Ensuring that Experts Update and Improve Wikipedia SDG Articles - Bridging a Key Knowledge Management Gap

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Abstract

The English Wikipedia is read widely which can be seen from its 21 billion pageviews per month. Readers also look for topics that are related to the UN SDGs. We analysed the quality of 145 articles related to SDGs 6, 13 and 14 and found a large variation in quality. It is therefore a "missed opportunity" that the SDG-related content is often still poorly developed in Wikipedia.

We scored the quality of these articles and then searched for suitable content experts who had published on those topics. We subsequently worked with 39 academics to help us improve and update the articles thus bringing their knowledge to Wikipedia. Article quality was measured with a scoring system with 11 parameters, resulting in scores between 16 to 92 (out of 100) at the baseline.

Our project improved the scores on the average by 22% for the main texts and 24% for the lead texts (abstracts). Although we had intended to focus on readability improvements for the benefit of lay persons and those whose first language is not English, it was the content (comprehensiveness, article tree structure) and logical flow improvements that dominated our work. Readability improvements will be a focus of a second phase.

1. Introduction: Why Wikipedia?

For citizens and voters to be fully supportive of the Sustainable Development Goals (SDGs)[1], it is important that they understand the goals, targets, indicators and the overall concepts on which they are built. To find information about these topics – just like for almost all possible topics – millions of people around the world turn to one key source - Wikipedia, essentially the online encyclopaedia of the Information Age. Wikipedia is the most-consulted Internet knowledge website, with its more than 21 billion page views per month[2], ranking the seventh most visited website after Google, YouTube, Facebook, Twitter, Instagram and Baidu[3]. Wikipedia is one of the most popular sites on the Web, with millions of users relying on it to satisfy a broad range of information needs every day (Singer at al., 2017).

The most common way to reach the content of Wikipedia is through external search engines. Wikipedia amounts to 3.1 billion Internet page loads per month (45.9% of all recorded traffic, or 77.5% of external traffic) (Piccardi et al., 2021). In fact, keyword searches in Google are

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[1] https://sdgs.un.org/goals

[2] https://stats.wikimedia.org/#/all-projects

[3] https://en.wikipedia.org/wiki/List_of_most_visited_websites

highly correlated (0.72) with Wikipedia pageviews[4]. The main factors driving users to Wikipedia are current events, media coverage of a topic, personal curiosity, work or school assignments, or even boredom (Singer at al., 2017). With regards to people looking for SDG-related content on Wikipedia, the same motivating factors are likely to apply. Users will differ in their motivation, information need and prior knowledge (Singer at al., 2017). For the SDGs it might be researchers, educators, local government decision makers, journalists, students, entrepreneurs and consultants that are the main users.

There is strong evidence that upon encountering low-quality pages readers tend to stop navigating along a specific branch in the navigation tree, continuing along a different branch or stopping altogether (Piccardi et al., 2021). This correlation was found by analysing the server logs of the English Wikipedia collected for four weeks between 1 and 28 March 2021 with the article quality model ORES, the official Wikipedia scoring platform (Halfaker and Geiger, 2019).

Explanations for increases and decreases are variable and dependent on several factors such as major events and publications accompanied with broad media coverage. For example, the release of the IPCC 6th Assessment Report in 2021 resulted in 10-fold increases in daily page views to over 10,000. So, the relative importance of article quality can be masked by other factors.

A 2-year project was carried out by the Stockholm Environment Institute to improve Wikipedia articles pertaining to three SDGs: SDG 6 (water and sanitation), SDG 13 (climate action) and SDG 14 (life below water), their targets and sub-targets and the underlying topics and scientific terms. The objective was to ensure the chosen articles were scientifically correct and easily understandable to a broad public. The project aimed to assist the international community of scientists to better translate their knowledge relating to these three SDGs into action and to disseminate their work to the public through Wikipedia.

2. Methods
2.1 Criteria for inclusion of articles

A total of 145 articles were chosen for investigation (see Table 1) based on the following criteria: relevance of the topic to SDG 6, 13 or 14; high pageviews (ideally more than 200 pageviews per day) and low quality at the baseline which was September 2020. Every article version ever saved is available in its "revision history" page which is visible for all, making Wikipedia and its editing processes very transparent. The range in daily view rates for the chosen articles was 4 to 10,000 at the project start. These daily pageviews were calculated as an average over the first six months of 2020 to balance out monthly variations which can be considerable. Of the 145 chosen articles, 103 had their scores improved during the course of the project. The other 42 articles also received minor improvements but their scores did not change.

2.2 Scoring article quality

Scoring of the articles was carried out at the start of the project (September 2020) and again at the end (June 2022), using a system with eleven parameters and a weighting system (see also Table 2 for more details). Six of these were "machine-based", objective indicators: readability, sourcing, completeness, quantity of illustrations, and embedding with incoming and outgoing links from and to other Wikipedia articles. Five of the quality parameters were

"expert-based" including an element of subjectivity: comprehensiveness, connectivity and article tree structure, formatting and adherences to style guide, neutrality and quality of illustrations. We scored the articles' leads separately from the main texts since the leads tend to be read more than the rest of the article. Therefore, the leads of articles (which are mini summaries) are actually of prime important but often underdeveloped – another missed opportunity.

2.3 Expert collaboration

We contacted about 150 content experts who had publications in the topic areas of our chosen Wikipedia articles. Of these, 39 experts agreed to donate their time and collaborated with us by revising existing articles (e.g. updating content and illustrations, removing unnecessary material or moving content to sub-articles), providing new content, improving article structure and adding new references.

Almost all of the content experts provided their comments in the form of marked-up Word documents while a few provided a review in online interviews using shared screens. Only 2-3 experts made edits directly in Wikipedia as registered editors. Two experts registered with Wikipedia to write comments to other editors on the article "talk pages"[5]. Only very few experts were able to provide new images to us (often, the requirement of being open access was a problem for them).

We tried to involve more experts from low-income countries and more females because we were aware that Wikipedia editing is currently dominated by volunteers who are male and reside in high-income countries. We did not achieve this target. Out of the 39 experts that we worked with, only seven were women (18%) and only one was from the Global South. This is similar to the ratio of male to female editors on Wikipedia in general. There is known to be a "gender bias at Wikipedia" and a "Geographical bias on Wikipedia" both of which are recognised problems.

3. Results and discussion

We compared the quality scores of the articles at the end of the project in June 2022 with those at the start (Sept. 2020); see Table 2 and Figure 1. The results show that the scores of the main text were improved by 22% (average score increase from 60 to 73). The final scores were in the range of 28 to 94, compared to a range of 16 to 92 at the start. The improvements for the main text were greatest for the following parameters: connectivity and article tree structure (58%), formatting and adherence to style guide (45%), illustration quality (42%) and comprehensiveness (38%).

The parameters that changed less significantly over the two years were: embedding (incoming Wikilinks) (16% improvement), sourcing (9%), illustration quantity (8%), embedding (outgoing Wikilinks) (6%), completeness (4%), readability (3%), neutrality (2%).

The score on readability was hard to improve since the first priority was to improve content and the experts were not science journalists or "wordsmiths". Also, the machine "Flesch-Kincaid Reading Ease" score had limitations relating to long syllable words. An article on "sustainability" will score quite low on readability just because of that long word alone. We had given readability a relatively high weighting (25 points maximum) in the overall score which meant it had a strong influence on the overall scores.

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[5] https://en.wikipedia.org/wiki/Help:Talk_pages

Figure 1. Quality scores for the article leads (orange dots) and main texts (blue dots) for 103 Wikipedia articles at project end versus project start. The diagonal line represents no change; the further a data point is above the line, the greater the increase in quality score.

During the course of the project, several new articles were created, often as spinoff articles from larger articles (SDG 7, SDG 13, SDG 14, Greenhouse gas emissions, Effects of climate change on agriculture, Effects of climate change on mental health, Marine plastic pollution). In other cases, smaller articles were merged into larger ones, particularly in the group of "effects of climate change on XX", or list type articles were created, for example climate action, marine resources, wastewater. Articles were improved by project team members in collaboration with content experts as well as "regular" Wikipedia editors.

The project website on Wikipedia contains all the details surrounding this project. https://en.wikipedia.org/wiki/Wikipedia:Meetup/SDGs/Communication_of_environment_SDGs

For those interested in participating in the second phase of this project which is commencing on August 1, 2022, please contact the authors.

Table 1. List of the selected Wikipedia articles related to SDGs 6, 13 and 14 including quality score improvement (comparing the June 2022 article version to the Sept. 2020 version) and daily pageviews at the project end (averaged for the first six months of 2022).

SDG 6 articles	Improvement	Daily page views	Article title SDG 13 articles	Improvement	Daily page views	SDG 14 articles	Improvement	Daily page views
Water scarcity	81%	658	Sendai Framework for Disaster Risk Reduction	76%	82	Marine plastic pollution	105%	69
Freshwater ecosystem	75%	202	Nationally Determined Contributions	63%	21	Sustainable tourism	90%	244
Capacity building	74%	242	Disaster risk reduction	59%	154	Sustainable Development Goal 14	50%	202
Official development assistance	58%	156	Energy policy	59%	53	Nutrient pollution	40%	70
Water scarcity in Africa	50%	94	Climate change in Africa	55%	246	Ocean	28%	2765
Sustainability	39%	1613	Effects of climate change on human health	54%	139	Least developed countries	23%	719
Public health	39%	885	Effects of climate change on agriculture	53%	103	Coast	22%	336
Sustainable Development Goals	35%	4398	Climate change adaptation	50%	208	Convention on Biological Diversity	18%	404
WASH	27%	143	Climate change and indigenous peoples	48%	31	Planetary boundaries	18%	286
Sewage	26%	428	Effects of climate change on mental health	45%	28	Eutrophication	18%	898
Sewage treatment	25%	938	Carbon capture and storage	37%	762	Microplastics	17%	650
Wetland	25%	790	Carbon farming	33%	60	Marine ecosystem	15%	281
Water security	23%	290	Greenhouse gas emissions	30%	704	Fishing industry	12%	151
Sustainable development	22%	3375	Climate resilience	28%	106	Aquatic ecosystem	10%	568
Groundwater	21%	657	Effects of climate change on oceans	27%	57	Sea	9%	837
Water resources	21%	1115	Sustainable energy	23%	1543	Overfishing	9%	270
Industrial wastewater treatment	20%	300	Paris Agreement	21%	1434	Marine pollution	8%	368
Freshwater	20%	121	Sustainable Development Goal 13	21%	274	Marine debris	6%	120
Waterborne diseases	19%	476	Intergovernmental Panel on Climate Change	21%	682	Sea surface temperature	6%	161
Neglected tropical diseases	18%	262	Climate change vulnerability	18%	77	Marine protected area	5%	85
Ecosystem	18%	1930	Flood	15%	1846	Ocean fertilization	4%	31

	%			%			%	
Rainwater harvesting	16%	1391	Climate justice	15%	148	Aquaculture	1%	581
Water supply	16%	284	Instrumental temperature record	14%	118	Artisanal fishing		59
Developing country	15%	2059	Effects of climate change	13%	871	Commercial fishing		227
Open defecation	14%	356	Arctic sea ice decline	13%	124	Coral reef		1223
Hygiene	13%	830	Drought	12%	1614	Destructive fishing practices		23
Sustainable Development Goal 6	13%	228	Tropical cyclone	11%	1919	Exclusive economic zone		956
Reclaimed water	12%	168	Natural disaster	10%	2938	Fish stocks		25
Water issues in developing countries	12%	46	Renewable energy	10%	1961	Fisheries management		76
Drinking water	12%	699	Wildfire	10%	941	Fisheries subsidy		7
Hand washing	11%	348	Sustainable Development Goal 7	9%	186	Fishery		222
Wastewater treatment	11%	625	Carbon sequestration	9%	487	Illegal, unreported and unregulated fishing		63
Sanitation	11%	665	Retreat of glaciers since 1850	8%	136	Intergovernmental Oceanographic Commission		11
Aquifer	8%	697	Extreme weather	7%	277	Law of the sea		140
Dangerous goods	7%	230	Greenhouse gas	7%	1969	Marine conservation		106
Water pollution	6%	2984	Climate change mitigation	6%	445	Marine habitats		119
International development	6%	196	Sea level rise	5%	624	Marine life		372
Groundwater pollution	3%	216	World energy supply and consumption	3%	428	Marine technology		16
Fecal sludge management	2%	103	United Nations Framework Convention on Climate Change	2%	769	Overexploitation		245
Behaviour change (public health)		54	Climate change	2%	6523	Small Island Developing States		124
Cholera		2010	Efficient energy use	2%	259	Sustainable fishery		45
Diarrhea		2501	Developed country	-9%	2446	United Nations Convention on the Law of the Sea		680
Gastroenteritis		1838	Carbon dioxide in Earth's atmosphere		439			
International waters		518	Green Climate Fund		130			
Public participation		169	Low-carbon economy		234			
Wastewater		219	Ocean acidification		411			

Table 2: Overview of the scoring system and its results to assess article quality before and after (for the main article text) - maximum possible score: 100. The assessment time "before" was the 1 Sept 2020 version of the article or nearest older date. The assessment time afterwards was around June 2022.

Parameter (M: machine, E: expert)	Max. possible value	Average before	Average afterwards	Improvement (%)	Comments on how the values are derived	Tool to use or expert assessment	Guidance to improve scores
M1 - Readability	25	14.9	15.4	3%	Calculated, based on Flesch Kincaid Reading Ease score	WebFX tool	Use Hemingway App to improve readability. E.g. shorter sentences, less passive voice, less complicated words, less technical jargon
M2 - Sourcing	15	8.4	9.2	9%	Calculated assessment, based on ratio of references per hundred words.	WebFX tool and Wikipedia statistics	More references
M3 - Completeness	5	3.5	3.7	4%	Based on Wikipedia's ORES analysis tool indicating quality.	WikiEdu tool	Improvements to achieve Wikipedia rating Good Article or Featured Article standards
M4 - Illustrations (quantity)	5	2.7	3.0	8%	Calculated, based on number of images per thousand words.	Xtool (Wikipedia statistics)	More images
M5 - Embedding (incoming wikilinks)	2.5	1.2	1.4	16%	Calculated, based on number of incoming Wikilinks.	Xtool (Wikipedia statistics)	More Wikilinks from other articles to this one
M6 - Embedding (outgoing wikilinks)	2.5	1.6	1.7	6%	Calculated, based on number of outoing Wikilinks per hundred words.	Xtool (Wikipedia statistics)	More Wikilinks from this article to other articles
E1 - Comprehensiveness	15	8.4	11.6	38%	Subjective assessment (based on how fully the article covers significant aspects of the topic.)	Expert assessment	Ensure the article is comprehensive, with appropriate detail and has a summary style where appropriate.
E2 - Connectivity and article tree structure	10	5.8	9.2	58%	Based on how well a "parent article" interacts with sub-articles.	Expert assessment	Ensure the article is well connected to any relevant parent or sub-articles
E3 - Formatting and adherences to style guide	10	6.7	9.8	45%	Based on how well the section headings conform with standard headings style; also the quality of the article's layout and adherence to the Wikipedia's Manual of Style.	Expert assessment	Ensure the article uses standard headings where possible, has a logical flow to the sections, good use of level 1, 2, 3 headings. No or few bullet point lists (mainly prose is used). Length of article is within guidelines (readable prose is less than 50 kB).
E4 - Neutrality	2	1.9	2.0	2%	Based on adherence to the Neutral Point of View policy.	Expert assessment	Neutral, encyclopaedic language, watch out for words to watch.
E5 - Illustrations (quality)	8	4.0	5.7	42%	Based on quality of images and captions.	Expert assessment	Select suitable images and add high quality captions.
Total	**100**	**59**	**73**	**22%**			

Acknowledgements

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