other words, are the thoughts just accepted, or is there discussion on the theorization and categorization?*

The nature of these questions allowed to use the method of a *scoping literature review* (see, e.g., Arksey & O'Malley, 2005; Munn et al., 2018; Daudt, van Mossel, & Scott, 2013). It has to be pointed out that there is no agreed upon definition of the method, as various authoritative researchers have proposed their own description of the method on purpose (Daudt et al, 2013) to clarify the definition laid out by Arksey and O'Malley (Levac, Colquhoun and & O'Brien, 2010). However, the main points of these definitions resemble each other closely for the most part.

This scoping literature review method was already utilized with the PACIS article. The answers for these research questions were found in the research material that was found and analyzed during the scoping literature review, but the targets of this phase were different and more precise. Next, I will describe why we chose this method when writing the PACIS article.

Our initial thought for the method was a *systematic literature review* (Munn et al., 2018). However, as the research for the PACIS article went on, Väyrynen thought of changing the method to *scoping literature review*, which ended up being most suitable and beneficial method for us to use in writing the paper for several reasons. Firstly, a scoping literature review is a better option than a systematic literature review when the topic of the study is not that clear (Arksey & O'Malley, 2005). For example, at the start of the research our intention was to find out *something about technology neutrality and regulations and policies*. As scoping literature review is especially suitable to chart the area of interest and what is already written about it, utilizing the method by doing searches and finding out what topics were brought up suited our well. This way we also got an overall picture of the subject of technology neutrality and how it is regulated. If a systematic literature review had been used, the research idea should have been narrower

than “let’s find out what is written about this” to achieve relevant results, or possibly even to be able to carry out the research with said method.

Secondly, in contrast to a systematic literature review, in a scoping literature review the quality of included studies is not assessed (Arksey & O’Malley, 2005; Levac et al., 2010), even though some researchers have proposed to include also this assessment to said method (see, e.g., the reasoning in Levac et al., 2010; and Daudt et al., 2013). Examining the quality would have been outside of our own intentions and goals of what we wanted to accomplish with our research. However, if an especially well written or reasoned paper was found, we pointed out its merits when including them. We also kept in mind the weaknesses of some papers when discussing them in our paper.

Thirdly, we also wanted to avoid using the label of “systematic literature review” too loosely, as some researchers have pointed out that the label may be used incorrectly when the nature of the research has not followed the requirements of said method (Arksey & O’Malley, 2005). The decision to conduct a scoping literature review proved out to be a good decision, as the amount of work required was reasonable and the PACIS article got published in an international conference, namely Pacific Asia Conference on Information Systems 2021 (PACIS).

However, as the idea of a systematic literature review was beneficial for us to utilize at least in part, we tried to apply systematic approach to the research otherwise, for example, by keeping notes of the process, formulating one search string to be used in all the databases, formulating precise inclusion and exclusion criteria and overall ensuring that we can justify all of our decisions made in the process. For example, only one article was snowballed, meaning that an article that was not found in the searches from the databases but found through the included papers, was included (Koops, 2006). This decision was made after noticing how often the article came up in other articles and how original quotes were brought up of it. Koops (2006) revealed to be a principal work in the context of technology neutrality, so the decision to include it was justified.

The framework for a scoping literature review proposed by Arksey and O’Malley (2005) was chosen because it provides tools to conduct the research which suited our needs, and it also gives the researcher room for making decision. They have summarised the nature of a scoping literature in the following way: The reasons to choose the method of a scoping literature review can stem especially from the need to

1. examine the extent, range and nature of a research activity.
2. determine whether undertaking a full systematic literature review would be valuable.
3. summarise and distribute research findings, and
4. detect research gaps in existing literature.

All these four reasons were activated in our research. At first, we needed to figure out what was written about our topic of interest, in what contexts and publications, and to what extent. Secondly, it was clear that a full systematic literature review should not be carried out. After finishing the data gathering and analysing phase, we wanted to sum up what research gaps we found out to aid other researchers who are interested in examining those topics further.

Next, I will elaborate how we utilized this framework in our research.

### 3.1.1 Step 1, “identifying the research question” and databases

At first, we discussed our interests and objectives. The subject of the research was based both on the scope and interests of the research group and my personal skills and interests. I was interested in conducting research that included laws and other forms of regulation. Me and my supervisor juggled some ideas and options and ended up deciding to find out *what are the benefits and challenges related to a technology neutral regulation of ICT*. During the preliminary research we had noticed that usually technology neutral regulation is applied to create more flexible regulation that would allow future technological development. However, many researchers were concerned that technology neutrality was applied without proper knowledge, skills and even without properly considering whether technology neutrality was suitable for certain legal matter or not. We focused on the field of ICT, as the work was done under the department of information processing science of the University of Oulu.

During this phase I examined which databases would be suitable for our intentions. At first, I did test searches in Google Scholar and Google to find out in what kind of journals relevant papers were published. Then I browsed different databases in Oula-Finna that the University of Oulu provided full access to. After taking a couple of different databases to the test, I experienced various search strings in these databases. The decision on the search string affected the decision to choose three databases to be perform the searches on: Scopus, EbscoHost and ProQuest ABI/Inform Complete.

*Scopus* is a large database that covers various fields, including computer science, economics and social sciences. Scopus revealed to be the most fruitful database for us when compared to the other two (see Table 2). *EbscoHost* was a close second. EbscoHost includes, among other things, databases that focus on information science and technology.

*ProQuest* covers business, management, economics, and fields related to it. This database was included in search for papers that would be especially on the economic side of the principle of technology neutrality, but with no avail. Even though the chosen search string found 8 matching results, none of these ended up relevant for our research.

### 3.1.2 Step 2, “identifying relevant studies” and search string

Our quest for relevant studies started with searching for articles that addressed both technology neutrality in the field of ICT and laws, regulations, or policies. At first, we familiarized ourselves with the terminology by conducting Google and Google Scholar searches on technology neutral regulation.

After getting a grasp on how technology neutrality was addressed in the previous research and what kind of terminology was used, we started to form the search string. With the guidance of my supervisor, I formulated multiple different versions and tried them out in a couple of databases. After experimenting with different words, characters and combinations in different databases, it took around six to eight different formulations to find a search string that provided a reasonable number of matching articles to be examined in research of this size.

I found out that while the key phrase needed to be open enough, which was ensured by “\*” (the phrase being “tech\* neutr\*”), it should not be too allowing. For example, when in one search there were other key phrase options such as “technology-specif\*”, “technology discrimin\*”, “technology depend\*” and a few others, there were simply too many matches found in the results, namely over two thousand: reviewing some of the

titles and abstracts of the matches revealed that there were still a vast majority of not relevant subjects, so the search string needed to be stricter.

The number of the matches at this phase is shown in the Table 2 below, where the bolded column is the final, chosen search string. After pruning the search string to (“tech\* neutr\*”) AND (policy OR regulat\* OR legal OR legis\*) a reasonable and doable number of matches was found, a few less than 400. The search was done in May 2020. At this point the type of the result was not defined to only include articles, for example. This thinking process taught me that it is extremely important to figure out what are the key words and phrases that might be included in relevant research. By examining the already-existing literature and research the suitable wordings can be found and irrelevant results are left out without the need to browse them through, when compared to a situation where the search string was not accurate enough. Formulating the best search string also forces the researcher to sharpen the idea of what the current research questions are and where the research is focused to.

**Table 2 Examples of search strings used (the bolded string was chosen)**

	Search string and number of results		
search field: TITLE-ABS- KEY (Scopus)/ ABSTRACT	"tech* neutr*" AND regulat* OR legal OR legis*	<b>"tech* neutr*" AND policy OR regulat* OR legal OR legis*</b>	"tech* neutr*" OR "media neutr*" OR "technology-specif*" OR "technology-independ*" OR "technology-depend*" OR "technology indep*" OR "technology depend*" OR "technology-discrimin*" OR "techno* discrimin*" AND policy OR regulat* OR legal OR legis*
ProQuest ABI/INFORM Complete	8	10	419
Ebscohost	212 (Eng. 196)	193 (Eng. 170)	883 (Eng. 818)
Scopus	165 (Eng. 157)	215 (Eng. 207)	984 (Eng. 947)

The databases Scopus and Ebscohost were used in the research. These databases provided fruitful results. A database ABI/INFORM Complete, and Google Scholar were also searched with the search string, but these did not yield articles that were analyzed in the final version of the PACIS article. However, some of the articles that were included in the research were accessible through Google Scholar.

As even when the language of hits was chosen to be English, the results included thousands of matching articles in these three databases, we changed the settings of the search to be carried out only within the abstracts of the articles, not all fields. This resulted in total of 418 results (Scopus 215, Ebscohost 193 and ABI/INFORM 10 results). As Scopus and Ebscohost returned 61 articles that were included in both set of results, we removed the double versions, ending up with 357 articles.

### 3.1.3 Step 3, “study selection” and inclusion and exclusion criteria

This step started with removing all articles that were not written in English (31 articles). As we wanted to focus on what was written in academic articles, I also removed results that were in other forms, such as book chapters and newspaper articles. Also, articles that did not address ICT-related technology were removed. This decision was made based on the abstracts, as I started forming the inclusion and exclusion criteria while reading the abstracts. In this context ICT meant all electronic information and communication technologies, for example, devices, software, and telecommunication networks. No limitations for the year for publication was made, as we were not familiar with when the research on technology neutrality had started.

Further selection was made by reviewing the 50 first articles of the results. In this phase me and Väyrynen did a cross-check by reading 50 same abstracts and took notes on which were to be included, which excluded, and which were left unsure based on the abstract. The decisions were based on the research question, meaning that papers that seemed not to be related to our research question were excluded. Then we compared our notes to see whether our thoughts on the relevancy matched. As there were a couple mismatches, we discussed our reasonings and I formed a more elaborate inclusion and exclusion criteria. One common finding was that we had noticed that all articles that focused on climate policy or energy policy were not relevant to our research question since they did not address ICT-related regulation. The decision of excluding articles on these themes was made. The criteria resulted to be the following (Table 3):

**Table 3 Inclusion and exclusion criteria**

<b>Inclusion criteria</b>
1. Addresses technology neutrality relating to ICT.
2. Addresses the definition of technology neutrality or its benefits or challenges to the field of ICT.
<b>Exclusion criteria</b>
1. Language is other than English.
2. Does not address ICT AND technology neutrality OR regulation OR policy OR law OR legal.  (By “ICT” we mean processing information with an information technology device, telecommunication, computers, software, middleware, storing data, audio-visual systems, etc.)
3. Is not an academic paper, but for example a book or a conference review.
4. Addresses some other technology than ICT technology.  (When going through the results of the cross-check we noticed that all the papers that were focused on climate policy or energy policy did not address ICT technology and the papers were thus excluded. For example, papers on energy policy often addressed technology neutrality in relation to energy neutrality, technology neutral renewable energy or technology neutral EU climate.)



After going through the full text of the articles that were left after the exclusions, I looked for articles that addressed benefits and/or challenges of technology neutral regulation. In most papers text search was possible, and these were gone through by searching word “neutral”. Those papers that did not enable this function were browsed through. This resulted in 38 relevant articles of the reviewed 50 articles that we started with. After this, the inclusion and exclusion criteria were refined once again based on the findings in this phase, and the abstracts of the 357 articles were read. The articles that were considered not to meet our research interests were excluded.

#### 3.1.4 Step 4, “charting the data” and raw results

Charting the data of the included articles revolved around an Excel sheet which I filled with relevant information on the papers that were included in step 3. Charting consisted of the following information: paper title, paper reference, publication forum, context/what ICT it is about, definition [of technology neutrality found in the paper], main findings summarized, goals [of technology neutrality], benefits [of technology neutrality], challenges [of technology neutrality], and snowball [of relevant studies discussed in the paper]. If a paper was left out in this step, it was justified per every paper that was left out.

Also, in this stage I carried out further elimination by marking the papers in the following categories based on the full text: very relevant, in, unsure, out. This resulted in 17 very relevant papers, 48 probably relevant papers, 7 unsure and 237 out. The papers that were deemed very relevant seemed to address technology neutrality heavily, at least based on the abstract. It is important to notice that some of these abovementioned articles were not accessed as some were available only after requesting them from the authors, and some responded too late.

For example, a paper from Hildebrandt & Tielemans (2013) was deemed very relevant. Here is what information the Excel included on said paper (shown in Table 4). For the sake of saving space in the original Excel, “T” means technology and “N” means neutral. Numbers in parenthesis mean the page number where the citation or information was extracted. The data chart is an expanded adaptation of the proposition of Arksey and O’Malley (2005), where collecting data on relevancy of the paper, context, definitions, goals, benefits, and challenges are an addition to the proposed version to suit the needs of our research.

Table 4 An example of charting the data in step 4.

<b>Relevancy</b>	very relevant
<b>Paper reference</b>	Hildebrandt & Tielemans 2013
<b>Paper title</b>	Data protection by design and technology neutral law
<b>Publication forum</b>	(2013) Computer Law and Security Review, 29 (5), pp. 509-521
<b>Context/what ICT is it about</b>	Data protection (by design), cookies. Theory of TN
<b>Definition</b>	Prevent an unfair competitive advantage for existing Ts or for specific companies that produce or employ one or the other T. The use of a particular ‘rules [that] should neither impose, nor discriminate in favour of type of technology to achieve those objects.’ (2) as long as the rules do not single out and discriminate certain Ts, they can be considered N.
<b>Main findings summarized briefly</b>	(12) DPbD violates TN. (1,2) To achieve a TN law, TS law is sometimes required. Though T in itself is neither good nor bad, it is never N. in order to be N, the law may have to provide for T specific provisions to retain the substance of the legal right they support.
<b>Goals of PTN</b>	(2) Whether a user is acting offline or online should not have an impact on the level of protection.
<b>Benefits of PTN</b>	(2) Unjustified discrimination could result in interference with the market dynamics of competing Ts and create competitive disadvantages for other Ts. (6) Normative impact of e.g. human rights should not depend on whatever Ts are employed. (7) Legal regulation should not cause unfair competitive advantages for companies that employ, develop or produce e.g. existing, novel, or alternative Ts, because this could stifle innovation or create unfair constraints on free market behaviours (7) Legislation should not require continuous adaptation to emerging Ts.
<b>Challenges of PTN</b>	(3) How to make sustainable TN law?  Often, online technologies require a different legal approach to create similar effects of legal protection offline.
<b>Snowball</b>	[Information on the possibly relevant snowballed articles to be explored]

This article by Hildebrandt and Tielemans (2013) is a good example of a very relevant research for our purposes, as it pondered with the theory and even ethics of technology neutrality and legislation and addressed both benefits and challenges.

### 3.1.5 Step 5, “collating, summarizing, and reporting the results” and the publication process

After finishing gathering the data into the Excel sheet, it was time to gather the information and start categorizing the results. During collecting the information to said Excel certain reoccurring had gathered my attention and carrying out step 5 was based on these findings. These reoccurring themes on benefits and challenges were divided further into following categories (Table 5). The number in parenthesis means how many papers were referenced in our paper from said category. “PTN” refers to the principle of technology neutrality.

**Table 5 Categorization of benefits and challenges used in the final paper**

<b>Benefits</b>	<b>Challenges</b>
[B1] Future-proof (5)	[C1] Difficulties in applying regulation due to uncertainty and ambiguity (15)
[B2] Competition, markets, non-discriminating (14)	[C2] Problems in understanding, PTN is undertheorized (4)
[B3] Tackling regulators’ limited understanding of the regulated technology (4)	[C3] Should PTN be pursued in all regulation? (10)
[B4] Flexibility, innovation, room for future development (9)	[C4] Can regulation be neutral? (6)
	[C5] Competition (6)
	[C6] Costs (1)
	[C7] Wrong reasons in applying/pursuing PTN (4)

After I finalized this phase, Väyrynen finetuned the naming of the categories in the following way:

- Future-proof regulation [B1]
- Non-discriminating regulation and resulting benefits to competition [B2]
- Tackling regulators’ limited understanding of the regulated technology [B3]
- Allowing for innovation and future development through flexibility and freedom to choose [B4]
- Difficulties in applying technology neutral regulation due to uncertainty and ambiguity [C1]
- The PTN is undertheorized [C2]
- Evaluation of when the application of the PTN is suitable is challenging [C3]
- Doubts whether regulation even *can* be neutral [C4]
- Negative effects on competition [C5]
- Providing both technologically neutral and standardized options can increase enforcement costs [C6]
- The PTN might be applied by regulators for the wrong reasons [C7]

As the maximum page count of our intended publication forum was strict, 12 pages, I started summarizing the findings to under the themes presented in Table 5 above. After this Väyrynen did further compressing and formatting and wrote the introduction, discussion and conclusions chapters as well as proposed ideas for future research.

My role in the writing process is described in the previous subchapters. However, here it can be noted that in addition to writing down the findings that were later finetuned, I was also responsible for formatting the references and proofreading the paper. Also, after we received the comments and suggestions from the referees, I examined those and made propositions on how to react to said suggestions. Together with Väyrynen we then improved the content of the paper and submitted it.

### 3.2 The student's role in the research process and lessons learned from the publication process

During the process of writing the PACIS article I was responsible for the research in the following ways: determining the appropriate databases to use, formulating the search string, determining what articles were to be included and excluded, examining and categorizing of the 357 included articles and making notes of them. After these I compiled the basis for the findings section, which Väyrynen summarized to meet the page restriction of the publisher. I also took part in finalizing the discussion section and took response on formatting the references to meet the required style. Väyrynen wrote the introduction and discussion chapters of the PACIS article. After receiving the recommendations from the referees, I took the lead in thinking what modifications should be done to improve the article based on the referees' comments. More information of my role regarding writing the PACIS article can be found in the subchapter 3.1 where the research process is explained in detail.

As I had no previous experience from the publication process in an ICT related publication, conferences, or other international publications, there were certain differences to my previous experiences. I have been the second writer to a few legal articles that were published in Finnish publications and proofread tens of legal Finnish and English academic articles.

The referee process was slightly different to my previous publication experiences, as the paper was submitted to a conference, not to a publication, and our paper was accepted as it was. Also, the proposals for modifications were more suggestive of the nature. However, the suggestions and observations from the two referees were insightful and we decided to do some notable changes to the way of how we presented the results, for example, which raised the quality of the PACIS article. Contemplating with Väyrynen on what to do with some of the recommendations or comments gave me some academic self-confidence, as I had thought that some comments did not require any actions, and experienced researcher Väyrynen agreed on this.

Version management of the current paper was one good practice that I learned more about during the process, as in this case we ended up with more than 20 versions of the paper. Version management was conducted by always updating the name of the newest version after receiving it from the other writer and sending the new version back after being done with the phase. My previous co-writing processes have had significantly less versions and they were handled slightly differently, for example by having online access to the same draft and updating it even simultaneously.

At the start of the internship my supervisor reminded me multiple times to keep notes of how the research process went on, to ensure that I had all necessary information

available when the time comes to write the PACIS article and present the research process, as our choice of method, scoping literature review, required quite a thorough explanation. Almost a year later, when it was time to start writing the PACIS article, I soon noticed that it would have been beneficial to take more thorough notes to make some parts of the writing go easier. Nevertheless, I had taken enough notes to be able to form a concise report of the process. This is definitely one of the lessons that I learned during the process.

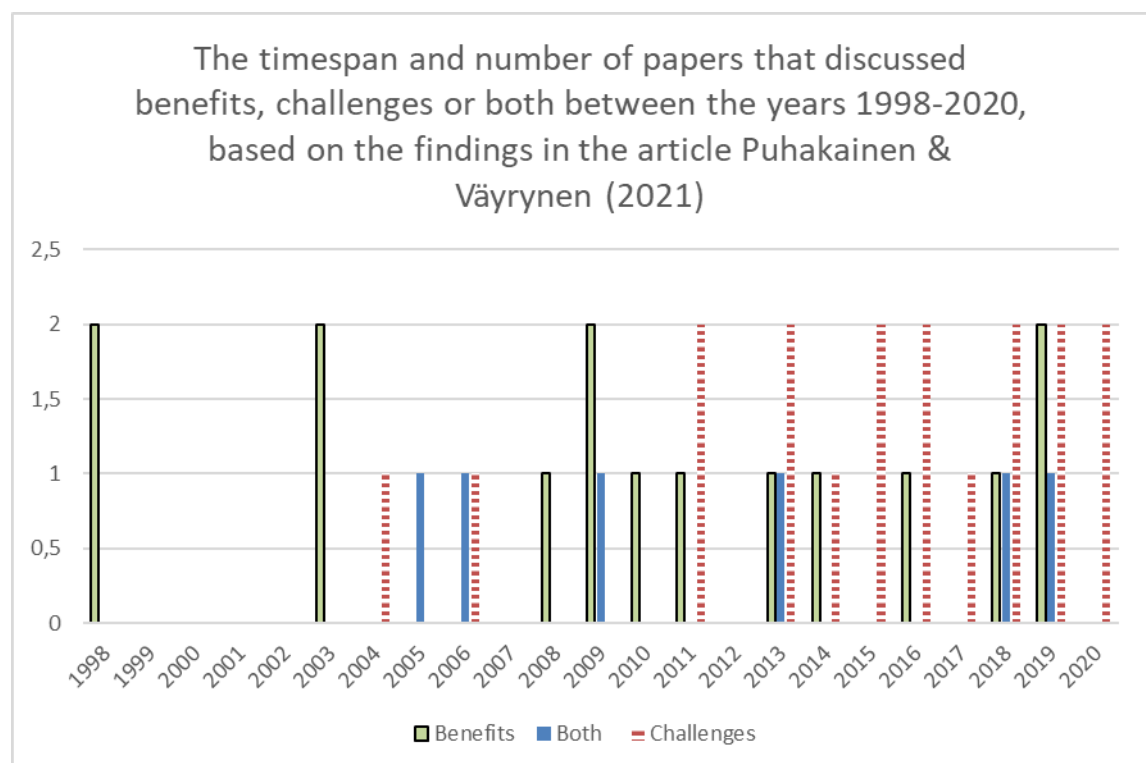
## 4. Main findings

In this chapter the following findings are presented: how the tone towards the principle of technology neutrality has changed during the years, what guidance and warnings the researchers have provided regarding certain themes, and what research has been referred to most often. These findings are brought up after analyzing the source material and the results of the article again.

### 4.1 The development of tones during the years

After forming the Table (Table 1 in the PACIS article, *Summary of the analyzed articles*), we noticed that research on technology neutrality has clearly increased in the last 10-20 years. Three of the articles that we included in our review were published before the year 2000, ten were published between 2000-2009 and 26 articles were published between 2010-2020.

Before examining the Figure 1 below, where the timespan and tones of the included papers are displayed, it must be kept in mind that not all papers on technology neutrality and law or regulation were not possible to include in the scoping literature review, so these findings do not demonstrate the entire truth and opinions of the scholars that published articles before the year 2021.



**Figure 1** The tones of the papers scrutinized in the PACIS article that this master's thesis is based on.

As we can see in the Figure 1, there has been a notable growth in the papers that had a more negative or skeptical tone on technology neutral regulation. During the years 2011-2020 in total 17 papers that we categorized as papers that discussed only the challenges were published. During this time span there were 7 papers on the benefits and 3 papers on both benefits and challenges. Before the year 2011, only 2 this kind of papers were published. Before the year 2011, 8 of the papers were discussed only the positive aspects and 3 papers discussed both benefits and challenges.

## 4.2 Guidance and warnings on certain technologies

In this subchapter I present some of the theory, guidance, and warnings on applying the principle of technology neutrality to certain technologies. The findings are based on the papers that were included in the PACIS article, and the themes were chosen by their perceived importance while doing research for the published article. During that process these themes seemed important and worth examining further

### *Theory*

In his widely referred essay Koops (2006) addressed the question “should ICT regulation be technology-neutral?” (Koops, 2006). He overviews some of the e-policies that have taken technology neutrality as a starting point of regulation, analyses the components of the starting point and the potential meanings, and shows how the mentioned starting points work in practice. After this he creates a criterion of the starting point to create a tool which can be applied to real cases. Also, he contemplates on when the starting point is feasible and when it likely is not. Koops (2006) ended up in a conclusion that the starting point “ICT regulation should be technology neutral” can be used in many ways, such as thinking about the goal of regulation: that the *effect* of ICT should be regulated, not technology itself. When it comes to technology development, it means that regulation should not affect negatively to technology development or unduly discriminate different technologies. The last perspective, namely legislative technique, emphasizes that legislation should not address concrete technologies, if possible, but also provide legal certainty.

Koops (2006) provided some viewpoints on the aspect of legislation. He calls this a trade-off: technology neutrality requires abstractness, but it should also provide enough legal certainty. Some actions to take would be having multi-level legislation, open-ended formulations and a combination of abstract and concrete rules that are regularly evaluated, would create both adequate legal certainty for existing technologies, but also leave room for future development.

The work of Koops (2006) is one of the foundations of research on technology neutrality in the ICT field. Working on the findings could be continued, for example by using the same categorization of the goal of legislation, technology development, and legislative technique. These themes could be applied to certain technologies to examine how these have been taken into account in the legislative process, and also compare cases where the end result is considered positive to cases where the end result is more questionable.

### *Spectrums*

Spectrums were the most discussed context in the papers that were included to the PACIS article. This might be due to the fact that the regulation on spectrums has intentionally aimed for technology neutral provisions for several years (Irnich, Kronander, & Selén, 2013). Regarding technology neutrality, in the context of

spectrums six papers focused on the benefits<sup>1</sup>, two addressed both benefits and challenges<sup>2</sup>, and one focused on the challenges<sup>3</sup>. The benefits-focused papers addressed, for example, the regulatory issues that affect business models for mobile TV (Falch, Henten, Tadayoni, & Skouby, 2009), different spectrum auction models and supporting technology neutral auctions (Cramton, 2013), how IMT standardization activities do not prevent applying technology neutrality (El-Moghazi, Whalley, & Irvine, 2019), and how technology neutral metrics reduce the administrative work of updating regulation and clarifies the relationship between regulatory measures and use of shared spectrum (Kruys, Anker, & Schiphorst, 2016).

When it comes to the paper on both benefits and challenges, it was argued that while technology neutral provisions lessen the risk of under-utilized spectrums, it also creates uncertainty over which technologies will be in use. This would require a mechanism to ensure compatibility between different uses to avoid harmful interference. (Chandra, 2009) Ercole (2005) proposed moving to a less centralized spectrum regime. In a paper that addressed the challenges, the authors argue that sometimes the situation requires a certain technological solution (Irnich et al. 2013).

One proposition for research regarding spectrums could be this: Can the viewpoints presented in the context of spectrums be applied to other contexts, or is the context of spectrums unique in a way that this is not reasonable?

#### *Legal access to traffic data and privacy*

Escudero-Pascual & Hosein (2004) discussed the aspects of the fact that the number of technology neutral policies on lawful access to traffic data have increased. In the context of phone calls, traffic data means, e.g., data on calling and receiving phone numbers, when and where the call was made, and how long did the call take. This data does not include the contents of the communication. Law enforcement uses this information for investigation and intelligence gathering. However, if the regulation on traffic data is written in a technology neutral way, there are risks that the extent of the lawful access to traffic data becomes broader than what was meant to, as the technological means develop constantly. It was pointed out that technology-neutral language may be used to avoid dealing with the challenges and risks that come with applying the power of lawful access to new infrastructures. (Escudero-Pascual & Hosein, 2004)

The authors took actions on the Internet as a reference: the subject line and text field in emails may be content, which are not considered traffic data, but what about the URLs and search parameters? They can reveal information on the content rather than being only traffic data, if the search parameters include, for example, words such as “how to make explosives” or the URL belongs to a website which guides people with AIDS. This can lead to a situation where the legal protection of different types of data is not always clear, which is a very legally problematic situation.

These research questions relate to these themes: Do technology neutral provisions pose threats to lawful privacy? If yes, what kind of threats? How can lawful privacy be ensured when using technology neutral provisions?

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<sup>1</sup> Cave (2008), Chochliouros and Spiliopoulou-Chochliourou (2003), Cramton (2013), El-Moghazi et. al (2019), Falch et al. (2009) and Kruys et al. (2016).

<sup>2</sup> Chandra (2009) and Ercole (2005).

<sup>3</sup> Irnich et al. (2013).



### 4.3 Referenced studies

When composing the Figure 1, I had a hypothesis that there were a couple of papers that were the start to this significant change in the tone after the year 2010. When doing the original research, the criticizing paper by Hildebrandt (2011) and the theory-heavy Ohm (2010) left a memory trace in my mind. I also expected that Koops (2006) and Reed (2007) would be often mentioned, as they have reached a somewhat vanguard position with their then-new doubting opinions on technology neutral regulation, at least by now. Next, I will elaborate why I Koops and Reed have received this status in this context.

The works of Koops and Reed are considered to be groundbreaking, as Koops was the first who analyzed the concept of technology neutrality outside the telecommunications sector (Reed, 2007). Koops asked and answered some insightful questions regarding technology neutrality, namely the following:

1. *Why* would the principle of technology neutrality be a starting point for certain legislation, i.e., what is the reason that this principle should be applied?
2. *When* would it be appropriate to have the principle as a starting point?
3. *How* would the principle be used in formulating legislation?

Koops was one of the first researchers that contemplated on this matter this deeply. Reed, on the other hand, extended Koops' research by creating a classification of the different meanings of technology neutrality for the legislators to utilize to understand better what technology neutrality is, before actually applying it to the regulation. Also, Reed analysed whether the (at least at that time current) thought of technology neutrality being always applicable and the best option, is correct. Reed also presented some scenarios where undesirable consequences might arise after too vague regulation that is drafted in order to reach technology neutrality.

In conclusion, Reed stated that when applying technology neutral legislation, a few things must be taken into account: the lawmaker must understand the technology and how it is operated; a technology indifferent approach should be taken if the lawmaker is sure that different technologies do not affect the behaviour that is to be regulated; choosing between implementation neutrality and potential neutrality; and finally, it should be considered whether a *technology specific* approach would lead to better regulation. Even though Reed critiques the way of technology neutrality is used in legislation, he still points out the challenges in technology specific legislation, such as the difficulty of having the provisions up to date.

The depth of these two research was memorable compared to the other articles that were included in the PACIS article. To find out if the abovementioned hypothesis of these two researchers and Hildebrandt (2011) and Ohm (2010) being widely referred to would apply, I reviewed how many times these articles were what references that were used in the 19 challenge-focused papers that were published between 2011-2020.

Next, I will elaborate how the work of these ground-breaking authors, namely Koops (2006) and Reed (2007), were referred to. Also, Ohm's (2010) paper was included, as his paper also got referred to a couple of times. My hypothesis was that the statements presented in the papers would be analyzed and discussed instead of just having them as a reference. The results were the following: of those 19 papers, Koops (2006) was

referenced in nine<sup>4</sup>, Reed (2007) in eight<sup>5</sup>, Ohm (2010) in four<sup>6</sup> and Hildebrandt (2011) only in one<sup>7</sup>. In six papers none of these were mentioned.

Somewhat surprisingly, the references to Koops (2006) were mostly in footnotes instead of discussing the theories and opinions in the text. Bygrave (2015) had gotten feedback from Koops for his paper draft and the references to Koops' publication was done in footnotes. Also, in the following papers the authors merely backed their reasonings with the help of Koops: Craig (2016), Hildebrandt (2011), Hildén (2017) and Marcinauskaite, Pukanasytė, & Šukytė, (2020).

In four papers the researchers discussed Koops' arguments in a deeper level. Harasta (2018) examined the distinct legislative goals that Koops had dissected and made his own summary of it. Hildebrandt (2011) and Hofman, Lemieux, Joo, & Batista (2019) presented the various meanings of the concept "technology neutrality" that Koops had formed in his paper. Whitley (2013) addresses on the categorization and classification of technology neutral regulation that Koops presented.

The papers that mainly referred to Reed (2007) in footnotes were Craig (2016), Harasta (2018), Hildén (2017), Mangano (2018) and Marcinauskaite et al. (2020). In one paper there was more pondering: Whitley (2013) addresses the different aspects of neutrality, such as implementation neutrality and potential neutrality.

The thoughts of Ohm (2010) were not discussed a lot in these papers, as only footnotes were used in Greenberg (2015), Harasta (2018), and Marcinauskaite et al. (2020). Only Hildén (2017) discusses certain opinions of Ohm, but these do not have a significant role in the paper.

Based on these findings, it looks like Koops (2006) has presented such research and reasoning for the principle of technology neutrality, that his paper has a special position on the matter. This is understandable, of course, as he has theorized the principle thoroughly and more than most of the other scholars that are interested in the subject.

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<sup>4</sup> Bygrave (2015), Craig (2016), Harasta (2018), Hildebrandt (2011), Hildén (2017), Hofman et al. (2019), Marcinauskaite et al. (2020), Veerpalu (2018), Whitley (2013).

<sup>5</sup> Craig (2016), Harasta (2018), Hildebrandt (2011), Hildén (2017), Mangano (2018), Marcinauskaite et al. (2020), Veerpalu (2018), Whitley (2013).

<sup>6</sup> Greenberg (2015), Harasta (2018), Hildén (2017), Marcinauskaite et al. (2020).

<sup>7</sup> Harasta (2018).

## 5. Discussion

In this section I discuss further the themes that were discussed in the discussion section of the PACIS article.

After reviewing the relevant research and processing the benefits and challenges of technology neutral regulation based on the included research papers, we found out that these benefits and challenges were mostly discussed in legal journals instead of ICT journals or other outlets. We identified three themes and related research questions for future research on the regulation of ICT, as there is a research gap. Next, I will expand the discussion on these themes.

**Research theme 1** suggested that further research should be done on whether technology neutrality is beneficial in *specific* ICT or would the challenges outweigh the benefits. As is shown in Table 1 of the PACIS article (Appendix B), in some contexts the focus has been on benefits, in some contexts in challenges, and in some in both. We argue that taking into account the context of where technology neutrality would be applied is important, as technology neutrality is not a blanket solution that fits all situations and all technologies. It should be kept in mind that technology neutrality might not even suit all technologies, but more critical research should be conducted on this. This notion of how the context is important when deciding whether to apply technology neutrality was also voiced in previous research, both older and newer (e.g., Hojnik, 2017; Ohm, 2010).

One major restriction of the results of the PACIS article is that the review included mainly only one or two papers on each technology contexts, which means that while the scope of research was relatively wide, it lacks some depth on whether the overall research on each technology context has examined the benefits, challenges or both. Spectrums was an exception to this, as in total of 9 papers addressed this technology. Interestingly, within this theme there were papers in all three groups (thoughts on benefits, challenges, and both, see Table 1 in the appendix B), so in the context of spectrums the question of whether to apply technology neutrality or not seems to be most scrutinized.

**Research theme 2** addressed the question of freedom to choose, but on the other hand, the legal uncertainty that follows. Based on the findings not much research was done on the situation where technology neutral regulation could lead to such legal uncertainty that the challenges would outweigh the benefits. By legal uncertainty we mean a phase after a new regulation where it is difficult to predict how the new provisions will be applied to a certain situation, when there are no preliminary rulings (Depoorter, 2008). This can lead to a situation where organizations are not willing to adopt a technological innovation if the close future of how said technology will be regulated is unsure (Demlehner and Laumer, 2020). A good example is the field of copyright: technological development has caused various difficult situations where it has been unclear whether existing rules are applicable or not. For example, when sharing copyrighted material via Internet became possible, this was an enormous change and there was a burning question whether the liability for copyright infringement was applicable or not since the manner if act was different than before. (Depoorter, 2008).

**Research theme 3** pointed out that the principle of technology neutrality is still undertheorized. In the PACIS article we argued that by conducting more research on the research themes 1 and 2, this leads to having more general and applicable parameters and conditions to the subject of technology neutrality, instead of having mostly research on the principle on certain, individual technology contexts. Having more “general” research can lead to better understanding of the principle, and also assist the research on new technology contexts.

As many scholars have argued, accepting the principle of technology neutrality without criticism and just trying to apply it without considering the specialties of the current technology context can even lead to a harmful situation (e.g., Craig 2016; Greenberg 2015; Ohm 2010). Thus, we need more understanding of the principle and what to consider when applying it – and tools on contemplating whether the principle would even apply to a certain context or not. I believe that having more general research could also shed some light on these matters. In some cases, it is even considered a good practice if the ever-evolving technology forces the legislators and politicians to reconsider certain legislation regularly. For example, the surveillance law in the U.S. has been mentioned. Ohm (2010) has argued the following:

*“Most importantly, a tech-specific surveillance law, even one imposing few constraints on the agencies conducting surveillance, forces the Executive Branch to consult with Congress whenever technology changes in significant ways, which might help offset the troubling culture of secrecy in national security policy by bringing broader, more participatory democratic oversight to the conduct of national surveillance.”*

This means that even though technology neutral legislation could lead to legislation that would be applicable longer without revisions, it is not always a good thing. Special aspects, such as evolving the culture around certain technology could be a more beneficial and sought factor than having a law which could be left alone for a longer period. I would argue that this is one of the aspects that should be considered when thinking of applying technology neutrality to a certain situation and having more general research on the nature and applicability of technology neutrality would be beneficial, for example, in a form of a framework.

The principle of technology neutrality is pursued on high levels. For example, the European Union encourages the Member States to make technologically neutral regulation (see, e.g., Directive 2002/21/EC, recital 18). During the process of writing the PACIS article, no clear framework or guidance was found. It would be beneficial for the legislators, politicians, and stakeholders to have a framework which would discuss the situations when technology neutrality would apply, when it does not and what to consider when thinking of applying it. As applying technology neutrality is – at least currently – somewhat a marginal aspect in the big picture and the legislators have a lot of things to take care of while drafting new legislation, it is likely that there are difficulties in applying and understanding it as it is unlikely that many people have the knowledge.

A multiple case study (Gustafsson, 2017) on real cases could be conducted to chart the benefits and challenges that were brought up during the original process and to find out how the situation had developed after the legislation or regulation has come into force. As far as I am aware of, currently this kind of research is not published. The case studies have mostly focused on individual cases of individual themes, such as in Whitley (2013), Veerpalu (2018) and Gikay (2019). There are various case examples around the world where the principle of technology neutrality was applied, such as the case of Finnish taximeters (Lanamäki et al., 2019) and the Net Neutrality 2021

Legislation (Morton, 2021). By further research a framework for applying technology neutrality might be possible to create.

## 6. Conclusions

At the time of writing this master's thesis, the principle of technology neutrality cannot be considered mature or comprehensively theorized. Research gaps on various technology themes exist, a common framework for utilizing the principle does not exist, and the viewpoints presented in contexts of certain technologies vary from positive to critical or straight up negative.

The main findings of this master's thesis include information on how the evolution of researchers' tones on technology neutrality have changed during the years 1998-2020 (research question 1). This information is based on the 39 articles that were included in the PACIS article. Based on the data, at first the views on technology neutrality were mainly positive, but as more research was conducted, the scholars started to present also critical or even negative viewpoints. Naturally, to have a more thorough and comprehensive view on the development, probably a systematic literature review ought to be conducted.

The second section of the main findings addressed what kind of guidance and warnings on certain technologies have been presented in former research regarding theory, spectrums and legal access to traffic data and privacy in the context of technology neutrality (research question 2). Suggestions for future research were also given and continuing the work of Koops (2006) was suggested due to its importance in developing the principle of technology neutrality further.

The third section of the main findings that extends the findings in the PACIS article involves scrutinizing how some of the research (Koops, 2006; Reed, 2007; Ohm, 2010) that seemed rather groundbreaking during the process of writing the PACIS article were referred to in the other research that were included in the PACIS article (research question 2). For this the number of referencing was counted, and the content of the references was analyzed. For the most part there were two options: the reference was either just a footnote, or further contemplating on the matter. In some cases, the arguments were discussed in a deeper level, which is beneficial for future research. Too often the theorization and categorization of the source material was not discussed in depth, but only referred to, which does not take the research further.

The limitations of this master's thesis relate to the form of the thesis, namely it being based on a scientific article. This decision imposed certain restrictions to the structure of the master's thesis and the research questions to be chosen. The limitations are connected to the practical implications of this thesis: one practical use for this thesis is to use it as an example to how to conduct a systematic literature review for an article by following the steps that are explained in the context of writing the published article (Puhakainen & Väyrynen, 2021).

Further research is proposed to be carried out on specific technologies, legal uncertainty, further theorizing, drafting a framework for utilizing the principle, applying the categorization of Koops (Koops, 2006) or viewpoints from research on spectrums to other specific technology contexts, and technology neutrality and privacy.

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## Appendix A. Scientific publication as part of Information Processing Science Master's thesis

13.9.2021

Scientific publication can form a part of master's thesis. This type of thesis consists of two parts: Introduction and accepted scientific publication. The scientific publication must have been accepted in JuFo 1, 2 or 3 -level publication forum and it must be included as an appendix to the Introduction. Supervisor must confirm beforehand that the publication forum allows self-archiving or open access. Student must be the first author in the publication. If the publication has been accepted but it has not yet been published, the acceptance email or other proof of acceptance is submitted as part of evaluation by the supervisor. Both Introduction and the scientific publication are evaluated with following criteria (grade 4 or 5):

- For grade 4, the Introduction must include all mandatory parts.
- For grade 5, the Introduction must either include optional parts or the publication must include these parts comprehensively and with student contribution.
- If the publication has been accepted in JuFo 2 or 3 –level publication forum, grade is 5 (also here the Introduction must include all mandatory parts).

The Introduction extends the information and contributions that were presented in the publication (but not exceeding 20 pages, including references), follows the template of master's thesis and consists of following parts:

1. Cover page (mandatory, title and author information)
2. Abstract (mandatory)
3. Introduction to research topic and research questions (mandatory, 2-3 pages, with references)
4. Theoretical background (optional, can extend and elaborate the background presented in the publication)
5. Research methods and process (mandatory, 3-7 pages or longer if needed, with references)
  - 5.1. Details of research methods and research process
  - 5.2. Detailing the role of the student in every part of the research work and writing of the publication, reflection of lessons learned from the publication process (The Introduction should extend the parts of the publication where student had less contribution)
6. The main findings of the research (optional, can extend and elaborate the findings presented in the publication)
7. Discussion (optional, can extend and elaborate the discussion in the publication)
8. Conclusions (mandatory, 1-2 pages, with references)
9. References (mandatory, for Introduction)
10. The scientific publication as an appendix (mandatory, camera ready publication, or final content without formatting)

## Appendix B. The publication “The Benefits and Challenges of Technology Neutral Regulation - A Scoping Review” (Puhakainen & Väyrynen, 2021)

The article is the accepted author version of the PACIS article.

Puhakainen, E., & Väyrynen, K. E. (2021). The Benefits and Challenges of Technology Neutral Regulation—A Scoping Review. *PACIS 2021 Proceedings* 48. <https://aisel.aisnet.org/pacis2021/48>

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# The Benefits and Challenges of Technology Neutral Regulation – A Scoping Review

*Completed Research Paper*

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## Abstract

*The principle of technology neutrality (PTN) is being used as a starting point for regulation by regulators around the world. While technology neutral ICT regulation is seen as an answer to regulators' struggles to keep up with fast-paced changes of ICT, also critique towards this principle has been voiced. Here, we report on the results of a scoping review we conducted on literature in three research databases to summarize the current understanding of the benefits and challenges in the context of technology neutral regulation. We contribute to IS research by introducing to the IS community four benefits of and seven challenges related to technology neutral regulation – which has been foremost addressed in legal research so far – and by suggesting three research themes and questions for future IS research on, e.g., technology innovation, the development, adoption and use of technology, and a better theorization of the PTN.*

**Keywords:** literature review, technology-neutral regulation, principle of technology neutrality, ICT regulation, regulation of IT

## Introduction

Information and communication technology (ICT) regulation affects the development, adoption and use of technology (e.g., Bernardi et al. 2017; Klecun-Dabrowska and Cornford 2000; Väyrynen and Lanamäki 2020). One prominent characteristic for legislation is that it usually follows what is happening in the world, and legislators try to keep up with the development and changes that occur. ICT is often changing at a fast and increasing pace, which makes keeping ICT legislation up-to-date challenging. Law often lags behind the development of technology (Reidenberg 1997). One practical example of this are drones. When drones started to be more common in civil use in the 2000's and 2010's, there was a growing number of instances where drones caused harm to people or property. In addition to concrete harm, some of them also caused disturbance when they were flown in certain areas. The European Union, for example, has reacted to this and adopted a regulation that, e.g., requires operators of unmanned aircraft to register themselves in certain cases.<sup>1</sup> Regulation is often much slower to change than the technology it seeks to regulate, which poses certain challenges for regulators.

One approach taken to respond to this challenge is to design regulation based on the principle of technology neutrality (PTN) (Moses 2007). Legislation can be drafted in a technology-specific or

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<sup>1</sup> Commission Implementing Regulation (EU) 2019/947 of 24 May 2019 on the rules and procedures for the operation of unmanned aircraft C/2019/3824 article 14 section 5.a.

technology neutral way. Technology-specific legislation means that the legislator refers to specific types or classes of technology (Ohm 2010), e.g., in defining the tools that make a larceny (i.e., the theft of personal property of another person or business) into a grand larceny. For example, in Finland one of the reasons that a larceny can be considered grand larceny is that the perpetrator has used a firearm, explosive or similar dangerous equipment (The Criminal Code of Finland 39/1889, 28:1.1.4 §). Technology-specific legislation pays more attention to *how* something happens. Technology neutral legislation, on the other hand, focuses on regulating behavior and *what* happens instead of how it happens (Greenberg 2015). This means that the law is drafted in terms that are general and vague, with emphasis on general characteristics such as purpose and functions (Koops et al. 2006; Ohm 2010).

According to Harasta (2018) the term “technology neutrality” is used to describe how emerging technologies should be regulated, mainly in the field of ICT. The principle of technology neutral regulation has been accepted and implemented by regulators around the globe (e.g., European Commission 2019; Kim 2019; Koulu 2016). In Europe, this principle has been defined in the Framework Directive 2002/21/EC on a common regulatory framework for electronic communication networks and services<sup>2</sup>. It states that all member states should ensure that regulation is technology neutral, so that it “neither imposes or discriminates in favour of the use of a particular type of technology”. The PTN is commonly used as the starting point for ICT regulation (Koops et al. 2006; Koulu 2016). Some of the reasons for creating technology neutral regulation are to ensure that regulation does not prevent technological innovation (Kamecke and Körber 2008) and that it is flexible, time-proof and open to change (Ali 2009; Koops et al. 2006). However, also critique has been presented regarding the usefulness or applicability of the PTN. Problems that have been emphasized especially in legal research are the difficulty of regulating technology that does not yet exist, the danger of over- or under-inclusion of technologies in the law, and the question of whether technology neutral law really can be neutral (Greenberg 2015; Koops et al. 2006; Moses 2007).

Information systems (IS) research, among others, is interested in studying the development, adoption and use of technology. However, the regulation of information technology (IT) has been scarcely studied in IS research (see Gozman et al. 2020), and the PTN has not been addressed at all in the main IS outlets. Given the practical relevance of the PTN for ICT regulation, as well as the research gap on regulation of IT, we conducted a scoping literature review to answer the following **research question**:

*“What are the benefits and the challenges related to a technology neutral regulation of ICT?”*

With our paper, we make two contributions to IS research. First, we introduce some of the benefits and challenges of technology neutral regulation to the IS community, and second, we provide some directions for future IS research based on our scoping review.

We next describe the research methodology we applied. Then, we present the findings of our literature review. Finally, we discuss our findings and present potential research themes and questions that future IS research could address. We conclude our paper with practical implications and research limitations.

## **Methodology**

This research was conducted as a scoping literature review (Arksey and O’Malley 2005; Munn et al. 2018). Scoping reviews are a suitable approach to identifying the key characteristics or factors related to a concept (Munn et al. 2018), i.e., to summarize and disseminate research findings in the context of a particular area (Arksey and O’Malley 2005). In addition, scoping reviews can act as a precursor to a systematic literature review and to identify gaps that exist in the literature (Arksey and O’Malley 2005;

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<sup>2</sup> European Parliament and the Council (2002). Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services (Framework Directive). The principle of technology neutrality is mentioned in Section (18).

Munn et al. 2018). The main goal of our scoping review is to summarize and disseminate for the IS research community research findings regarding the benefits and challenges related to technology neutral regulation, and to also identify potential directions for future IS research. For our scoping review, we followed the five stages described by Arksey and O'Malley (2005).

In **Step 1 (“identifying the research question”)**, we identified our research question based on the observation that the PTN is being applied in practice by regulators as a way to create flexible regulation that would allow for future technological development, while at the same time some research has voiced doubts about whether the application of the PTN is really as beneficial as regulators seem to perceive it. In **Step 2 (“identifying relevant studies”)**, we first conducted a Google search on technology neutral regulation to familiarize ourselves with the terminology used (e.g., technology neutral regulation, technologically neutral regulation/legislation, etc.). We then conducted a search in three databases with the following search string: (“tech\* neutr\*”) AND (policy OR regulat\* OR legal OR legis\*) in May 2020. We did not set any restrictions to the publication date of articles. ABI/INFORM (Abstract search) returned 10 results, Ebscohost (Abstract search) 193 results, and Scopus (all fields) 215 results, in sum 418 results. We then removed the 61 articles that were returned in both Ebscohost and Scopus, resulting in 357 articles. In **Step 3 (“study selection”)**, we excluded 31 articles that were not written in English. We also excluded results that were not academic papers (e.g., books and book chapters, newspaper articles) and papers that – based on the abstract – clearly were not addressing ICT-related technology neutral regulation. By ICT we mean all electronic information and communication technologies, such as the devices, software, and (telecommunication) networks that are “defined by their use (communication) or area (information)” (Koops et al. 2006, p. 3). For example, when reviewing the 50 first search results, we noticed that no papers on climate policy and energy policy were relevant to our research question as those papers addressed other than ICT-related technology regulation. Therefore, we decided to exclude all results that were about those themes. We then went through the full text of the remaining papers to identify those papers that in one way or another addressed benefits or challenges of ICT-related technology neutral regulation. In papers where text search was possible, relevant content was mainly found by searching for the term “neutral”, other papers were browsed through. Only papers that gave some original insight were included in the review, resulting in 38 articles. In addition, the article by Koops et al. (2006), which we identified through snowballing (Koops et al. 2006), is also included due to its relevance and because of being referred to in many of the papers that are included in our review. As a result of this study selection process, 39 articles are included in this review (see Table 1). In **Step 4 (“charting the data”)**, we extracted from these 39 articles information on the study context (what ICT was the study about), what the main findings of the study were, and any benefits and challenges that were mentioned related to technology neutral regulation or the PTN. In **Step 5 (“collating, summarizing, and reporting the results”)**, we conducted thematic analysis (Vaismoradi et al. 2013) on the extracted benefits and challenges to identify common “themes”. This resulted in the identification of four categories of benefits and seven categories of challenges. We want to emphasize that even though we identified these different groups of benefits and challenges, the reader will notice that these are overlapping to some extent and interrelated.

## **Results**

Based on our literature review, we identified four categories of benefits, and seven categories of challenges. The benefits are Future-proof regulation (B1), Non-discriminating regulation and resulting benefits to competition (B2), Tackling regulators’ limited understanding of the regulated technology (B3), and Allowing for innovation and future development through flexibility and freedom to choose (B4). The challenges we identified are Difficulties in applying technology neutral regulation due to uncertainty and ambiguity (C1), The PTN is undertheorized (C2), Evaluation of when the application of the PTN is suitable is challenging (C3), Doubts whether regulation even *can* be neutral (C4), Negative effects on competition (C5), Providing both technologically neutral and standardized options can increase enforcement costs (C6), and The PTN might be applied by regulators for the wrong reasons

(C7). Table 1 summarizes the literature we reviewed in form of a simple concept matrix (see Webster and Watson 2002). The table is split into 3 sections – research that recognized only benefits of technology neutral regulation, research that recognized only challenges related to technology neutral regulation, and research that recognized both benefits and challenges of technology neutral regulation.

**Table 1. Summary of the analyzed articles**

	Authors	Context	Benefits				Challenges										
			B1	B2	B3	B4	C1	C2	C3	C4	C5	C6	C7				
[1]	Cave (2008)	Spectrums		x													
[2]	Chochliouros and Spiliopoulou- Chochliourou (2003)	Telecommunication, Spectrums		x													
[3]	Cramton (2013)	Spectrums		x	x	x											
[4]	El-Moghazi et al. (2019)	Spectrums, International mobile telecommunication			x												
[5]	Falch et al. (2009)	Spectrums		x	x	x											
[6]	Jordan (2009)	Telecommunications	x	x													
[7]	Julia-Barcelo and Vinje (1998)	Electronic signatures		x		x											
[8]	Kim (2019)	Electronic signatures		x		x											
[9]	Kruys et al. (2016)	Spectrums	x	x													
[10]	Lipinski (2003)	Copyright law in cyberspace		x													
[11]	Miller and Hoffman (2011)	Digital infrastructure policy		x		x											
[12]	Pritchard-Kelly (2018)	Satellites, Broadband				x											
[13]	Vittet-Philippe (1998)	Digital convergence	x														
[14]	Briglaue et al. (2020)	Broadband policy						x							x		
[15]	Bygrave (2015)	Information + data concepts in regulation						(x)									
[16]	Clarke and Bennett Moses (2014)	Drones										(x)					
[17]	Craig (2016)	Copyright law in information age							x	x	(x)						
[18]	de Lanerolle (2011)	Broadcasting + telecommunication regulation						x									
[19]	Escudero-Pascual & Hosein (2004)	Regulation of access to traffic data															x
[20]	Goodman (2006)	Sponsorship disclosure law						x									
[21]	Greenberg (2015)	Copyright law, technology neutrality theory						x	(x)	x	(x)						(x)
[22]	Harasta (2018)	Artificial Intelligence						(x)						x			(x)
[23]	Hildebrandt (2011)	Theoretical, legal protection by design								(x)	(x)						
[24]	Hildén (2017)	Information privacy regulation						x		x			x				
[25]	Hofman et al. (2019)	Blockchain, GDPR						(x)									
[26]	Hojnik (2016)	Digital goods regulation								x							
[27]	Imrich et al. (2013)	Spectrums															x
[28]	Mangano (2018)	Blockchain (insolvency law)							x								
[29]	Marcinauskaitė et al. (2020)	Electronic payments						(x)									
[30]	Shah and Srivastava (2014)	e-commerce, e-governance						x									x
[31]	Veerpalu (2019)	Distributed ledger technology						(x)									
[32]	Whitley (2013)	E-identity						x		x	x						x
[33]	Chandra (2009)	Spectrums		x				x									
[34]	Cohen and Koosed (2019)	Public notice regulation (digital information)	x			x				x							x
[35]	Ercole (2005)	Spectrums				x	x										x
[36]	Hildebrandt and Tielemans (2013)	Theoretical, data protection by design		(x)						(x)	(x)						
[37]	Koops et al. (2006)	Theory		(x)				(x)		(x)							
[38]	Ohm (2010)	Surveillance laws	x					(x)	x	(x)							
[39]	Veerpalu (2018)	Blockchain, payment technology		(x)		x		x									

Within each section, the articles are alphabetically ordered. For each article, the table shows the “reference number” we use due to space limitations and for brevity to refer to the respective article in the remainder of the Results section, the author information, the (technology) context in which the study was conducted, and the identification of what benefits and challenges the article contributed to. If an “x” in the table is presented in brackets “(x)”, it means that the respective benefit/challenge has not been



mentioned in relation to the specific (technology) context the article addresses, but in relation to technology neutral regulation more generally.

Research interest in technology neutral regulation and the PTN seems to have increased over the past 3 decades. While only three of the articles in our review have been published before the year 2000, ten articles have been published between 2000-2009, and 26 articles have been published between 2010-2020. Considering the types of technology regulations and technologies addressed in these articles, this also makes sense. Over the past 20 years, technology and technological possibilities have considerably changed, which has increased the need to take the rapid changes in technology into account also on the level of laws/regulations. An interesting observation that can be made from Table 1 is that the ‘tone’ of how technology neutral regulation is considered in research has changed. Of the 19 articles that only address challenges related to technology neutral regulation, 17 have been published after 2010. In contrast, all three articles published before 2000 only address benefits of technology neutral regulation. Thus, without claiming any statistical significance, it appears that research has become more critical towards the PTN. Of the 39 articles in our literature review, 26 have been published in forums that focus on law and/or policy research – thus, our study is quite heavily informed by legal research.

Next, we describe the benefits and challenges we identified in more detail.

### ***Benefits of Technology Neutral Regulation***

#### ***B1 – Future-Proof Regulation***

Future-proofness is one of the most prominent characteristics that the supporters of the PTN discuss. A technology neutral approach tries to reduce or remove the need of revising regulation whenever a new technology has been developed [9], as technology neutrality allows methods to evolve with the society [34]. Technology neutral regulation can survive development and innovations in technology [6], and it has a better statutory longevity than technology-specific regulation [38]. Especially in areas and environments where rules are short-lived, technology neutral regulation may be required to ensure the longevity of the regulation [13].

#### ***B2 – Non-Discriminating Regulation and Resulting Benefits to Competition***

Numerous scholars have discussed the positive aspects of the PTN for a non-discriminating regulation and healthy competition: technology neutral legislation promotes innovation in technology and competition (see, e.g., [8, 39]). One aim of the PTN is the attempt to prevent unfair competitive advantage for existing technologies [36] and to avoid discriminating or favoring different methods or technologies [5, 36, 6, 9] to ensure equal treatment of the same services, regardless of the way of delivery [2, 10]. New possibilities of competition can be created by technology neutral regulation, as they could, e.g., reduce the risk of underutilization of spectrums [33], and technology-neutral spectrum auctions would promote competition between potential technologies on an equal basis [3]. By technology neutral regulation the technology could be used for other services, too, in addition to the already regulated purposes [33]. In addition, also the need of revising technology-specific regulation can be seen as an anti-competitive feature [9].

Competition can be encouraged, for example, by leaving room for future development, because then it is easier to develop new technologies and business opportunities [7] or to avoid regulation that is both country-specific and technology-specific, because country/technology-specific regulation hinders or even prevents international competition by being confusing and conflicting with each other [11]. Technology neutral rules can also combat market problems, such as environments where former monopoly operators continue benefiting from the market power they gained earlier [2], and they can provide predictability and consistency in the treatment of different technologies [10]. Together with flexibility (see B4), technology neutral rules can create higher investment security and lower transaction costs [1]. According to Koops et al. [37], “what holds off-line should also hold on-line” (p. 7).

### *B3 – Tackling Regulators’ Limited Understanding of the Regulated Technology*

In a spectrums context, failed policy decision on technological choices might cause lock-in of technology development and limit competition to that particular service area [5] or cause locking into an inferior standard that hinders development of new tools and technologies [4]. The PTN helps to tackle the problem that often, legislators do not possess the best knowledge on the most suitable and applicable technologies and the challenges related to forcing the markets to use a certain standard [35]. As the technologies develop fast, legislators need the market test to identify the best technologies [3].

### *B4 – Allowing for Innovation and Future Development through Flexibility and Freedom to Choose*

Technology neutral regulation provides significant flexibility as the legislator can let the governments, actors in the market and other private entities decide how they want to carry out a particular task in a way that is suitable for their needs [34, 5, 8] or which standard is the best option for them [35]. Since the legislator cannot or should not predict emerging technologies and what technologies will be in use in the future, providing flexible regulation would allow the actors to find the best options [34] to, for example, implement the most cost-effective services, irrespective of the technology that is used [12]. Technology-neutral spectrum auctions, for example, would allow flexibility by allowing the spectrum to be organized in different ways for different technologies [3].

Technology neutral legislation can allow methods/technology to evolve with society [34] and leaves room for future development. This encourages innovations and development of new business opportunities [7]. Technology neutral regulation also speeds up adoption of innovative services [12]. Technology neutral goals and principles can also make worldwide collaboration with innovations easier [11].

## ***Challenges Related to Technology Neutral Regulation***

### *C1 – Difficulties in Applying Technology Neutral Regulation Due to Uncertainty and Ambiguity*

The challenge that was addressed most often in the context of the PTN is the wording of it. Numerous scholars describe technology neutral provisions as too broad, vague or ambiguous (see, e.g., [24, 25, 39]). This vagueness/ambiguity causes challenges for both regulators and those that have to adhere to the regulation (= the subjects of the law). It leads to the law being obscure and difficult to interpret [30] or causes a low level of adoption of the new technological possibilities [32]. Vague or broad language can result in difficulties to interpret what objects/technologies are in the range of the regulation [20, 29]. Too neutral provisions and language can also cause the regulation to be meaningless [37].

Sometimes the broad language causes unsureness of how a certain technology neutral law will regulate a particular technology [25] or leaves in other ways the meaning and intent of the law unclear to the subjects of the law, causing non-transparency in the rule [39]. When rules are defined too broadly, they might need to be complemented or replaced by stricter norms, leaving unnecessary ambiguity in the legislation for a while [15]. It is also argued that to create a fundamentally technology neutral regulation, it must be specific about the technologies to which it will be neutrally applied [21].

Applying the PTN to a certain regulation requires that the legislature understands the context – and to understand that there *is* some context in the first place. However, policy makers often fail to study the context of technology at hand when enacting laws [38]. Not providing this context can lead to confusion in the creation, application and interpretation of the legal framework [22]. If there is a default of applying the PTN, this can result in very narrow and quickly outdated conflict-specific results [21]. As technology neutrality allows various uses and utilizations for particular contexts, such as spectrums, and it is not clear which technologies will be used, regulators should develop strong mechanisms to avoid harmful interference between the technologies and to ensure compatibility between them [33].

However, the fast pace of technological innovation causes difficulties for the legislators, as new innovations can challenge the neutrality of the regulation time and again. Sometimes, amendments must be made to the existing regulation to ensure that new uses of technology or business models get the same treatment as the former technology [31]. Sometimes, the legislators do not know in advance whether they want to apply certain technology neutral regulation to some new technology or not, or whether the application of such regulation to a new technology will promote or hinder the new law's policy goals [21]. If a technology definition that the PTN should be applied to is broad to begin with, it can give an unstable basis for technology neutral regulation, as it could lead to an unclear or unwanted result regarding what technology is regulated [18].

The role of the PTN is limited as long as the EU and national politicians continue talking about specific technologies, as this promotes certain technological solutions to achieve policy goals and hampers implementation of the PTN [14]. Depending on the approach the legislator has chosen, the end result can vary a lot. Craig [17], for example, has formulated three approaches to the PTN: restrictive, intermediate and expansive. Restrictive and intermediate approaches can produce very different, sometimes even contradictory conclusions about how to apply the PTN to some technology case [17].

### *C2 – The PTN is Undertheorized*

The PTN has been argued to be undertheorized, and that therefore scholars, legislators and others often are not aware enough of all the relevant aspects, possibilities and restrictions of the principle [21]. It is, for example, unclear whether PTN is a rule of law or rather a rule of thumb [28]. Ohm [38] argues that the PTN lacks theoretical definitions, and that the PTN is considered as a general principle. Lacking understanding and undertheorization leads to a situation where scholars and legislators are often too optimistic about the possibilities of PTN: they may simply assume that utilizing the PTN will lead to statutory longevity and equal treatment of old and new technologies, even though the matter is not that simple, and factors exist that weaken the possibility to achieve said goals [21]. In the context of copyright, the PTN has been criticized for being applied in a too restrictive manner in which foremost the rights of a copyright owner are protected and extended, but where changes in how technology can exploit these rights have received too little regard [17].

### *C3 – Evaluation of when the Application of the PTN is Suitable is Challenging*

Some critics of the PTN see it as a starting point or a guiding principle for regulation rather than as the end goal or as something to be treated as a main principle or default choice for technology regulation (see, e.g., [17, 38, 32]). Legislation should not always be technology-proof [34, 36]. Technology neutral regulations are not appropriate in all legal aspects, and it should be examined whether they fit the modern society and its values that are protected by the EU [26], for example. Some fields, such as information privacy, are seen to require clear and concrete technical mandates instead of just guiding principles such as the PTN, as technology neutral regulation has the risk of being “too vague or all-encompassing” [24, p. 159]. The legislators should first gain an understanding of how the technologies at hand work, are used and deployed, to be able to make an educated decision of applying the PTN to the respective technology regulation [38]. It should also be noted that over the years, a sustainable law can also lead to a situation where the interpretation of the rules has diverged for different technologies, leading to technology specificity [37].

Sometimes, technology specific regulation is necessary to ensure the effectiveness of legal norms [36, 37], and interestingly, sometimes sustaining technology neutrality might require the embedding of legal protection into innovative technological infrastructures [23]. It is even argued that discriminating different technologies is necessary to achieve the benefits of technology neutral regulation [21].

#### *C4 – Doubts whether Regulation Really can be Neutral*

Some criticism against the general idea of neutral laws and regulation has been voiced. According to some scholars, regulation and laws cannot be neutral, and technology neutral regulation should be considered as being rather an aspiration [16, 17]. Generally speaking, regulation is not meant to be neutral, and the technological ICT infrastructure that enables the law takes away the neutrality [36]. The possibility of “neutral” regulation has also been challenged by the argument that the law is already embodied by technology [23], as well as by political and social choices [32]. As each technology has its own force since it allows or inhibits certain behavior, it means also that technology is never neutral [23]. It has even been argued that neutrality itself is not neutral, and that neutrality is not only suboptimal, but also often self-defeating due to its elusive neutrality and fading normativity [21].

#### *C5 – The PTN Might Hinder Competition*

Technology neutral provisions do not provide enough guidance to the actors in the markets [24] or describe how to achieve the objectives of the PTN [14]. This reduces competition by causing uncertainty in the actors that operate in the markets, because they are not sure how certain different technologies will be treated by the law [24]. In addition, the obscureness and ambiguousness of some technology neutral terminology choices in legislation [30] can hinder competition. In the context of spectrums, it has been argued that competition can also be reduced by technology neutral regulation, e.g., by creating environments where technology neutral regulation would allow competing technologies to operate in the same area in such a way that they interfere with each other and make each other’s operations less effective. Interference reduces, e.g., the value of spectrums and makes their use less efficient. [27]

Even if a guiding and prescriptive technology neutral regulation was enacted, it is not certain that it would lead to changes in actual practices. The changes in operations/technologies that *would* be possible under a new, technology neutral regulation are not automatically suitable in practice. [35] New technology neutral regulation can also be seen as a regulatory burden for the new technology [22].

#### *C6 – Providing Technologically Neutral AND Standardized Options can Increase Enforcement Costs*

Technology neutral regulation can increase the costs of enforcing a regulation. Cohen and Koosed [34] identified this aspect in the context of public notice<sup>3</sup> regulation. The authors proposed that regulations that specify where/how public notices can be published (e.g., print newspaper, online newspaper repository) should be formulated in a technology neutral way. However, they also argued that at the same time, safe harbors<sup>4</sup> should be specified that would take into account, e.g., the demographic and socio-economic characteristics of those whom a public notice should reach. The safe harbor would present a way of acting in compliance with the technology neutral standard, while the actors could also choose their own method which would have to be in accordance with the standard. However, Cohen and Koosed [34] also argue that the implementation costs of such a technology neutral regulation could be higher than otherwise, as not all actors would decide to use the safe harbors forms of notice. The wide range of options could then cause extra costs for the reason that the notice receivers might bring suits over public notices they mistake to be inadequate. [34]

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<sup>3</sup> Public notice is a notice given to the public by a government office or legislative body regarding some legal procedures, e.g. about the possibility to comment on a law proposal.

<sup>4</sup> Safe harbor means that the regulator makes a provision in connection to a law or regulation that specifies that a certain conduct will be bestowed compliance with the applicable standard (Cohen and Koosed 2019), in other words it is stated that certain conduct will not be against the law.

### *C7 – The PTN Might be Applied by Regulators for the Wrong Reasons*

Some critique against the PTN – or against those who apply it – addresses the motivations of applying the PTN. It is claimed that often, the PTN is applied to avoid the work that would be required to address emerging technologies and how to regulate them. In other words, sometimes legislators shift the burden to the courts and administrative agencies, and those then end up with the responsibility to decide whether a law applies to a new technology. [19, 21] For example, in the UK, this delegating leaves technology-specific decisions to secondary legislation, where they do not receive as thorough examination as they would require, and this can lead to unintended or poor legislation [32]. Harasta [22] pointed out that sometimes, legislators seem to approach the PTN or the regulation of technology from the viewpoint that *avoiding* the regulation of technology is one way to keep up with countries that have less strict regulation for technology or non-existing regulation.

### **Summary of Results**

The PTN, and the benefits and challenges related to the PTN, have been addressed in a number of technological contexts (see Table 1), with the most common ones being spectrums (e.g., for 3G or DySPAN technologies), blockchain and distributed ledgers, electronic signatures and e-identity, and copyright. In addition, several articles [see 15, 17, 21, 23, 36, 37, 38] were focused more generally on a discussion of benefits and/or challenges of technology neutral regulation.

Based on our scoping review, technology neutral regulation is seen to be potentially beneficial in the context of electronic signatures [7, 8], copyright law in cyberspace [10], digital infrastructure policy [11], and digital convergence [13]. Most prominent were the benefits identified in relation to spectrums regulation: B1 - Future proof regulation [9], B2 - Non-discriminating regulation and resulting benefits to competition [1, 2, 3, 5, 9, 33], B3 – Tackling regulator’s limited understanding of the regulated technology [3, 4, 5, 35] and B4 – Allowing for innovation and future development through flexibility and freedom to choose [3, 5, 35]. Only C1 – Difficulties in applying technology neutral regulation due to uncertainty and ambiguity [33] and C5 – Negative effects on competition [27, 35] have been identified as challenges in the context of spectrums regulation. Also in the context of telecommunication regulation and broadband policy the same benefits (except B3) and challenges have been identified [14, 18].

In contrast, technology neutral regulation has been identified to be potentially challenging in the context of e-identity [32], e-commerce [30], information privacy regulation [24], regulation of access to traffic data [19], sponsorship disclosure law [20], artificial intelligence [22], and digital goods regulation [26].

### **Discussion**

Regulation has an impact on IS phenomena and on the development, adoption and use of information technology (Bernardi et al. 2017; Klecun-Dabrowska and Cornford 2000; Väyrynen and Lanamäki 2020). Nevertheless, research on the regulation of IT/ICT has been scarce in the IS field (e.g., Gozman et al. 2020). While the principle of technology neutrality (PTN) in regulation is being widely applied by regulators in Europe and elsewhere (e.g., European Commission 2019; Kim 2019; Koulu 2016), the IS community has not yet addressed this important topic (with the notable exception of Escudero-Pascual and Hosein 2004), and the benefits and challenges of technology neutral regulation have been discussed foremost in legal research outlets, as our scoping review indicates. Our contribution with this review is twofold: first, we introduce some of the benefits and challenges of technology neutral regulation to the IS community. The regulation of IT is an emerging and important topic in IS research, and we believe that also the PTN is becoming more and more important, especially considering attempts to create flexible regulation to allow for future technological innovation (e.g., Kamecke and Körber 2008). Second, we identify three themes and related research questions (this is not an exhaustive list) that provide directions for future IS research on the regulation of IT/ICT, see Table 2.

**Research Theme 1** (see Table 2) is the technology neutral regulation of specific ICT. We found that while technology neutral regulation has been seen beneficial for the regulation of some technologies, for other contexts there has been a focus on the challenges (see Section “Summary of Results”). This points towards the importance of the context in which technology neutral regulation is being applied, which also has been pointed out by previous research (e.g., Hojnik 2017; Ohm 2010). However, there is also division regarding whether technology neutral regulation is seen as beneficial or not in a *specific* technological context: research on spectrums and on blockchain, for example, have emphasized both benefits and challenges of technology neutral regulation (see Table 1). This warrants further investigation of the circumstances under which technology neutral regulation should be considered in the context of a specific technology or group of technologies. However, with the exception of papers addressing spectrums, our review only included one or two research papers for each different technology regulation contexts. Therefore, while our review gives a good general overview of the different benefits and challenges of applying the PTN to ICT regulation, it does not allow us to make strong claims regarding whether or not the benefits of applying the PTN for regulation of a *certain* ICT would outweigh the drawbacks. This opens possibilities for future IS research to contribute to our understanding of technology neutral regulation in different ICT contexts. For example, the PTN has – on a hypothetical level – been proposed as a potential approach to address challenges of Artificial Intelligence (AI) regulation (see Kerkimäe and Pärn-Lee 2020). However, how to regulate AI technology neutrally, and what the effects of such a regulation would be, has not yet been studied. The same is true for other ICT contexts.

**Research Theme 2** concerns the effects of technology neutral regulation on innovation, development, adoption and use of technology (see Table 2). The benefits of technology neutral regulation for innovation and future development through flexibility and freedom to choose has been proposed for numerous different ICTs (see B4 in Table 1). However, legal uncertainty might follow from a technology neutral regulation (Marcinauskaitė et al. 2020). Legal uncertainty, in turn, can negatively affect organization’s adoption of technological innovation (e.g., Demlehner and Laumer 2020). Future IS research should investigate this contradiction in depth.

**Research Theme 3** concerns the theorization of the PTN. Our review directly pointed towards an undertheorization of the PTN (e.g., Craig 2016; Greenberg 2015; Mangano 2018; Ohm 2010). We believe that by addressing Research Themes 1 and 2, IS research also can eventually make a valuable contribution to the theorization of the PTN by stepping up from investigation of specific technology neutral ICT regulation to identifying more generally parameters and conditions that affect the outcomes (e.g., innovation; development, adoption and use of technology) of technology neutral regulation. Also, when comparing the benefits and the challenges we identified, we found contradictory indications of whether the PTN supports or hinders fair and healthy competition. Through our scoping review, we also found that benefits/challenges refer to different actors: the regulator, and the “regulatory subjects” who have to abide by a regulation/law (e.g., technology organizations developing and organizations adopting new technology). For the regulator perspective, future research could study the benefits of the PTN (i.e., to overcome the problem that regulators often have only a limited understanding of the technologies they seek to regulate) versus the problem arising if regulators apply the PTN “too easily” to avoid the need to dive deep into technical details. For the “regulatory subject” perspective, future research could focus on the benefits of technology neutral regulation for those who want to develop, bring to the market or adopt new technological innovations versus a potentially resulting sub-optimal market situation from the perspective of consumers. The vagueness and ambiguity of technology neutral regulation (see C1) and resulting challenges are relevant for both regulators and regulatory subjects.

In regard to many of the questions presented in Table 2, one possible approach would be a comparison of the regulations of a certain ICT in different countries (e.g., technology neutral vs. technology specific regulation) coupled with an evaluation of the effects of these regulations on technology innovation activities, or on adoption and use of technology.

<b>Table 2. Possible Research Themes and Exemplary Questions for Future IS Research</b>
<p><b>Theme 1: Technology neutral regulation of specific ICT (e.g., AI, blockchain, ...)</b></p> <p><b>1a:</b> Under which conditions should a technology neutral (technology-specific) regulation formulation be considered in the context of a specific ICT?</p> <p><b>1b:</b> What are the benefits and drawbacks of technology neutrality in the regulation of a specific ICT?</p> <p><b>1c:</b> For what types of technologies is a technology neutral regulation more (less) beneficial than technology specific regulation, and why?</p> <p><b>1d:</b> What are the factors that determine whether technology neutral or technology specific regulation is more beneficial in the context of a specific technology (type)?</p> <p><b>1e:</b> What are the challenges involved in the formulation of future-proof regulation for a specific ICT?</p>
<p><b>Theme 2: Effects of technology neutral ICT regulation on innovation, and on development, adoption and use of technology</b></p> <p><b>2a:</b> What are the impacts of technology neutral regulation vs. technology-specific regulation on technological innovation (potentially in a specific industry)?</p> <p><b>2b:</b> What factors influence whether a technology neutral regulation is beneficial for future technological innovation or not?</p> <p><b>2c:</b> What are the impacts of technology neutral regulation vs. technology specific regulation on the development, adoption and use of technology?</p>
<p><b>Theme 3: Theorization of the principle of technology neutrality</b></p> <p><b>3a:</b> What are the parameters that should be considered when evaluating the suitability and effects of a technology neutral ICT regulation formulation?</p> <p><b>3b:</b> Under what conditions is technology-neutral ICT regulation beneficial for market competition?</p> <p><b>3c:</b> What are the challenges related to developing “future-proof” regulation and how to overcome them?</p> <p><b>3d:</b> Under what circumstances (e.g., regulated technology, intended outcome of the regulation) does the PTN provide benefits merely to the regulator (or the regulatory subjects), and why?</p>

## Conclusion

With this scoping review, we identified several benefits and challenges that are related to technology neutral regulation and the PTN. With this, we hope to provide the IS research community with a first basis for taking up this important and current topic related to the regulation of ICT.

In addition to implications for research in form of the directions for future IS research we have identified in the discussion above, our research also has practical implications. For regulators, it is clear that applying the PTN to regulation in an overoptimistic manner without comprehensive enough understanding of the technological context or the features of the PTN can lead to an unwanted situation, where the PTN is expected to solve technological challenges the regulator would otherwise have to solve themselves when drafting the regulation. However, the PTN is not a miracle solution and applying it requires careful planning and research, just as “the normal”, technology-specific regulation does. It is also necessary to examine what exactly is the beneficial impact of the PTN that the regulator aims to achieve.

Our research has several limitations, which also open possibilities for future research. First, this review was not conducted as a systematic literature review, and thus not all relevant literature that might provide information on the benefits and challenges related to the PTN and technology neutral regulation has been identified. In addition, even though we have identified the general context of ICT regulation that the articles referred to, we did not conduct a systematic analysis of whether certain benefits or challenges are specifically relevant in certain technological contexts. We limited our review to academic articles, and the inclusion of other types of sources (such as book chapters) might have revealed additional insights. However, our scoping review gives some indication that a systematic literature review would be beneficial and called for. This would then also allow a systematic analysis of regulator vs. regulatory subject point-of-view, of the benefits vs. challenges of the PTN in the context of different,

specific technologies, and the provision of more detailed directions for future research (for also other than research fields than IS, e.g., legal research).

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