

[Submitted for review to the International Journal for Standardization Research; comments are welcome and can be sent to the corresponding author Tineke Egyedi, t.m.egyedi@diros.nl]

Distinguishing standards and regulation for innovation research: Accommodating standards in Lessig's framework of regulatory modalities

Tineke M. Egyedi (*DIROS*), Arjan Widlak (*Kafka Brigade Foundation*) &
J. Roland Ortt (*Delft University of Technology*)

ABSTRACT

Innovation impact studies often do not explicitly distinguish between standards and regulation. Is there a need to differentiate them? That is, do standards and regulation differ significantly in how they work (inner workings) and how they work out (effects) in innovation processes?

In this article Lessig's (1999, 2006) framework of regulatory modalities and their constraints is extended and applied to shed light into the black box of direct innovation effects. The extension of his framework with Standards as a separate regulatory modality follows careful consideration of alternatives (i.e., accommodating standards as a special instance of Lessig's modalities of Law, Norm, Market and Architecture; or as a hybrid modality). It is used to identify the functions, essential inner workings and effects of Standards and Law, and shows that the two rule-sets show significant differences.

To reconcile Lessig's emphasis on constraints with the findings of innovation research (i.e., enabling and constraining effects), the authors differentiate between direct inherently constraining effects of regulatory modalities and modality-specific generic effects - as opposed to indirect effects. They conclude that Standards and Law merit differentiation in innovation research.

To further strengthen their conceptual foundation for empirical research the authors recommend that follow-up research e.g. addresses the relevance of the distinction between regulatory modalities and implementations thereof; and applies complementary frameworks to uncover unaddressed issues in how standards and regulation affect innovation.

Keywords: committee standards, regulation, law, innovation, regulatory modalities, tools of governance approach, constraints, inner workings, direct effect, ISO/IEC definition, Community Innovation Survey, regulatory standards, self-regulation, ADICO grammar

1. STANDARDS AND REGULATION: IS NOT-DIFFERENTIATING A PROBLEM?

It is not uncommon for laypersons as well as professionals to talk about rules in an undifferentiated manner, for example, in the context of bureaucracy. Rules, among which customs, norms, regulations and standards guide human behavior (Baer, 2011, p.277) “[These] terms (...) are often used indiscriminately (or at least interchangeably) and no agreed set of definitions exists.” (Carmona, 2017, p.6) Likewise, studies on effects of standards and regulation on innovationⁱ, the setting of this article, often also do not distinguish the two – neither theoretically nor empirically (Hawkins & Blind, 2017, p.5; Blind, Petersen & Riillo, 2017, p.258). Is this a problem? Before continuing, let us illustrate lack of differentiation in this field by taking a closer look at the formal definition of standards (section 1.1) and at the UK version of the Community Innovation Survey, a data gathering tool used in high profile innovation research (section 1.2).

1.1 ISO/IEC Definition of Standard

One might expect formal standards bodies, under whose auspices standards are developed, to define standards in a way that sets them apart from regulation. The official international standardization bodies of ISO and IEC define a standard as:

“(...) a document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.”(ISO/IEC, 2016)

Table 1. Key elements of the ISO/IEC definition of standard applied to regulation

ISO/IEC definition of standards Rules/ Institution	Rules, guide- lines, charac- teristics for activities or their results	Documented	Consensus (negotiated agreement)	Approved by a recognized body	For common & repeated use	Aim: optimum degree of order in a given context
Standard	X	X	X	X	X	X
Regulation	X	X	X	X	X	X

However, examining the definition element by element standards do not differ significantly from regulation.ⁱⁱ See Table 1. Note that the demarcation problem exists specifically between standards and regulation. The ISO/IEC definition is not so general that it could encompass any rule-type. For example, a ‘de facto standard’ concerns a product or service that emerges from the market; it is not established by consensus and is not a priori meant to achieve an ‘optimum degree of order in a given context’; and a social norm, a cultural phenomenon, is typically not documented or explicitly ‘approved by a recognized body’.

1.2 Community Innovation Survey

The lack of differentiation is also illustrated by research commissioned by the UK government concerning the influence of standards and regulation on innovation (Swann, 2000; DTI, 2005; King, 2006; Swann & Lambert, 2010), research which has strongly inspired our own (e.g., Ortt & Egyedi, 2018). The researchers were given the opportunity to incorporate additional questions on standards in the UK versionⁱⁱⁱ of the Eurostat Community

Innovation Survey (CIS3; DTI, 2005, p.37, p.80). The UK CIS3 (2001) for the period 1998-2000 included three questions on standards for UK companies (DTI, 2001; Eurostat, 2001):

- Question 8.1 asks respondents to comment on a range of factors that may inhibit the enterprise's ability to innovate, including the 'Impact of regulations or standards'. They are asked to grade the importance of these constraints. (adapted from Eurostat CIS3 question 10.2^{iv})
- Question 11.1 asks respondents to indicate the impact their innovation activities have had on their enterprise, among which the effect of having 'Met regulations or standards' (compare Eurostat CIS3 question 6)
- Question 12.1 asks respondents to rank the different sources of knowledge or information used in innovation activities. The different sources include 'Technical standards, Health and safety standards and regulations, and Environmental standards and regulations'.

Except for one element in question 12.1, the survey questions do not distinguish between standards and regulation. Is this problematic? One might argue, pragmatically, that such a distinction would have been meaningless to most respondents anyway. Or more principled, that it would not matter if standards and regulation had the same effect on innovation. But we cannot conclude this based on data from the above survey questions.

1.3 Research Questions, Definitions and Conceptual Approach

Whether differentiating between standards and regulations is always necessary, remains to be seen. If respondents usually make no distinction, there is an argument to be made for treating them as one and the same thing in surveys used for studying their *perceived* effect on innovation. But is this distinction also negligible when studying their *actual* effect? To those interested in which interventions best foster and support innovation, it is relevant to know whether standards and regulation work differently and have distinct effects (Pelkmans & Renda, 2014; Blind, Petersen & Riillo, 2017, p.258). Their inner mechanisms and direct effects on innovation are still a 'black box' (Swann and Lambert, 2017, p.32).

In this article we aim to develop a conceptual foundation for addressing the overall research question whether it is necessary to distinguish standards and regulation in innovation research. Such a conceptual effort is a precondition for any empirical examination. We do so in three subsequent steps. First of all, while the area covered is of an interdisciplinary nature, influential literature reviews (e.g. Swann, 2010) and the *Handbook of Innovation and Standards* (Hawkins et al., 2017) indicate that most innovation studies have been done from an economic or business management perspective. The perspectives of law and public administration, however, would seem better-suited to explore the difference between standards and regulation vis à vis innovation. We turn to Lessig's seminal work on 'code as law' (1999, 2006) and concepts from constitutional law that inspired him. Lessig has a broad take on regulation. It includes, next to Law, the regulatory modalities of Norm, Market and Architecture – but not standards. Our first subquestion is therefore: How can standards best be accommodated in Lessig's framework of regulatory modalities?

The term ‘standard’ refers in this article to committee standards, i.e., agreements that have been negotiated and documented for common and repeated use in committees of formal standards bodies, consortia, professional organizations, (inter)governmental agencies, etc. (Egyedi & Hommels, 2015, pp. 348-9; uses elements from ISO/IEC’s definition; ISO/IEC, 2016). The way the term ‘regulation’ is used in innovation research - and in our overall research question - can be read as “rules made by a government or other authority in order to control the way something is done or the way people behave.” (Cobuild English Dictionary). As we will discuss, this resembles Lessig’s use of the term ‘Law’. His use of the term ‘regulation’ encompasses all modalities that regulate behavior and will be addressed when introducing Lessig’s framework.

Once having argued how best to accommodate standards in Lessig’s framework of regulatory modalities, we explore in what manner his conceptual framework sheds light on the second subquestion, i.e. whether standards and regulation (i.e., ‘Law’ in Lessig’s terms) differ in how they work (inner workings) and how they work out (effects), a distinction introduced in Egyedi & Ortt (2017). This second step focuses on gaining insight into general mechanisms and direct effects.

In a final step we apply these insights to the area of innovation. That is, we seek to answer the subquestion how standards and regulation (i.e., ‘Law’) affect innovation.

The article is structured as follows. First, Lessig’s framework is introduced and positioned theoretically (section 2). Next, different ways are discussed in which standards may fit into his framework. One of these is argued to be most obvious and relevant to the research question, i.e. extending Lessig’s framework with standards as a fifth regulatory modality (section 3). Following, the two regulatory modalities of standards and regulation (i.e., Law) are examined and compared on their inner workings and effects (section 4). These generic insights (section 4) are then applied to the area of innovation (section 5). The article closes with a discussion on applying Lessig’s extended framework to the overall research question on innovation effects, the limitations of using the framework and recommendations for follow-up research (section 6).

2. REGULATORY MODALITIES

To explore the difference in nature of standards and regulation we take Lessig's framework of regulatory modalities (1999, 2006) as a starting point. His work stands in two important traditions of thought, traditions he is aware of but remain implicit. The first is that of *legal positivism* as developed by Hart in 1994 (2012, 2nd edition). We will discuss this tradition briefly, because it provides the a priori justification for an empirical examination. The second is the *tools based* approach that started out as the *tools of government* approach developed by Hood (Hood, 1983; Hood & Margetts, 2007). We will discuss this tradition briefly as well to show that Lessig’s approach is an – albeit interesting - loot from a tree with a more generic scope and richly filled toolbox.

We will discuss these traditions in so far as they contextualize and help understand Lessig's implicit assumptions and (undefined) notion of regulatory modality (section 2.1). Thereafter

we introduce his framework of regulatory modalities and the context in which he developed it (section 2.2).

2.1 Theoretical Traditions Implicit in Lessig's Approach

The concept of law in legal positivism. Lessig's framework of regulatory modalities (1999, 2006) stands, first of all, in the tradition of legal positivism as developed by Hart (1994). Lessig defines law as “a command backed up by the threat of a sanction”, although qualifying that “[o]bviously law is much more than a set of commands and threats” (Lessig, 1999, p.235). It can also be facilitating. It allows us to sign contracts and other authoritative acts that are legally binding. His definition implicitly draws on Hart's famous essay *The concept of law* (Hart, 1994). In this essay Hart paves the way for Lessig's mode of reasoning. He argues that laws are rules made by human beings and there is no necessary connection between law and morality. The important distinction Hart makes is that there is the observable fact whether people obey a rule on the one hand and the normative quality of law that brings about the internal sense of obligation to follow a rule by an individual. This is not undisputed. Dworkin, for example, denies that a theory can identify what regulation is and how it works without resorting to its moral dimensions.^v Hart describes legal systems in *The concept of law* as two sets of rules. The primary rules are the rules that govern social conduct by formulating legal obligations and consequences. The secondary rules govern the establishment, maintenance, and alteration of primary rules (Hart, 2012, p.94). This, in turn, separates the question of the moral dimension of law from positive law as man-made rules that specify obligations.

Hart's separation between law and morality – that allows for empirical investigation of law as a regulating modality - and the distinction between the internal (rule development) and external point of view of rules – that allows for separate empirical investigation of observable conformity and the mechanisms that lead to conformity. This lays the groundwork for Lessig's reasoning.

The tools based approach. Lessig states that “law-talk typically ignores [...] other regulators (...). Many speak as if law must simply take [...] other [...] constraints [such as market, social norms and architecture] as given and fashion itself to them (Lessig, 1999, p.91).” Here he refers to the essay *Five things to do* written by John de Monchaux and J. Mark Schuster (1997, pp. 5-11) wherein “they describe the 'five and only five things that governments can do – five distinct tools that they can use – to implement their policies: ownership and operation (the state may own the resource); regulation (of either individuals or institutions); incentives; property rights; information” (Lessig, 1999, p.256). He shares with these authors the aim to compare different modes of constraint. These authors stand in a broader tradition that is referred to as the “tools based approach” by Christopher Hood (1983; Hood & Margetts, 2007). The goal of the tools approach is first and foremost to find the tools that will actually produce what is desired. The approach allows for comparison of tools and their workings between layers of government, countries, and organizations, to compare combinations of tools and to compare tools over time (Hood, 2007). Raab & De Hert (2007, pp. 16-17) summarize Hood's construct:

Hood (1983: Chapter 1) identifies four basic administrative tools with which government 'detects' (takes in information) and 'effects' (makes an impact on the world). The acronym 'NATO' stands for the four basic resources available to government for detecting and effecting: nodality, authority, treasure and organization. Nodality is positional in socio-spatial terms. It 'denotes the property of being in the middle of an information or social network'. It 'gives government the ability to traffic in information'. It 'equips government with a strategic position from which to dispense information, and likewise enables government to draw in information for no other reason than that it is a center or clearing-house'. Authority 'denotes the possession of legal or official power'; it 'gives government the ability to "determine" in a legal or official sense'. Treasure 'denotes the possession of a stock or moneys or "fungible chattels"', which it can use for purposes of influence or to purchase resources such as 'mercenaries'. Finally, organization 'denotes the possession of a stock of people with whatever skills they may have, land, buildings, materials and equipment'; it 'gives government the physical ability to act directly, using its own forces rather than mercenaries'. In the 'digital age', the nature, availability and deployment of these tools are often considerably different from before (Hood & Margetts, 2007). (Raab & De Hert, 2007, pp. 16-17)

Although Hood speaks about the *tools of government* he acknowledges that few are specific to government and that many organizations try to have an impact on the world outside and use propaganda, licenses, hire other organizations, just like government does^{vi}. “Hood's schema is too state-centric to encompass the way in which detectors and effectors are implemented as social practices that are available, in principle, to other agencies and individuals” is the way Raab and De Hert put it. And, “following the drift of academic policy-studies approaches in recent years, we shift Hood's analytical framework from *government* to *governance*.” (Raab & De Hert, 2007, p.17; see also Fenger & Bekkers, 2007, p.16 a.f.) In the following we will adopt the term *tools of governance* (Raab & De Hert, 2007, p.17).

Hood's (1983) instrumental view has paved the way for Lessig and others to reflect on alternative sources of regulation and their nature. As Hood states, there is no single right way to classify tools of governance, and many classifications have since developed (Carmona, 2017).

While Carmona's (2017) extensive exploration of tools of governance typologies does not include Lessig's typology, relevant to our article is that several of the authors which Carmona discusses point to standards and regulation as seemingly identical. One of these is Baer. “Baer (2011, p.277) observes that 'There are a number of words that mean approximately the same thing' relating to devices to guide human behavior', and identifies customs, norms, rules, regulations and standards, using rules as the generic catch-all within which regulations ('government-issued rules') and standards ('profession's internally devised rules') can be located. These terms, and a wide range of others, are often used indiscriminately (or at least interchangeably) and no agreed set of definitions exists.” (Carmona, 2017, p.6) Carmona also cites other authors (Lang, Delafons) who mention several terms for “what specifies how to meet an objective” (Carmona, 2017, p.6). In Carmona's discussion, therefore, we see an earlier example of introducing voluntary standards as part of a framework of governance

tools, albeit in the specialized field of urban design policy. How standards are best accommodated in Lessig's framework of regulatory modalities is addressed in section 3.

2.2 Lessig's Regulatory Modalities

The above discussed work of Hart and others on the concept of law and of Hood and others on tools of governance help us position Lessig's framework theoretically. Below we introduce the framework itself, first, by briefly describing the empirical question he wanted to use it for, as this explains e.g. his salient choice for including 'architecture' as a modality ('code as law') (section 2.2.1). Next we present the core of his framework (section 2.2.2). In the final part of this section we reflect on his framework and discuss possible (dis)advantages of the different regulatory modalities in the light of policy intervention (section 2.2.3).

2.2.1 Positioning Lessig's Framework: Regulating Cyberspace

In one important respect Lessig differs from Hood and most other authors on the tools approach. He has a specific aim when comparing tools – while in Hood and others the specific goal is outside the scope. At a time when the Internet was still viewed by many as a free and unregulated space that should remain that way, Lessig (1999, 2006) developed his framework to argue the opposite. He argued that liberty in cyberspace would not be protected by non-regulation. Quite contrary, if left to itself, the freedom most were experiencing in cyberspace would be encroached by private interests. This would likely entail a shift from an architecture of access to one of control, regulated increasingly by hard- and software code and driven by companies rather than government.

Different from other authors using the tools approach, Lessig develops a framework in which code is explicitly recognized as a form of regulation. Quoting Michael Sorkin, "[W]hatever the source of the content of the codes, their consequences are built" Lessig writes (1999, p.345). Code embeds and promulgates values and interests, and can therefore also play a role in furthering and protecting public interests and societal values like liberty.

2.2.2 Essentials of Lessig's Framework

Lessig identifies four regulatory modalities as central to regulating behavior in cyberspace (Lessig, 2006, p.122):

- **Architecture.** Drawing a parallel between code and the built environment^{vii}, Lessig coins code - and designed artifacts in general - as architecture. Architecture regulates the behavior of individuals by physical constraint^{viii};
- **Law** regulates behavior by threatening punishment, a threat backed-up by the state's power of enforcement;
- **Norms** of a community indicate how members are to behave.^{ix} Compliance is achieved by the threat of criticism or sanctions such as ostracism; and
- **Markets** regulate behavior through price and price-related signals.

Lessig characterizes regulatory modalities by their source (e.g. in the case of Law: the state), how they constrain (e.g., in the case of Law: threat of punishment), when they constrain (e.g., in the case of Law: the threat of punishment is meant to prevent transgressions, i.e. to correct behavior ex ante; Lessig, 2006, p.344), and whether advance knowledge and understanding is

needed for the constraint to take effect (e.g., in the case of Law: if the threat is to work, legal rules and punishments must be known and understood beforehand). Lessig is not explicit on all issues. In the below table (Table 2) we summarize - and sometimes extrapolate – how he would likely characterize each of his four regulatory modalities in these four respects.

Table 2. Essential features of Lessig’s framework

Regulatory modalities Features	Law	Norms	Market^x	Architecture
Source	State	Community	Price	Built environment
How constraint functions (behavior modification)	Threat of punishment (e.g. jail, fine)	Threat of punishment (e.g. ostracism)	Price threshold determines access to products & services	Self-executing inbuilt constraint
When it constrains	Corrects behavior ex ante	Socialization corrects behavior ex ante	Works ex ante	Disciplining design works when used
To be effective, is it necessary to know & understand the constraint?	Person must know and understand the constraint beforehand	Person must know and understand the constraint beforehand	Constrains without knowledge or understanding	Constrains automatically; no knowledge/ understanding needed

2.2.3 Modality Choice: Advantages and Disadvantages

Because Lessig, in contrast to Hood and others, has a specific goal in mind (liberty in cyberspace), advantages and disadvantages of regulatory modalities become relevant. Regulators “(...) constantly consider trade-offs among modalities of regulation.” (Lessig, 2006, p.130) Desired behavior can be achieved by different means. Lessig’s example is how to deter people from smoking. Smoking can be forbidden in cafes (Law) or be induced by raising the price of cigarettes (Market). Each has its advantages and disadvantages. Regulatory modalities can be applied directly (e.g. Law forbidding smoking) or indirectly (e.g. Law on taxing cigarettes, i.e. Law via Pricing); separately or in combination. The choice of modality depends among other things on its anticipated effect, its anticipated advantages and disadvantages, and how it is implemented in a specific situation (Lessig, 2006, pp. 122-124).

Lessig’s writings highlight an important advantage of ‘Code as Law’ (see Table 2). For, different from other regulatory modalities that require extra measures to enforce them, code constrains behavior automatically. Behavioral compliance in Architecture is self-executing. It is therefore a powerful tool - especially for regulating the Internet.

3. ACCOMMODATING STANDARDS IN LESSIG’S FRAMEWORK

Why Lessig confines himself to four regulatory modalities, and not more or less, is unclear to us. Relevant is that he leaves room for adding new modalities, albeit in passing^{xi}. ‘Standards’ is one such candidate.^{xii} However, there are different ways to accommodate standards in his framework. In the following we explore whether standards should primarily be viewed as an extra fifth regulatory modality (section 3.1), as a special instance of Lessig’s four regulatory modalities (section 3.2), or as a hybrid modality, as Murray and Scott (2002) argue (section

3.3). In the following we discuss each of these options successively in the light of our research question ‘How can standards best be accommodated in Lessig’s framework of regulatory modalities?’ We revisit our considerations and synthesize our findings in an extended version of Lessig’s framework (section 3.4).

3.1 Standards as A Fifth Regulatory Modality?

Our discussion of the tools of governance approach mentioned that some authors include voluntary standards in their listings of means to guide behavior (e.g. Baer, 2011; Carmona, 2017). They treat standards and regulation (‘Law’ in Lessig’s terms) on an equal footing, sometimes as similar institutions or at least as comparable in many ways. In the following we examine how standards can be characterized in terms of Lessig’s three aspects of constraint: source, how it functions and required knowledge of and understanding thereof.

Source of constraint: The standards this article focuses on originate in committees^{xiii}. They range from technical committees of formal standard setting organizations like ISO, consortia and fora like the Internet Engineering Task Force; to committees of professional organizations like the American Psychiatric Association and (inter)governmental committees of e.g. the Food and Agriculture Organization of the United Nations.

How constraint functions: Except where legally enforced or subject to professional self-regulation (see section 3.2 and 3.3), compliance to standards is voluntary. If voluntary, what mechanism might nevertheless convince potential users to comply? One way to look at standards is to view them as infrastructures (Swann, 2010; Mair, 2016). Infrastructures ease life. They save mental effort, material and energy (‘Energetic’ function of standards, Kienzle, 1941). The knowledge and information they embed facilitate and focus, for example, innovation projects (Egyedi and Ortt, 2017). The expected benefits from standards use and their expected uptake determine whether potential users will actually use the offered infrastructure, adopt the standard and voluntarily introduce required changes. Those who do not expect to benefit, e.g. producers who make stand-alone products, need not adopt the standard.

When constraint functions: Standards constrain when adopted.

Required awareness of constraint: Adopting a standard is a conscious decision that requires knowledge and understanding of the constraints involved.

The above characterization of Standards as seen from Lessig’s constraint-perspective on regulatory modalities will be revisited in section 3.4.

3.2 Standards as a Special Instance of another Modality

Are there convincing reasons to forego accommodating standards as a separate modality in Lessig’s framework? One reason to do so is if the constraints of committee standards can be well-understood as special instances of one of Lessig’s four modalities. How standards relate to these modalities is explored in the following, starting with the two most promising ones.

Standards and Architecture: In literature on standardization there is a clear distinction between standards and their implementation. A standard can be implemented in different ways, which means that in principle different implementations can be created, each of which

may regulate behavior differently. This difference between standard and standard-implementations is not made in Lessig with respect to design and its implementations. Lessig conflates design and implementation in his regulatory modality of Architecture. While most standards are voluntarily adopted and are therefore hardly constraining, once implemented in code or artifacts standards acquire the constraining characteristics of Architecture (i.e., self-executing in-built constraint, unavoidably constraining the behavior of those subjected to the Architecture).^{xiv} That is, while standard-compliant artifacts (i.e., standards' implementations) could be seen as a special instance of Architecture, standards themselves cannot. (We revisit the difference between standards and their implementations in the concluding section.)

Standards and Law: Where externally developed committee standards are incorporated or referred to in legislation (Stuurman, 1995; Murray & Scott, 2002) or where governments “develop standards themselves and make their use mandatory” (Wiegmann et al., 2017, p.1374), standards can be viewed as a special instance of Law. These *regulatory standards* (Hawkins et al., 2017) inherit the constraining characteristics of Law. But most standards are voluntary. The way voluntary standards constrain (self-imposed constraint by adoption, Table 3) differs too much from how Law constrains (i.e. corrects behavior ex ante, enforceable). Therefore, treating them as a special instance of – compulsory - Law is not tenable.

Standards and Norms: There is an area of overlap between Norms and Standards, for example, between shared ideas on how people should behave in certain circumstances (Norms) and, for example, how ‘normality’ is defined by committees of professional psychiatrists (Standards).^{xv} But the wider range of voluntary standards and norms differ too much on both the source of constraint and the way they constrain behavior to consider one as a special instance of the other.

Standards and Market: There is no notable commonality in how Standards and Market (which Lessig specifies in terms of price thresholds) constrain behavior: they have different origins, constrain in different ways and differ in the degree of awareness required to affect behavior. See Table 3.

In sum, while in some cases and from a specific perspective certain standards can be argued to be special instances of Architecture and Law, this does not apply for standards in general. Moreover, doing so would also introduce new inconsistencies. For example, like standards, legal constraints can be implemented in artifacts (e.g. alcohol locks in cars). But does that mean that Law should be viewed as a special instance of Architecture?

3.3 Standards as Hybrid Modalities?

Murray and Scott (2002, pp. 17-20) follow a third line of reasoning. They address subsets of standards as hybrid modalities in Lessig's framework. They identify the subset of regulatory standards (i.e., those enforced top-down by the state) as being a hybrid of Law; and the set of mandated and self-enforced^{xvi} industry standards as a hybrid of Norm. The latter set of standards is enforced by the community and is a tool for co-regulation and self-regulation, respectively:

Co-regulation and enforced self-regulation each link some of the strengths of community-based control (notably within self-regulatory regimes) with the use of hierarchy, for example

by state approval of standards set by industry groups (co-regulation) or mandating firms to establish and sometimes enforce their own standards (enforced self-regulation). (Murray & Scott, 2002, p.20)

In the quote, ‘hierarchy’ and ‘community-based’ regulation refer to Lessig’s regulatory modalities of Law and Norm, respectively (See Table 3). Murray and Scott (2002, p.20) thus enrich Lessig’s characterization of regulatory modalities with the notion of ‘types of control’^{xvii}. We will revisit this notion in the next section.

Murray and Scott re-interpret Lessig’s community-based regulation by Norms as including committee standards. In our view, however, standards and social norms differ too strongly to merit this (see also Table 3). Moreover, in picking-and-mixing characteristics of different modalities to define hybrids the accommodation of standards in Lessig’s framework appears to have become an end in itself rather than a means of strengthening a conceptual research tool. Furthermore, the solution of hybrid modalities muddies the waters of a regulatory tools approach; it complicates comparing regulatory modalities.

3.4 Conclusion: Extending Lessig’s Framework With Standards

Summing up, the inclusion of Standards as a fifth regulatory modality not only agrees with the tools approach literature (Baer, 2011; Carmona, 2017) and Lessig’s approach; attempts to otherwise accommodate standards in his framework were unsuccessful (section 3.2) or required too much conceptual ‘brute force’ (section 3.3).

We therefore, first of all, add Standards as a fifth modality (Table 3, column 6). To summarize, further detail and ease comparison of regulatory modalities, we include extra features in addition to Lessig’s four (i.e., Source of constraint, How it constrains, When it constrains and required Awareness and understanding of constraint; Table 2, Table 3 rows 2, 4, 5 and 6). In Table 3, (*) indicates that this addition stems from Murray and Scott (2002); (**) are extensions we introduce ourselves. The extra features are:

- **Type of control.** Murray and Scott’s (2002, p.20) notion of ‘Type of control’. Rather than adopt their term ‘community-based’ as a means to control Norms (see section 2.3), we prefer the term ‘group pressure’; rather than explaining Market (i.e. Price) as being control by ‘competition’, we speak of control by supply and demand’. Where Standards are concerned control is self-imposed; self-regulation is involved.
- **Not applicable to...**The ‘Not applicable to...’ notion in order to illustrate that some individuals may not feel constrained by the respective Regulatory modality. That is, Law may not constrain less socialized or desperate people; Norms may not constrain, for example, those with an ‘Anti-social personality disorder’ (mental disorder of the DSM4 classification); Price mechanisms of the Market modality seem not to apply to altruistic acts (e.g. anonymous donations); despite the disciplining nature of Architecture, users can be seen to behave unexpectedly (user innovation); and finally, voluntary Standards are only relevant to those affected by the standard’s ‘infrastructure’ and not to those that are ‘off the grid’.
- **Degree of constraint.** Given how the constraints of the different modalities function, interpreting Lessig (2006) they can be practically unavoidable (Architecture), highly constraining (Law) or substantially constraining (Norm, Market). In contrast,

voluntary Standards hardly constrain upfront; the regulatory modality constrains only if its uptake is such that actors feel forced to adopt them.

- **Intended effect of compliance.** To characterize the fundamental differences between regulatory tools, we also try to specify the essential aim of each regulatory modality. This we induce from Lessig and Kienzle (1955). The intended effect of Law is creating a stable society; of Norms a stable community; of Market an optimal price; of Architecture the ‘programmed outcome’ and of Standards what Kienzle (1955) calls ‘energetic efficiency’, that is, an efficient use of human effort, material and physical energy (see the primary function of standards Variety reduction and its effect in Egyedi & Ortt, 2017, Table 6.2).^{xviii}

Table 3 shows that ‘Standards’ have a distinctly different profile compared to other regulatory modalities and to ‘Law’ in particular. The difference goes beyond differences in degree of constraint (i.e., voluntary standards vs. mandatory regulation).

Table 3. Extension of Lessig’s framework of regulatory modalities

Regulatory modalities Features	Law	Norms	Market	Architecture	Standards**
Source	State	Community	Price	Built environment	Committee
Type of Control	Hierarchical* (power to enforce)	Group pressure**	Supply & demand**	Design-based*	Self-imposed, self-regulation
How constraint functions (behavior modification)	Threat of punishment (e.g. jail, fine)	Threat of punishment (e.g. ostracism)	Price threshold determines access to products & services	Self-executing inbuilt constraint	Traction of standards as infrastructure
When it constrains	Corrects behavior ex ante	Socialization corrects behavior ex ante	Works ex ante	Disciplining design works when used	Constrains after adoption
To be effective, is it necessary to know & understand the constraint?	Person must know and understand the constraint	Person must know and understand the constraint	Constrains without knowledge or understanding	Constrains automatically; no knowledge/ understanding needed	Person must know and understand the constraint
Not applicable to/does not work for e.g. **	Less socialized, desperate people	‘Anti-social personality disorder’	Altruistic acts e.g. anonymous donation	Unforeseen use (user innovation)	‘Off the grid’ actors
Degree of constraint **	High degree of constraint	Substantial constraint	Substantial constraint	Practically unavoidable constraint	Low degree of constraint
Effect of compliance **	Stable society	Stable community	‘Best’ price	‘Programmed’ outcome	‘Energetic’ efficiency

Moreover, each regulatory modality has different advantages and disadvantages. An initial listing is summarized in Table 4. They differ, for example, in their source of legitimacy. Legitimacy is the reason that those who are subjected to regulation comply with it voluntarily (Bekkers et al., 2007, p.37). Voluntary compliance is relevant when deliberating which regulatory modality best serves a certain purpose, which was Lessig’s question. For example, as Hood comments in the case of government regulation, “as government encounters

increasing resistance (...) the 'price' of compliance becomes higher” (Hood, 2007, p.100). The less the legitimacy of regulatory modalities is likely to be contested – e.g., because it has been explicitly addressed (Law and, to a certain degree, Standards) or remains implicit (Norms and, most likely, Architecture) - the more likely it will be that those who are subjected to them will comply voluntarily.

While the issue of legitimacy falls outside the immediate scope of this article (see the discussion in section 6.2), its effect - i.e., voluntary compliance – is relevant when comparing the inner workings and effects of regulatory modalities, the topic of the next section.

Table 4. Advantages and disadvantages of regulatory modalities

Regulatory modalities	Law	Norm	Market	Architecture	Standards
Advantage	Stable, long term; Democratic legitimation	Stable; Community legitimation; Works by self-disciplining	Equilibrium-driven mechanism	Self-executing compliance (legitimation implicit)	Interest & capacity-based legitimation; Revision cycles; No enforcement needed
Disadvantage	Enforcement needed; Slow and costly to change	Dilemmas difficult to address; Divisive (creates in- & out-group)	Insensitive to complex circumstances; Price threshold is passively discriminatory	Implicit underlying values and interests; Factors away autonomy; High exit costs	Select stakeholders participate; Uncertain uptake; Exit costs unaddressed

4. INNER WORKINGS AND EFFECTS

The extension of Lessig’s framework with Standards as a fifth regulatory modality provides the necessary stepping stone for exploring our second subquestion, i.e. whether standards and regulation (i.e., ‘Law’ in Lessig’s terms) differ in how they work (inner workings) and how they work out (effects). We briefly clarify this distinction. It was first introduced by Egyedi and Ortt to research commonalities and differences between standards from a functional perspective. They “conceptually distinguish ‘function’ in terms of: (1) how standards work, that is, what they do (compare: workings of a machine); and (2) how they work out, that is, their effect (compare: a machine’s output). In other words, [they] define a standard’s function as the essential inner working of a standard and its effect as its inevitable consequence.” (Egyedi & Ortt, 2017, p.107)

In their classification of standards, the function ‘Variety reduction’ characterizes all classes of standards. It entails defining a selection, next to identifying relevant characteristics and creating an order (i.e., inner workings). The effect of ‘Variety reduction’ is saving ‘energy’ (human effort, material, physical energy) - in Kienzle’s terms: energetic efficiency (Egyedi & Ortt, 2017, p.119).

Re-appraising their findings in the light of Lessig’s framework, Lessig focuses on the constraints regulatory modalities impose. (See Table 3.) Taking a closer look, when he writes about how constraints function, he actually addresses the question why those subjected to different sorts of regulation comply with constraints. In the case of Law this is the ‘threat of punishment’ which corrects behavior ex ante; in the case of Standards, this is the traction of a

standard as an infrastructure, the threat of missing out ('angry orphan'^{xix}; David,1987). There is more at stake, however, than the different mechanisms of compliance. The substance of Law and Standards differs.

In the following, we proceed in two steps. We adopt Egyedi & Ortt's findings on the key function, inner workings and effects of Standards, and first focus on how to portray Law analogously. We then discuss what it means to frame both Law and Standards in terms of Lessig's 'constraint' perspective.

Briefly summarizing Lessig's use of the concept of Law, as discussed in section 2.1, he follows Hart (1994) in separating law and morality, which paves the way for empirically investigating how Law works. Also, he narrows down the concept of Law to "a command backed up by the threat of a sanction", consciously leaving out other aspects of law to clarify his line of argumentation (Lessig, 1999, 2006). In our words, the function of Lessig's Law is 'Imposing behavior'; the way it works is by 'command backed up by the threat of a sanction'. The latter refers to Law's inner workings.

To further specify these inner workings, we turn to Vatn, whose class of formally sanctioned rules - also called formal rules or legal relations (Vatn, 2005, p.68) - seems to coincide with Lessig's concept of Law. Formally sanctioned rules "combine a certain situation with an act that is *required or forbidden* and which is governed by *third-party sanctioning*." (Vatn, 2005, p.65) These rules "are backed by the formalized power and sanctions of the collective (...)" and entail formalized types of punishment (Vatn, 2005, p.78). To distinguish formally sanctioned rules (in Lessig: Law) from other rule-types, Vatn refers to the ADICO grammar developed by Crawford and Ostrom (1995). Their grammar characterizes sentences pertaining to Law (in their words: 'rules') as having five elements:

- **Attribute:** Characteristics of those to whom the institution applies;
- **Deontic:** Defines what is permitted, obliged or forbidden;
- **aim:** Describes actions or outcomes that are permitted, obligatory or forbidden;
- **Condition:** Defines when, where, how or to what extent an aim is permitted, obligatory or forbidden;
- **Or else:** Defines the sanction for not following the rule.

Given science's aim of parsimony, three elements of the ADICO grammar seem to suffice to capture the inner workings of Law: Condition, Deontic and Or else. In our own wording, in essence Law specifies: *If [in a certain situation] then [behavior: do/do not] or else [sanction]*. In the following, we refer to this inner working of Law as 'if-then-else'.^{xx}

The effect of Law is that it corrects behavior ex ante. As Lessig formulates it, "objective constraints [e.g. being locked up in jail; *TE/AW/RO*] are subjectively effective prior to their actions [i.e., threat of being locked up; *TE/AW/RO*]" (Lessig, 2006, p.344). Law disciplines citizens. The empirically measureable effect is predictable behavior, behavior that fosters societal stability.

Both the inner workings of Standards, i.e., defining a selection, and the inner workings of Law as captured by if-then-else are evidently constraining. This is their inherent direct effect. It precedes the effect of ‘energetic efficiency’ (Standards) and ‘ex ante correction of undesirable behavior’. See Table 5. We elaborate on this in the next section.

Table 5. Inner workings and effects of Standards and Law

Regulatory modality	Function	Inner workings	Effects
Standards	Variety reduction	Defining a selection	Energetic efficiency (human effort, material, physical energy) Acts as a focusing device
Law	Imposing behavior	If-then-else	Corrects behavior ex ante Predictable behavior

5. INNER WORKINGS AND EFFECTS APPLIED TO INNOVATION

Much has already been written on the innovation effects of standards and regulation (Hawkins et al., 2017). For an up-to-date literature review we refer to the introductory chapter of the Handbook edited by Hawkins et al. (Hawkins & Blind, 2017). As stated in our introduction (section 1.2), however, studies on innovation effects often do not clearly distinguish between standards and regulation (Hawkins & Blind, 2017, p.5)^{xxi}; and their direct effect on innovation is still a black box (Swann & Lambert, 2017, p.32). Based on the insights and conceptual tools developed in the previous sections, we can now address this ‘black box’. While Lessig’s framework strongly differs from the dominantly economic and innovation management frameworks in innovation literature, he shares their view that standards and regulation enable as well as constrain innovation (Swann, 2005; Swann & Lambert, 2010; King, 2006). King, for example, cautiously observes that, “(...) [the data] suggests that those who make use of standards to help them achieve a particular goal feel to some extent constrained by them.” (King, 2006, p.76) This applies to standards as well as regulation (Swann & Lambert, 2010). Lessig concurs. While focusing on constraints - and not enablers – he, for example, remarks that “(...) [Architecture] limitations can be features; they can enable as well as disable” (Lessig, 2006, p.86). He illustrates this with the text-oriented architecture of early cyberspace, which enabled the literate and disabled physically attractive people relative to real space (Lessig, 2006, p.87).

How does this fit with Lessig’s characterization of regulatory modalities in terms of constraints only? This question is particularly relevant because his ‘constraints’ perspective initially seems to well-capture the regulatory aspect of his modalities. In the previous, we concluded that the inner workings of Standards (Defining a selection) and Law (If-then-else) both constrain; ‘constraint’ is inherent to their inner workings. It precedes the generic effect of Standards (‘energetic efficiency’) and Law (‘ex ante correction of behavior’). These inherently constraining effects, which they share with all regulatory modalities, and the modality-specific generic effects can both be viewed as direct effects. Direct effects are often

black-boxed in innovation studies (‘one-step mechanisms’; Swann & Lambert, 2017, p.25 a.f.) unlike indirect effects (i.e., two- and multi-step transmission mechanisms; Swann & Lambert, 2017, p.25 a.f.), which have been well-addressed. Reconciling anomalies between different perspectives on effects in the literature, we distinguish

- *inherently constraining* effects of regulatory modalities; i.e., effects inherent to the inner workings of all regulatory modalities (Lessig, 1999); they precede
- *direct generic* effects of regulatory modalities; these are a) modality-specific and b) ‘generic’ in the sense that all indirect effects can be retraced to such direct effects (Egyedi & Ortt, 2017, pp.124-5); and
- *indirect* effects (Swann & Lambert, 2017, p.25).

Direct generic effects and indirect effects of regulatory modalities are two-sided coins: they can be perceived as enabling (by constraining)^{xxii} as well as constraining, depending on those involved.

Innovation effects are indirect effects, i.e., derivatives of direct generic effects. Egyedi & Ortt (2017, p.124) list possible innovation effects of variety reduction by Standards, for example:

- They direct innovation along certain trajectories (cognitive guideposts) and marginalize other trajectories (i.e., derivatives of ‘standards as a focusing device’);
- They ease the build-up of market cohesion and critical mass (i.e., derivatives of ‘energetic efficiency’); and
- They increase variety and customer choice (which are two-step derivatives of ‘energetic efficiency’ and the ‘exchangeability of standards-based products’).

Possible innovation effects of Law (i.e., by ‘Imposing behavior’) are that it:

- Outlaws or stimulates certain innovation avenues (which is a derivative of ‘corrects behavior ex ante’);
- While Law notably creates a stable innovation environment, this may be caused by Law’s focus on long-term regulation rather than by it being a derivative of ‘predictable behavior’.

The above examples illustrate our line of reasoning. The systematic research that is needed for a comprehensive listing of innovation effects falls outside the scope of this article.

6. CONCLUSION

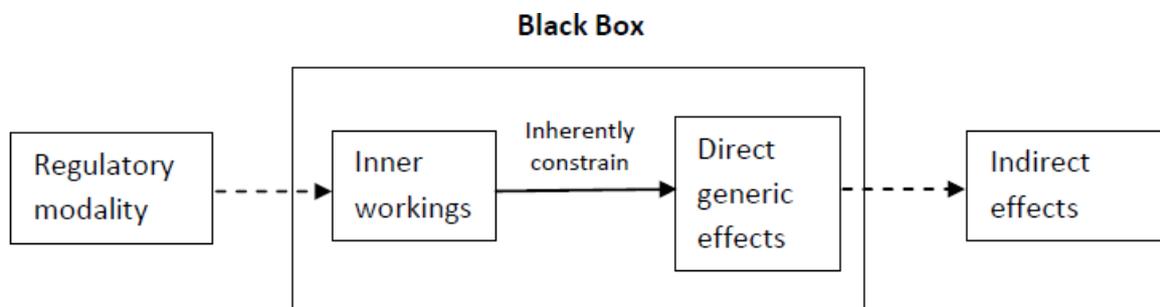
In this article we asked ourselves whether the lack of distinction between standards and regulation in innovation literature, noted by Hawkins and Blind (2017, p.5), is in fact a problem. We conclude that it is. While both inherently constrain, as all regulatory modalities do, they regulate in different ways and have different direct generic effects. To arrive at this straightforward conclusion, we needed to extend Lessig’s conceptual framework of regulatory modalities with Standards and pry open the ‘black box’ of inner mechanisms and direct effects (Swann & Lambert, 2017, p.32). Below, we highlight our theoretical contributions, address the limitations of our approach and close with recommendations for follow-up research.

6.1 Research Approach and the Conceptual Tools Developed

Summarizing our successive steps and intermediate results, we showed that, rather than approaching standards as a special instance of one of Lessig’s four modalities (Law, Norms, Market and Architecture) or as a hybrid modality (Murray & Scott, 2002), Standards merit inclusion as separate fifth regulatory modality. Our extension to his framework (Table 3) is in line with the tools of governance approach that inspired Lessig and complies with corresponding literature that mentions standards as a rule-type (e.g. Carmona, 2017; Baer, 2011). It allows comparing Law and Standards on an equal footing.

Next, to address the question whether distinguishing Standards and Law is in fact relevant, we applied Egyedi & Ortt’s (2017) functional approach. That is, we examined whether they logically differ in how they work (inner workings) and how they work out (effects). Drawing from their classification of Standards, the function of (all) standards is Variety reduction. Variety reduction is essentially about ‘defining a selection’ (inner workings); its essential effect is ‘energetic efficiency’ (of human effort, material and physical energy). Analogously, Law’s primary function is ‘Imposing behavior. Inspired by Crawford and Ostrom’s ADICO grammar (1995), we coined the inner workings of Law as essentially consisting of an ‘If-then-else’ rule. Its essential effect is ‘Correcting behavior ex ante’ (Lessig, 1999). See Table 5. In this conceptual step we thus showed that Standards and Law clearly differ in how they work and how they work out, and therefore the relevance of distinguishing the two.

Figure 1. Inner mechanisms and direct effects in the black box of regulatory modalities



Subsequently we applied these insights to the effect of Standards and Law on innovation. To do so, however, meant addressing the anomaly between Lessig’s persuasive analysis of regulatory modalities exclusively in terms of constraints and the undisputed findings in innovation studies that standards and regulation constrain as well as enable (Swann & Lambert, 2010; Ortt & Egyedi, 2018); and it meant addressing the ‘black box’ of inner mechanisms and direct effects (Swann & Lambert, 2017, p.32) and adopting Swann and Lambert’s distinction between direct and indirect effects. To resolve the anomaly, we posited that Lessig’s regulatory constraints are an inherent effect of the modalities’ inner workings. It precedes the effects Egyedi and Ortt (2017) focus on, i.e., direct generic effects. That is, to understand what happens in the black box we need to discern a) the inner workings of regulatory modalities and their inherent constraining effect and b) modality-specific direct generic effects from c) the *indirect* innovation effects they lead to (i.e., two- and multi-step transmission mechanisms; Swann & Lambert, 2017). While all regulatory modalities

inherently constrain, how they do so (i.e., their inner workings) differs. Their modality-specific direct generic effects and their indirect innovation effects can enable as well as constrain.

6.2 Discussion: Limitations and Research Recommendations

The aim of this article was to strengthen the theoretical basis for empirical research on innovation effects. To this end we developed new conceptual tools, i.e. an extended framework of Lessig's regulatory modalities, as summarized in Table 3; we identified the modality-specific inner workings and direct generic effects of Law and Standards, as summarized in Table 5; and further specified effects in terms of inherent constraining effects, direct generic effects and indirect effects, as captured by Figure 1. While together they allow us to answer our overall research question, there are of course also limitations to our approach, as well as relevant issues we have not covered. We restrict ourselves to those we view as most pertinent to tools of governance and innovation research.

First, while we have opened up the black box of direct effects, this article has more or less black-boxed indirect innovation effects. Follow-up research is recommended that takes in and tests the direct generic effects that underlie indirect innovation effects.

Moreover, our starting point was Lessig's framework of regulatory modalities. But as Carmona's (2017) overview indicates, many more angles and frameworks exist in the tools of governance literature. It is likely that another choice of framework will highlight other differences between standards and regulation (here: Law). In Egyedi and Widlak (2018), Vatn's (2005) institutional-economics framework is applied to explore the added value of this complementary approach. Vatn's approach addresses the genesis of standards and regulation, something which tools of governance approaches like Lessig's typically do not address (e.g., Hood, 1983). Theories of new institutionalism (e.g. March & Olson, 1989; Jepperson, 1991) and institutional economics (Vatn, 2005) promise to clarify in what manner the process of developing standards and regulation reflects on their content and likely effect (e.g. the issue of their legitimacy). Confronting the findings of Lessig's tools-based approach with those of Vatn (2005) will hopefully identify any remaining gaps in the conceptual groundwork for empirical research on how standards and regulation affect innovation.

Back to Lessig, Lessig does not make a distinction between regulatory modalities and their implementation, a distinction which is not uncommon in standards literature (Egyedi, 2007). That he equates regulatory modalities with their implementation may explain why he has not included standards in his framework. For, especially with regard to technical standards, implemented standards acquire the self-executing constraining workings of Architecture. To Lessig, their inclusion as a separate modality would therefore be superfluous. However, we suspect that this point touches on a more principled issue. We hypothesize that it might be worthwhile to critically review Lessig's framework from this angle and consistently introduce this distinction for all five modalities. For example, in the case of Architecture, Architecture would be the implementation, 'Design' the regulatory modality; for Market, Market could be the regulatory modality and Price the implementation. This issue needs further thought.

Finally, we did not address choice in tools of governance and the role of regulators in, for example, stimulating innovation. Regulators can choose between or combine regulatory

modalities to foster certain behavior. We listed possible advantages and disadvantages of each modality in Table 4. However, a more systematic study is needed to confirm and extend this list. Moreover, Lessig points out that, where combined, regulatory modalities often interact in opaque ways. A notable example is the class of ‘regulatory standards’. Interactions between Law and Standards give rise to complex and ambiguous situations (Stuurman, 1995; Elferink, 1998; DeVries & Verhagen, 2016). For example, if safety-related technical standards developed in private standards bodies are referenced in national law, should these standards be made publicly available for free – like law itself? (Elferink, 1998)

Regulatory modalities may reinforce or undermine each other. For example, Law “will constrain the design of IT solutions and economic incentives, but an information infrastructure [*i.e.*, *Architecture*] will also constrain what is possible to enforce by law.” (Bygstad & Hanseth, 2010; see also Widlak & Peeters, 2018). Changes in one modality may affect the impact of other modalities. How their constraints interact, add up and work out also deserves further study (Lessig, 2006, pp.122-124; Raab & de Hert, 2007, p.15 a.f.). Such a study will help regulators optimize situation-specific combinations of modalities that balance the advantages and disadvantages for the range of societal stakeholders.

ACKNOWLEDGMENT

We sincerely thank Peter Swann, Ray Lambert and Knut Blind for sending us the Community Innovation Survey underlying their studies (*i.e.*, the UK CIS3 and the German CIS of 2011, respectively); we gratefully acknowledge the four EURAS reviewers and Valerio Torti for their valuable comments on an earlier version of this article. This is a fully revised version of Egyedi et al. (2018).

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ENDNOTES

ⁱ 'Innovation' refers to products, processes, and so on that are at the time of introduction new to the market and the state of the art in their respective discipline (see *OSLO Manual*; OECD and Eurostat, 2005). More specifically, their functionality is new to the market; their price–performance ratio is significantly better than that of contemporary products, services, and so on; and/or they are based on new technical or other principles (Garcia & Calantone, 2002). In this article, we interpret 'innovation' broadly as including performance improvement in any respect (for example, environmental improvement), and as occurring during pre-diffusion as well as diffusion phases (Oudshoorn & Pinch, 2008).

ⁱⁱ It may seem puzzling “why the ISO definition for ‘standard’ does not include, as does e.g. the WTO-definition, the attribute that a standard is voluntary. The reason (...) [is] that ISO/IEC Guide 2 also contains the term ‘mandatory standard’. This means that, based on Guide 2, a standard is - in itself – not necessarily mandatory or voluntary, but can be both. For this reason, the aspect of being mandatory or voluntary is kept outside of the ISO-definition. The ISO-definition of ‘standard’ is agnostic towards whether it is binding or not.” (Reinhard Weissinger, ISO; personal email communication, October 9, 2018).

ⁱⁱⁱ Several innovation studies have been based on CIS data. Note the national versions differ, however. For example, different from the UK version discussed below, the German version used by Blind et al. (2017) includes separate questions on the influence of regulation and standards, respectively. Question 12.1 of the German 2011 CIS survey addresses: What effect did the following impeding factors have on the innovation activities of your firm in the years 2008-2010? Among the listed 15 pre-formulated factors are (a) Standards and (b) Legislation and legal regulations. Respondents can score on whether these factors (1) lengthen the duration of innovation projects, and (2) whether they caused innovation projects to be (a) discontinued or initiated, (b) not started in the first place, or (c) not relevant.

^{iv} The UK CIS3 question is similar to Eurostat CIS3 question 10.2, although here the factor is less neutrally formulated, i.e. as “Insufficient flexibility of regulations or standards” (Eurostat, p.10).

^v This argument historically centers on the question of *adjudication*. In short: Dworkin, Hobbes and other Natural Law theorists argue that 'there are certain principles of human conduct, awaiting discovery by human reason, with which man-made law must conform if it is to be valid' (Hart, 2012, p.186). Legal rules have obvious cases, but also “penumbral” cases, where legal rules are incomplete. Judges must make rational decisions on how to extend the law. For these discussions to be rational they must be guided by a notion of what *ought* to be. Does this *ought* need to be a *moral ought* is the question in this debate.

^{vi} Even very ‘government-like’ tools, such as the minting of coin are not exclusive to the government. See Binley (1958, p.31) in Hood (2017, p.127) for more examples.

^{vii} ‘Built environment’ is a powerful source of comparison, as the literature shows (e.g. the design of bridges and squares in cities and their influence on the behavior of citizen groups; Winner, 2000).

^{viii} “Differently constituted spaces enable and disable differently.” (Lessig, 2006, p.86)

^{ix} “Norms govern socially salient behavior, deviation from which makes you socially abnormal.” (Lessig, 2006, p.340)

^x Lessig’s framework would gain consistency by redefining Market as the source of the regulatory modality ‘Price’. Our dilemma vis-à-vis adapting Lessig’s framework along these lines is whether consistency within the framework weighs up against the possible confusion which different versions may create.

^{xi} In discussing the example of AOL cyberspace, Lessig remarks “Every time AOL decides that it wants to regulate a certain kind of behavior, it must select from among *at least* [emphasis added *TE/AW/RO*] four modalities – rules, norms, prices, or architecture.” (Lessig, 2006, p.94) He points to an extra modality in someone else’s work In (Lessig, 2006, p.129). But this modality remains unexplained and isolated, and does not seem relevant to this paper.

^{xii} While he does not explicitly include standards as separate modality, Lessig does incidentally mention them, e.g. end-to-end, peer-to-peer protocols of Internet and their regulatory implications (e.g. application development and policy implications): “Which architecture we encourage is a choice about which policy we encourage.” (Lessig, 2006, p.112)

^{xiii} I.e., in contrast to market share defined ‘de facto standards’.

^{xiv} Lessig incidentally mentions Internet standards in this light (IPv6, authentication and the problem anonymity; 2006, p.54).

^{xv} The DSM classification is a form of self-regulation with legal implications (e.g. where use of the classification is mandated by health insurance companies).

^{xvi} Stuurman (1995, p.139) asks whether industry-driven technical standardization is a form of self-regulation. Quoting Van Driel (1989), he defines self-regulation as “Non-state rules that (...) are specified by those whom the rules address or their representatives, the supervision of which is (co-)taken up by these same groups. ” The definition does not include self-enforcement of rules, i.e. sanctioning by the rule-drafting community, as implied in Murray and Scott (2002, p.20). But it does suggest oversight, a role uncommon in technical standardization but recognizable in standardization in some professional communities.

^{xvii} They distinguish four types: Hierarchical, community-based, competition-based and design-based control.

^{xviii} The ISO/IEC definition and other sources (e.g. Stuurman, 1995, p.139) speak of standards as creating order or ordering society, respectively. However, this may not be distinctive for Standards since authors such as Vatn (2005, p.65) view Law as doing so as well.

^{xix} In standardization literature this expression indicates the fear being stuck with an incompatible system and becoming an 'angry orphan' (David, 1987).

^{xx} Similarly, Bovens & Zouridis (2002, p.15) point to the law's 'if ... then' structure in the context of a "conditionally programmed legal framework". While there may be other reasons to abide by the law than threat of punishment (e.g. because those targeted morally agree with its intention), the issue is here the disciplining mechanism of Law.

^{xxi} Some authors excepted. For example, Blind (2012) reviews literature on the overall effect of different types of regulation on innovation: economic, social and institutional regulation. Economic regulation involves laws regarding competition, anti-trust, and mergers and acquisitions; whereas social regulation involves regulations regarding environmental protection, as well as workers' health and safety protection.

^{xxii} For example, while a certain language convention may restrict a speaker, it enables her to communicate with others (enables by constraint), albeit that communication is restricted to those who also speak the language, it excludes others (second order constraint).