

Chapter 10

Video Networks of Sustainable Design: The Doughnut Perspective



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Abstract Economics is going through a radical change to better account for biological and social indicators of health and prosperity, the so-called Doughnut Economics proposed by Kate Raworth. Through this framework, design understood as creating ways of being is an integral component of economic development. On the other hand, some recent studies are proposing to incorporate Doughnut Economics in specific design areas. Previous research by the authors analysed YouTube sustainable design videos in English and Spanish. However, the present study classifies the videos according to Doughnut Economics indicators to provide a more comprehensible description of local design processes and products, the contextual factors tied to them, and communication patterns of sustainable design in YouTube. There was a clear difference on design areas and approaches; and types of communication hubs across country groups. The study has implications for the conceptualization of design as a multidisciplinary and participatory process, where global and local dynamics should account for planetary sustainability and resilience.

Keywords Sustainable design · YouTube · Doughnut economics

10.1 Introduction

Meadows and colleagues reported in 1972 that our current economic system can not continue to grow forever (Meadows et al. 1972). Today, we face financial excesses, cultural colonialism and exploitation of living systems at an unprecedented rate. Based on (Hanington and Egenhoefer 2018), the consequences in the design field

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are failed products saturating land, sea and atmosphere; materials and processes wasted; physically and/or psychologically hurt living beings; and lost jobs. Better accountability and assessment of design processes is needed, which is challenging in our densely interconnected world.

10.1.1 Literature Review

Different systems have been proposed to assess sustainability, like the Millennium Ecosystem Assessment (Alcamo 2003), The Economics of Ecosystems and Biodiversity (TEEB) (Sukhdev 2008), Planetary Boundaries (Rockstrom et al. 2009), and the Sustainable Development Goals (Assembly 2015). However, their level of complexity and/or disconnection to other aspects of sustainability make them hard to understand/apply from an economic point of view. The biggest issue is within the economic mindset, which was influenced by white male Enlightenment and thus views economics as a science with general laws governing decision making processes.

Economist Kate Raworth proposed a model called Doughnut Economics, where the goals should be meeting the needs of all within planetary boundaries, view the economy as embedded, nurture human nature, consider complex systems, design to distribute, design to regenerate and be agnostic about growth (Raworth 2017). We should note that two of her arguments include the word design, which can be understood as creating ways of being. Hence, through the Doughnut Economics framework, the impact of what designers do is more easily grasped. Design is ubiquitous, its success depends on social context, other fields are realizing its vital role in achieving sustainability, and thus has outgrown our discipline (Escobar 2018).

On the other hand, some studies are proposing methods to incorporate the Doughnut Economics paradigm into industrial design (Stopper et al. 2016), fashion design (Rissanen 2018) and design theory (Boehnert 2018). However, given the complexity of current design processes, there is a need to understand which aspects of Doughnut Economics are being achieved within design and where can we locate gaps.

One option to explore complex human systems and their interactions is through Social Networking Sites (Boyd and Ellison 2007). Among them, YouTube is the second largest search engine after Google and the third most visited site after Facebook (Alexa 2019), counting with a video ecosystem that tends to form small world networks. Considering its high usage rate in creative scenarios, YouTube has potential for research in design communities.

10.1.2 Research Objectives

Research questions are as follows:

RQ1. Which types of design are shown in YouTube videos classified according to Doughnut Economics indicators?

RQ2. Which are the characteristics of relevant video hubs across Doughnut Economics indicators?

RQ3. Which contextual factors are tied to such content and communication patterns?

10.2 Methods

10.2.1 Data Collection and Classification

We employed data previously analyzed by the authors in (Vargas Meza and Yamanaka 2017; Vargas Meza 2019), where an extensive description of our methods is included. Because the original intention was to explore the role of academia in diffusion of sustainable design, keywords included “university” and “lecture”. Data on YouTube videos in English and Spanish related to sustainable design was collected in 2015 with YouTube Data Tools (Rieder 2015). Videos were watched to discard unrelated content and to classify them on several categories, including contextual factors like type of uploader, type of speaker, uploading date, YouTube channel’s country and type of design.

Given the unequal economic and communication structural power, former analysis mostly highlighted countries like US and UK in the English sample, and Spain and Colombia in the Spanish sample. However, their social and environmental issues are different from those in other countries with equal or larger number of netizens. Therefore, the present study also classified the videos according to Doughnut Economics indicators (O’ Neill et al. 2018) of their countries of origin, which are based in measurements revised in the literature review section and in Raworth’s proposals.

It should be noted that so far, no nation on Earth counts with thriving economy, society and living systems at the same time. Nevertheless, groups of countries were considered according to their biological and social indicators. A high average in biological indicators means that the nation is trespassing planetary boundaries, while a high average in social indicators means human well-being.

Therefore, if the biological indicators average was moderately low and the social one was moderately high (0.52–3.33 and 0.70–1.13 respectively), countries were classified as Bio Socially Compromised (BSC). If both averages were low (0.18–1.99 and 0.29–0.89 respectively), countries were classified as Socially Compromised (SC). Finally, if both averages were high (2.08–7.98 and 0.91–1.20 respectively), countries were classified as Biologically Compromised (BC). It should be noted that most countries (40) detected in the YouTube video samples fell in the BC category, followed by 27 SC countries and 13 BSC countries.

To answer RQ1, statistical tests for comparison of categorical and numerical data were computed with R (Team 2013). For RQ2 basic social network metrics were calculated and graphs visualized with Gephi (Bastian et al. 2009), in order to

Table 10.1 Description of network centralities

Centrality	Definition
Degree	Total number of connections a video has with other videos
Indegree	Number of connections directed to a video
Outdegree	Number of connections a video directs to other videos
Betweenness	Number of shortest paths that connect other videos in the network by passing through a given video
Closeness	Average number of steps a video requires to access all the other videos in a network
Clustering Coefficient	Measure of how close is a video to be part of a group
Local Clustering Coefficient	Measure of how close is a video to be part of its local group

detect relevant videos and communication hubs. Table 10.1 includes a description of network centralities employed in the present study. A connection refers to videos likely to be featured in the recommendation area of YouTube, which are based on overall viewing patterns, user interactions, playlists, etc.

Also, to compare network centralities across country groups, ANOVA was computed with Ucinet (Borgatti et al. 2002). Finally, to answer RQ3, qualitative analysis was performed in top videos in terms of YouTube metrics and network metrics.

10.3 Results

10.3.1 Types of Design

Table 10.2 shows that English videos from BC countries were more numerous across design areas but differences were non-significant; while in Spanish, most videos

Table 10.2 Design across country groups

Design area	English videos			Spanish videos		
	BSC	SC	BC	BSC	SC	BC
Architecture	13	57	915	129	97	157
Industrial D	8	32	180	30	58	46
Graphic D	4	1	59	10	10	17
General	5	7	258	32	20	32
Mixed	4	21	231	38	61	52
Total	34	118	1643	239	246	304
	$\chi^2 = 46.981, df = 8, p > 0.05$			$\chi^2 = 26.038, df = 8, p < 0.005$		

about architecture and graphic design were from BC countries; most videos about industrial design and the mixed area were from SC countries; and most videos about the general area were from BSC and BC countries ($p < 0.005$). The architecture content was related to both cities and rural localities.

10.3.2 Uploaders and Speakers in the Doughnut

Most English videos from BC countries were uploaded by Universities (699, 38.9%), most from SC countries by media channels (34, 1.8%), and most from BSC countries by students (8, 0.4%). These student videos were mostly related to Shell. As for Spanish, most videos from BC and SC countries were uploaded by Universities (100, 12.6%; 64, 8.1%), with content predominantly about architecture and fashion design respectively. Most videos from BSC countries were uploaded by media (63, 7.9%), which included public television channels.

As for speakers, most English videos from BC countries showed professors (419, 23.3%); most from SC countries showed designers (30, 1.6%); and most from BSC countries, students or didn't depict humans at all (9, 0.5% in both cases). Videos by students were once more related to Shell. In contrast, most Spanish videos from BC countries showed a mix of education related individuals with other people (58, 7.35%). Most videos from SC countries showed students (56, 7%), predominantly related to toys. Finally, videos from BSC countries showed designers (56, 7%) principally.

We will now revise the role of women across country groups, as there is little research on women designers outside the architecture and engineering fields. Table 10.3 shows the number of videos where women were identified as uploaders or speakers. Although differences were non-significant across country groups, it is worth mentioning that women speakers were found in nearly half of English BSC countries videos and in all the Spanish groups.

Most of English videos from BC countries depicted architecture students (71, 3.9%), followed by designers (53, 2.9%), citizens (45, 2.5%) and other actors (37, 2%); and professors (33, 1.8%) and researchers (18, 1%) in the general area. This

Table 10.3 Presence of women across country groups

	English videos			Spanish videos		
	BSC	SC	BC	BSC	SC	BC
Uploaders						
W/Women	5	1	46	17	33	7
W/o Women	29	117	1597	222	213	297
Speakers						
W/Women	16	36	625	117	113	141
W/o Women	18	82	1018	122	133	163

result reflects the considerable quantity of English architecture videos, and a preference for content related to theory and interdisciplinarity. Women in SC and BSC countries were mostly industrial design students (12, 0.6% and 4, 0.2%; respectively) shown in Shell related videos.

As for Spanish videos, 16 (2%) from BC countries showed diverse women actors in architecture, and 9 (1.1%), women professors in the mixed area. The video content was related to architecture; and engineering and fashion design respectively. 14 (1.7%) videos from SC countries showed women students and 8 (1%), business related women in the mixed area. Most of such content was about fashion design. Finally, 16 (2%) videos from BSC countries showed women architects.

10.3.3 *YouTube Metrics and Qualitative Descriptions of Top Videos*

Previous literature (Vargas Meza 2019) found that the most reliable metric of YouTube videos is number of views. Table 10.4 shows this measure across country groups. In English, videos from BC countries were significantly the most viewed ($H(2) = 6.6471, p < 0.05$), while differences were not significant in Spanish. This result reflects the algorithmic bias in YouTube that favors content from English BC countries.

We will proceed to analyze the most viewed videos in detail. The Top 10 English videos from BC countries were uploaded mostly in the U.S., although videos from U.K, Denmark, Canada and Australia were also among the most viewed. The content was largely related to industrial design and was uploaded by media channels, notably TED Talks. A noted exception was a video from the Story of Stuff educative channel, ran by an NGO. Half of the content showed women. On the other hand, Top 10

Table 10.4 YouTube metrics across country groups

English videos			
Views	BSC	SC	BC
Average	489.82	6349.25	12698.31
Median	305	507.5	556
Std. Dev	626.42	4130.74	8585.911
$H(2) = 6.6471, n = 1795, p < 0.05$			
Spanish videos			
Views	BSC	SC	BC
Average	11748.14	3463.74	3735.07
Median	299	219.5	316
Std. Dev	74012.27	18068.33	30231.93
$H(2) = 3.934, n = 789, p > 0.05$			

Spanish videos were uploaded in Spain principally, although videos from Chile and the U.S. were also present. The content versed mostly on architecture techniques, was uploaded by a diverse set of actors and half had ties with universities. 3 videos showed women.

Top 10 English videos from SC countries were mostly uploaded in India, although content from Uganda, South Africa, Philippines, and Peru was also found. Design areas were architecture and the mixed area (natural resources and waste management, often related to architecture). Videos were mostly uploaded by educational entities and one included women. As for Spanish, videos were uploaded in Colombia, although one video from Peru was found. The content largely versed on techniques in architecture, industrial design and the mixed area (notably fashion design). Videos were uploaded by education actors, including 2 women. The content showed mostly citizens, although 3 videos included women.

As for Top 10 English videos from BSC countries, they were mostly uploaded in Malaysia, although content from Thailand, Vietnam, Lebanon, Moldova and Brazil was also frequently viewed. Most of the Malaysian content was related to Shell and was education oriented. 3 videos were uploaded by women, 4 depicted women and 4 did not show humans. On the other hand, Spanish videos were mostly uploaded in Mexico, followed by Argentina and Panama. The content largely versed in architecture techniques and concrete design examples; and was uploaded by businesses, 3 including women. The videos showed citizens and 3 included women. It is worth mentioning that only one top video in each language was uploaded in 2015, which was the year of the data collection.

10.3.4 Network Metrics and Qualitative Descriptions of Top Videos

Table 10.5 shows significant ($p < 0.0005$) differences in terms of network metrics for English videos across country groups. We included the whole network sample ($n = 2452$) in this analysis, labelling videos from countries without Doughnut Economics indicators as “Unclear”. The centrality that accounted for most of variance ($R^2 = 0.962$) was degree, followed by indegree ($R^2 = 0.699$). Videos from SC countries were the highest across all network indicators, suggesting that they form a community subnetwork. However, betweenness centrality was low for this sample, pointing to an overall disconnected network.

On the other hand, Table 10.6 shows significant ($p < 0.0005$) differences in terms of network metrics for Spanish videos across country groups in the whole network sample ($n = 1075$). Once more, the centrality that accounted for most of variance ($R^2 = 0.918$) was degree, followed by indegree ($R^2 = 0.896$). This suggests that the English network videos are more dependent on outdegree than the Spanish ones. Although averages tended to be more similar across groups, videos from SC countries

Table 10.5 ANOVA in English videos network metrics

Group	BSC	SC	BC	Unclear
Degree	F = 1054.7639, R ² = 0.962			
Mean	2.4411	6.0338	4.6171	3.7488
Std. Dev	3.6696	9.9896	9.0081	7.1277
Indegree	F = 255.8935, R ² = 0.699			
Mean	0.7352	3.1440	2.3791	1.7001
Std. Dev	1.1885	7.2209	6.6648	4.7227
Outdegree	F = 1228.7771, R ² = 0.334			
Mean	1.7058	2.8898	2.2379	2.0487
Std. Dev	2.7472	3.9174	3.3312	3.1000
Closeness	F = 1165.4085, R ² = 0.322			
Mean	0.1285	0.2148	0.1630	0.1775
Std. Dev	0.2438	0.2929	0.2473	0.2757
Clust. Coef	F = 1165.4085, R ² = 0.322			
Mean	0.1197	0.2137	0.1251	0.1351
Std. Dev	0.2469	0.2965	0.2285	0.2373
Loc. Clust. Coef	F 47.8688, R ² = 0.262			
Mean	0.0431	0.0827	0.0490	0.0539
Std. Dev	0.0919	0.1289	0.0974	0.1035
Betweenness	F 491.9396, R ² = 0.167			
Mean	0.0001	0.0004	0.0003	0.0002
Std. Dev	0.0004	0.0022	0.0016	0.0013

tended to be the highest across network indicators. The exceptions were betweenness, which was highest for BC countries; and local clustering coefficient, which was highest for countries without Doughnut Economics indicators. Interestingly, betweenness centrality was as low as in the English network.

In order to visualize indegree and doughnut indicators, network graphs were drawn in Gephi. Figure 10.1 shows the English video network in the left and the Spanish video network in the right. In the case of English, interlinked groups of architecture and academic videos mostly from BC countries tended to be more central, while videos from SC and BSC countries versed more often in eco villages. In contrast, the Spanish video network has more central nodes from SC and BSC countries, particularly from Mexico. The video groups labelled in the figure were usually uploaded by university students.

Next, we will analyze videos with the highest indegree more in depth. Top 11 English videos from BC countries were mostly uploaded in the U.S., followed by the Netherlands and UK. 5 were related to industrial design, uploaded mostly by education related actors including one woman. 7 of the videos were related to universities, 6 included women, 5 showed education related actors, 4 were about Shell and 2 were

Table 10.6 ANOVA in Spanish videos network metrics

Group	BSC	SC	BC	Unclear
Degree	F = 534.2640, R ² = 0.918			
Mean	3.9246	4.5853	3.7960	3.7979
Std. Dev	5.8563	6.5750	5.8052	5.9007
Indegree	F = 295.9653, R ² = 0.826			
Mean	2.0669	2.2317	1.9309	1.8292
Std. Dev	3.8908	3.6810	3.7896	3.3452
Closeness	F = 1076.9187, R ² = 0.501			
Mean	0.1860	0.2669	0.1884	0.2000
Std. Dev	0.2687	0.3638	0.2853	0.2935
Outdegree	F = 1014.1048, R ² = 0.486			
Mean	1.8577	2.3536	1.8651	1.9686
Std. Dev	2.6163	3.2702	2.4839	2.9640
Betweenness	F = 475.1337, R ² = 0.307			
Mean	0.0003	0.0002	0.0004	0.0002
Std. Dev	0.0012	0.0013	0.0013	0.0011
Loc. Clust. Coef	F 1.5698, R ² = 0.030			
Mean	0.0362	0.0481	0.0394	0.0520
Std. Dev	0.0657	0.0898	0.0718	0.1066

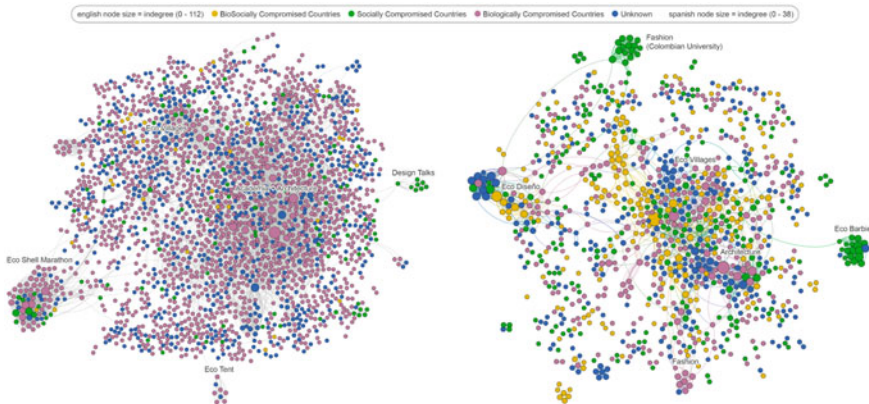


Fig. 10.1 Video networks of sustainable design

uploaded in 2015. Meanwhile, top 11 Spanish videos were from Spain and only one was from France. 8 videos were about architecture, 7 were related to universities, 8 were uploaded by education related actors, 5 showed citizens and 2 included women.

The Top 10 English videos from SC countries were mostly from South Africa, although videos from Philippines, India, China, Indonesia and Pakistan were also found. Content was largely related to industrial design. 8 videos had ties to universities, 6 were about Shell, 5 were uploaded by education related actors, 5 showed students, 4 were uploaded in 2015 and 3 included women. As for Spanish videos, the top 11 were from Colombia and only one was from Peru. 9 videos had ties with universities and 7 versed on industrial design, including 5 about toys. 6 videos were uploaded by students, including women in 2 cases. 6 videos showed education related actors and 3 included women.

Regarding BSC countries, 6 English Top videos were mostly from Malaysia, although videos from Brazil, Lebanon and Thailand were also found. The content was diverse and uploaded by education related actors, including 1 woman. 4 videos were related to universities, and they tended to show a diverse set of speakers, 3 including women. 2 videos had ties to Fuji Xerox and 1 with Shell. Finally, 2 videos were uploaded in 2015.

In contrast, Top 8 Spanish videos were mostly from Argentina and Mexico, although a video from Panama was also present. 6 had ties with universities, 5 videos were about architecture, 5 included women, 4 were uploaded by universities and 4 showed education related actors mixed with citizens. In particular, 3 videos were programs produced by a private university in Mexico and ran by students, explaining sustainable design and presenting products and services in a didactic manner.

10.4 Discussion and Conclusions

10.4.1 *Content Across Doughnut Indicators*

We will start the discussion with English videos. Urban architecture content was more numerous in this sample, while rural architecture was more frequent in Spanish. Regarding videos uploaded by students, the most visible in terms of views and network metrics were sponsored by the multinational Shell Oil Company.

This enterprise has teamed up with students since 1979, allegedly due to environmental concerns (Wellington 1982). However, projections of fossil fuel impacts were held by the company since the 80s without disclosing them to the public (Franta 2018), while they lobbied governments to curb environmental laws (Laville 2019). Some universities collaborate with enterprises to develop sustainable products (Esslinger 2013), but as it is unclear how much fuel based energy efficiency has improved thanks to the Shell Eco Marathon, this initiative could be considered as a case of greenwashing, understood as marketing used to promote a false perception of an organization as environmentally conscious at the expense of university collaboration.

In contrast, some of the few noted videos related to graphic design in BSC countries (Malaysia in this case) had ties with Fuji Xerox, a Japanese company

that produces printers. Their model, developed in 2000, was based on Corporate Social Responsibility and divided sustainability in Strategic Human Sustainability and Strategic Ecological Sustainability to develop a cycle of remanufacturing and material recovering (Benn and Dunphy 2004).

This model has been widespread in similar industries across Japan (Matsumoto and Umeda 2011). Some of the reasons why it was shown in Malaysia might be the importance of Japanese investment in that country (Karim and Majid 2009), the high penetration rate of internet and social media (we Are Social 2019), and the collectivism of Malaysian society. This created a network effect, where online communities add value to platforms (Regalado 2014).

Regarding speakers across country groups, BC content depicted professional designers while non-BC countries showed students. SC and BSC countries videos versed on more interdisciplinary and collective approaches to the design process but tended to limit participation to professors, designers, researchers and students, the “professionals”. In other words, non-BC countries students who are exposed to video sources from BC countries are at risk of decontextualizing the design process and of being culturally colonized.

As for Spanish videos, SC countries had popular content generated by public television and actors often mixed with common citizens, communicating less hierarchical societies where governments are active diffusors of sustainable design. The big quantity of videos versed on fashion design and toy production in BSC countries was partly due to a set of laws promoting sustainable development, design and children welfare, particularly in the case of Colombia (Abello Llanos 2010; Cálad Idárraga 2013; Gómez Barrera 2010). However, Latin America has a long tradition of maquila for the fashion industry that should not be ignored as a warning for what accounts as sustainability for brands (Villanueva Ponce et al. 2015) versus working conditions in such industries (Frey 2003; Guadarrama 2006).

BSC countries tended to be more related to businesses and architecture. In the case of Mexico, this is influenced by solid frameworks, financial incentives and government participation (Galvez 2011).

Despite that equality is one of the Sustainable Development Goals and should be included by default in the social dimension of sustainable design, what our data suggests is that women participation in this particular area is more prominent in English speaking BSC countries (particularly in Malaysia) and in Spanish videos. Given that gender equality is one of the 3 less financed goals (Ramos 2019), such results are not surprising. Regardless of the numerous women students participating in sustainable design, systemic barriers still largely difficult their progress towards professional and academic positions.

10.4.2 Communication of Sustainable Design in YouTube

Despite being well connected, English SC countries videos and Spanish videos lack visibility partly due to algorithmic bias influencing exposure to BC countries content.

However, there is also a psychological bias confirmed in (Vargas Meza 2019), a perception of virtual colonialism, where YouTube users from non-BC countries consider BC content as of higher quality and more “professional”.

What is problematic is that content generated by media is also preferred and watched more often than content generated by universities. Media, particularly from BC countries, tended to portray sustainable design as a profession for loner visionaries (both men and women). On the other hand, Spanish videos tended to show a more participative approach where, as Manzini mentions, “everyone is a designer” (Manzini 2015).

Another aspect to be mentioned was the small amount of recent content among the most viewed and most connected videos, regardless of YouTube algorithmic priority for fresh content. Based in our data, such content is better connected in English SC countries. However, average videos related to sustainable design in Spanish tended to be from recent years, which was not the case for those with highest number of views or indegree.

Taking on account that Facebook is behind YouTube in terms of web traffic and that its penetration is high in Latin American countries (Kemp 2019), it is likely that traffic for average videos is partly influenced by multiplatform sharing, while a more specific but fragmented audience related to education seeks high quality video content regardless of the year it was uploaded. Therefore, despite the many structural, social and environmental issues provoked by social media platforms, valuable content is still viewed and appreciated in some scenarios, generating micro spaces for sharing economies.

10.4.3 Conclusions

Based in our analysis and discussion, we conclude the following:

RQ1. Videos from BC countries tended to verse on urban architecture and graphic design, while videos from SC countries tended to depict more industrial design and design from the mixed area; and BSC videos were more centred on rural architecture. Multidisciplinarity and participatory design were shown more frequently in Spanish videos.

RQ2. Regarding video hubs:

RQ2.1. In terms of video views, media channels were relevant for English BC countries, while Spanish videos were diverse. Education related actors were relevant for SC countries, and corporations for BSC countries.

RQ2.2 In terms of network centralities, education related actors were relevant in BC countries and SC countries. Actors in BSC countries tended to be diverse.

RQ3. Algorithmic bias, corporative influence and psychological bias played in favor of videos from English BC countries. In contrast, comprehensive political and educational frameworks, and government and citizens participation have

contributed to the development and practice of sustainable design in SC and BSC countries.

The present study is a first re-exploration of YouTube data that functions as knowledge source for many without access to formal education, and as electronic repository for education related actors. We could uncover communication patterns and characteristics of groups of countries that are largely absent in Video Social Networks literature. Limitations include video content in other languages used by large numbers of netizens like Chinese and Portuguese. Therefore, future analysis could target such languages. Further, a next step is to analyze public discourse in the YouTube videos to uncover more communication patterns and other factors across country groups related to sustainable design from a Doughnut Economics perspective.

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