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Energy Efficiency Standards:
The Struggle for Legitimacy

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ABSTRACT

The decrease in the regulatory power of national governments has generated a governance gap that has been filled by, among others, international standard-setting bodies. In these bodies, private actors develop rules that govern commonly used technologies and ultimately shape relevant public policy. The legitimacy of such regulatory outsourcing is largely based on a variety of quasi-democratic mechanisms and principles, which these bodies have endeavored to make central to the standard-setting processes. This paper examines such legitimacy-seeking aspirations by comparing the normative claims of implementing democratic principles with the actual practices of developing standards at the International Electrotechnical Commission (IEC). The analysis is based on interviews with stakeholders and a review of numerous public and IEC internal documents. The findings suggest that the process is inadequate if the goal is not just to bundle technical expertise but also to meet the standards of democratic governance. The study thus contributes to the literature on international standard-setting as well as legitimacy of global governance.

KEYWORDS

Energy Efficiency, IEC 62087, International Electrotechnical Commission, Labeling Regulation, Private Governance, Television, Transnational Governance

INTRODUCTION

Over the past few decades, scholars have witnessed a transference of a part of regulatory power from national governments to various non-state transnational (private) actors (Cashore et al., 2011). Such transference has been most prominently observed in governance gaps (Strange, 1995), whereby some of these actors integrate their rules in governmental regulations in the form of international technical standards. Despite being nominally voluntary in terms of adoption, these international standards often transform into mandatory requirements that shape national public policy and hence become authoritative.

Standards are often developed and promoted by International Standard-setting Bodies (ISSBs). These bodies operate based on mechanisms and practices that are in tension with democracy principles commonly held by political institutions. ISSBs emphasize technical expertise and efficiency in their decision-making and at the same time are not held accountable toward stakeholders (Brunsson & Jacobsson, 2000). Scholars have expressed concerns that such technocratic decision-making process (Cafaggi, 2011) is ultimately causing uneven distributional gains among the stakeholders (Büthe & Mattli, 2011, p. 220) as well as a legitimacy deficiency in the overarching global governance

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arrangement (for a recent extensive study, see, Eliantonio & Cauffman, 2020). Indeed, studies repeatedly provided evidence suggesting issues with various aspects of the legitimacy of international standard-setting, such as the marginalization of actors with less technical and financial capabilities in decision-making (see for example, Büthe, 2010b; Forsberg, 2012; Fuchs et al., 2011; Hauert, 2010; Heß, 2020). Meanwhile, legitimacy remains crucial for ISSBs—as a form of global governance institutions—to *survive* and obtain support from stakeholders.

Against this backdrop, the WTO and major ISSBs established guidelines and procedural safeguards in an attempt to achieve what has been termed as "good standardization" and ultimately *legitimize* standard-setting processes. Within the framework of the TBT agreement, the WTO established six principles for the development of international standards (Technical Barriers to Trade Committee, 2000). Meanwhile, the International Standardization Organization (ISO) and the International Electrotechnical Commission (IEC) developed the ISO/IEC Guide 59:2019 (referred to here as Guide 59) to serve as an internal guideline for recommended practices for standardization (ISO/IEC, 2019). Both are essentially geared to address various issues that could hinder the legitimacy of the standard-setting process, such as low transparency or the marginalization of certain stakeholders.

Despite the importance of this development, we know very little about the extent to which such guidelines and procedural safeguards are implemented in practice. Indeed, our knowledge about the internal operations and dynamics in ISSBs is very limited. Arguably, this is due to the very reason behind the introduction of the good standardization guidelines, namely the strict access rules to ISSBs.

This paper seeks to achieve a better understanding of the ISSBs' internal processes and practices by analyzing the case of developing the international standard for the Television (IEC 62087) at the IEC. This is a case whereby an international standard plays a central role in the functionality of a public policy. The standard has been integrated in the energy efficiency labeling regulations for the Television in the U.S. and European Union (EU). The ultimate aim was to reduce the energy bill and environmental footprint generated by the use of TVs and create market incentives for manufactures to design more energy-efficient devices.

Given the far-reaching consequences of the IEC 62087, at stake are not only governance procedural aspects but also the effectiveness of the overarching regulatory arrangement in achieving its intended societal and environmental objectives. Examining the legitimacy of the embedded standard in such governmental regulation is, therefore, warranted. As the guidelines referred to above aim to address/safeguard such issues, this paper asks how legitimate the process of setting the international standard for TVs is with respect to the principles of good standardization?

To answer this question, the process of developing the IEC 62087 will be analyzed against the procedural safeguards of good standardization articulated in the WTO six principles and the Guide 59. Both guidelines are viewed as rooted in the normative principles of democratic legitimacy—input, throughput and output—and collectively comprise an overarching framework that international standard-setting should adhere to in order to legitimize their processes. Similar to other major ISSBs, the IEC claims to adhere and implement both guidelines.

The IEC 62087 proves to be an interesting subject of study since it both governs a globally used technology (i.e., TVs) and was integrated into regulations that were widely applied and have far-reaching societal consequences. Since the standard was adopted, it has repeatedly been criticized for being ill-suited to achieve its objectives making it an interesting case to analyze its output legitimacy. Finally, the IEC—as a subject of study—has been surprisingly overlooked in the literature despite its focal role it plays in international standard-setting (for an exception, see, Büthe, 2010a).

To the author's knowledge, only a handful of papers have conducted a similar analysis (See, Delimatsis, 2014; Forsberg, 2012; Kanevskaia, 2020), and this paper is the first to shed light on why such standard might have failed to achieve its intended objectives (i.e., deficiency in output legitimacy). As developing the standard followed typical IEC procedures, lessons from this paper will allow us to broadly reflect on how the good standardization principles are implemented in practice at this institution. While the generalizability of the findings might be limited—given the scope of the

study—they still can provide preliminary knowledge about the standard-setting dynamics in other similar ISSBs, such as the ISO. The paper also seeks to explore what can be learned from a detailed tracking of a single standard-setting process and interviewing the involved actors. The paper also supplements a shortage of empirical studies on the legitimacy of global governance institutions and contributes to this literature by fostering our understanding of the potential legitimacy of international standard-setting.

The author argues that the standard-setting practices in developing the IEC 62087 are inadequate if the goal is not just to bundle technical expertise but also meet the standards of democratic governance in filling the respective governance gap. The paper points to several practices in developing the IEC 62087 that are hindering the legitimacy of the IEC standard-setting process.

The remainder of the paper is organized as follows. The following section presents the theoretical approach by showing how the procedural safeguards defined by WTO, ISO and IEC can be rooted in the principles of normative legitimacy. The output of this is a set of components that serve as a criterion for analyzing the legitimacy of the IEC 62087 development process. In the methods section, the methodology and the data used are introduced. This is followed by background information about the case. The subsequent section provides an analysis of the IEC 62087 development process using the legitimacy criterion developed in the theory section. The last section concludes by arguing that this research's findings call into question the legitimacy of the standards developed by the IEC.

THEORETICAL FRAMEWORK

Legitimacy has been broadly defined as "a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions" (Suchman, 1995, p. 574). In the realm of global governance, whereby legitimacy cannot be derived through traditional democratic sources, the concept is multidimensional and contains significant ambiguity. One of the primary sources of normative legitimacy for ISSBs is the implementation of quasi-democratic mechanisms in their structures and decision-making processes (Cafaggi, 2014). Literature has told us little about what these mechanisms might entail and even less about how they can be implemented in practice.

These mechanisms are articulated in the two guidelines mentioned above, and in principle, grant international standards with their legal effect. In developing standards, ISSBs need to adhere to six procedural safeguards required by the WTO: transparency, openness, impartiality and consensus, effectiveness and relevance, coherence, and to address the concerns of developing countries. For that, major ISSBs have developed internal codes of conduct to ensure adherence to such principles. A key guideline is the Guide 59 which was first developed in 1994 and later updated in 2019. This guideline requires national participating actors to respect six principles in standard-setting: inclusiveness, consensus-building attitude and skills, compliance with the procedures, efficiency, impartiality, commitment to quality and dedication of personnel and experts. In principle, such guidelines offer procedural safeguards to address the democratic deficits in standard-setting and ultimately lead to "good standardization."

A close examination of these guidelines shows that they are rooted in the democratic principles for legitimating global governance regimes. Such principles have been identified by scholars as they sought to establish a criterion for the evaluation of the normative legitimacy of non-state rule-making. Most of this research builds on the work of Scharpf (1999) and Schmidt (2013) and distinguishes between three dimensions of legitimacy, namely input, throughput and output. This paper considers the procedural guarantees articulated in the WTO six principles and Guide 95 as inherent in the three dimensions of legitimacy and that they collectively comprise an overarching framework that international standard-setting should adhere to in order to achieve legitimacy. To make such kind of a framework empirically tractable, its concepts and operationalization is discussed below.

Input legitimacy refers to the participatory and deliberative qualities of the decision-making process in the institution as well as its accountability toward stakeholders (Bäckstrand, 2010, p. 149). Studies have repeatedly provided evidence suggesting numerous deficiencies in ISSBs' input legitimacy, such as the dominance of relevant industries and an underrepresentation of developing countries, women and stakeholders representing non-commercial interests (Büthe, 2010b; Dingwerth, 2008; Forsberg, 2012; Fuchs et al., 2011; Hauert, 2010; Heß, 2020; Wilcock & Colina, 2007). Procedural safeguards from the WTO six principles and the Guide 59, such as openness, inclusiveness, and addressing the concerns of developing countries, are considered means to enhance input legitimacy.

The governance literature is unclear about what throughput legitimacy actually entails (for an extensive review, see, Steffek, 2019); however, scholars emphasizes transparency and the consideration of all stakeholders' interests in actual decision-making. In order for the stakeholders to monitor how the institution perform with respect to such aspects, they should be able to access records/information relevant to the institution's decision-making processes (Bekkers & Edwards, 2011). Relatedly, Faure and Philipsen (2020) show that the confidentiality practices implemented in ISSBs might serve the interests of the powerful stakeholders only. Procedural safeguards from the WTO six principles and the Guide 59 such as transparency, consensus, impartiality and to a less extent coherence, compliance with the procedures, building attitude and skills, commitment to quality and dedication of personnel can enhance throughput legitimacy.

Output legitimacy, in turn, is associated with the evaluation of the effectiveness of regulations in fulfilling the intended objectives (Bäckstrand, 2010, p. 149). Studies on the legitimacy of international standard-setting have so far refrained from empirically assessing the extent to which standards meet this criterion. This has been attributed to the complexity of identifying a particular objective for the standard being assessed and variable implementation time which makes it difficult to evaluate the impact of the standard (Hahn & Weidtmann, 2016). Or as de Bakker et al. (2019, p. 366) put it "evaluating problem-solving effectiveness is a complex exercise influenced by timing, measurement, and most of all who is judging." The IEC 62087 has to date been in use for two decades, and its efficacy has been independently validated and perceived by a number of expert and even studies. The following analysis of the output legitimacy of IEC 62087 builds on these evaluations. Procedural safeguards from the WTO six principles and the Guide 59, such as effectiveness and relevance are viewed to enhance the output legitimacy of the standard-setting process.

Mena and Palazzo (2012) operationalized the three dimensions to assess the legtimacy of global governance bodies exercising regulatory power. The authors define four criteria for assessing input legitimacy (inclusion, procedural fairness, consensual orientation, and transparency) and three to assess output legitimacy (efficacy, coverage and enforcement). This article builds on their operationalization for the analysis of the IEC 62087 setting process as it covers the main democratic principles that have been identified in the literature as well as the procedural safeguards from the WTO six principles and the Guide 59 as conditions for a governance process to be considered legitimate. Despite not being classified as a separate criterion for assessing legitimacy, throughput legitimacy is inherent in the operationalization framework. Following Schmidt and Wood (2019) and DeMenno and Büthe (forthcoming), the author views it as being covered by the aspects of procedural fairness, consensual and transparency.

According to the operationalization of Mena and Palazzo (2012), the chances for a process to achieve high input legitimacy are strong if all relevant stakeholders participate (inclusion) and are considered equal partners in the decision-making process (procedural fairness). Regarding the throughput dimension, chances for a process to achieve high legitimacy is strong if the elaboration of a standard, the voting procedures, or the repartition of power, are disclosed (transparency) and stakeholders are able to change their positions in a given discussion on the basis of convincing reasons (deliberative and consensual orientation). Finally, high output legitimacy can be achieved if the number of stakeholders implementing the standards is high (coverage), problem-solving effectiveness of the process output is high (efficacy), and the ISSB ensures that their rules are followed and applied in

practice (enforcement). Due to the difficulty in counting all the manufacturers that have implemented the standard, coverage is considered relatively less helpful in evaluating the legitimacy of IEC 62087.

Scholars have applied different legitimacy assessment models to standard-setting processes, such as corporate social responsibility and nanotechnologies (Eliantonio & Cauffman, 2020; Forsberg, 2012; Hahn & Weidtmann, 2016). Most of them conclude that ISSBs need further refinement in terms of inputs and throughput legitimacy—such as inclusiveness, transparency and accountability—to be legitimate mechanisms for setting different international rules. Similar legitimacy deficiencies may be found in the process of setting IEC 62087 (i.e., low input and throughput legitimacy).

Meanwhile, none of this work has analyzed how legitimate standards are in terms of achieving the intended regulatory objectives (i.e., output legitimacy). This paper seeks to contribute to filling this gap in the literature as well as show the extent to which previous findings can be present in an institution that governs commonly used electrical appliances. Moreover, the paper will show how deficiencies in the legitimacy of such international standard can ultimately contribute to a failure to safeguard certain stakeholders' interests.

METHODS

The paper employs multiple qualitative methods to collect and analyze empirical data for a case study (Yin, 2014). The data were derived from several sources: (1) fifty-nine internal IEC documents comprised of different drafts of the IEC 62087, compilations of participants' comments and results of ballots; (2) dozens of public documents related to the development of the labeling policies in the U.S. and EU such as documents related to the ENERGY STAR program developed by the U.S. Department of Energy, environmental agencies' reports, verification studies and other documents related to the development of the European labeling policy; (3) the author conducted semi-structured interviews with the actors who have been identified through the analysis of the documents. Additional actors were interviewed because they have specific experience in the field (e.g., performing energy testing or developing standards for TVs). See Appendix 1 for further details about the interview subjects.

Interview questions were generally focused on the following aspects: (1) how the participants in developing the IEC 62087 have formed their respective national positions at the IEC and what interests have they represented; (2) how the energy measurement procedure was designed; (3) how the participants coordinate with their domestic standardization body; and finally (4) how the principles of "good standardization" were implemented throughout the process.

BACKGROUND

In the early 2000s, the TV industry attracted the attention of policy makers around the world due to an increase in the electricity consumption of TV users. This was mainly due to the introduction advanced, ever-larger then-new Plasma and Liquid Crystal displays (Crosbie, 2008). In response, several policy efforts in the U.S. and the EU attempted to limit that increase in energy consumption.

Setting the Standard

An essential component of an energy efficiency policy is a measurement procedure that reasonably estimates the energy consumption of the appliance(s) being regulated. Such a procedure needs to specify, among other elements, the conditions under which the energy measurement should be conducted. These conditions, in principle, should reflect—as much as possible—real-life use environments.

For TVs, there was a need to adopt an energy measurement procedure to act as a basis for estimating the energy efficiency level that would eventually appear on a label affixed on the outer packaging. The procedure was, therefore, crucial not only for the implementation of the regulation but also for TV companies that are concerned about how efficient their TVs will appear to consumers.

Indeed, energy labels have been recognized as an effective instrument in helping consumers to compare the energy efficiency of appliances on a reasonable basis (Stadelmann & Schubert, 2018). Bearing an energy label highlights the TV's energy efficiency, which leads to an increase in sales (Northwest Energy Efficiency Alliance, 2011).

Around the year 2005, three standards existed for measuring TVs' energy consumption with different technical approaches: the U.S. Department of Energy measurement procedure, a procedure developed by the Japan Electronics and Information Technology Industries Association and the first version of the IEC 62087 that was developed by the IEC in 2002. The industry tested the consequences of applying the existing energy consumption measurement procedures to their newly developed displays. Based on their testing results, the leading actors from both dominating technologies—Plasma and Liquid Crystal Displays (LCD)—argued that the three procedures are applicable only for the old cathode ray tube TVs and that they all failed to control for an essential element later called the Average Picture Level (APL). These actors claimed that this failure causes an exaggeration in the energy amounts measured (Stobbe, 2007). In other words, they believed that their displays consumed less energy than what the testing results showed. This created a deep concern for the industry, especially for manufacturers producing Plasma displays. The display manufacturers offered to help regulators from the U.S. and EU develop a new measurement procedure that would overcome the deficiencies present in the existing standards. It was agreed to develop the new procedure within the IEC framework and include it in the subsequent version of the IEC 62087 (Stobbe, 2007, p. 22).

Due to different technical reasons, the APL played a greater role in determining the amount of energy consumed by the Plasma displays (Jones et al., 2007)—the effect was less for LCDs. Plasma sponsors' fear of the APL issue was reflected in the substantial amount of work done by the main Plasma promoter, namely Dr. Larry Weber. With the help of other market players, Dr. Larry Weber found a way to measure the APL and even estimated a *global average level*. In addition to developing this fundamental component, he edited the procedure's main testing component, namely a 10-minute dynamic broadcast-content video signal. It was claimed that the video contains a variety of TV fragments that match what people typically watch on their TVs and imitate the average APL level (LCD TV Association, 2008).

The resulting measurement procedure was an essential element of the IEC 62087:2008. In simple words, a meter will record the energy consumed by TVs while a video is playing, with all settings set to default (i.e., manufacturer-recommended or out-of-the-box settings). The industry advocated that the test be performed based on manufacturer-recommended settings (Fairhurst, 2009) later called Home Mode. While this was not a definite requirement in the standard, the labeling regulations explicitly required it. Performing the test while the TV is on default settings was based on the assumption that consumers never change the default settings of their TVs.

Developing the Labeling Regulations

IEC 62087:2008 and its three subsequent versions 2008, 2011 and 2015 were integrated into TVs' energy labeling programs in the U.S. (versions 4.0, 5.0, 6.0, 7.0 and 8.0 of the ENERGY STAR specifications) and EU regulations (EC/642/2009, no. 801/2013, EU 2016/2282, no. 518/2014 and EU 2017/254). In the US, in order for a TV to bear an ENERGY STAR label the amount of energy consumed—measured according to the testing procedure included in IEC 62087—should fall below a certain threshold. Major TV manufactures were extensively involved in developing the specifications for the program.

In the EU, the Commission adopted another approach, whereby an energy efficiency rating is estimated for a given TV—based on performing the energy measurement method included in the IEC 62087—then displayed on the label. The EU Commission conducted several preparatory studies based on market data provided by the industry and discussed drafts of the regulation with stakeholders within consultation forums (their considerable involvement can be seen in, Stobbe, 2007).

Introducing the IEC

In the century since it was established, the IEC has become one of the most important technical ISSB for millions of electronic devices used around the world (Büthe, 2010a). The IEC consists basically of its' members, executive and advisory bodies and internal officers. Countries interested in participating in the IEC work need to have an established National Electrotechnical Committee (NEC), which upon admission, is called the National Committee (NC) of the respective country. Only one NC can participate per country and it should participate in standard-setting based on a consolidated position representing all national stakeholders (IEC, 2001). In principle, domestic standardization bodies establish national mirror committees composed of national stakeholders who coordinate with the respective NC to form a consolidated national position at the international level. Arguably this *aggregation principle* is a major source of input legitimacy for the IEC standard-setting process.

Developing a new or revising an existing standard is carried out within groups of NCs – interested in standardizing a given electrotechnical area—under an overarching Technical Committee (TC) umbrella. The different versions of the IEC 62087 were developed within the framework of the TC 100. NCs can participate as "P" members, who tend to take an active role by attending meetings and voting, or "O" members, who are allowed to attend certain meetings as observers with no voting rights. A broader range of stakeholders—such as environmental and consumer associations—can also participate but only as liaison members with certain participation rights. Organizations representing citizens and environmentalists' interests in ISSBs—such as the European Association for the Co-ordination of Consumer Representation in Standardization (ANEC) and the European Environmental Citizen's Organization for Standardization (ECOS)—can take part in the IEC work as "Category A Liaison" a non-voting membership that allows them to attend certain meetings.

SETTING IEC 62087 AND THE LEGITIMACY CHALLENGES THEREOF

Based on the framework introduced above, this section undertakes a detailed legitimacy analysis for the process of setting IEC 62087. Specifically, the analysis is structured along the three dimensions of legitimacy by focusing on the criteria of inclusion and procedural fairness (comprising input legitimacy), transparency and consensual orientation (comprising throughput legitimacy), coverage, enforcement and efficacy (comprising output legitimacy).

Inclusion and Process Fairness (Comprising Input Legitimacy)

IEC internal documents show that the TC100 was composed of 30 NCs who submitted a total of 471 comments. Seven P members only representing industry-leading players and developed countries provided all comments. One of these NCs submitted around 50% another two jointly submitted 40% of the total comments. Apart from these seven, no other NCs submitted any comments. When the author asked about the reason behind this distribution of voting, interview subjects suggested that expertise plays an important role and that this situation is not unusual. For example, one interviewee responded: "from my several years of experience, a small number of people do most of the work in a given TC—the ones with expertise. The rest basically decide if they can live with the content" (Interview Subject no. 4).

Moreover, ANEC and ECOS were neither involved nor consulted in developing the standard. Several interviewees confirmed the absence of consumer and environmental representatives and interests. For example, one interview subject said: "Government was involved but not TV users. Consumers associations are usually worried about risky products but not TVs" (Interview Subject no. 2). Evidence suggests that a lack of funds is preventing such bodies from being present at the meeting. A former ANEC employee confirmed that: "We have experts, and I believe that if we could sit at the table the industry would listen to us. Unfortunately, we do not have enough funds to participate in the meetings" (Interview Subject no. 11).

All this suggests that several major (technical) assumptions regarding how TVs are typically used were made without (sufficient) consultation with consumers, such as the assumption that consumers never change default TVs' settings. Similarly, the global average APL level was estimated without consulting consumer associations or testing labs and based on data collected from a small number of countries. The author is concerned here about the interest served when the actors from Plasma technology dominated the processes of measuring as well as estimating the global average level of APL. As the plasma sponsors were relatively more concerned about the measurement method delegating the task of estimating a global average level APL level to them—with no consultations with consumer associations—increased the risk of biasing the data.

The industry is also able to increase its influence, when needed, in a given TC by *activating* NCs to effectively increase their voting power. When the author asked about the interests represented in developing the IEC 62087, two interview subjects—who participate in several TCs—answered: "I try to convince my national mirror committee that the position of my sponsor will be best for the country. If I fail in doing that, my sponsor will most probably *activate* additional NCs to support our position" (Interview Subject no. 10); Interview Subject no. 3 said as a reply to the same question: "Companies increase their influence, whenever needed, by increasing their voices in a given TC."

Moreover, evidence points to insufficient implementation of the aggregation principle. In setting IEC 62087:2008, there is a lack of coordination between NCs and respective national mirror committees. Responses from interview subjects confirmed that NCs primarily consulted their employers—in this case, primarily manufacturers—in the process of forming their national positions regarding different aspects of the IEC 62087. Several interview subjects confirmed the finding: "I consult my company, as they are the ones paying me, you know" (Interview Subject no. 5); "In setting the IEC 62087:2008, NCs were not able to consolidate inputs from mirror committees. For me, I consulted my manufacturer first" (Interview Subject no. 3); "NCs' inputs usually reflect manufacturers' opinions and/or their own expertise. In fact, mirror committees usually consist of manufacturers only" (Interview Subject no. 4); "I need to balance between three interests: of the manufacturer I am presenting, the national interest, and the IEC interest. I prioritize my sponsor interest; it's an industry-driven organization" (Interview Subject no. 10). The same interviewee added: "Members representing governments face issues in organizing their voice in a consolidated position, mainly due to bureaucracy and weak coordination with the industry. It is not the IEC job anyway to ensure balanced representation at the national level, it is the responsibility of the NCs"; "We do our best to ensure a balanced representation of interest in the national mirror committee; however, in this case it was only the industry" (Interview Subject no. 9). Moreover, the author had the chance to review the composition of one of the NCs that submitted a substantial amount of the comments. The committee consisted of five producers and suppliers with no presence of consumer associations or environmentalists.

Concerning public access, the main relevant tool introduced by the IEC to obtain public comments through their website proved to be ineffective. One of the interview subjects who has access to performance data of this tool said that the public commenting tool introduced a number of years ago on their website has registered a few records only (Interview Subject no. 9). Consequently, the public has no other way than this tool to participate in developing IEC standards.

In summary, the process was dominated and hence the IEC 62087 was shaped by a very small number of male industry representatives from developed countries. Consumer and environmental groups as well as women were absent. The process lacks an effective mechanism for public participation and does not provide all stakeholder with equal chances for obtaining different participation rights. The financial and technical capabilities of a given stakeholder seem to play a role in gaining participation rights. All this undermines the input legitimacy of the IEC standard-setting process.

Transparency and Consensual Orientation (comprising throughput legitimacy)

Access to IEC meetings or documents is restricted to certain members. In fact, such access varies even amongst members of a given TC. For instance, NCs with O membership cannot access all technical documents and meetings. For research purposes, the author was able to access an internal IEC portal where—according to the IEC—all available documents related to developing the IEC 62087 were posted. In this regard, several findings should be highlighted.

First, important documents such as minutes of (technical) meetings were not available in the portal or even did not exist. Evidence from the interviews points to informal avenues of decision-making: "At TC100, we resolve conflicts (if any) based on technical negotiations. We try to avoid conflicts at the voting stage" (Interview Subject no. 3). Another interviewee responded when the author asked about how agreements on different issues are achieved: "Most of the agreements are concluded during coffee breaks" (Interview Subject no. 4). This suggests that technical agreements are reached and potential conflicts are resolved without (sufficient) documentation. For example, in order to develop and estimate the global average APL—that reflects what consumers experience while watching TVs in real-life—TC100 had to rely on *scientific data* and expert opinions provided by certain participants (Interview Subject no. 1). The author failed to find any related documentation even after asking several TC100 participants for them. The same applies to the assumption that consumers do not change their TVs' default settings—which had a considerable ultimate effect on how the measurement procedure should be designed. Many of the documents accessed by the author were merely short summaries of discussions and drafts of the IEC 62087 showing almost no details about the rationale/data behind the (technical) decisions made.

Moreover, the author failed to find any documentation related to how the experts were identified to get involved in the work at the so-called Working Group level. These external experts—invited by the TC100—can their opinions as technical inputs to the work. These sub-committees have even stricter access rules. For example, O members are not allowed to attend such meetings. Given that these participants are sponsored (in many cases employed) by their market players, transparency becomes crucial for the maintenance of impartiality. The same applies to TC100 participants themselves. Relevant details such as names and affiliations of some participants were not publicly available. The author had to obtain such information from interview subjects and through researching the TC100.

In the case of IEC 62087, stakeholders representing interests other than the commercial were almost entirely absent. Consequently, consensus had to be achieved among the participating manufacturers only. In fact, due to lack of documentation there was no way to review how disagreements (if any) among the participants were resolved despite the existence of No votes in the ballots. Moreover, some NCs have rules that oblige their representatives to vote Yes by default unless there is a major issue that is not in the interest of the NC. Such practices exaggerate the acceptability of the standard at least among the participating stakeholders. Interview subjects confirmed this practice; for example: "Every NC has its' own rules for voting. Generally, if they can live with the content, there is no reason not to vote Yes" (Interview Subject no. 4).

In summary, the closed-door policy for conducting meetings and lack of documentation hinders the transparency and traceability of the process especially for non-participating stakeholders. Almost all relevant information and documents are rarely disclosed even for research purposes. All this made it difficult to analyze how agreements were reached and disagreements were resolved (if any) in developing the standard. Consequently, several aspects of the throughput legitimacy are undermined.

Efficacy, Coverage and Enforcement (comprising output legitimacy)

Several recent testing and market studies have found that the intended objectives of developing the standard were insufficiently achieved. This has been repeatedly suggested—for different versions of the standard—by a number of related studies and expert reports (Hall, 2017; Neslen, 2016; Tinetti et al., 2015). Achieving the energy labeling objective depends upon the meaningfulness of the information shown on the label (Stadelmann & Schubert, 2018). Yet, many studies have found that

the energy consumption amounts indicated on the labels overestimate the TVs' efficiency in the U.S. and EU. Verification tests and expert opinions below show that the energy measurement procedure was applied under unrealistic testing conditions causing TVs to consume less energy.

One common problem is that most TVs' out of the box settings leave consumers unsatisfied with the brightness of their screens when first turned on. Most consumers, therefore, had to modify the settings and increase luminance to achieve a reasonable picture (DECO Proteste, 2015; Taub, 2009). This suggests that manufacturer-recommended settings repeatedly failed to reflect real-life use conditions—at least with regards to luminance level—and were unrealistically low. Evidence from the author's discussion with the Portuguese consumer association that conducted one of the testing studies confirms this: "Unfortunately, through our tests done in 2014, we found a disturbing discovery. In many devices, in order to achieve a good energy label—more appealing to the consumer—manufacturers have begun to offer poor image quality with the default settings. On many TVs, the images are even darker and have less contrast than desired" (Interview Subject no. 12). Meanwhile, verification tests suggested that changing default settings causes a substantial increase in the power consumption—up to 50% beyond the value declared on the label (Michel et al., 2013; Stiftung-Warentest, 2011).

The discrepancy has even been described as a loophole in the labeling regulations by ANEC and the Bureau Européen des Unions de Consommateurs in their comments on the 2012 discussion paper presented by the Commission (Malizou, 2015). A loophole in the sense that manufacturers lowered their default settings to achieve a higher energy efficiency label taking advantage of the fluid requirements in both the IEC 62087 and the labeling regulations. Evidence from the interviews suggests that testing experts would have a different approach if they were present during the standard-setting: "If I were there, I would have sat the TV to average using conditions and then applied the test. We normally inform the IEC when we find the testing procedure unrealistic" (Interview Subject no. 11). Meanwhile, consumer reports and verification studies continued to suggest, among other things, that testing conditions are not representative of real-life use conditions (see, for example, Baton et al., 2017; Willcox, 2015). A study by the Natural Resources Defense Council estimated the value of the unpredicted energy consumed by TVs at $1.2 billion in the United States alone (Horowitz & Remick, 2016). In the EU, the regulation was amended in 2016 because the verification tolerances laid down in the implementing measures were exploited by some manufacturers to achieve higher energy efficiency ratings (EU Commission, 2016).

Finally, developing each version of the standard took a number of years. Consequently, by the time a new version is developed the technology is already beyond it making the standard already outdated. Indeed, TV technology developed faster than anticipated by the regulators in the EU and the U.S. (Howard et al., 2012). Evidence suggests that this was partly due to the industry providing outdated data as part of their inputs to help design the labeling regulations. In the EU, the predictions made by the preparatory study—in terms of the market status and technology progress—were far from what later materialized (Centre for Strategy and Evaluation Services and Oxford Research, 2011). In fact, the majority of TVs met the requirements before the labeling regulation even entered into force (EU Commission, 2012; Michel et al., 2014). Critics suggested that the standard and/or related regulations were based on manufacturers' preferences and helped them achieve exaggerated energy efficiency (Huulgaard & Remmen, 2012). All this resulted in hindering the regulations' ultimate positive impact (Christensen et al., 2019).

Determining the exact number of adopters of IEC 62087 would be too time-consuming. It would also not be a meaningful metric. While the implementation of the IEC 62087 per se is voluntary and not legally binding, adherence to the overarching labeling regulations—and hence adopting the standard—is inevitable for TV manufacturers if they want to access the American and European markets. The standard, therefore, was indeed adopted by many TV manufacturers and, in that sense, has high coverage. However, this cannot be considered indicative of high output legitimacy.

In terms of enforcement, the IEC does not monitor the implementation of standards (Büthe, 2010a). The task was left to different public and market verification/testing authorities. Additionally,

it is not clear how failure to comply with the standard could be sanctioned. IEC 62087, therefore, can be characterized as having low enforcement.

As noted above, the standard has been repeatedly evaluated for its effectiveness in accurately measuring the energy consumed by TVs at different points in time and by a number of experts and verification studies. All of this work points to deficiencies in fulfilling the standard's intended objectives further undermining the output legitimacy of the standard.

CONCLUSION

This paper has sought to examine the legitimacy-seeking aspirations of the IEC by comparing its normative claims of implementing the good standardization principles with the actual practices of developing the IEC 62087. By and large, the analysis shows that the process of developing the IEC 62087 is inadequate if the goal is not just to bundle technical expertise but also meet the standards of democratic governance in filling various governance gaps at the interface of technology and society. This deficiency has ultimately contributed to a failure to safeguard the interests of consumers and environmentalists. Yet, the author believes that IEC can contribute positively to the governance of commonly used electrical technologies if the raised issues are addressed.

First, while the representation of all stakeholders might be an unrealistic goal, the analysis of this case suggest a worrying level of unbalanced representation of interests resulting in a bias in the distribution of power among the stakeholders. A small number of male actors representing developed countries and associated with commercial interests dominated almost the whole process. At the same time, actors representing non-commercial interests and developing countries were almost absent. None of the participants in developing the standard was a female at any stage. All this considerably undermines the input legitimacy of the process.

Second, while the technical expertise employed in developing the IEC 62087 should act as a source of legitimacy, insufficient transparency regarding how it shaped the IEC decision-making might undermine the throughput legitimacy of the process. Non-participating stakeholders were unable to evaluate the performance of the IEC in terms of including their preferences in the IEC 62087. Consequently, the ability to participate and influence the resulting standard is distributed unequally amongst stakeholders representing different interests and countries. In fact, the lack of transparency does not allow for a verification of how certain claims are implemented in practice such as the consideration of all stakeholders' interests. All this further hinders the accountability of the IEC as an organization as well as the actors involved toward the stakeholders.

Finally, many expert reports and verification studies have criticized the ability of the standard and ultimately the labeling regulations to fulfill the intended objectives. The unexpected increase in the amount of energy consumed by TVs caused a rise in both consumer energy bills and potentially the respective environmental footprint. This has been—at least partly—caused by TC 100 members making inaccurate assumptions about how users watch TVs in real-life environments. Output legitimacy has been further undermined by the IEC's inability to ensure proper compliance with the standard by the industry. Indeed, despite the many complaints raised by consumer and environmental associations about the issues in the standard no serious corrective action were taken by the IEC—such as a change in their internal procedures to prevent future similar issues—beyond amending the standard.

All these findings raise additional questions over lines of accountability, the participation of non-commercial stakeholders and roots of decision-making in international standard-setting processes. Future research should suggest ways to enhance the transparency of the standard-setting process without jeopardizing the confidentiality of the technical work.

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APPENDIX 1

No.	Bio of Interview Subject	Date	Duration	Method
1	Widely recognized as a leader in the display community with a number of inventions and awards. He served at the IEC as the principal architect of the TV energy measuring procedure in the IEC 62087:2008.	April 17, 2019	Two hours	Phone
2	He was the head of standardization at one of the major displays manufacturers. He served as the national committee for the U.S. and as a technical area manager at the TC100. He is known for, among other things, spearheading the IEC 62087. He was awarded with eighteen patents related to multimedia.	May 21, 2019	One hour	Phone
3	A senior standardization manager at one of the major displays manufacturers. He served as a senior member of multiple technical areas in TC100 as well as acted as an NC.	April 30, 2019	Two hours	Phone
4	A senior manager at a major telecommunications equipment manufacturer based in the US. He was involved in drafting various international standards and efficiency initiatives, including the European Code of Conduct on the energy efficiency of digital TV devices and the ENERGY STAR program. He acted as an NC at TC100.	April 25, 2019	One hour	Phone
5	A former engineering vice president at one of the main Plasma TVs manufacturers and acted as an NC at TC100.	May 8, 2019	One hour and 30 min.	Phone
6	An audio product engineer who is working at one of the major displays manufacturers. He acted as a project leader for the audio part of IEC 62087.	May 15, 2019	-	Email
7	A standardization manager who is working in one of the national standardization bodies that significantly shaped the IEC 62087.	April 23, 2019	-	Email
8	A standardization consultant at the Netherlands Standards Institute/ Netherlands Electrotechnical and a secretary for the Dutch mirror committee. He was also working with the Dutch consumer association Consumentbond.	September 23, 2019	Two hours	Phone
9	Director at the Royal Netherlands Standardization Institute and a National Secretary at the IEC.	January 31, 2020	Two hours	Personal
10	Senior standardization counsel at one of the major displays manufacturers and a member of the standardization management board at the IEC.	January 30, 2020	Two hours	Personal
11	An expert in home appliances' testing. ANEC also hired him for many years.	February 07, 2020	Two hours	Phone
12	Serves for Public Affairs & Media Relations at the Portuguese consumer association.	December 20, 2019	-	Email

ENDNOTES

1 Governance gaps are basically areas where governments are reluctant/unable to regulate.

2 For instance, the World Trade Organization (WTO) promotes the use of international standards as benchmarks for numerous national technical regulations through the Technical Barriers to Trade (TBT) agreement.

3. These principles mirror the guidelines in Articles 2, 5 and Annex 3 of the TBT Agreement for the preparation of mandatory technical regulations, conformity assessment procedures and voluntary standards.

4. The author is grateful to the IEC for making the documents available. Analyzing these documents allowed the author to track the development of the standard as well as identify the actors who submitted most of the comments on the different drafts and hence shaped the IEC 62087.

5. The author wanted to include more interview subjects from civil society organizations such as the European Association for the Co-ordination of Consumer Representation in Standardization (ANEC) and the European Environmental Citizen's Organization for Standardization (ECOS). However, they ignored/rejected several invitations for an interview.

6. The APL is a measure of the luminance content of the television signal. In simple terms, it equals 0% when the screen is totally black and increases with brighter signals to reach 100% when the screen is totally white. By that time, APL as a notion was almost unknown, with no available way for measuring it.

7. This can be seen in letters submitted to the Environmental Protective Energy (EPA) by Larry Weber. Available at https://www.energystar.gov/index.cfm?c=archives.tv_vcr_spec

8. The average was estimated based on data collected from the US, the UK, Australia, the Netherlands and Japan.

9. TVs typically have several operating modes, and each mode has certain settings to suit different environments. For example, Shop Mode is used in shop environments with very high luminance to show TVs' capabilities and attract potential customers. Other modes are typically dimmer for comfortable viewing in average watching environments such as the living room.

10. This can be seen in the letters submitted to the EPA by different market players in the process of developing the specifications. https://www.energystar.gov/index.cfm?c=archives.tv_vcr_spec

11. Efficiency level is expressed in letters, whereby "A" is the most environmentally friendly.

12. The author was unable to view more than one due to the strict IEC privacy policy.

13. Evidence from several interviews suggests that NCs prefer to vote Yes by default. Three voting options are available: Yes, No or Abstain.11

14. This is an umbrella group for 44 independent consumer organizations from 32 European countries.

15. Verification tolerances are designed to allow for variations that emerge in the measurements taken during verification tests, which are due to the differences in the measurement equipment used by manufacturers and surveillance authorities (EU Commission Regulation 2016/2282).