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Research Article

Quality Assessment of YouTube Contents regarding Hydroponic Technology

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Purpose. The purpose of this study was to assess overall quality of the YouTube contents regarding hydroponic technology. *Methods*. On YouTube, the keyword "hydroponic technology" was searched, and 393 contents were identified. A total of 202 contents matched the inclusion requirements which were graded using a modified standard scoring scheme. A panel of six reviewers scored the contents utilizing a scoring scheme and evaluated likes, dislikes, views, and duration of the contents. Content was categorized based on quality, themes, publisher type, publisher country, and publishing year. To explore multiple comparisons, the Kruskal-Wallis test was applied ($P < 0.05$ considered as statistically significant). *Findings*. We observed that the significant portion of YouTube content on hydroponic technology was of poor quality (52.5%). A small portion of the evaluated content was of medium quality (32.2%), with the rest being of good quality (15.3%). Depending on quality, variables such as likes, views, and duration differed significantly. According to video demographics, the USA published most of the content, and 2020 was the peak year for content released. Majority of contents were produced by organizations with an emphasis on practical application. *Conclusion*. Despite the fact that YouTube contains a wide range of hydroponic technology content, the amount of good-quality content on YouTube is still insufficient. *Originality/Value*. This report summarizes the present scenario and sets standard content quality schemes that disclose the content quality debate regarding hydroponic technology. Furthermore, understanding viewing patterns will assist policymakers to disseminate hydroponic technology information effectively.

1. Introduction

Climate change is one of the major concerns in the twenty-first century. In the agricultural sector in particular, climate change in the future will result in an increase in unexpected extreme climatic events that may put agriculture in a vulnerable position [1]. The projected result of climate change will be the scarcity of water and other resources, drought and desertification, decrease in soil quality, increase incidence of diseases and pest, increase salinity, increase in sea level, and submerging low-lying areas [2]. Impact of such important agricultural production factors will adversely affect the production. According to an early estimate, climate change will result in 4-24% production loss in developed countries and 14-16% production loss in developing countries which will occur mostly in Africa, South, and East Asian countries [2]. In this scenario, new farming methods, such as controlled-environment agriculture, might be a one-way solution to mitigating the negative effects of climate change in agriculture [3].

In agriculture-dependent countries, hydroponic technology has become a boon to manage serious risk of climate change. Hydroponic farming technology is considered as one of the most promising sustainable technologies in today's world in the context of adaptation of climate change in agriculture. It has emerged as the fastest growing and

second-generation crop production technology in terms of dealing with numerous manifestations of climate change, drought, and rising food demand [4]. Hydroponic system allows efficient utilization of fertilizers and water and effective control of pest- and climate-related factors that ensures high productivity and quality production. The systems allow the efficient use of water and fertilizers and better control of climate- and pest-related factors that ensures high productivity and quality production [5]. In developing countries, hydroponic crop production is progressively rising to ensure sustainable production against climate change [3, 6–8].

To spread hydroponic technology information to mass people, YouTube can be the easiest and fastest way. According to Statista 2021, YouTube is currently the second largest social media platform with 1.86 billion users where people share videos. As a large number of individuals are connected through this platform, it has become an important for disseminating information. The technology dissemination research concluded that YouTube fits all elements of a broad context of social involvement, including public knowledge, accessible and free access, user-created material, and the ability to play on demand [9]. YouTube-based content is a low-cost information-sharing method that has increased access of public to developments [10]. Video-mediated learning is not just transferable; it also works well in conjunction with television and mobile devices [11].

For these reasons, various govt. or non-govt. organization involved in agriculture make videos on significant topics and promote them on YouTube. Several YouTube channels of various organizations in the field of agriculture are found on YouTube (Table 1).

As big organizations gradually adopt this platform as a means of publishing and disseminating information, agricultural content on YouTube is constantly emerging. As it continues to establish itself as a powerful repository of information in the field of agriculture, its significance in expanding agricultural education continues to grow. To ease the learning process for students and to enhance their engagement, YouTube serves as an effective tool [12]. YouTube provides social learning instructions and instructional lessons and acts as a teaching resource [13]. The USDA Agricultural checkoff program for quality content revealed that target audience–based videos obtained more views that were of high quality [14]. YouTube channel developed by the collaboration of the National Institute for Occupational Safety and Health (NIOSH) and AFF (Agricultural, Forestry, and Fishing Centers) was found effective [15].

Universities are now producing and disseminating YouTube-based instructional resources. To promote the release of a new blackberry cultivar, the University of Arkansas Division of Agriculture created YouTube videos [16]. Some of the major university websites are found on YouTube (Table 2).

From the students' perspective, it is evident that they consider YouTube as a useful platform for acquiring knowledge and learning valuable skills. Investigation on undergraduate students revealed that YouTube videos increase student engagement, understanding, and general satisfaction in higher education classes [17]. YouTube videos had a positive influence on students' perspectives, and in many cases, they judged videos to be more beneficial than others [18]. Among the undergraduate students, students found to have a positive attitude towards the importance of YouTube and had agreed to conduct course activities by incorporating YouTube [19]. Even farmers watch YouTube content to learn and adopt new technologies. Several studies found that farmers from different countries used YouTube as an information source [20, 21]. A study of Arkansas University revealed that YouTube videos increased exposure of fruit cultivars, and feedback from propagators and growers was very positive [10]. In improving farmers' skills, YouTube is found effective in sowing rice seeds by pilot method [22]. Farmers have a positive outlook on the need for appropriate adaptation strategies in response to climate change [23]. For young farmers and professional agriculturists, YouTube is a popular media platform for information seeking and agricultural innovation, and the generated programs on YouTube improve farming knowledge, facilitate innovation adoption, increase productivity, and elevate farm income [24]. When video-assisted learning is used, agricultural extension is more successful, and this method lowers complicated agroecological concepts, prejudice, and learners' normative judgments [11].

When all facts are considered, YouTube seems to be a valuable source of information. However, the problem with YouTube is that anyone can upload any type of content, and there is no peer review system that ultimately defects the quality of content. Thus, the quality of the contents remains unknown, increasing the chance of contaminating information sources with low-quality content. As an educational content or in terms of distributing technological information, a certain level of quality is obligatory. If the quality of those videos is questionable, the dissemination of useful hydroponic technology information will be restricted. Misleading information used in the videos can cause extensive damage at the field level. Such kinds of studies were mostly evident in the field of public health [25, 26], food science [27], marketing [28], and many more. Regardless of the fact that YouTube content analysis is significant in the agriculture sector in particular, very limited study [29] has been observed.

Therefore, we tried to close this gap by analyzing the quality of contents on hydroponic technology. The aim was to depict how hydroponic technology–based information is portrayed in YouTube by conducting in depth systematic analysis on the content quality of YouTube videos. The study tried to clarify on how YouTube materials serve as an information source on hydroponic technology through the use of different metrics. The focus of this research was to examine the scenario by establishing standard content quality schemes that disclose the content quality controversy around hydroponic technology. The study will encourage the agriculturists, research professionals and content creators to work on providing quality contents by using YouTube as an information media and to utilize YouTube effectively as an information dissemination tool. Hence, research development and information regarding

Table 1: YouTube Channel of different agricultural organization.

Organization	YouTube link
Food and Agriculture Organization (FAO)	https://www.youtube.com/c/UNFAO
US Department of Agriculture (USDA)	https://www.youtube.com/c/UsdaGov
International Rice Research Institute (IRRI)	https://www.youtube.com/c/irrivideosofficial
Consultative Group on International Agricultural Research (CGIAR)	https://www.youtube.com/c/cgiar

Table 2: YouTube Channel of different educational institutions.

Institutions	YouTube link
Wageningen University & Research	https://www.youtube.com/user/WageningenUniversity
Cornell University	https://www.youtube.com/user/CornellUniversity
University of Oxford	https://www.youtube.com/c/oxforduniversity
Massachusetts Institute of Technology (MIT)	https://www.youtube.com/c/mit

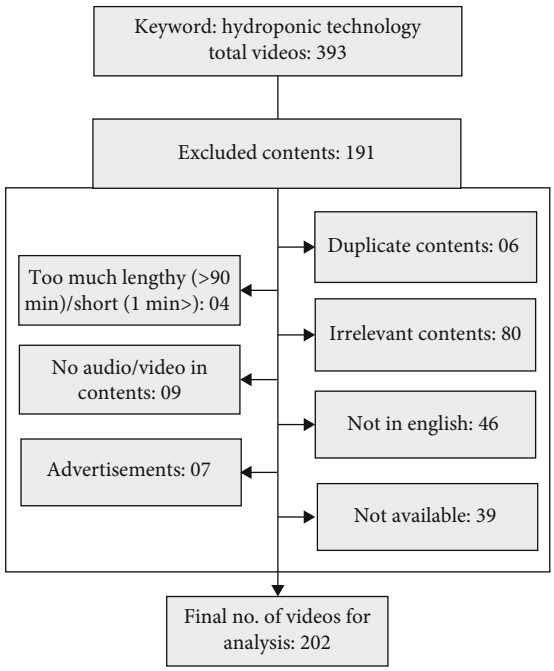

Figure 1: Details search methodology for included hydroponic technology videos.

Table 3: Customized content scoring process.

(A) Hydroponic technology aspect (scoring range: 0 to 10)
Introduction
Necessary instruments
Nutrition management
Management of pest
Harvesting of hydroponic produce
Suitability of different hydroponic systems
Management cost
Water management
Management of waste
Precautionary measures
(B) Technical aspect (scoring range: 0 to 5)
Video resolution at least 720p
Subtitle is present on the video
Audio of the content is clear
Completely focused and stable
Relevant audio and video clips are used
(C) Comprehensive aspect (scoring range: 0 to 5)
Whole content is easily understandable
Content fulfill its' objectives
Content discussion is on point
Content publisher is reliable
Content provided additional resources

the hydroponic technology could be enhanced by the assistance of YouTube.

2. Materials and Methods

2.1. Content Search. The data search was launched on https://www.youtube.com on October 11, 2021, with the keyword "hydroponic technology" using the latest windows version 94.0.4606.81 of the chrome browser. History, cookies, site data, and cache files-free Chrome browser were used, while searching standard sort by relevance option and incognito mode was used on YouTube. Links of those search results were listed in the Excel version 2016, and a total of 393 videos were identified. Details search methodology flowchart for included hydroponic technology videos are given in (Figure 1).

2.2. Content Review. The two authors initially independently reviewed all the identified videos and prepared a final list of content for evaluation. During the review, the videos were excluded on the basis of certain criteria which were irrelevant to hydroponic, duplicate video, language was not in English, no audio or video, and duration (very long or short). A total number of excluded videos were 191, and a total 202 videos were selected for final evaluation. Similarly,

Table 4: Grading of YouTube contents regarding hydroponic technology.

Category	Content scores(0 to 20)	Description
Good quality	Above 80%	Have sufficient information on hydroponic technology, technically sound, broadly useful
Medium quality	60% to 79.9%	Limited information given on hydroponic technology, technically limited, limited use
Poor quality	Below 60%	Lack of important information, technically limited, not useful for learning purpose

Table 5: Summary of all included YouTube videos on hydroponic technology.

(a)

Video characteristics					
Variables	Total	Mean	S.D	Min.	Max.
Number of likes	535167	2649.34	11367.02	0	115000
Number of dislikes	24385	120.72	534.97	0	5500
Number of views	58508633	289646.7	1415300.34	16	16140658
Duration of videos (min)	1752	8.67	9.38	1	66
Content score (CS)	2224	11.01	3.85	2	19

(b)

Video demographics					
Content publisher	Frequency ($n = 202$)	Percent	Good quality	Medium quality	Poor quality
Independent	83	41.1	19	23	41
Organization	85	42.1	8	27	50
News channel	19	9.4	1	10	8
Others	15	7.4	3	5	7

(c)

Content theme	Frequency ($n = 202$)	Percent			
Theoretical explanation	56	27.7	1	12	43
Practical application	78	38.6	18	29	31
News	35	17.3	4	16	15
Others	33	16.3	8	8	17

(d)

Content released	Frequency ($n = 202$)	Percent			
2006 to 2009	4	1.98	1	2	1
2010 to 2013	14	6.93	N/A	7	7
2014 to 2017	59	29.21	5	14	40
2018 to 2021	125	61.88	25	42	58

such criteria have been already used in YouTube content selection [30, 31].

The contents of the final list were reviewed and evaluated by a panel of six authors. Collected data from videos were publisher country, video publisher type, theme of the video, number of likes, number of dislikes, number of views, videos duration (min), and year of video published. To evaluate quality, contents scoring criteria were categorized into three aspects, namely, (i) hydroponic technology aspect, (ii) technical aspects, and (iii) comprehensive aspects. Content scoring parameters on hydroponic technology and technical aspects were developed by the authors themselves, whereas comprehensive aspects were adapted by reviewing prior research [32]. For fulfilling each parameter, one point was given, and a total twenty criteria were used. This evaluation was done to determine the appropriate value by giving content score (CS). Those customized content scoring criteria are given in (Table 3).

2.3. Content Analysis. The data collected from the YouTube contents were coded, entered, and analyzed through Microsoft Excel 2016 and IBM SPSS Statistics 26. Categorical data

such as content type, type of contents publisher, country of publisher, and year of contents releases were reported in frequencies and percent. Numerical data such as number of likes, number of dislikes, number of views, and videos duration (min) were reported in mean and standard deviation. Content quality was analyzed based on the content score of each video. Coding (present = 1; absent = 0) was done based on the presence and absence of components within the content, taking into account the three aspects of each content. Each video got scored according to the provided parameters; determined content score range was 0–20. All videos were categorized into three groups based on Blooms' cutoff point [33], which were given in (Table 4). The Kruskal-Wallis test was implemented in this study to carry out multiple comparisons ($P < 0.05$ considered as statistically significant).

3. Results and Discussion

We analyzed a total of 202 videos featuring hydroponic technology that met our inclusion criteria. Video metrics such as the amount of likes, dislikes, views, and content duration (min) were assessed (Table 5). Overall, there were 535167 likes, 24385 dislikes, 58508633 views, and a runtime of 1752 minutes for all videos. The analysis on video metrics revealed that the mean of "number of likes" was 2649.34 ± 11367.02, while the mean of " number of dislikes" was 120.72 ± 534.97. Meanwhile, "number of views," " duration (min)," and "content score " obtained mean 289646.70 ± 1415300.34, 8.67 ± 9.38, and 11.01 ± 3.85, respectively.

From an educational perspective, on one side, YouTube has created an enlarged opportunity for instructors to share and learners to acquire knowledge effectively and efficiently. On the other side, questions arise on the quality of the contents. Our research provided a clear picture by eliminating any questions regarding the quality of hydroponic technology–related YouTube content (Figure 2). We found that most of the content in YouTube regarding hydroponic technology was poor quality (52.5%). These materials were typically of limited technical quality, lacked the most of the crucial features of hydroponic technology, and were generally untrustworthy as a learning tool.

Only 15.3% of the content was observed of good quality. The good quality of contents provided adequate, sustainable information regarding the hydroponic technology and the information was beneficial to the viewers as they emphasized both theoretical and practical implications. Those contents, found technically sound, covered all the important aspects of hydroponic technology and were a very reliable source of information learning purpose. Meanwhile, there was little content on hydroponic technology that aimed at providing sustainable information, but somewhere it found lacking in terms of providing efficient information. These contents missed certain essential details, were technologically constrained, or failed to communicate effectively. Such kind of contents found 32.2%, considered as medium quality.

YouTube is a platform where anybody can create channels and broadcast videos. As a consequence, during our investigation of hydroponic contents, we discovered a wide range of content creators. After screening all of the content,

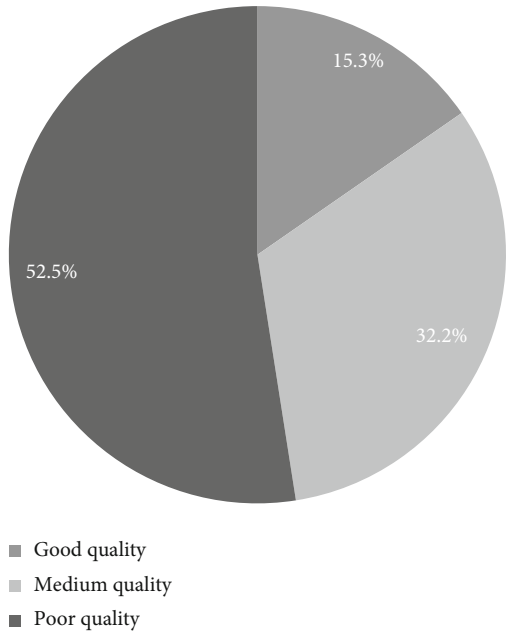

Figure 2: Category of contents regarding hydroponic technology based on quality.

we divided content creators into four categories: Independent, organizations, news channels, and others. Independent publishers are individuals, groups of individuals, farmers, bloggers, and other content creators who are not affiliated with any organization. We found 41.1% of our contents published by independent publishers. As per our observation, such publishers may be motivated by a desire to disseminate knowledge, establish a personal brand, and generate money and social responsibility. However, "independent publisher" was found responsible for publishing most "poor quality" videos.

We included government, nongovernment organizations, and educational institutions under the category of organizations that are associated with agriculture. The investigation revealed that most of the contents were released by organizations (42.1%), indicating that the organizations had a specific emphasis on YouTube. However, the organization released most of the videos that were poor in quality. Organizations generated content primarily with the purpose of disseminating knowledge and technology to the global level. News channels involved with the framing and transmission of various news events pertaining to hydroponic technology information discovered another contributor in content publishing with 9.4% of contents. Apart from these, the other content publisher types are described as other, with 7.4% of all content falling into this category. The publisher group of "news channel" provided most of the "medium quality" videos.

On YouTube, we discovered a variety of hydroponic technology–related videos focused on various themes. We divided hydroponic technology contents into four categories based on theme: theoretical explanation, practical application, news, and others. The theoretical explanation category included items that primarily provided a theoretical

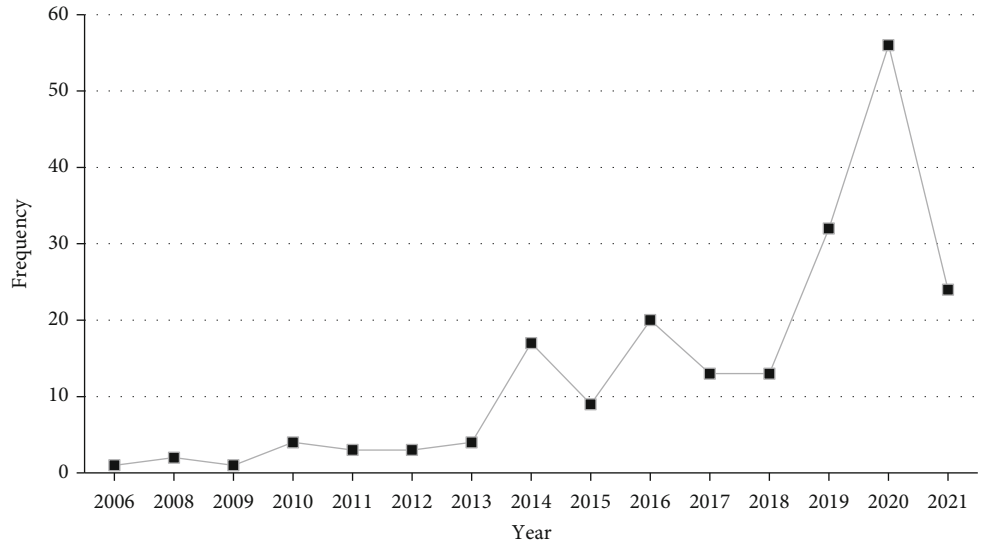

Figure 3: Distribution of YouTube content regarding hydroponic technology based on publishing year.

foundation of hydroponic technology, with an emphasis on technological introduction, description, and explanation of technique of application. These contents are mostly intended for those who require theoretical components in order to develop clear conceptions, such as students and agricultural professionals. Around 27.7% of the content identified was about hydroponic technology, with a focus on theoretical aspects. But most of the videos released based on theoretical explanations were poor quality. The contents were oriented on visualizing the operation of hydroponic technology and portraying the whole technological implementation in the farm, which was classified as practical application. The emphasis of these resources is on real hydroponic technology setup rather than explanation. The majority of the hydroponic technology–related content identified on YouTube (38.6%) was practical in nature. The audience for these types of contents is diverse, since these videos are seen by anyone who is interested in hydroponic technology. These are mostly beneficial for farmers, students, and agri-professionals that want to establish a hydroponic setup. However, the content theme "practical application" was mostly found to be implied in "poor quality" videos. The amount of news-based content about hydroponic technology was 17.3%. Content produced by news media that provides notable information and events and features farmers' hydroponic farms in the field is classified as news. The remaining 16.3% of content was classed as "others." Most of the "news" content was observed in "medium quality" videos, while "others" belonged to poor quality videos.

The popularity and users of YouTube are increasing every year. In this context, the amount of hydroponic technology–related YouTube content has also changed from year to year. Even in terms of technology requirements and the popularity of communication media, the amount of content varies from time to time (Figure 3). The analysis depicted that, in recent three years 2019 to 2021, more than half of total contents were published. The reasons could be the COVID-19 pandemic situation when online platforms were used intensively for getting information. During this time the online platform has gained acceptance among the most diverse classes of people as an important source of information. Content creators were focused on online platforms to disseminate the information regarding hydroponic technology. Before 2019, content regarding hydroponic technology was quite limited, and their quality was not up to the mark. In recent years, 2018 to 2021 though the number of content increased, but still most of the contents were poor quality.

Since hydroponic technology is considered effective all over the world, we have reviewed which countries are publishing more hydroponic-related contents. In our study, we considered only English language contents; thus, most of the contents were found from English-speaking countries. The top 5 content publisher countries regarding hydroponic technology were the USA, Australia, India, the UK, and Canada (Figure 4). Meanwhile, other countries published content regarding hydroponic technology, but those were mainly in their regional language. Thus, a very small amount of English content was found from those countries. After reviewing the contents of the top 5 countries, a substantial amount of content regarding hydroponic technology was poor quality. We found that 50% content in the USA, 29.62% content in Australia, 72.27% content in India. 30.77% content in the UK, and 65% content in Canada were poor quality.

Table 6 depicts the analysis of variables in relation to YouTube content quality on hydroponic technology. The analyzed mean score of "number of likes" among videos on hydroponic technology of good quality was 6717.03 ± 21017.45, whereas in videos of medium quality and poor quality, the mean stood 1049.98 ± 1760.36 and 2440.47 ± 10617.55, respectively. The resulting mean value for the "number of dislikes" among "good quality" videos was 220.03 ± 705.19 while 48.09 ± 100.75 in "medium quality" and 136.21 ± 627.02 in "poor quality". In terms of "number of views," the respective mean values assessed for

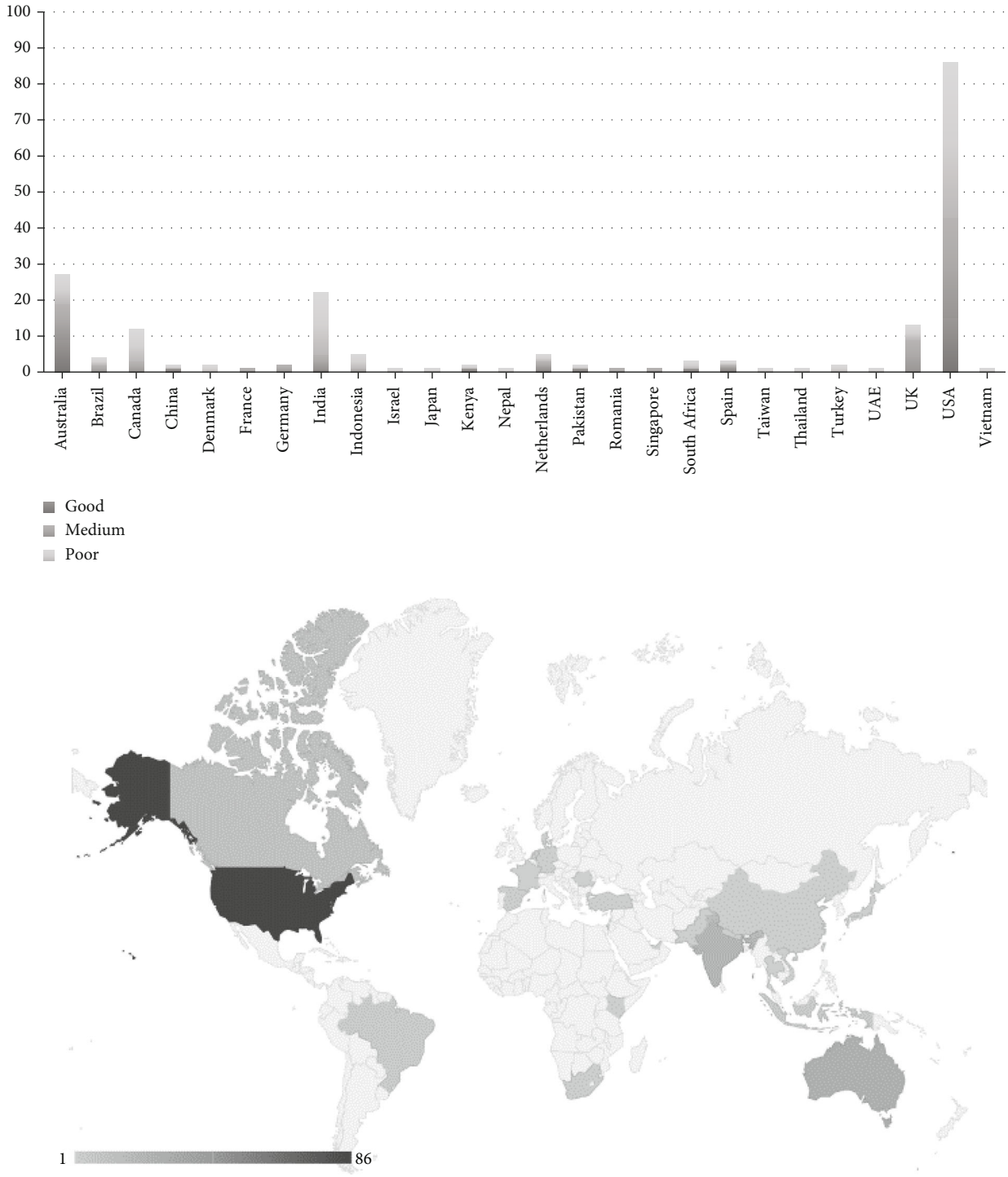

Figure 4: Country-wise distribution of categorized hydroponic technology content on YouTube.

videos of good quality (310032.06 ± 784262.18), medium quality (106542.03 ± 214999.18), and poor quality (395966.10 ± 1896908.08) were found. The mean score of "duration (min)" determined 12.68 ± 6.28 among "good quality " videos, while in "medium quality" and "poor quality" videos, the assessed mean scores were 8.75 ± 7.96 and 7.45 ± 10.61, respectively. Statistically significant difference was recorded in video characteristics "number of likes," " number of views," and "duration" among different content quality groups ($P < 0.05$).

Table 7 represents the analysis of variables in relation to publishers of YouTube contents regarding hydroponic technology. The calculation on variables in relation to hydroponic YouTube content publisher determined mean score of "number of likes" was 1494.49 ± 3761.43 (independent publisher), 4234.66 ± 16928.09 (organization), 1161.37 ±

Table 6: Analysis of variables in relation to YouTube contents quality on hydroponic technology.

Variables	Good quality ($n = 31$)	Medium quality ($n = 65$)	Poor quality ($n = 106$)	P value
Number of likes (mean ± SD)	6717.03 ± 21017.45	1049.98 ± 1760.36	2440.47 ± 10617.55	<0.001
Number of dislikes (mean ± SD)	220.03 ± 705.19	48.09 ± 100.75	136.21 ± 627.02	0.057
Number of views (mean ± SD)	310032.06 ± 784262.18	106542.03 ± 214999.18	395966.10 ± 1896908.08	0.03
Durations (mean ± SD)	12.68 ± 6.28	8.75 ± 7.96	7.45 ± 10.61	<0.001

Table 7: Analysis of variables in relation to YouTube content publishers on hydroponic technology.

Variables	Independent ($n = 83$)	News channel ($n = 19$)	Organization ($n = 85$)	Others ($n = 15$)	P value
Number of likes (mean ± SD)	1494.49 ± 3761.43	1161.37 ± 1924.83	4234.66 ± 16928.09	1940.80 ± 4622.96	0.736
Number of dislikes (mean ± SD)	60.66 ± 126.75	40.26 ± 63.82	207.51 ± 807.81	63.13 ± 121.35	0.738
Number of views (mean ± SD)	109844.92 ± 241634.36	144724.37 ± 260061.58	529194.96 ± 2147661.11	110678.00 ± 227869.86	0.808
Durations (mean ± SD)	10.60 ± 9.78	5.37 ± 4.75	7.06 ± 8.67	11.33 ± 12.78	<0.001
Content scores (mean ± SD)	11.16 ± 4.22	11.74 ± 2.62	10.54 ± 3.73	11.93 ± 3.58	0.438

Table 8: Analysis of variables in relation to YouTube content theme on hydroponic technology.

Variables	Theoretical ($n = 56$)	Practical ($n = 78$)	News ($n = 35$)	Others ($n = 33$)	P value
Number of likes (mean ± SD)	1266.11 ± 5620.62	3111.36 ± 10537.30	5941.43 ± 21009.20	413.00 ± 517.04	0.002
Number of dislikes (mean ± SD)	57.68 ± 213.68	147.23 ± 631.04	251.74 ± 824.27	26.06 ± 48.92	0.021
Number of views (mean ± SD)	140236.16 ± 669934.64	369529.53 ± 1839672.60	574393.83 ± 1803958.36	52373.36 ± 87746.89	0.054
Durations (mean ± SD)	9.23 ± 12.79	9.54 ± 8.83	6.40 ± 5.47	8.09 ± 6.66	0.026
Content scores (mean ± SD)	9.48 ± 3.07	11.94 ± 3.79	11.37 ± 3.57	11.03 ± 4.72	0.001

1924.83 (news channel), and 1940.80 ± 4622.96 (others). In terms of "number of dislikes," the publishers "independent", "organization," "news channel," and "others" scored mean values of 60.66 ± 126.75, 207.51 ± 807.81, 40.26 ± 63.82, and 63.13 ± 121.35, respectively. The mean "number of views" in videos on hydroponic technology assessed 109844.92 ± 241634.36 (independent publisher), 529194.96 ± 2147661.11 (organization publisher), 144724.37 ± 260061.58 (news channel), and 110678.00 ± 227869.86 (others), while the mean number for "duration" in videos published by independent (10.60 ± 9.78), news channel (5.37 ± 4.75), organization (7.06 ± 8.67), and other publisher groups (11.33 ± 12.78) was also assessed. "Content scores" had respective mean values published by independent publishers (11.16 ± 4.22), while videos published by organization determined 10.54 ± 3.73 value of mean. In videos published by "news channels" and "others," the calculated mean values were 11.74 ± 2.62 and 11.93 ± 3.58, respectively. A significant difference was found only for "duration" in relation to publishers of YouTube contents regarding hydroponic technology ($P < 0.05$).

Table 8 showed that in terms of theoretical (1266.11 ± 5620.62), practical (3111.36 ± 10537.30), news (5941.43 ± 21009.20), and others (413.00 ± 517.04), respective mean values were found. The analysis revealed that the mean value of " number of dislikes" in news-based content was 251.74 ± 824.27. Meanwhile for practical, theoretical, and other, the generated mean values were 147.23 ± 631.04, 57.68 ± 213.68, and 413.00 ± 517.04, respectively. The observed mean value for the "number of views" was found in terms of news-based content (574393.83 ± 1803958.36), theoretical (140236.16 ± 669934.64), practical (369529.53 ± 1839672.60), and other (52373.36 ± 87746.89). The mean values for "duration" were found for practical (9.54 ± 8.83), theoretical (9.23 ± 12.79), news (6.40 ± 5.47), and other (8.09 ± 6.66) content themes, respectively. The mean value for "content score" was found in terms of practical theme (11.94 ± 3.79), theoretical (9.48 ± 3.07), news (11.37 ± 3.57), and others (11.03 ± 4.72). Statistical difference was found among the group of content quality in respect of "number of likes"," number of dislikes," "duration," and "content score."

Table 9 showed that the mean scores in terms of content release year were assessed from "2006 to 2009" (1380.50 ± 1980.91), "2010 to 2013" (787.93 ± 1875.73), "2014 to 2017" (1721.63 ± 5623.36), and "2018 to 2021" (3336.30 ± 13887.43) in terms of "number of likes." Meanwhile, 65.75 ± 103.62, 21.43 ± 34.13, 103.47 ± 239.25, and 141.74 ± 659.51 mean scores were obtained among content

Table 9: Analysis of variables in relation years of YouTube content release on hydroponic technology.

Variables	2006 to 2009 ($n = 4$)	2010 to 2013 ($n = 14$)	2014 to 2017 ($n = 59$)	2018 to 2021 ($n = 125$)	P value
Number of likes (mean ± SD)	1380.50 ± 1980.91	787.93 ± 1875.73	1721.63 ± 5623.36	3336.30 ± 13887.43	0.635
Number of dislikes (mean ± SD)	65.75 ± 103.62	21.43 ± 34.13	103.47 ± 239.25	141.74 ± 659.51	0.281
Number of views (mean ± SD)	137774.00 ± 105590.92	109192.29 ± 173948.64	255899.46 ± 746382.79	330646.22 ± 1725180.56	0.009
Durations (mean ± SD)	5.75 ± 0.50	6.43 ± 3.88	4.73 ± 4.12	10.88 ± 10.96	<0.001
Content scores (mean ± SD)	12.75 ± 2.50	9.71 ± 3.87	9.85 ± 3.93	11.65 ± 3.73	0.019

quality group in years "2006 to 2009," "2010 to 2013," "2014 to 2017," and "2018 to 2021," respectively, for the variable "number of dislikes." The mean values for views were 137774.00 ± 105590.92 (2006 to 2009), 109192.29 ± 173948.64 (2010 to 2013), 255899.46 ± 746382.79 (2014 to 2017), and 330646.22 ± 1725180.56 (2018 to 2021). For the variable "duration," the assessed mean values were 5.75 ± 0.50 (2006 to 2009), 6.43 ± 3.88 (2010 to 2013), 4.73 ± 4.12 (2014 to 2017), and 10.88 ± 10.96 (2018 to 2021). For the content score, the calculated mean values from periods of "2006 to 2009," "2010 to 2013," "2014 to 2017," and "2018 to 2021" were 12.75 ± 2.50, 9.71 ± 3.87, 9.85 ± 3.93, and 11.65 ± 3.73, respectively. The findings revealed that views, duration, and content score showed significant differences in relation to year of content release ($P < 0.05$).

4. Limitation

We only included English-language content, and the criterion for scoring was subjective. Further, this study only evaluated current data, but YouTube data might change over time.

5. Conclusion

YouTube videos covering controlled-environment farming systems such as hydroponic technology are critical for managing the impact of climate change on agriculture. Most of the content regarding hydroponic technology on YouTube was published by agricultural organizations with an emphasis on practical application. YouTube content about hydroponic technology, in particular, has grown significantly in recent years. Despite having a large range of hydroponic technology–related video on YouTube, this research discovered just 15.3% of contents to be of good quality, indicating that YouTube does not contain a sufficient amount of high-quality content. So, YouTube is still not a trustworthy platform for hydroponic technology–related information. Thus, viewers have to be careful while collecting information on hydroponic technology from YouTube. From an agricultural perspective, YouTube contents are regarded as a key source of information for rapid learning and distributing technologies to the root level. This study established a standard scheme for quality contents; therefore, in order to promote content reliability, publishers must maintain standard quality. As a response, it is recommended that agricultural YouTube contents should be monitored on a periodic basis.

Data Availability

All the necessary data is included in the article.

Conflicts of Interest

The authors declared that no competing interests exist.

Authors' Contributions

Conceptualization was conducted by KC and UBR; methodology was contributed by KC, UBR, and SR; validation was performed by AA, AH, KC, HFM, TNE, TT, and UBR; formal analysis was initiated by GD, KC, SR, and UBR; investigation was conducted by AA, AH, HFM, KC, TNE, TT, and UBR; data curation was performed by AA, AH, KC, TNE, TT, and UBR; writing was performed by AH, FL, HFM, KC, TNE, TT, and UBR; review and editing was initiated by AA, AH, GD, TNE, and TT; visualization was contributed by FL, KC, and UBR.

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