

Quantifying Public Value Creation by Public Service Media Using Big Programming Data

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In recent years, a renewed interest in how public service media (PSM) generate public value has emerged emphasizing how such value may express itself in multidimensional and nonlinear ways. However, little has been achieved in systematically studying these ways and providing evidence to policy makers. In this article, we propose that content diversity in TV programs and the extent to which PSM collaborates with external partners could serve as quantifiable markers that enable the measurement of multidimensional public value creation. We also propose the utilization of an untapped resource for this purpose—data from broadcast management systems. Based on a comprehensive case study—Estonia’s public broadcaster, ERR—we demonstrate a set of approaches to facilitate such analysis. This article suggests further ways for developing the approach with a longer-term goal of turning the multidimensional public value generation into an automated and systematic study in the service of policy interventions.

Keywords: public value, public service media, cultural data analytics, media innovation systems, content diversity, innovation system diversity

In recent years, there has been renewed interest in how public service media (PSM) generate public value (Cañedo, Rodríguez-Castro, & López-Cepeda, 2022; Lowe & Martin, 2013; Mazzucato, Conway,

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Mazzoli, Knoll, & Albala, 2020). However, much of this work has been conceptual, with no practical alternatives emerging to the much-critiqued “public value test” (Donders & Raats, 2012; Lee, Oakley, & Naylor, 2011; Michalis, 2012) for measuring public value creation. In this article, we propose a new methodological approach: Building on institutionalist and evolutionary economics (Commons, 1931; Dopfer & Potts, 2008; Lundvall, 2010; Mazzucato, 2018; Veblen, 1899) and “cultural science” (Hartley, Ibrus, & Ojamaa, 2021; Hartley & Potts, 2014) approaches, we work toward a new way to infer public value creation using data from broadcasters’ *broadcast management systems* (BMSs).

BMSs constitute management systems; they are designed to enable the coordination of information and tasks in time-critical production, programming, and airing workflows. The data in BMSs may also be used for internal accounting and to disseminate program information to the public, for example, as part of content framing on *video-on-demand* (VOD) platforms. These databases are extensive. They list granular metadata on all shows, including content descriptions, genres, airing times, data on rights and technical formats, and information about production teams and budgets. The granularity of BMS databases enables research into various aspects of broadcasters’ activities, for instance, the nature and sources of aired content, program foci and biases, the producer networks, collaboration patterns, or investments in different program types. By capturing information on most broadcasters’ operations, workflows, and outputs, such data enable an analysis of the potential value they generate to the public. It could also be argued that the public provision and analysis of BMS data could become an additional way PSM creates public value—by ascertaining their public accountability through insight into operations, including how public value is being created.

In this article, we demonstrate how BMS data can be used for such analysis using a decades-spanning television programming data set acquired from Estonian Public Broadcasting (*Eesti Rahvusringhääling*, ERR). We first analyze how ERR creates value for society by broadcasting content that enhances semantic diversity in the public sphere. Second, we examine how ERR collaborates with the independent production sector to cocreate public value. For comparison, we acquired an additional, smaller data set from Kanal2—a commercial channel in Estonia. We also purchased a data set of TV audience data and linked it to the ERR BMS data set to develop a new approach for comparing exposure and consumption diversity.

We investigated the broadcasting dynamics of a PSM institution on a scope and scale not previously afforded in media studies. Although there have been attempts to study program evolution and value creation using TV schedules (Hellman, 2001; Navarro, García-Muñoz, & Delgado, 2022; Prado, Delgado, Núria, Monclús, & Navarro, 2020) or sample-based content analysis (Cañedo, 2019), granular BMS data have remained an untapped resource. While we only analyze television programming data in this contribution, the approach developed here could be extended to other content delivery channels (online platforms and radio channels) to study the creation of public value within and across them.

Relationship Between Public Value and Diversities in Media (Innovation) Systems

The conceptualization of “public value” has been ongoing since the time of Aristotle, whose original distinction between exchange value and use value is still useful. The first refers to private properties that are exchanged in the market, and the second to publicly owned resources that are free to use by all members of the society. These resources could also be used for further value creation, public or private. Contemporary

discussion on how public agencies could generate public value, however, started with the work by Mark H. Moore (1995) within public administration studies—with his proposed alternative to the New Public Management approach. According to Moore and his colleagues (Benington & Moore, 2011; Moore, 1995), public agencies should act not only as rule setters, service providers, and providers of social safety nets but also as value creators and active shapers of the public sphere. However, as Benington and Moore (2011) put it, the values that public agencies should work toward should be defined by the public and should emerge in dialogues and interactions in the public sphere. Hence, public value is, first, something that is valued by the public and, second, something that adds new qualities to the public sphere (Benington & Moore, 2011, pp. 14–31). These two aspects should be seen as interdependent: What is valuable is identified in a well-functioning, inherently heterogeneous public sphere. The latter is often seen as constituted by PSM and other mainstream media channels. Today's public sphere involves multiple actors and different types of institutions, including independent media and international platforms. In this context, Benington and Moore (2011) suggest that thinking about public value involves analyzing the interactions, interdependencies, and cocreation between complex sets of institutional actors (p. 15).

What should result from institutional interactions is discursive diversity: A public sphere should be inherently diverse and rich in meaning to enable grounded dialogue and deliberation on values. Diversity in the public sphere is considered important for facilitating societal resilience. A discursively diverse public sphere supports citizens' ability to make sense of the dynamic lives around them and develop the skills needed to operate in complex ecosystems of meaning and values (Hartley et al., 2021).

Yet, for the creation of discursive diversity, media systems need institutions with alternative and complementary goals. Therefore, we propose that for understanding the role of PSM in public value creation, the concept of "innovation systems" is useful. Innovation systems are understood as systems of institutions that interact regularly and exchange knowledge and other resources (Freeman, 1995; Lundvall, 1992). Generally, national innovation systems include institutions such as private firms, universities, libraries, incubators, government regulators, investment banks, etc. If knowledge circulation in such systems is well coordinated, they generate innovative solutions and firms, growth in productivity, and, ultimately, general well-being (Dopfer & Potts, 2008). Public institutions need to be included in these systems because they invest in coordination activities that are specifically aimed at producing public value. They bring alternative objectives to market-based systems because of their differing missions (Gregersen, 2010, p. 136). By creating new markets and shaping existing markets, public agencies stimulate additional investments in the public interest that would not otherwise have been made (Mazzucato, 2018, p. 266). They broaden the range of possible directions for innovation, increasing the diversity of alternatives and enhancing the resilience of societies.

Regarding media and culture, PSM are often considered important coordinators of media innovation systems. By commissioning different content, they provide novel challenges and quality requirements for the independent production sector (Ibrus, 2015). They also take risks by investing, for instance, in new content formats without prior known commercial value. However, all other kinds of actors can benefit (there is "use value") once PSM has developed new functional formats, created recognition for specific content, or driven a popular discourse (Ibrus, Rohn, & Nani, 2019).

Based on the discussion above, we focus on system diversity as an important marker of public value. From the media policy studies perspective, valuable critique has been provided on the “strategic uses” of the public value concept (e.g., Donders, 2021; Moe & van den Bulck, 2013). In addition, classifications of how PSM could produce public value have been provided (Cañedo et al., 2022; Chivers & Allan, 2022). Our approach in this article does not depart from the recent discussions of the strategic uses of “public value” in media policy making but from classical conceptualizations of public value since Aristotle and builds especially on institutionalist and evolutionary economics (Commons, 1931; Dopfer & Potts, 2008; Lundvall, 2010; Mazzucato, 2018; Veblen, 1899) and cultural science (Hartley & Potts, 2014; Hartley et al., 2021) approaches. According to these, value perceptions are never universal but are always culturally contextual and specific. They change through dialogic communications between different cultural or knowledge communities; hence, both the economy and culture evolve via exchanges between such communities. Relatedly, many of the subcategories of public value that are sometimes listed (Cañedo et al., 2022; Chivers & Allan, 2022) are not only mutually conditioning but, for the most part, derive from various diversities within media systems and interactions within these systems. An institutionally diverse media innovation system where knowledge exchange is well coordinated not only facilitates industry growth and exchange value generation by all its participants but is also a precondition for discursive (civil value) and cultural (systems of meaning) diversity. As such, “public value” differs from “public good” as it is not static but an emergent property—always context-specific and changing, emerging in interactions and public dialogues.

While not all dimensions of public value have a direct relationship with system diversities (e.g., access to information, media literacy advancement, and accountability), it is worth studying the relationships between different value-generating system diversities and interactions. Our suggestion accords with Mazzucato et al.’s (2020) work, which addresses the need to study how PSM generates “dynamic value.” This means creating value for different beneficiaries—individuals, industries, and societies—and cocreating it in a changing environment with multiple partners.

For this article, the available data allow us to focus on two types of diversity relevant to public value creation. First, we study whether content diversity in PSM output can support broader societal learning capabilities, as citizens are potentially exposed to a more diverse range of information, topics, perspectives, and ideas. Second, we study the diversity of institutional systems and how PSM links to, collaborates with, and commissions content from various independent production companies to include their alternative ideas, thus broadening PSM’s discursive output.

Diversity can be measured across the dimensions of variety, balance, and disparity (and a combination of the three; Stirling, 2007). In this article, we focus on measuring different varieties and assessing their balance. With “variety,” we refer to “the number of categories into which system elements are apportioned” (Stirling, 2007, p. 709); this could be, for instance, the number of independent origins from which content is imported. Our suggestion is that the diversity a PSM can create should not be measured simply as various inputs or outputs but also as their relative balance. Current affairs, drama content, and other genres need motivated balancedness within a program, for example.

When studying diversity in content output, we build on Hellman (2001, see also Farchy & Ranaivoson, 2011), who showed that TV content diversities are multidimensional—and hence a multi-measure method could provide a more versatile picture. Therefore, we employ different concepts, such

as source, content, and exposure diversity (Napoli, 1999, 2011). Source diversity refers to “the extent to which a media system is populated by a diverse array of content providers” (Napoli, 2011, p. 247). This is the off-screen diversity by whom or how a program is produced or from where it is imported. Exposure diversity, according to Napoli (2011), is “the extent to which audiences consume a diverse array of content” (p. 248). This would mean measuring viewership numbers to understand how various types of content have actually been viewed. Different from Napoli and in line with Coate, Verhoeven, Arrowsmith, and Zemaityte (2017), we suggest distinguishing between actual exposure diversity and consumed diversity (Moreau & Peltier, 2004). According to our proposition, “exposure diversity” refers to how much (on-air hours) and how effectively different program types are exposed to audiences: Are they screened during prime or non-prime time, and do they get repeat airings? Conversely, “consumed diversity” measures what content is actually consumed—that is, how diverse the resulting set of popular programs is.

Case Study and Data

The following case study aimed to experiment with and develop novel ways to study public value creation using quantitative data analytics on big programming data. While the ERR and its BMS constitute a fairly specific case, they contribute to this study, given the relatively complete and comprehensive data set. With 1.3 million inhabitants, Estonia is one of the smallest countries in Europe, and its national broadcaster has very limited resources. To highlight some structural limitations, the ERR’s annual budget (which it receives from the national budget) in 2022 was €48 million, which is approximately 10% of the budget of the public broadcaster of neighboring Finland, YLE. ERR currently operates three TV channels (two in the Estonian language and one in Russian), five radio channels, and several mobile applications and websites, including a VOD platform.

Our analysis focuses on three TV channels: ETV, ETV2, and ETV+. ETV is ERR’s flagship Estonian-language channel and has operated continuously since 1955. ETV2 was launched in 2008 to serve multiple purposes: to provide children’s content, some Russian-language content, and “high” cultural value content—art house cinema, documentaries, and classics. Its Russian-language content was moved to the new channel, ETV+, in 2015. The latter was created in response to the start of the war in Ukraine in 2014 to provide alternatives to TV channels from Russia. The latter has been popular among Russian-speaking Estonian inhabitants, but Estonian authorities see it as channeling Russian propaganda.

This study builds on ERR’s current BMS database, which has been in use since 2004. Developed by the Czech vendor Provys, it is used mainly for program airing. It includes all the TV content files to be aired, along with the relevant technical metadata, content descriptions, genres, synopses, import origins, target groups, production teams, and budgets. The data provided to us by the ERR comprise static snapshots exported from the original relational database in early 2021. The 2004–2020 subset we focus on contains 201,027 total screen time hours across 408,444 program-at-time entries across the three channels, representing the airing times of 144,912 unique content items, which include 5,249 unique multipart series. For the time series, our approach is analytic rather than inferential in the statistical sense, describing the entirety of ERR TV programming during that period.

For simplicity, we used full years as the primary unit of time to construct a time series for diachronic comparison. An average year at the recent end of the data set amounts to about 18,600h of airtime, or 51h per day (~17h per channel). For perspective, a change of 1% in airtime of a given content type or import category between two years amounts to about 186h, or in daily programming terms, about a 10-minute difference per channel per day.

To aggregate screened content within a unit of time, we used three measures, each providing complementary insights into the previously discussed concept of *exposure diversity* or the extent to which audiences are exposed to diverse content: *hours*, *titles*, and *new titles*. The primary metric, *screen time in hours* based on scheduling data, shows how much a specific genre or foreign content was screened by a given channel in a given year. The data set uses a unique identifier system to mark programs, with IDs assigned to every content item. Based on this, the *number of titles* is derived as counts of unique program IDs within a year to provide insight into the repetitiveness of programming. Content freshness is explored using the fourth metric, the *number of new titles* per year, where only program IDs previously unseen in the program archive are counted.

To facilitate meaningful comparisons of the dynamics of content type, import source, and production type prevalence, we aggregated the original categories describing the aired content to reduce unnecessary detail and cross-category inconsistencies. First, we simplified the original content type variable (58 unique values) into 10 categories:

- series, films, and theatre recordings
- entertainment, games, and lifestyle shows
- music
- sport
- news and political commentary
- informative and documentary shows and series
- infotainment (including breakfast TV)
- culture and religion
- science and education
- kids and animation

The last category was amended by an additional criterion: We tagged programs that had kids or youth as the intended audience (in the relevant variable) as "kids and animation" to match the reporting categories used by the European Broadcasting Union (Cimino, 2020).

The 124 countries in the database relevant to content import sources were categorized into the following seven groups:

- Estonia (i.e., domestic production)
- Russia and the former USSR
- the Nordics (Finland, Norway, Sweden, Denmark, Iceland, and the Faroe Islands)

- the United Kingdom
- the United States and Canada
- other European Union (EU) countries
- rest of the world.

This grouping is driven by our interests and Estonia's geopolitical positioning. Content produced in Russia is often seen as targeting Russian-speaking residents of Estonia. The Nordic market is adjacent to Estonia, both culturally and geographically. The United Kingdom, no longer part of the EU, is one of the largest television production markets and an effective exporter in Europe. The United States and Canada function as globally dominant joint production markets. It is relevant to consider the EU separately, as it is governed by a distinct set of regulations aimed at developing a single content market that includes Estonia. For coproduced content, we counted the first listed (primary) country in the production country statistics.

Information on the production type of each piece of content, originally in a partially hierarchical taxonomy of 11 categories, was reduced to three main types: own production (in-house by ERR); coproduced and commissioned content (i.e., produced outside but with ERR involved); and acquired content, including bought and exchanged program items.

We also distinguished between prime and non-prime time screening. Prime time is defined as programs starting between 7:00 pm and 11:00 pm and ending no later than 11:30 pm; everything else is considered non-prime time.

The data set that we acquired from the commercial channel Kanal2 (includes data since 2007) was processed in the same way as the data from ERR, with one exception: the Kanal2 content type taxonomy lacked types corresponding to "science and education" and "culture and religion." Hence, even if they did have some of such content, it would not be visible in the data. We also acquired an ERR audience viewership ratings data set from the market research firm Kantar Emor, covering 2018–2020, and aligned it with the ERR BMS data. It is based on their panel-based (N = 765 . . . 930) audience measuring survey; the composition of the panel is changed by 10–12% every year.

Results

Domestic/Foreign Balance

PSM creates value for society by creating diverse content on national culture and current affairs and curating the inflow of foreign content on other cultures and societies. It is a cultural policy discussion about which of these functions is more important; hence, the measure of diversity here is about an appropriate balance.

The cumulative ERR programming (Figure 1) reached a nearly equal split between domestic and foreign content over the 17-year period via the introduction of two specialized channels. The cross-channel analysis (Figure 2) shows that the more recent ETV2 and ETV+ have become increasingly

focused on foreign content, while ETV has leaned toward domestic programming over the years. The increasing prevalence of foreign dramas and documentaries on ETV2 aligns with its intended profile as the “culture channel.” Yet, the amount of foreign content on ETV+ is surprising, since the channel’s original purpose was to better introduce the ethnic Russian population to Estonian society and culture.

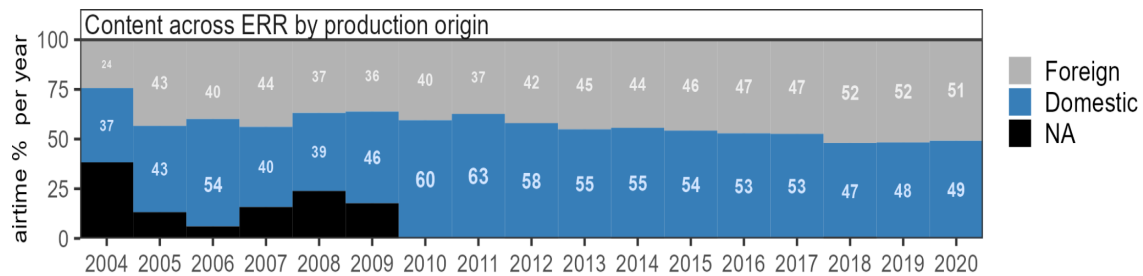


Figure 1. Share of airtime between domestic and foreign productions across ERR.

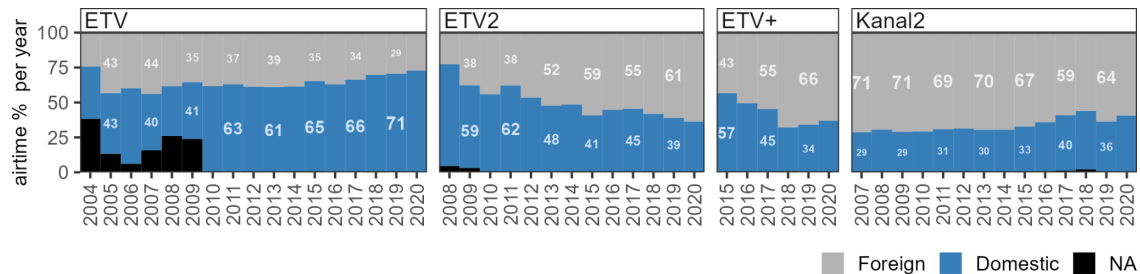


Figure 2. Share of airtime between domestic and foreign productions, split by channel (three ERR channels and Kanal2, an independent commercial channel).

A comparison between source and exposure diversity reveals that foreign programming has been disproportionately favored across ERR—it is repeated more than domestic content (but mostly during non-prime time). For instance, ETV purchased 19% of its programs from abroad in 2020 but dedicated 27% of airtime to it. Greater foreign content repetition may not be due to value perceptions but to differences in content. In 2020, ETV imports comprised 65% of fiction content, which is typically more suitable for repeats than, for example, evening news.

ERR’s editorial decisions regarding the balance between domestic and foreign content are contextualized by the Kanal2 program. Kanal2 airtime is dominated by foreign programming (Figure 2), suggesting that ERR creates public value within the media system by showing more freely available domestic content and adding diversity to the system.

Public Service Media as a Curator of Incoming Cultural Flows

An important cultural function of the public broadcaster is to provide audiences with access to culturally diverse programming by curating incoming cultural flows. Hence, we tested how to use BSM data to analyze the origins of imported content and their changes over time.

We first studied the *variety of production countries* and learned that this has been continuously decreasing across all ERR channels (Figure 3), more so on ETV2 and ETV+, where the variety has shrunk by more than four times between their inception and 2020 (fewer than five countries represented for 1000 aired programs).

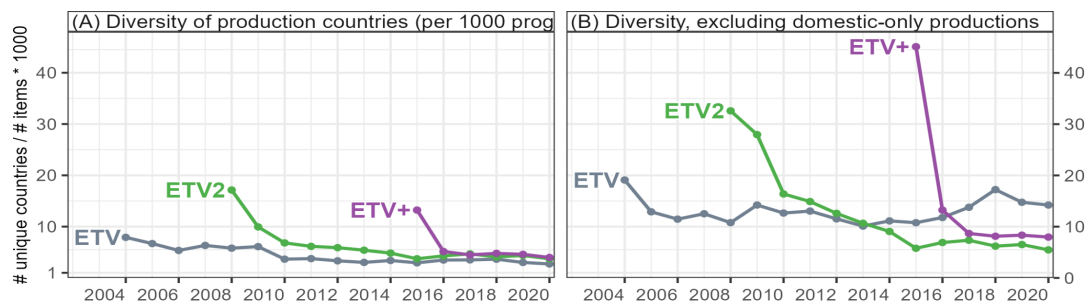


Figure 3. The diversity of content in terms of countries of production, expressed as the number of unique production country listings (including coproductions) in a year in a given channel, normalized by the total number of program items in a given year and channel, and scaled by a factor of 1000 (e.g., a value of 10 can be interpreted as follows: If 1000 TV shows were randomly sampled from a channel's schedule, an average of 10 countries would be among the production countries listed). Panel B displays the same data but for imports only.

The Growth of UK Prominence

The objective of European media policy—at least since the 1989 Council of Europe's *Television Without Frontiers* convention—has been to limit U.S. TV exports to Europe to enable more European content to be produced and distributed across the continent. The convention and subsequent EU Audiovisual Media Services directives have forced European TV channels to have at least 50% of their programs produced in Europe. This has, in general, been seen as a successful policy, creating a demand for European content. However, the policy has favored some countries—particularly the UK and its producers—over others (Donders & Van den Bulck, 2016; Steemers, 2016). In recent years, the international distribution of UK content has become increasingly effective. To the extent that, as Donders and Van den Bulck (2016) put it, the BBC's aggressive exporting strategies could be seen as undermining public service values in their destination countries.

Our analytic approach enabled us to confirm this tendency with ERR. What we found somewhat surprising but indicative of the ERR's editorial decisions was the relatively low share of U.S. content. Similarly, the share of UK content was very high. (Figure 4.A). The share of the UK content of foreign imports has been gradually growing and has been becoming especially dominant on ETV's main channel: 44% of new import content items (excluding repeats) were from the UK in 2016–2020. On ETV2, the share of new

showings of UK programs among imports has been growing again since 2015, reaching 30% by 2020 (Figure 4.E; this is 15% of all new program items on ETV2). UK content is more dominant during prime time (Figure 5) and is also the most repeated import category across ERR channels (Figure 6.A).

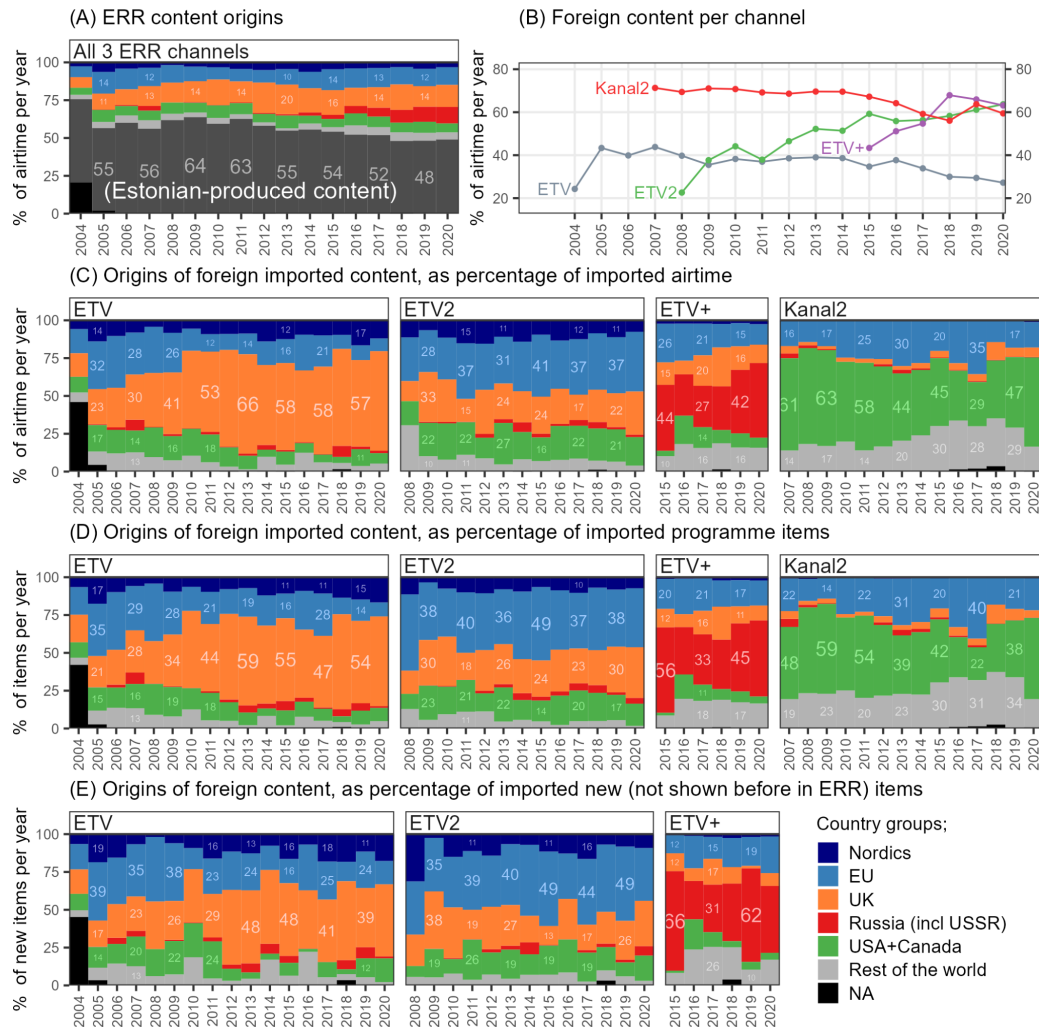


Figure 4. Share of imported content sources across ERR channels and Kanal2 for comparison. Panel A displays all the content sources in ERR as a whole. Panel B shows the share of imported programs per channel. Panels C–E show the source countries for imported content only as a percentage of airtime (C), percentage of items (D), and percentage of newly premiered, never-before-shown program items (E). The percentage values for larger shares are displayed for odd years. Panels C–E should be interpreted in light of Panel B: for example, UK imports dominate in the flagship ETV2 channel (~60%), but the overall share of imports is relatively lower in ETV than for the other channels (green line in panel B).

Nordic Content

Nordic content, similar to the UK, has recently earned international recognition for its high production quality. With Estonia being geographically and culturally close to the Nordic countries, one would expect to see substantial shares of the ERR's programming dedicated to Nordic content, based on the theory of cultural proximity (Straubhaar, 1991). However, the share of screened Nordic content is negligible across all ERR channels, especially when compared with British import volumes (Figure 4.C). This finding could suggest that more favorable content pricing that exporters from larger production markets can offer beats cultural proximity or, alternatively, that company and production universals beat potential cultural lacunae (Rohn, 2010, 2011). However, the viewing statistics (Figure 7) show that, despite its limited airtime, the Nordic content is valued among audiences since its median reach is comparatively high—higher than that of UK content. These statistics suggest that ERR has not been responsive to the particular cultural preferences of its audiences.

Other European Content

Content produced in the rest of the EU has little prominence on ERR, which raises a concern about granting audiences access to culturally diverse European programming (Figure 4). While the aggregate airtime of EU content across ERR appears almost as high as UK content (Figure 4.A), most of it comes from ETV2, which dedicated much of its non-prime hours to EU content, thus attracting smaller audiences (Figure 5). Furthermore, the analysis of genres and target audiences of this content revealed it to consist mostly (53% of content airtime in 2016–2020) of children's animations, a genre that generally carries little cultural specificity (Rohn, 2010, 2011).

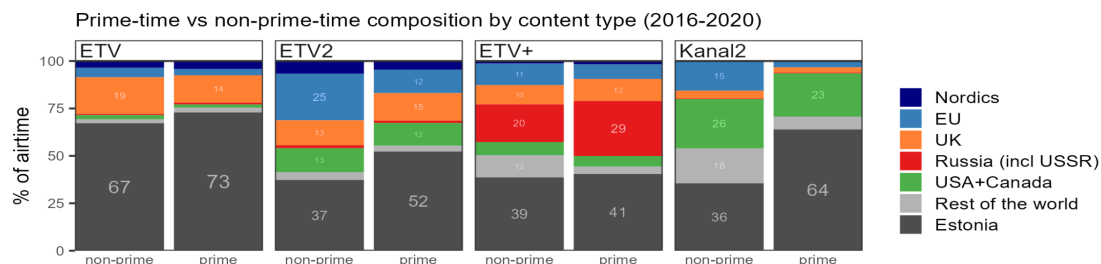


Figure 5. Channel programming split by prime vs. non-prime time, showing average over 2016–2020 for origin countries (Estonia here includes content produced by ERR itself).

Russian Content

Russia has not been a prominent content supplier to ERR, except for the ETV+ channel geared toward Russian-speaking audiences in Estonia (Figure 4). There, content from Russia has not only increased in importance overall, but even more so in peak viewing times (Figure 5). Throughout the years, this growth has come primarily at the expense of Estonian programming. This reduction in domestic airtime on ETV+ is significant, given that the channel was established primarily to bring content on Estonian realities to local Russian-speaking audiences. This trend might not necessarily indicate that the channel has had a pro-

Russian agenda, but instead a problem of constrained supply, given the lack of resources available at ERR to produce sufficient original Russian-language content. The growth in Russian imports on ETV+ was not known to policy makers and the wider Estonian society before the start of the renewed Russian aggression in 2022 and the finalization of our study. This is another indication of why our proposed approach and BMS data analysis could prove valuable and serve media policy interests.

	(A) Average repetitiveness of new content (within same channel and year)				(B) Likelihood of being a repeat, i.e. not a new programme (across ERR, across years)			
Estonia	0.76	0.54	1.46	1.52	0.58	0.78	0.66	0.69
UK	0.98	1.21	1.18	0.53	0.79	0.91	0.84	0.57
USA+Canada	0.69	1.18	0.93	0.64	0.74	0.9	0.75	0.73
Nordics	0.94	0.91	0.78	0.79	0.71	0.86	0.74	0.62
EU	0.58	1.24	1.07	0.42	0.71	0.89	0.76	0.63
Russia (incl USSR)	0.81	0.73	1.22	0.51	0.72	0.93	0.76	0.79
Rest of the world	0.72	0.72	1.02	0.39	0.59	0.85	0.74	0.38
	ETV	ETV2	ETV+	Kanal2	ETV	ETV2	ETV+	Kanal2

Figure 6. Repeated content across ERR channels in 2016–2020, for content origins. Panel A shows how many times a new program item in a given category is repeated within the same year in the same channel, on average. A value of 0 would mean that new shows are only shown once (in a given channel within the year); 1 would mean that new shows are repeated once.

Panel B takes into account all programming data (since 1960 for ERR) and displays the likelihood of being a repeat item, i.e., something that has already been shown before, in any of the ERR channels at any point in time (this is calculated separately for Kanal2; its data goes back to 2007). A value of 0 would mean that only new shows are aired, while 1 would indicate that no new shows are being broadcasted.

Content From the Rest of the World

Content produced in the rest of the world is thinly represented in ERR programs, with even a slight decrease in 2018–2020 on ETV and ETV2. Upon being founded in 2008, ETV2 World content constituted 31% of imported airtime, but this number was down to 4% in 2020—relating to the broader decline in source country variety (Figure 3). World content mainly reaches audiences via the ETV+ channel, where it constitutes 17% of imported airtime and 19% of new import titles in 2016–2020. The imported content constitutes 10% of the total ETV+ airtime. Of these, 44% were from Ukraine, 23% from Turkey, and 7% from South Korea. However, world content primarily fills non-prime time on ETV+ (Figure 5), which has a very low median reach compared with ETV; hence, the world content reaches very small audiences (Figure 7).

Foreign Content on Kanal2

To fully understand the extent to which content diversity on ERR channels translates into public value, the data from the public broadcaster need to be interpreted in the context of the larger cultural and media system, particularly in contrast to commercial television. Unlike ERR, Kanal2's foreign imports are dominated by content from the United States (25% of airtime in 2016–2020; 42% of all imported content), followed by the World Group with 17% (28% of imported airtime), which in this case means mostly content from Turkey and Australia, known for daytime series production. Notably, UK content has only 4% screen time.

Consumed Variety

Figure 7 compares the exposure (BMS data, panel B) and consumption of content in 2018–2020 (audience reach data from Kantar Emor, panel A). We found that exposure variety has little direct relationship with consumed variety. For instance, while UK content enjoys significant exposure, the median reach of Nordic content is higher (1.1 vs. 0.9). This suggests that the cultural proximity theory is still relevant.

The relationship between ERR's editorial decisions and consumption becomes evident as we compare the most popular (highest reach) UK and U.S./Canadian content items. In the first case, these are well-known detective series, and in the second case, they are mostly documentaries, history-based films, or Canadian public service TV productions that address various social issues. That most EU content comprises animations for kids is confirmed by audience statistics—the median audience age is 37 (56 for domestic Estonian content).

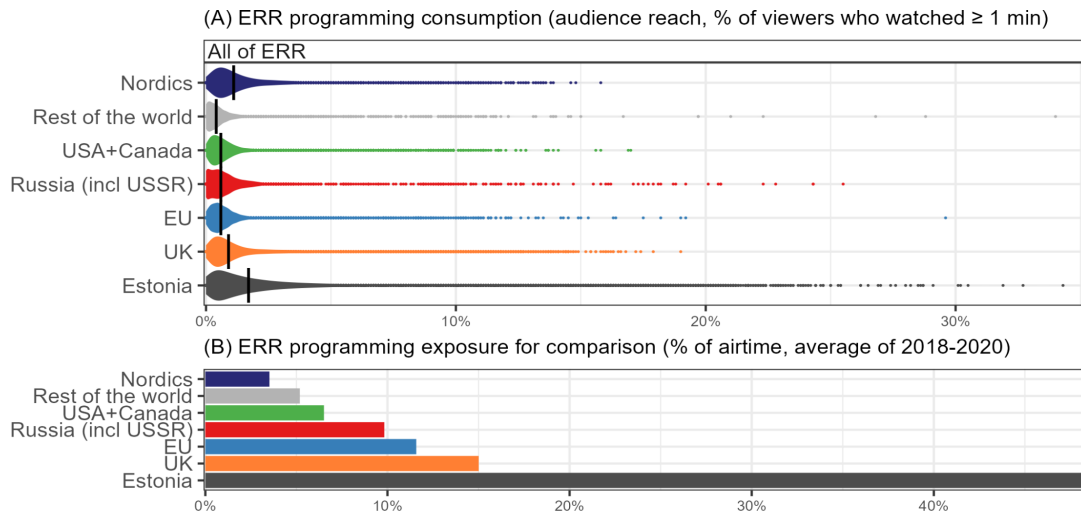


Figure 7. (A) Consumption variety of ERR programs in 2018–2020, operationalized as average reach per program—the percentage of viewers who viewed a given program for at least 1 minute. Each import category is displayed as a distribution of its program items over reach values (horizontal axis), with outlying popular shows visible as individual points and medians displayed as black bars. (B) Exposure variety (airtime share) for comparison.

Summary of the Curation of Incoming Cultural Flows

Our approach to analyzing BMS data in combination with audience data enabled us to explore the curation of incoming cultural flows in unprecedented detail. We could show how ERR adds value to the public sphere, as it increases its diversity by showing considerably more European than American content compared with a commercial competitor. However, much of this content originates from the United Kingdom,

and its share has been gradually growing. This brings about the dominance of Anglo-American content, as on commercial competitor Kanal2, content from the United States and Australia prevails.

Against this backdrop, it can be suggested that ERR is one of the small PSM negatively affected by the aggressive strategies of UK content distributors, as discussed by Donders and Van den Bulck (2016). There is also very little content from EU countries—or from the rest of the world, the share of which has been in decline. From this, we conclude that ERR TV programming is not explicitly oriented toward increasing the diversity of cultural flows to Estonian audiences. Hence, ERR's public value generation could be limited in terms of empowering its viewers to learn increasingly international and culturally complex ecosystems of meaning (Hartley et al., 2021).

Public Service Media Curating Thematic Content Diversity

We also examined BMS data to explore the thematic/discursive diversity of the content. In Estonia, private media institutions have criticized ERR for providing entertainment content online, while the broader culture and arts sector has condemned ERR for featuring too little arts programming. Relating to this discussion, we discovered that while culture, arts, and current affairs were in relative decline over the years (Figure 8), entertainment content experienced the largest boost in airtime at ERR. The addition of ETV2 and ETV+ channels and an increased focus on entertainment within ETV have driven this increase (Figure 9). On the main ETV channel, infotainment airtime share has also increased from 17 to 20% in 2016–2020.

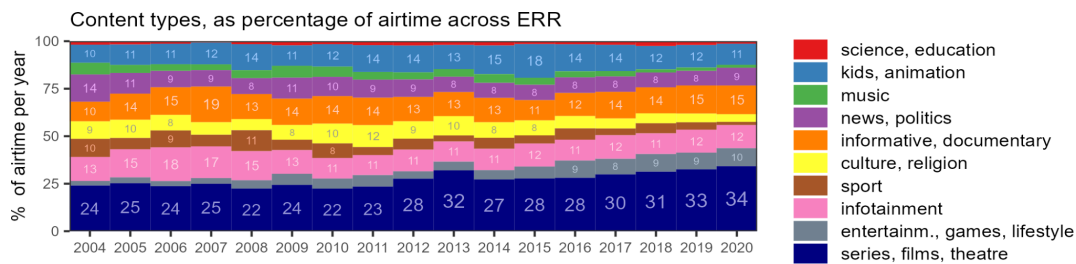


Figure 8. Share of airtime per year by content category (takes into account repeats and differences in running time).

Various kinds of current affairs and informational content, as well as documentaries, however, received only a moderate increase, partially because of the addition of ETV+. Separately, politics and news have been one of the stable categories in terms of airtime over the years (Figure 9). However, with the addition of ETV+, the repetitiveness of this typically least-repeated category increased (Figure 10), which signals the reutilization of news shows across multiple channels.

The added channels (in 2008 and 2015), on the other hand, had little impact on screen hours dedicated to arts and culture (religion is also in this category, although its share is marginal). Hence, perhaps paradoxically, with the increase in screen time available within the ERR ecosystem, arts and culture programming has become less prominent (Figure 8, yellow). While it has received slightly more prime than non-prime airtime on ETV2 (13% of prime airtime, compared to 5% on ETV; Figure 11) and a stable 4–6%

of airtime on ETV in 2016–2020, arts and culture programming was barely aired on ETV+, decreasing from a similar share to just 1% in 2019–2020.

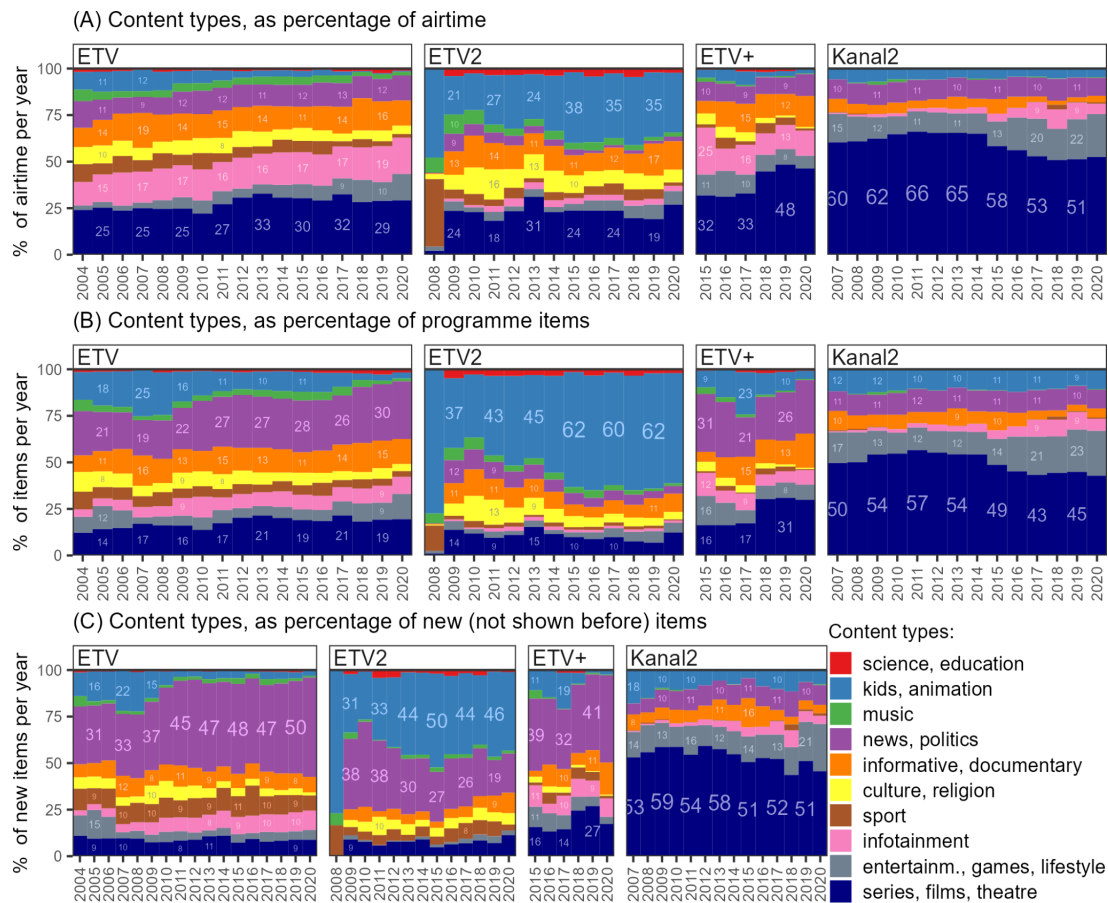


Figure 9. Analyses of exposure to content categories on different channels.

Our analysis of sports content was driven by the question of how much local/regional sports coverage there is and whether ERR contributes to the diversity of sports coverage. We discovered a reduction in hours dedicated to sports across ERR, with bi-yearly airtime fluctuations around significant international events, such as the Summer/Winter Olympics or World Cup in men's football (Figure 8, brown). This suggests that ERR focuses mainly on high-level international sporting events, and while it has started to lose these events to private channels, this gap has not been filled with coverage of local sports, such as local leagues and national events—the kind of content that would increase the diversity of sports programming and would constitute public value in terms of informing audiences about local sporting communities and activities.

	(A) Average repetitiveness of new content (within same channel and year)			(B) Likelihood of being a repeat, i.e. not a new programme (across ERR, all years)			(C) Production type repetitiveness in ERR		
	ETV	ETV2	ETV+	ETV	ETV2	ETV+	BoughtCom.	Own	
science, education	2.07	1.61	1.66	0.85	0.89	0.84	1.3	2.3	2.7
entertainm., games, lifestyle	1.54	1.3	1.73	0.81	0.92	0.76	1.5	2.6	1.8
informative, documentary	1.31	0.94	1.48	0.77	0.87	0.77	1.4	2.7	1.8
culture, religion	0.91	1.15	1.6	0.75	0.83	0.79	1.4	1.4	1.8
kids, animation	0.78	1.35	1.06	0.79	0.9	0.8	1.4	1.4	1.6
series, films, theatre	1.16	0.89	1.12	0.83	0.87	0.78	1.3	2.2	0.9
infotainment	1.2	0.01	1.8	0.55	1	0.65	2.9	1.5	1.7
music	0.83	0.63	0.88	0.75	0.88	0.87	1.5	0.7	1
news, politics	0.56	0	1.3	0.36	0.27	0.57	1.1	2.1	0.8
sport	0.05	0.31	0.46	0.09	0.3	0.36	0.4	1.2	0.1

Figure 10. Repetitiveness of new content across ERR channels in 2016–2020, for content types (similarly to Figure 6). Panel A: how many times a new program item in a given category gets repeated within the same year in the same channel, on average. Panel B: the likelihood of being a repeat item (takes into account all of ERR's programming history). A value of 0 would mean that only new shows are aired, while 1 would mean that only old content is repeated (see infotainment on ETV2). Panel C: repetitiveness of new content by production type, similar to A.

If we compare ERR channels with Kanal2 (Figure 9), we see that the latter airs more fiction content and has experienced growth in domestic nonfiction entertainment and infotainment in 2010–2020. Yet, the commercial channel contributes little to the public sphere for content on arts and culture or informative and documentary content. Against this backdrop, ERR could be seen as a provider of public value to society.

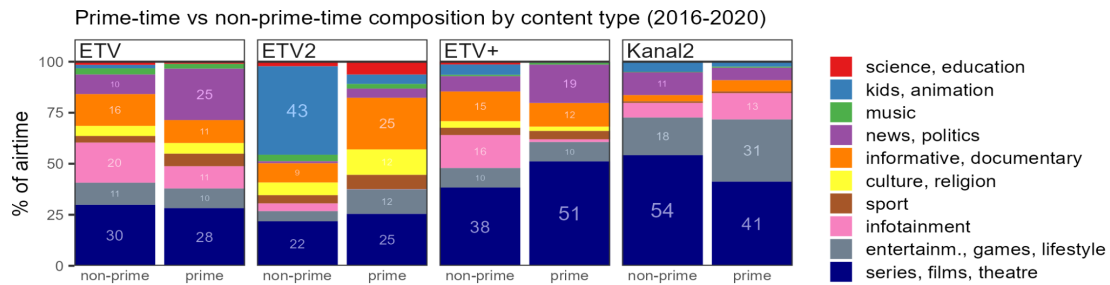


Figure 11. Share of airtime per year by content category and channel split into prime/non-prime time in 2016–2020 (enables discussion of exposure diversity and takes into account repeats and differences in running time).

Consumed Variety

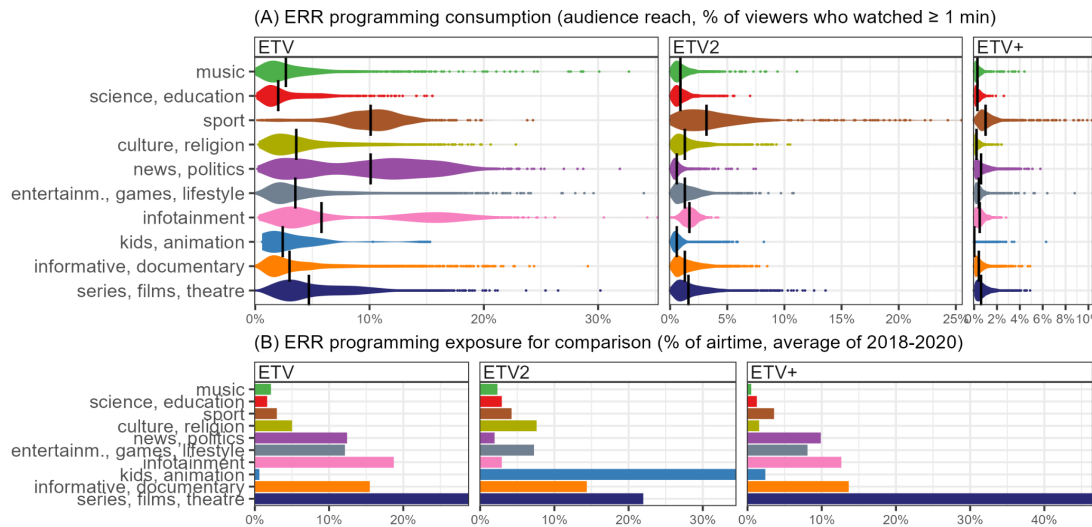


Figure 12. (A) Consumption variety of ERR programs, operationalized as the average reach per program. Each content category is displayed as a distribution of its program items over reach values (horizontal axis), with outlying popular shows visible as individual points. Medians are displayed as black bars. (B) Exposure variety (airtime share) for comparison.

To interpret how exposure variety affects consumption, let us explore the average reach of program types split between ERR's channels (Figure 12). We learn that ERR reaches most of its audience mainly via its flagship channel, ETV. We also learn that it is the large sporting events, infotainment, and news and political talk shows that increase ERR's average reach. In the case of news and politics and infotainment shows, non-prime time repetitions drive this reach (two peaks in the distributions of these categories in Figure 12). We also learn that the median reach of ETV entertainment shows does not exceed that of arts and culture programming. This finding suggests that there could be a greater demand for the latter than is currently supplied—that is, what is valuable to the public is not provided.

Summary of Curating Thematic Content Diversity

Our approach enabled us to demonstrate that while entertainment and fictional content have been on the rise on ERR channels, arts and culture content has been on a relative decline. However, as the median reach of entertainment and culture categories was similar, it raises questions as to whether this growing imbalance has been justified. In the case of sports content, we learned that its share of exposure variety has been low and decreasing, but its median reach (consumption) is high. This means that ERR sports programming focuses on high-profile international events, and its actual inherent variety has been low. The findings about arts and culture and sports coverage could suggest that not enough public value is served in cases with low exposure diversity but high consumption. That is, media institutions do not provide what the public values.

Public Value in Terms of Industry Collaboration

As argued above, PSM not only creates public value for society in terms of content offers but also in terms of the coordination of broader cultural innovation systems. Therefore, we analyzed how ERR interacted with independent producers (that consists of small enterprises), either via commissioned content or by collaborating with them on production. For that purpose, instead of studying aggregate screen hours or all titles shown (including repeats), we focused on the showings of new titles—as these refer most directly to production or acquisition processes within a given time frame. Our first finding was that over the studied period, the balance of production types fluctuated somewhat; however, the general trend has been that own productions have always dominated the aggregate output and, especially, the main ETV channel (Figure 13). Since 2016, self-produced content has been steadily gaining ground, reaching 80% on ETV. Since 2012, ERR has gradually commissioned less content from independent producers.

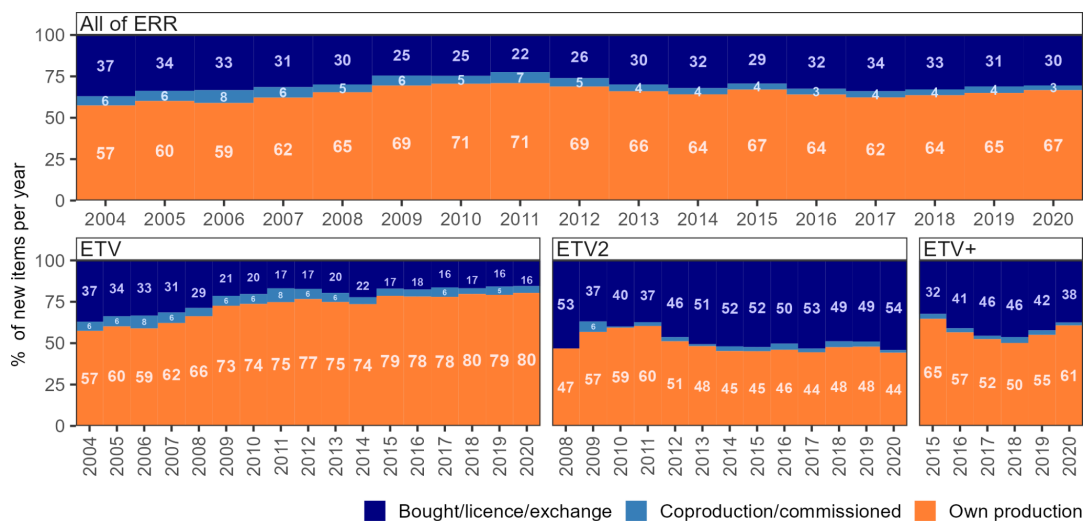


Figure 13. Production mode of first-time showings of titles on ERR, as a percentage of new, non-repeat titles.

Let us look at some of the program types in more detail (Figure 14). First, regarding fictional content (films, series, theatre recordings), we can see that ERR purchases most of it (in 2016–2020, 93% of new fiction items) and does so largely from abroad. ERR self-produced >3% of its fiction content in 2008–2010, reduced to 1.3% in 2020. Commissioned fictional content has been decreasing too—from 16% in 2006 to 4% in 2020. This is very little in international comparisons (Navarro et al., 2022). Yet, different from own-produced shows, commissioned fiction content is repeated more (on average 2.2 times across all ERR channels in 2016–2020; Figure 10.C), suggesting that commissioned domestic content is generally valued higher than bought foreign content (repeated 1.3 times). Domestically commissioned fiction content also comprises somewhat shorter formats (median length 28 minutes in 2016–2020)—typically sitcoms rather than longer-format quality dramas. This suggests that the ERR can only afford to commission cheaper forms of content compared with purchased series and films (median length 49 minutes).

Regarding content type “informative, documentary” (includes documentaries, docuseries, shows about history, environment, economy, foreign affairs), the trends have been similar but at different scales: While the share of content produced in Estonia (either own-produced or locally commissioned) is higher, it is getting increasingly replaced by (presumably cheaper) foreign content. With regard to commissioned content, the trend is also down, from a peak of 32% in 2009 to 7% in 2020. However, we learned again that ERR repeats these commissioned shows, on average, 2.7 times (Figure 12.C) more than own-produced informative content (1.8), suggesting that it values these shows more. Again, generally shorter formats are commissioned (median length 28 minutes) compared to bought content (46 minutes).

We saw above that the share of “entertainment, games and lifestyle” programming has been growing, from 3% in 2007 to 9% in 2020. ERR commissioned more than half of it from independent producers in 2011–2014, while by 2016–2020 it had produced more than half of its entertainment content in-house (similarly to 2004–2007). Hence, we suggest that the general growth of such programming has come from ERR focusing more on entertainment production. This could come at the expense of informative and documentary content—as its share of own-produced shows has come down. Still, also with entertainment content, commissioned content is repeated more (on average 2.6 times, compared to 1.5 for both bought content and 1.8 for produced content)—referring to their perceived higher value by the program managers.

In this section, we show that BSM data allows for analyzing how PSM institutions collaborate with the independent sector and coordinate media innovation systems. In this regard, ERR was shown to commission very little new content (presumably for specific taxation-related reasons). Still, when they did, they highly valued this content by repeating it more than other content. This suggests that the commissioned content was exceptional and that ERR might have had some coordinating effect on the Estonian media innovation system. While limited, this effect could be understood as public value—value generated to the broader industry and society by increasing diversity in the media system.

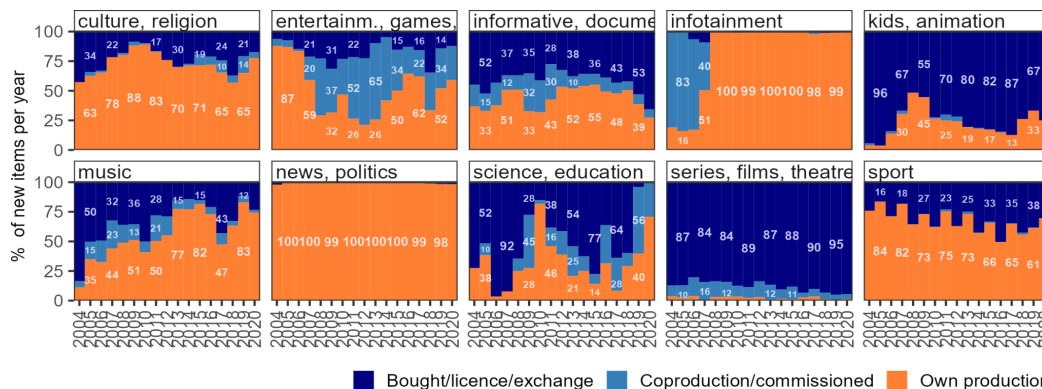


Figure 14. Changes in production modes of different program types across all channels—calculated using unique program titles as units.

Concluding Discussion

The main result of this study is that the analysis of data from broadcasters' BMSs could enable novel methods and provide systematic evidence on whether and how PSM institutions are generating public value. In this article, we highlight two ways in which PSM could create public value: by increasing diversity in the public sphere through content provision and by coordinating the "national media innovation system" by including a more varied set of independent producers in content production. We also show how comparing source, exposure, and consumed variety could be a useful way to analyze and understand the diversities and value created. Furthermore, this article also demonstrates how comparing aggregate screen time (minutes), all screened titles (including repeats), and new screened titles provides insights into how TV programs are structured, how exposure diversities are built, and what, relatedly, appear to be the value propositions of program managers. We also demonstrate the usefulness of aligning granular viewing data with BMS data to compare consumed diversities with exposure and source diversities. This enabled us to study the value perceptions of audiences as compared with the value perceptions of program makers. Our case study—Estonia's ERR—demonstrated how unique insights into program evolution and generated value can be garnered. Many of our discovered trends (summarized in the findings section) were not previously known to industry stakeholders and policy makers in Estonia. This suggests that there is value in such an analytic approach as a management instrument and a way to ensure the accountability of PSM institutions.

The aim of this article was not to present a full picture of ways in which a PSM could create public value (there are multiple interpretations of that), but rather to act as a starting point for discussions on how to analyze public value creation systematically, considering all its various dimensions, as well as their interdependences and trade-offs. We demonstrated, for instance, how source diversity does not necessarily translate into exposure diversity and how the latter may not have a direct relationship with consumed diversity. However, we also showed how these different dimensions could still be interdependent: for instance, when ERR replaced commissioned entertainment with in-house production (reduction in source diversity), it seems to have led to what could be considered imbalanced overproduction (reduction in exposure diversity).

To better understand such interrelationships and start using BMS data analytics in the service of media policy and program development, more work needs to be done. First, the relationships between various diversities need to be studied in more detail—between institutional and content diversities, but also between content diversities and civil value (news coverage and engagement). Furthermore, more dimensions could and should be included in such analyses using the existing BMS data systems. For instance, including program budgets in the analysis could enable a comparison of value invested and (public) value gained. It could also enable explorations of how diversity in people or external firms involved in production could affect value production. A promising avenue could be to study the nature of long-term networks of professionals or firms and the collaboration patterns that lead to increased public value production. It could also be informative to complement genre categories (standardized by metadata schemas) with topic and sentiment modelling based on either program synopses or program content in BMS databases. This could enable content disparity analysis—an important dimension for understanding diversity (Stirling, 2007). Content modelling and disparity analysis could also enable the assessment of the quality of existing metadata in BMS systems. The latter is a potential weak point in using BMS data due to inconsistencies in

how the data have been entered into the systems over long periods and by different actors. Finally, BMS data analysis could also be applied to radio and online output as well as to their reception.

In this article, we also compared how ERR and a private broadcaster, Kanal2, generate public value via content provision. Our approach shows that systematic methods could be developed to analyze the public value generated by the whole media system and by the interactions and complementarities within it. This is important, as Benington and Moore (2011) suggest that what is of value to the public is sorted out in the public sphere of a country. Departing from this, we call on our colleagues to approach their national PSM and other media institutions and invite them to share their BMS data as open data to increase their accountability as well as to develop multidimensional ways of studying, comparing, and improving their public value creation practices. This kind of modelling would be multidimensional, taking into account the existing diversities, collaboration patterns, and value transfer trends of a given media system. It could point to existing market and innovation system coordination failures—enabling improvements in PSM accountability, and enabling its managers and policy makers to improve operations or develop new services based on transparent and systematic evidence.

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