Open WebSearch .eu

Market potential assessment of OpenWebSearch.eu

Exploring the economic and societal impact of an Open Web Index

Project report

Open Web Search

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Market potential assessment of a European Open Web Index

Exploring the economic and societal impact

Final project report

OpenWebSearch.EU

About the Report

This study was carried out as part of the EU project OpenWebSearch.EU as a third-party partner project under grant agreement No. 101070014.

The management consultancy Mücke Roth & Company (MRC) was commissioned following a call for tenders. The report was produced in close co-operation between Mücke Roth & Company (MRC) and the Open Search Foundation e. V., a consortium member of the OpenWebSearch.EU project.

Abstract

This report provides an in-depth assessment of the macroeconomic market potential of a European **Open Web Index (OWI)** as it is being conceptually developed in the **Open Web Search Initiative** and currently being piloted in the **OpenWebSearch.eu** (ows.eu) project. It evaluates the economic and societal impact, using both top-down and bottom-up methods to ensure a comprehensive analysis of different scenarios, including qualitative feedback from future users.

A number of significant benefits of an Open Web Index with broad applicability across Europe have been identified. Key findings indicate that the Open Web Search Index could achieve a return on investment within four years, with a projected net benefit of around €4.5 billion over a decade. These benefits are derived from economic gains and societal improvements such as strengthening European digital sovereignty and global technological competitiveness across a wide range of industries and use cases.

The report explores key societal impacts such as promoting European digital autonomy, fostering innovation and supporting open-source development. It highlights a reduction in dependency on non-European digital platforms, thereby enhancing digital sovereignty and creating a more balanced digital search ecosystem for European users.

In addition, the cost structures of the project have been aligned with the benefit analysis to underline the viability of the project. Recommendations for strategic directions and business model adjustments are provided to optimise economic and societal benefits. This report is intended to help OpenWebSearch.eu and/or its stakeholders to make informed decisions about the future of a European Open Web Index, e.g. to improve the effectiveness and efficiency of possible investments.

Content

Executive Summary

The study “Market potential assessment of a European Open Web Index” provides a detailed assessment of an Open Web Index (OWI), evaluating the market potential and impacts of the OWI — both economic and societal.

Methodology

By employing both top-down and bottom-up analysis methods, the study quantifies the benefits and costs, offering a robust framework for transparent decision-making for OpenWebSearch.eu and stakeholders.

Applications of an Open Web Index were derived in a broad variety, and over various industries. Use cases are detailed for a more tangible understanding of benefits from OpenWebSearch.eu for different customer and user segments, which could help to showcase the potential of a European Open Web Index in certain industries and for selected stakeholders.

Societally, while monetary quantification is challenging, the report outlines significant impacts on European digital sovereignty and independence from non-European tech giants. The societal benefits also extend to fostering innovation, supporting open-source development, and minimizing vendor lock-in effects, thereby enhancing the digital autonomy of European users.

The report examines cost structures and integrates them with benefit analyses to underscore the viability of the project. This includes detailed scenario-based evaluations that consider various potential outcomes, providing a nuanced understanding of the initiative’s strategic implications.

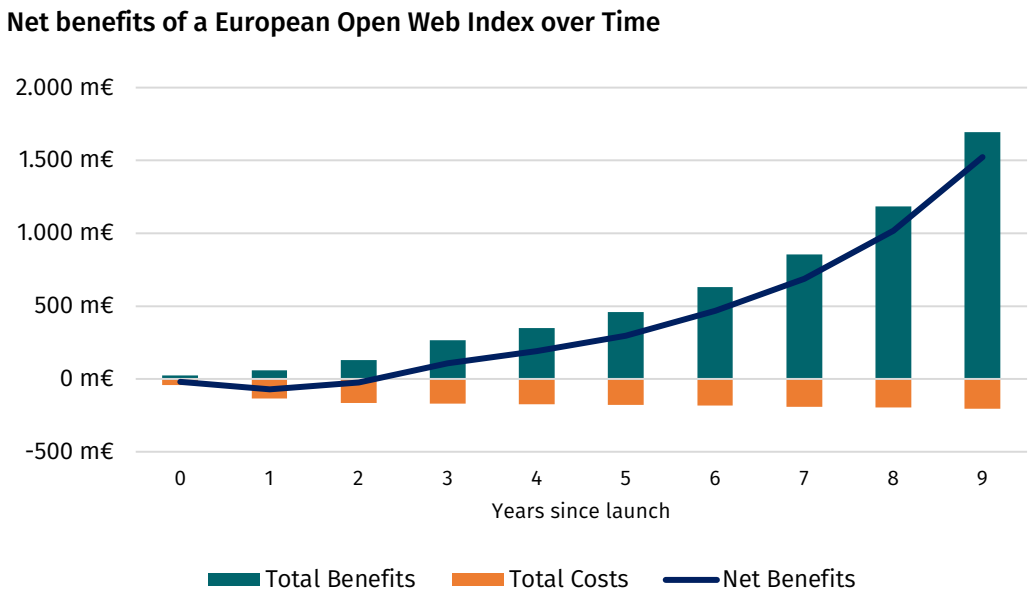

Figure 1
Net benefits of potential of a European Open Web Index over time since launch (currently assumed to be 2025), with total benefits vs. total costs accumulated. The solid line shows the net benefits as the bottom line resulting from benefits and cost (Million Euros, years date)

Key findings

The initiative is projected to reach a return on investment by the fourth year. It forecasts substantial benefits, estimating a total of 4 - 5 billion € in accrued net benefits (after subtraction of costs) over a decade. This economic valuation considers direct financial impacts from operational activities and indirect benefits that include enhanced economic efficiency and bolstered European competitiveness in the global tech industry.

In quantifying the market potential, the report confirms the potential of a European Open Web Index to generate significant economic and societal returns. For instance, by year five, the OWI is estimated to produce annual net benefits between 400 and 500 million €, highlighting its substantial impact on the market. Furthermore, the societal impacts, though more qualitative in nature, are projected to significantly enhance European digital sovereignty, promoting a more balanced and open digital ecosystem.

Outlook & Recommendations

From a purely economic-driven perspective, it is advised to continue the development and expansion of OWI to further leverage its benefits, which will strengthen Europe in various aspects, including technological independence, economic growth, and digital sovereignty, while not directly competing with search engines like Google.

However, a decision on investment options for OpenWebSearch.eu and a European Open Web Index is required, given the clear evidence from this study that the benefits outweigh the costs. It is important to determine whether the European Open Web Index should be approached as an investment case requiring further funding or as a self-sustained business case that can operate independently.

Investments in OWI should be strategically targeted to maximise network and scale effects, which are crucial for its widespread adoption. Effective leveraging of these effects will enhance the initiative's value and utility across the EU. The adoption and go-to-market approach for the European Open Web Index should be decidedly driven and potentially implemented in a step-wise manner. This approach could focus initially on selected industries, countries or business sizes that offer the highest potential for quick adoption and significant impact.

Finally, it is recommended that the European institutions and Member States adopt the further development and operation of the Open Web Index as a joint European programme, demonstrating that Europe is capable of acting together to address the major challenges of the digital age. This "be your own customer" approach will not only validate the OWI’s effectiveness and benefits but also strengthen trust in the initiative across Europe.

1 Introduction

Web search has become an essential part of our life. However, at present this field is dominated by few non-European players (“Gatekeepers”), following their own business purposes, restricting unwanted or uncommon activities or information and thus limiting our digital sovereignty and independence in Europe with unwanted effects and implications.

But as (almost) always, providing certain benefits comes at a cost: driving digital sovereignty and independence for Europe requires concerted efforts and investments. Here, we transparently quantify the impact of OpenWebSearch.eu and an open web index for Europe, so that the future way of such an initiative for better web search is clear and potential financial needs and requirements become apparent for decision-making.

This document is structured as follows: First, we review the search market and the Open Web Search Initiative for a European Open Web Index and then explain the methodology of assessing the market potential of a European OWI in a combined top-down and bottom-up manner. Afterwards we reflect on the scope and limitations of our chosen approach and the implications on the validity and generalizability of our study. Subsequently, we present in detail our findings and the results of the market potential assessment for the economic and societal benefits, combining costs into a holistic view on the return on investment of Open Web Search project.

European domestic market

The European domestic or single market describes the combined markets of mainly the 27 countries with a diverse, and heterogeneous structure of industries, topics and key players. Here, we review very briefly the market structure and dynamics, because this will also be important for our later discussions.

From the 2021’s overall net turnover of 32,709,465 Mio. €, Germany, France, Italy, Netherlands and Spain contributed most (eurostat, 2023). Industry-wise “manufacturing”, “mining and quarrying” and “wholesale and retail trade; repair of motor vehicles and motorcycles” have the highest individual contributions to the net turnover[1]. An overview of the contribution per NACE (industry-)codes (European Commission, 2008) per country can be found in Table 1.

[1] Here we have chosen net turnover defined by the net profit a business brings in from the sale of its goods and services, as a proxy for business success with consumers in the open market. This is an important quantity to gauge the impact of OpenWebSearch.eu later on.

Country	Industry	Net turnover in Mio. €
Germany	Manufacturing	2,497,768.
Germany	Wholesale and retail trade; repair of motor vehicles and motorcycles	2,292,163.
France	Mining and quarrying	1,485,733.
France	Manufacturing	1,042,775.
Italy	Mining and quarrying	1,072,475.
Italy	Manufacturing	1,082,397
Germany	Financial and insurance activities	654,025.
France	Financial and insurance activities	511,564.
Netherland	Mining and quarrying	829,875.
Germany	Human health and social work activities	386,668.

Table 1

Selected country-industry combinations with highest net turnover contribution for 2021, based on EuroStat data and NACE codes for the industry

Search engine landscape in Europe

The European search engine landscape is dominated by the global market leader Google, followed by Bing (with ~3 percent of European search market across all devices). Google's market share remains strong over time with over 90% (StatCounter, 2023). For Germany, Bing is the market follower of Google with a market share of 4,73% as of December 2023 (StatCounter, 2023). One implication of such dominance is large control and influence on (European) search behaviour or the under-representation of e.g. regional language preferences, cultural nuances, or privacy concerns. Others affect content providers in their efforts to promote their offerings by optimizing their content to the specifications of the gatekeepers, sometimes at the cost of quality. In general, the dominance of few large search engines with their multi-sided business models results in a rather closed business ecosystem with strict rules and centralised decision authority.

Besides the large non-European gatekeepers (such as Google, Bing and Yandex), also smaller and/or more focused search engines exist in the European landscape: Search engines like Startpage, Qwant, Ecosia or DuckDuckGo position themselves with special focuses on e.g. sustainability or privacy, providing an in-principle alternative to the established players[2].

Notably, business models differ between the players in the European search landscape, which indicate their chosen rationale and influence the choice of in- and outsourcing of search engine technology. One very common revenue stream is the monetisation through ads, which is realised through using search queries only or integrating customer data additionally for better matching ads with receptable recipients.

The overall market volume for Europe is estimated from historic values from 2023 onwards as ~100.000 million € for 2028, shown in Figure 2. For the estimation, market share values

[2] Although strictly speaking, these providers present no real alternative to the established large players due to various aspects, as discussed below.

from (StatCounter, 2023) were extrapolated with historic growth rates and cross-referenced with Google financial data (Alphabet, 2023).

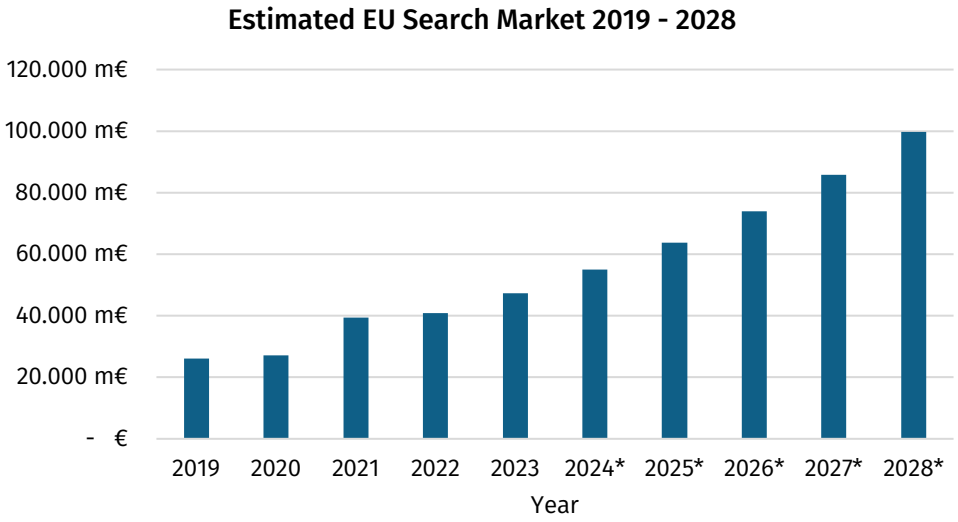

Figure 2
Estimated EU Search Engine Market, based on historic values until 2023 and published market shares. Asterices (*) indicate future estimations.

Search engine components

In general, search engines consist of few major components, which we will review for brevity in the following (for details, see e.g. (Manning, Raghavan, & Schütze, 2008)). These components work in a coordinated manner to index the vast amount of information available on the web and provide quick, relevant responses to search queries. The efficiency and effectiveness of a search engine largely depend on how well these components function together.

To recall, the primary goal of search engines is to facilitate information retrieval in large amounts of unstructured resources, which typically can be achieved in 3 steps:

1. **Crawling** of information from various sources and document types
2. **Indexing** of the crawled information, including storage in (semi-)structured manner, like a database
3. **Resolving of search queries** and link to information

Technically, these steps can be mapped to components of a search engine, such as ranking mechanisms, web crawlers or web indexes.

Many of the smaller search engine providers cannot or do not want to afford building parts of web search infrastructure, such as an own search index, or even resort to use end-to-end search solutions like Bing for providing relevant results to their search users. Especially, the search index and ranking are subject to contracting from Bing due to the financial implications or effort to create such services and technologies (Granitzer, et al., 2023).

Future evolution of the European search landscape

(End-)users of search engines represent a broad cross-section of society and with over 400 Mio. of internet user in the EU (Statista, 2023) constitute a very relevant set of customers for multi-sided business models. Also, the growth potential (for search engines from a demand side) with historic growth rates around 1 % signifies a promising future from a business perspective (based on the extrapolation of historic market volumes, shares and financial performance).

However, due to the emergence of large langue models (LLMs) and a change in search by e.g. vector searches, an evolution or even disruption of traditional established search engine business models is likely. In detail, this comprises a change in market dynamics from a "search engine market" to a "web data market", where web data is used in manifold applications (like social media research, training of AI products, price monitoring, etc.). For this study, we remain aware of such disruptive forces of altered search, but have not explicitly integrated this in our estimates – although, LLMs still need valid and scalable (web) information for training, which is present in our market model.

Open Web Search project

The OpenWebSearch.eu project ("OWS.eu"), launched in September 2022, aims to create a European Open Web Index (OWI) and an Open Web Search and Analysis Infrastructure (OWSAI). Addressing the dominance of a few non-European search engines, the project seeks to establish a more balanced and public-controlled web search environment. It focuses on developing core search, discovery, and analytics services, demonstrating new search paradigms, and fostering a network for piloting the OWSAI based on European values. The goal is to empower European innovation and ensure digital sovereignty in web navigation and search, aligning with European standards and legislation (Granitzer, et al., 2023).

The OWS Initiative addresses the current weak position of the EU in the technology, IT, and data sectors. OWS.EU seeks to level the competitive playing field, providing a counterbalance to the dominance of non-European entities in these critical areas.

Open Web Index

One of the central focuses of Open Web Search EU is providing an Open Web Index. For brevity, we recapitulate essential insights and implications of the OWI from (Granitzer, et al., 2023). In the paper, six principles are proposed for creating an OWI. Furthermore, the authors argue that the creation of an OWI requires crawling, enrichment and indexing. Central to this is the index being treated as open data and following the concept of declarative search engines. Based on a (distributed) information system similar to Docker hub, Open Web Search provides an Open Web Search Engine Hub for use by search engines.

Providing an open web index itself has effects on the search engine market like lowering the entry barriers, or enabling better economy of scales for web index consumers. For search engine operators with no own web index, lock-in effects and dependencies on the few gatekeepers or other technology providers become less important. Or, capital expenditures for new entrants are less of a deterrence for entering the market (due to a shared cost approach), which in turn could lead to an opening of the search ecosystem and fostering of innovation.

Due to the multi-sided nature of search engines, search engine users also profit from this innovation and e.g. new search engines in verticals emerge, like fragFINN, a search engine

for children. Additionally, the web search experience is enhanced due to optimised search and retrieval strategies (tied to the open web index) and web searches benefit from transparency and explainability. Furthermore, better control by users can be exerted, or users benefit from obtaining legally compliant web search, which is especially of importance due to European privacy laws such as GDPR for further processing search results. For the (end) user-side, the opening of the search ecosystem could also lead to reduced bias or a more broad or faster access to information due to many alternative search engines.

In that sense, an open web index is the foundation of a more balanced ratio between the provider and demand-side of the complex platform-like search engine market, resulting in a transition from a "one-search-engine-to-all-users" relationship to a "many-search-engines-to-many-users" relationship (Granitzer, et al., 2023).

Medium-term goal of OWS.EU is to provide an OWI comparable to Google and other gatekeepers, but for this study, we assumed a coverage of 50% of the web compared to the Google index.

Finally, it is important to notice that "the purpose of an Open Web Index is not to compete with dominant search engines like Google, but to provide the foundation for a competitive search engine ecosystem" (Granitzer, et al., 2023).

Business model of a European Open Web Index

In general, a business model describes how an entity creates, delivers and captures value. For the OWI this value can be expressed in terms of economic, social, cultural or other contexts[3].

Search engine environments constitute a (business) ecosystem with platform-like character, which differ from traditional, linear demand-and-supply business models, due to the multitude of business stakeholders on different sites of the ecosystem business model with each unique rationale. It is important for such ecosystems to facilitate and curate the interaction between different stakeholders, so that joint value is maximised. Scale- and network-effect within and between the different ecosystem participants are at the core for sustainably creating a successful business model, such as providing an incentive by the search engine provides for using high-quality content of the creators (being normally no search engine operator) in their search engines, leading to a self-sustaining "flywheel" of interactions between these participants.

The OWI value's focus is on offering the foundation for a competitive search engine ecosystem, realised primarily through, but not limited to, providing an open web index. Service-wise additional add-ons are planned, like a knowledge graph-as-a-service, and also a marketplace for (proprietary) web data is foreseen, so that search ecosystem participants can participate from the value created from their data. Additionally, it is conceivable that in the future the OWI infrastructure (like e.g. creating and maintaining the open web index) are provided to customers, so that they can create and maintain individual indexes for their own purposes.

Customers and users are the beneficiaries of the created value and for the Open Web Index, these can be segmented[4] by the nature of their business, their relationship with the

[3] For brevity, we will subsume these categories later on as "economic" and "non-economic" resp. "societal".
4 Here, the goal of the segmentation is to have addressable/actionable subgroups of users and customers, sharing certain characteristics. Albeit a segmentation scheme is not unique and the choice complex, a pragmatic "fit-for-purpose" approach is followed here.

index and the entity's size. Specifically, we distinguish different types of businesses according to their primary business purpose ("nature of their business"): One customer segment is for example that of "search engine providers" that obtain the OWI to operate their search engine, complementary to e.g. "enterprise customers" with non-search engine related core businesses, but the need for OWI for e.g. search engines embedded into their products and services. To distinguish customers from users, we introduce a quantity called "relationship with OWI", which indicates whether there is a relationship with OWI, e.g. in the form of (open source) licences or signed contracts.

"Size" refers to the number of employees (although yearly turnover is in principle also relevant, we neglect these aspects for simplicity) with "small" having less than 49 employees, "medium" from 50 – 249 employees and "large" denoting more than 249 employees. An overview of the customer segments can be found in Table 2.

Customer Segment	Nature of business	Relationship with OWI	Size
Search engine providers – small	Web search core business	Direct	Small
Search engine providers – medium	Web search core business	Direct	Medium
Search engine providers – large	Web search core business	Direct	Large
Enterprise customers – small	Non-web search core business	Direct	Small
Enterprise customers – medium	Non-web search core business	Direct	Medium
Enterprise customers – large	Non-web search core business	Direct	Large
LLM providers	AI and data-driven services as core business	Direct	Small – Large

Table 2 *Overview of OWS.eu customer segments for the chosen segmentation scheme*

"Users" have no direct relationship with OWI. They are typically end users of OWI customers (e.g. search engine users) or belong to an entity (employee, beneficiary, organisation or similar) that is a customer of OWI.

The revenue model of the OWI infrastructure (including the OWI itself) is part of the business model. Based on the proposed value(s) per customer segment, It details how revenue will be generated from different streams and sources and how it monetises the OWI, data and infrastructure as well as several of its add-ons. The add-ons are complementary to the OWI and can be booked separately at market prices. Due to the structure of the OWI, data can be provided in several scopes and at several price points. Furthermore, it is possible that infrastructure can be provided on a service-base for individual creations of search indexes, namely in the form of web crawlers or other developed technology.

The revenue logic for the Open Web Index has not been finalised at the time of writing, but three revenue model patterns are discussed. First, a subscription-based model, monetising the provision of the Open Web Index in a packaged logic (with the scope and extent of the Web Index as the relevant drivers between packages). Second, a freemium model as an extension of the subscription model, where a certain part of the OWI services is free of charge. And lastly, a pay-per-use model, where each OWI transaction is charged on a cost-plus basis (with a margin on top of the cost of the transaction).

Internally, the provision of computing infrastructure are key requirements, and the development of an open web index are the key activities necessary to provide the promised value to customers. Based on existing calculations and assumptions, a service-based procurement of resources is assumed. This enables a "capital expenditures"-light setup, with a major part of the costs being operational expenses; for the index and search

part, data transfer plus storage plus crawling are the three core components on the cost side. These are variable and scale with the number of OWI requests and all transactions associated with them.

Market potential

The market potential – commonly referring to the market's potential capacity to absorb a specific product or service, supported by purchasing or adoption power – is determined in this study by the (tapped and untapped) volume for the market defined around the open web index, i.e. through services and activities to collect, parse and store web data to facilitate information retrieval for web searches.

In the market different stakeholders are present with different rationales, activities and behaviours (see above for details), constituting relevant “sub-markets” for our study. Due to the non-linear relationship between demand and supply resp. different platform participants in (multi-sided) ecosystems, these sub-markets may share synergies and influence each other. Search engine providers might benefit from EU internet users, who are potential target customers of their search engines, and vice versa.

Search engine market vs. web data market

Here, a clear understanding of the market is essential but non-trivial. Since components of a search engine are closely interlinked, isolated modelling of the potentials would make limited sense or miss important side-effects. Because of this, we will focus on the effects of an open web index but in the general context of web search.

Additionally, data of an (open) web index can be used for data analytics tasks along the whole data value chain[5]. Examples like OpenAI with web crawl-data as training input for ChatGPT resp. OpenGPT (The Washington Post, 2023) showcase the importance of publicly available data – with clear attribution to the source and clarified legal status for using the data. Thus, the broader web data market is evaluated instead of the search engine market alone.

[5] Usage can range from data acquisition, to cleaning to model creation and/or monitoring, and from diagnostic to prescriptive use cases.

2 Market potential of the OWI

As already briefly mentioned, the market potential of a European Open Web Index is crucial for deciding about many aspects, starting from the most promising, initial business model to funding requirements or political decision-making.

To have a holistic view about the market potential and impact of an OWI, the assessment is separated in an economic and a non-economic part (details follow in the respective sections):

Economic Benefits

The economic benefits describe the impact of OWI, where financial currency (in some form) is exchanged – directly or indirectly – between the different ecosystem participants.

These benefits are twofold: direct benefits are tangible, monetised (or monetizable) impacts from core services, crucial for cash flow and self-sustainability. Indirect benefits reflect broader economic efficiency and the bolstering of the EU's stance in the Tech/IT/Data etc. sectors, leading to the widespread economic uplift.

The direct economic potentials stem from varied access to the Open Web Index infrastructure, influenced by the chosen revenue model. The provision of value-added services, such as crawler services, knowledge graphs, search engine as a service, earth observations, and business intelligence, represents another facet of direct potential. These services may not contribute significantly to monetisation in isolation but offer substantial customer value. They have the potential to spawn an ecosystem of customer-created, value-added services and open-source projects, contributing to indirect benefits.

Indirect economic potentials are of a macro-economic nature and encode effects of the Open Web Search initiative on the general European economy and its participants. For example, this could be certain competitive advantages within or outside of Europe due to stricter privacy rules that helps to stay in a market and defend it against new (non-European) entrants or in entering a new market with lower privacy regulations.

Societal Benefits

Under the super category "societal benefits" all non-economic aspects of the OWI impact are subsumed. This includes social, cultural or other contexts.

Typically, no financial currency "flows" between the ecosystem participants for societal benefits, which however does not imply, that a quantitative assessment of such benefits is not possible.

Here, societal impacts are modelled to manifest along the categories of 'digital sovereignty', 'environmental', 'social', 'cultural', 'community/collaboration', 'safety & health' and 'other'. For example, the societal impact of digital sovereignty results from better independence from international gatekeepers, better search governance and more unbiased access to (open) data through OWS.eu.

To assess the market potential along these two parts, a combined top-down and bottom-up approach is followed ("dual approach"). The top-down approach specifies the general market potential down to customer segment, industry, topic and use case-group level. The industries are especially relevant for the economic side, with the focus being on the ones with largest market volumes as per the creation date of this study. Topics are more

relevant for the non-economic part, so that non-monetary impact areas can also be mapped and assessed. Use case groups are clusters of similar search, search engine & data analytics use cases.

In the following, we will in-depth review the market potential assessments along these categories, dimensions and in the dual approach.

Aim of our study is to provide a holistic perspective with a well-validated foundation for the market potential. Hence, a balance between greater details and holistic validity needs to be found between all the presented dimensions and methods chosen in a "fit-for-purpose" approach. Although not the major focus of this study, cost estimates are based on the assumed growth rates through e.g. the number of OWI transactions, which itself are one of the key cost drivers. The analysis was conducted from an assumed start point of launching OWI to the broader public, which is 2025 ("year 0").

Here it is noteworthy, that a hypothesis-driven validation is central to the methodology employed, with hypotheses tested through "field" & literature research, interviews and evaluations on a granular level, encompassing large-scale benchmarks and in-depth details such as individual pricing strategies and customer growth rates.

Additionally, different scenarios are evaluated to understand the (modelled) dependencies, the impact of our assumptions and the achievable market potential under certain hypotheses, like the scope of marketing[6]; Figure 3 shows exemplarily the modelled dependencies for the economic part of the assessment.

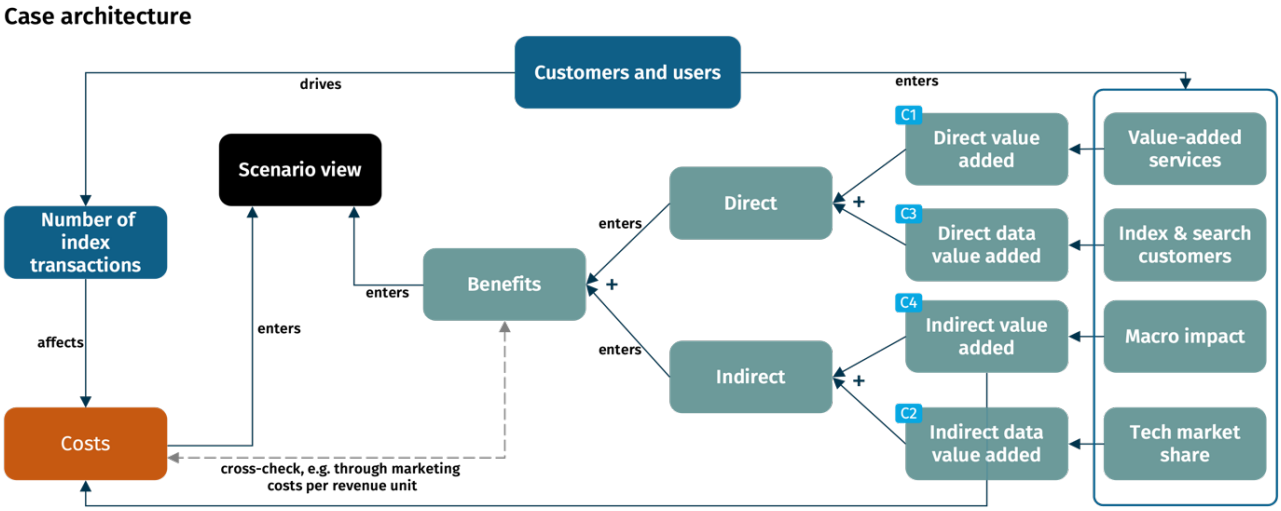

Figure 3
Dependencies of economic market potential assessment in our model. Details are described in the following sections

It's important to note that this study is not a detailed plan; it is based on certain assumptions that may change over time, such as market growth rates, pricing strategies, and the evolving nature of web search technology. Especially disruptive market developments, like complete shift of search engines towards Large Language Models

[6] There is a significant difference in terms of cost (and approach) between e.g. B2C and B2B marketing and the expected growth outcomes.

(LLMs) with a change in monetisation logic, market dominance, etc. is not explicitly modelled.

However, the estimated market potential can help to make sustained decisions and can be understood as a “minimum base line” required for enabling lasting impact. The created framework also allows to “reverse-engineer” the potential and might answer questions, like “what is the minimum number of customers required to balance our investments?”.

The results of the overall net benefits, as the difference between total benefits and costs, is shown in Figure 4. From this, it becomes clear that net benefits become positive early on about year 3 (with return-on-investment around year 4) and continuously rise over the decade.[7]

Benefits vs. Costs over Time

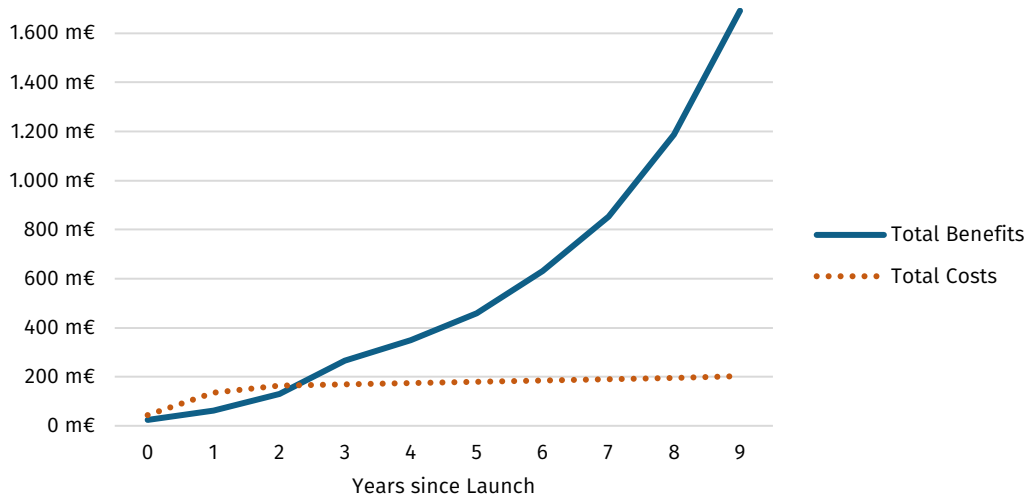

Figure 4
Net benefits of a European Open Web Index: Total benefits vs. costs

Economic impact

In general, already a relatively small market share creates significant economic benefits for the OWI and OWI infrastructure, with details following below.

The OWI's market potential depends on two main components—direct and indirect economic potentials, as explained above. The chosen modelling approach is based on assumptions about the market, the competitive landscape and the adoption of the OWI. From a benefit level or market potential driver perspective, Figure 5 below provides an overview of the relevant variables estimated by different methods, such as the combined bottom-up and top-down approach.

Here the two categories of “Direct + indirect value added” and “Data value added” are introduced as an auxiliary quantity to attribute the different potentials to the different customer segments, like Data Value added is linked to LLMs and mainly enterprise customers.

[7] Here it is noteworthy, that not only the economic impact alone is sufficient to create such an early return-on-investment, but the combination of economic and societal impact is required.

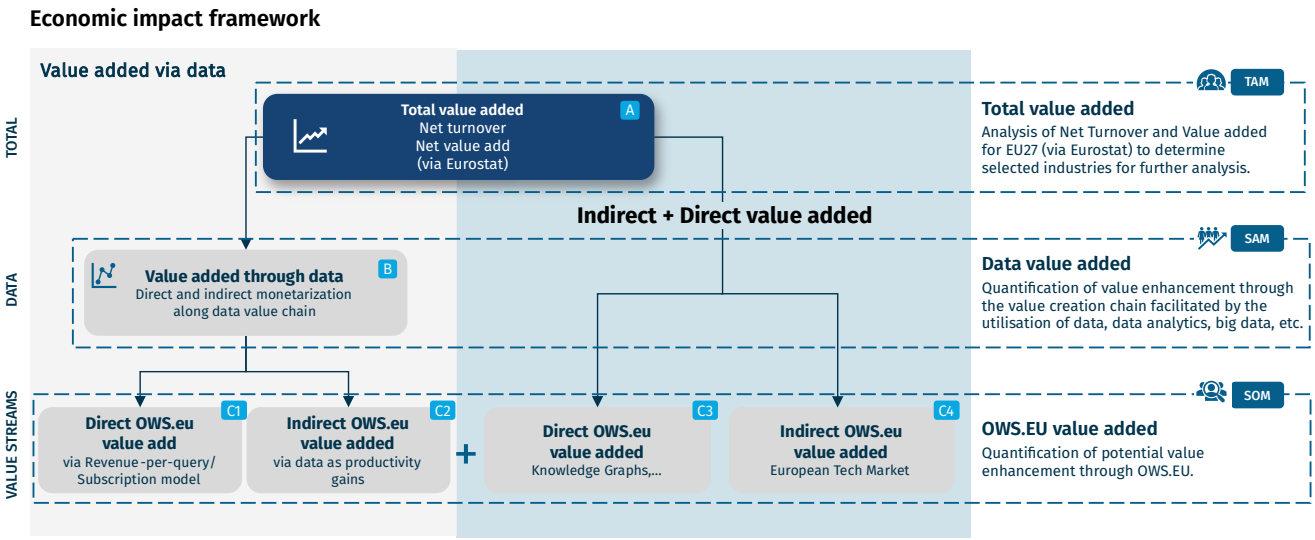

Figure 5
Key levers and drivers (from a market / business perspective) for a European Open Web Index

For the top-down approach, market data about the search engine landscape, European industry data and data value estimates from various sources (StatCounter, 2023) (eurostat, 2023) are used and aggregated, yielding the Total Addressable Market ("TAM)" of the Open Web Search initiative and in particular the OWI infrastructure. Based on the TAM, the Serviceable Addressable Market (SAM) and Serviceable Obtainable Market (SOM) are calculated.

The SAM is the theoretically reachable market potential based on e.g. geographic location and the SOM is the subset of SAM realistically achievable at the given time. However, in contrast to conventional top-down approaches, here we explicitly account for the innovative nature of the OWI by allowing an alteration of the market size through various effects, like the emergence of new, innovative search engine types (on top of winning shares of the existing market).

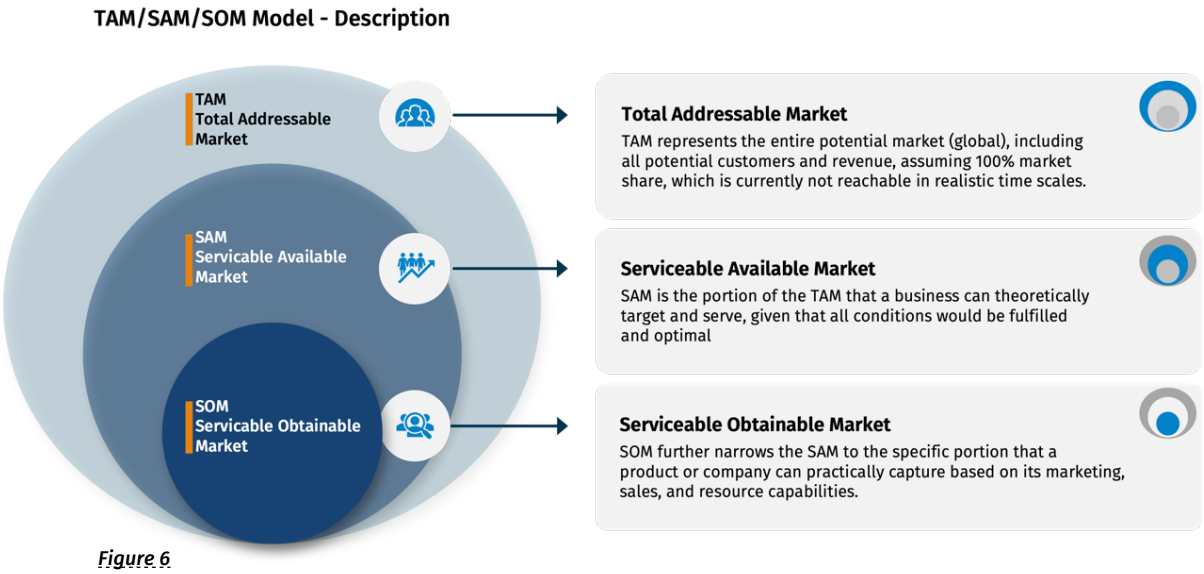

Figure 6
Schematic TAM-/SAM-/SOM-logic for estimating potentials

Complementary, the bottom-up estimate of the economic impact is mainly based on the adoption of OWI through the different customer segments and further details of the European OWI' business model, which manifests to large parts directly on SAM and SOM level.

Direct benefits

In the economic landscape of OpenWebSearch.EU, the direct benefits harnessed from the Open Web Index are structured to cater best to businesses of varying sizes. The number of B2B customers (with each having certain numbers of consumers behind), is shown in Figure 7 including the partition in the three size classes.

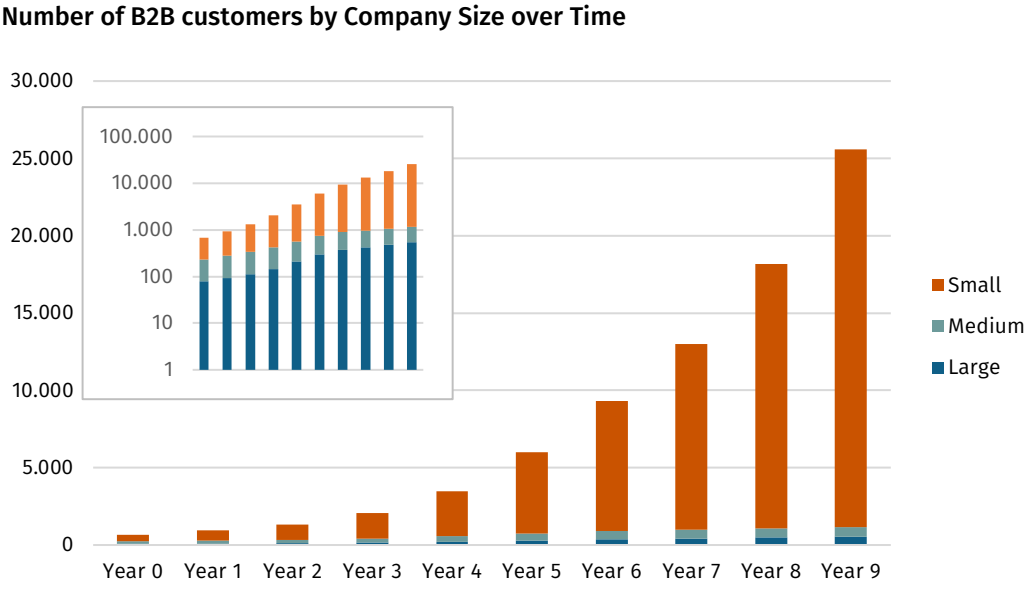

Figure 7
The OWI's B2B Customers over time, separated by the three company size classes

The number of B2B customers is primarily demand-driven, fuelled by the cannibalisation of existing offerings in the search engine market, growth of the search engine market through innovation, and innovative new applications outside of the search engine market. The latter has the most effect on the customers number through applications like integration of OWI data into own products & services, even for our very conservative assumptions. This is no surprise, since small companies form the largest number in the European company landscape – and already small adoption rates constitute a significant number.

Furthermore, adoption rates are modelled per customer segments and are divided into three time horizons (approximating an s-curve type of progression over time) as can be seen in Figure 8.

1. **Ramp-Up**: Entering of OWS.eu into market with rising adoption, no broad reach yet, from year 0 – 2 after OWS.eu launch.
2. **Rapid adoption**: Broad adoption of OWS.eu with self-strengthening market dynamics, from year 3 – 5 after launch.
3. **Plateau**: Broad adoption of market and beginning of saturation, after year 5 from launch.

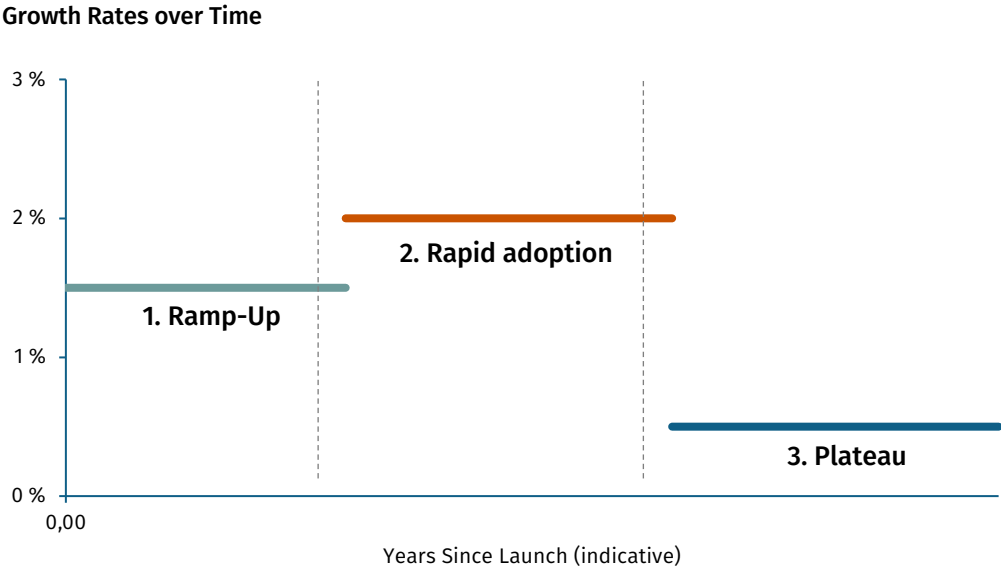

Figure 8
Customer adoption rate over time with different time horizons. The customer adoption rate denotes how customers adopt OWS.eu over time, i.e. how strong customer growth is.

To benchmark and estimate the adoption of the OWI (driving the rising of the customers over time), use case categories were derived with industry focus (specific industry vs. cross-industry), in a category (web search, information portals, content mgmt., web search, enterprise search, value-adding service and other) describing the primary benefit, a further subdivision in sub categories and the asset being at the core of the use case (Open Web Index, tools like knowledge graph, others)[8]. A list of selected use cases can be found in Table 3.

Since the adoption – besides others – is essential for having a valid picture on the market potential, special care was placed on substantiating it through various means. One is an analogy-driven inductive method from market best-practices for platform-business models[9]. Others are the validation with experts or possible future customers, as explained below – or, a sensitivity analysis for the quantities to have a basic high-level error calculation understanding.

Although certainly true, we do not account for country-specific adoption of OWI, assuming that effects for proportionally higher or lower adoption per country average out over the whole EU27 region, culminating in our adoption rates per customer segments used here.

These adoption numbers and the estimated customer growth are input for the monetary quantification of benefits. For this, a business model for the OWI was assumed including potential monetary sources or flows. The potential stems from varied access to the Open Web Index infrastructure, influenced by the chosen business model, whether Freemium, Subscription, or Pay-as-you-go (API access). Each model carries unique benefits and challenges, directly contributing to the project's monetisation. An overview of the general schematics is depicted in Figure 9.

[8] Note, that as stated above, only 6 key industries were considered, being responsible for approximately 80% of the EU27 turnover, but for the estimation an extrapolation is carried out.
[9] While not looking at the “delicate” question of a suited go-to-market-approach and scaling for such business networks, but solely focusing on adoption.

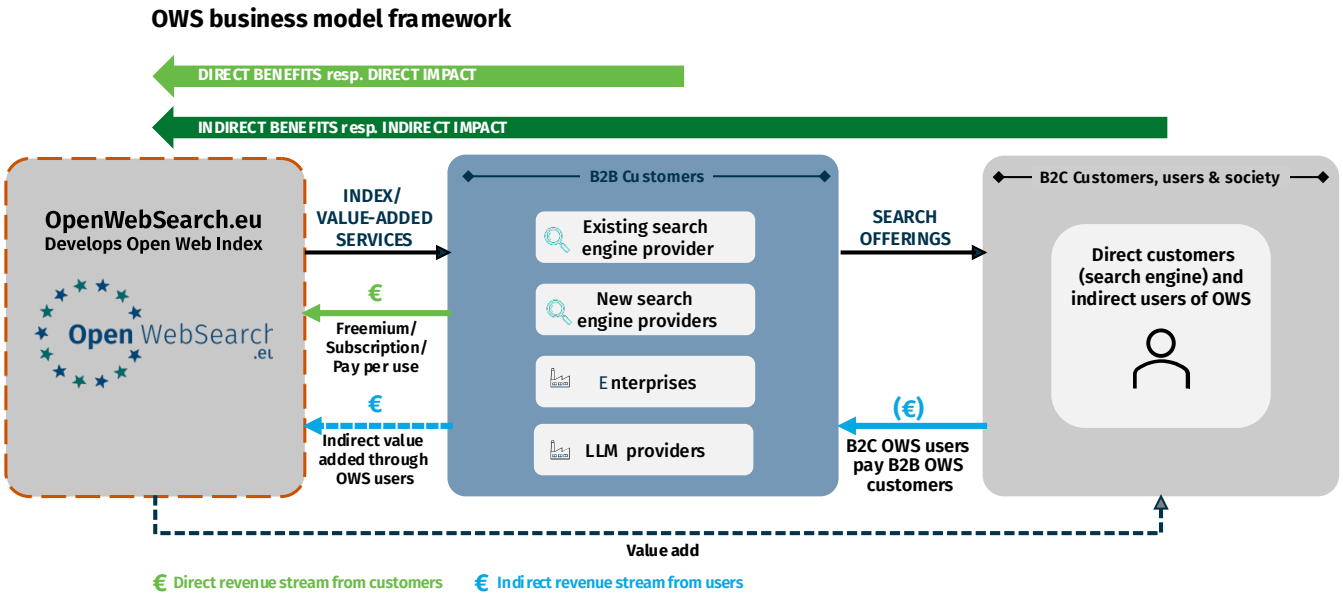

Figure 9
OWI business model and relationships with central stakeholders

Even though these three models are part of our study, we mostly focus on the freemium model, which this report will be based on. There, the basic structure is as follows: for simplicity, a two-package structure for the revenue model is used, one “free” package and a “premium” package. In the free package only basic functionality of the OWI is provided, while the driver to the premium package is the required range of functionality contained in the full OWI[10]. The majority of large companies were assumed to be subscribing to the premium package in this model. Small companies are with a ratio of 70% (vs. 30 %) subscribed to the free (vs. premium) tier[11].

Pricing of the core service OWI in the premium package is differentiated, with small businesses encountering price points at €5,000[12], medium at €30,000, and large enterprises at €65,000 and €110,000[13], especially for search engine customers who require extensive data. These price points are meticulously crafted, based on a “cost plus”-pricing, current market offerings of similar offerings, and insights from extensive market research and stakeholder interviews. As a reference, e.g. Bing Search APIs were evaluated from a pricing point, with up to $22 / 1,000 transactions in higher tiers of their offering their offering (Microsoft, 2023) since not all functionality is covered by the OWI, price points were adapted for comparison).

[10] Here, the exact details of the functionality range are not required for the market potential assessment, but it should be determined in customer-centric ways.
[11] Due to the anticipated quality issues based on a significant increase in search-like or search-based applications, and thus an overflow of low-quality offerings from user perspective, measures to ensure a minimum standard of OWI applications should be in place for the freemium model (e.g. by contractual obligations, or by e.g. limiting the free packages to certain industries, like scientific research).
[12] These price points were first assumptions, which have been made plausible through different methods and means, but might change (with high probability) in the future / at launch. Also note, that these prices may change with business model.
[13] This number is extrapolated to a web index from similar competitor offerings, like Bing’s Search APIs.

Use Case	Description	Industry	Category
Search Data together with confidential data sources	Integrate private datasets with secure search capabilities for sensitive information analysis. e.g. DLR	Cross-industry	Enterprise search
Search Data together with other data sources	Facilitates a more extensive and nuanced search experience, drawing on a diverse set of data pools to deliver richer, more accurate search results.	Cross-industry	Web search
Search Data together with government sources	Joint search with government sources	Cross-industry	Enterprise search
Providing and curating subset of data	Assemble and manage a specific data collection for targeted user needs	Cross-industry	Information portals
Custom search engine platform	Tailor a search engine to suit specific enterprise environments and use cases. e.g. Mercedes Home Zone, VW contextual search	Cross-industry	Enterprise search
Competitive Intelligence	Utilize advanced search tools for strategic business insights and competitive analysis. e.g. Linknovate	Cross-industry	Value-adding service
Start-Up radar	automatically extracts semantic relations between entities from unstructured and heterogeneous data sources	Cross-industry	Content mgmt.
Horizontal search engine	e.g. fragFinn, Mojeek, Qwant	Cross-industry	Web search
Vertical search engine	Biopharma, geo scientific, PubVis, patents, in property, travel, commerce, financial, health, local search, music, gaming/VR, software, education	Cross-industry	Web search
Combination of LLM frontend with question-answer system	Deploy a sophisticated query system to navigate complex data sets efficiently. e.g. Digital Cartography	Cross-industry	Information portals
Digital agent for search	Implement an AI interface to streamline search processes for users. LLM-powered interface to search	Cross-industry	Value-adding service
AI-ready Knowledge Assets	Utilize AI to structure and interpret vast knowledge bases for enhanced access and insights. e.g. OriginTrail	Cross-industry	Value-adding service
Sustainable search	Operate a search engine with an emphasis on environmental sustainability and resource efficiency. e.g. Leibniz Supercomputing Centre	Cross-industry	Web search
Crawling as a service	Offering crawler to customers	Cross-industry	Value-adding service
Full service End-to-End search machine	Offer a comprehensive search solution with potential for branding customisation.	Cross-industry	Web search
Visual search	Employ image recognition and search capabilities for media and entertainment applications; e.g. like nyris.io	Media & Entertainment	Web search
Customer support	Combination of generic information and specific company information for customer service	Cross-industry	Web search
Sales prospecting engine	Search for (B2B) customers/lead gen	Wholesale & Retail	Web search
B2B supplier portals	Listing of potential suppliers per industry/function/etc.	Manufacturing	Information portals
Trend discovery & monitoring	e.g. smart city monitoring, etc.	Cross-industry	Information portals
Decentralized search with same index	A search infrastructure that operates on a distributed network, enhancing user privacy and data integrity; e.g. Yacy	Cross-industry	Value-adding service

Geo search	find POI, incl. Recommendations, reviews, etc.	Cross-industry	Web search
Safety applications	Develop applications to enhance user safety and security.	Cross-industry	Value-adding service
Similarity search	locate similar images/data across space and time; intended to augment and make efficient the process of dataset gathering/generation for scientific studies.	Wholesale & Retail	E-commerce
Open Science search	Enhance scientific discovery with specialized search tools that connect diverse data sources. e.g. different context-connected data sources in geo sciences, etc.	Professional, scientific and technical activities	Web search
Privacy-preserving ML	Prevent data leakage in machine learning algorithms	Cross-industry	Value-adding service
Human-Centric Search	Create search solutions centered around user experience and needs.	Cross-industry	Web search
Hate-speech monitoring	Tools designed to detect and address hate speech across digital platforms, ensuring a safer online environment; e.g. Tilt	Cross-industry	Value-adding service
Fake news detection	Tools to identify and flag misinformation online.	Cross-industry	Value-adding service
Tourism	A comprehensive search portal tailored for the tourism industry, including destinations, accommodations, and activities; e.g. Kayak	Tourism	Information portals
Climate change resilience	Search tools to support climate change adaptation and resilience strategies.	Cross-industry	Web search
Open Government	transparent and collaborative government with access to open administrative data	Government	Information portals
Synthetic data	Artificially manufactured rather than generated by real-world events	Cross-industry	Value-adding service
Environmentally friendly search	Create eco-conscious search platforms with lower environmental impact.	Cross-industry	Information portals
Price monitoring	Allows businesses to gather pricing data from various sources quickly and efficiently	Wholesale & Retail	E-commerce
Federated search (similar to Elastic)	Well-suited for use cases involving text-based searching and analysis, such as log analysis, e-commerce search, and website search	Financial services / Media & Entertainment / Wholesale & Retail / Healthcare	Enterprise search
Full-text document search	e.g. SeekStorm (web-scale, real-time, full-text, instant search for documents)	Cross-industry	Information portals
Custom news search	custom news search API	Cross-industry	Content management.
Public gazette	Public gazettes such as official gazette, government gazette, federal gazette, law gazette, health gazette, stock exchange gazette publish information on a publicly accessible website.	Cross-industry	Web search
Public listings	Public listings for auctions, bids and company registrations can be monitored, crawled, scraped, aggregated and made searchable in real-time	Cross-industry	Web search
Sentiment Analysis	gauge public's feelings and interests and plan future company strategies accordingly	Wholesale & Retail	Value-adding service
Job-Posting aggregation	used to aggregate job postings from specific industries	Cross-industry	Value-adding service
Product data extraction	involves extracting product information from different sources like e-commerce websites, social media platforms, and review websites.	Wholesale & Retail	E-commerce

ADNS-alike	(Advanced Data Navigation Services) deals with the digitisation of massive volumes of aircraft-specific technical documents (size = 6 TB) and provide real time access to the same for handling customer queries.	Manufacturing	Information portals
Intelligent legislation support system	resolve pending issues raised by non-systematic investigation into legal data and time-consuming analyses	Government	Information portals
Technology standards	integrated and connected search service for technical standards that will provide convenient access to information on government standards, certification activities, and trends at home and abroad for the public and business.	Manufacturing	Information portals
Vector search	Advanced search capabilities that use vector space models to provide precise and contextually relevant results; e.g. Vespa	Cross-industry	Enterprise search
Open Consortium / Innovation Community	A collaborative platform that fosters open-source projects and community-driven innovation in search technology; e.g. Open Geo Consortium / Community	Cross-industry	Value-adding service
Visual search spare parts	Spare part search in manufacturing	Manufacturing	Information portals
Human Health Network	Connecting patients with clinical test studies (based on open data study register)	Human Health	Information portals

***Table** 3*
Use case collection of OWI (non-exhaustive)

Despite the larger number of small business customers, the revenue is significantly bolstered by larger corporations, which are fewer in number but contribute higher revenue per entity due to their greater demand and usage of the service. In order to ensure market traction, this could mean that Open Web Search EU (and/or other entities tied to the OWI) needs to execute decidedly marketing, targeting large B2B customers and attracting smaller B2B customers by e.g. spill-over effects. Conversely, this also could be interpreted as a requirement to target and convince only few customers to achieve the OWI (direct) market potential.

Additionally, within the business model, selected addons can be booked on subscription basis as value-added services, which takes place on top of consuming the OWI (both, in the free or premium package).

The provision of these value-added services, such as crawler services, knowledge graphs, search engine as a service, earth observations, and business intelligence, represents another facet of direct potential. These services may not contribute significantly to monetisation in isolation but offer substantial customer value. As a benefit, selected value-added services may already exist internally (like a crawler service) and may be leveraged towards customer-facing offerings at small effort (e.g. extending the crawler service towards a competitive intelligence tool for benchmarking competitor offerings).

They have the potential to spawn an ecosystem of customer-created, value-added services and open-source projects, contributing to indirect benefits. Fundamentally, these represent an important foundation for positive (reinforcing) network effects for the European OWI by allowing technology-driven customer lock-ins, higher market visibility of a source for (proprietary) high-quality data fed back to the OWI (if allowed by the customers).

The value-added services, that are considered specifically, are listed below and are mainly of a data products-type, but the analysis extrapolates to other, products and services that are not yet specified:

- Knowledge Graphs: Provision of extracted information from web as a knowledge graph for specific search requests.
- Crawler services: Offering of proprietary OWS crawlers for dedicated usage by 3rd parties.
- Search engine as a Service: Bundling of (new or existing) technology into a complete search stack, based on the OWI.
- Earth Observation Catalogues: Provision of (scientific) catalogue for data discovery and retrieval.
- Business Intelligence data: Enabling of BI suite based on e.g. competitor web data with technology provided by e.g. Open Web Search EU.
- Data enrichment for Large-Language-Models (LLMs): Offering of OWI data to train LLMs with conforming to European values, or by enhancing existing LLMs through context (e.g. by Retrieval Augmented Generation).

Monetisation of these addons follows a transparent "price × customer number"-logic. Price points here are influenced mainly from a market perspective, for which already available services were benchmarked. Take rates for the individual offerings are internally linked to the assumed marketing spendings, and have an inherent uncertainty[14].

Another revenue stream is the so called "data marketplace", an additional potential value component of OWI leading to further strengthening of the web as business and innovation resource. The idea here is that information owners (in the form of data) can directly participate on the value creation out of the provided information/data, which typically is not the case or only in indirect forms (like Google web search console) for available web indices. To realise best benefits for data providers, a marketplace logic is followed. In such a marketplace, data owners can actively sell their data, which may be anonymised for privacy, to a diverse range of data consumers. This data can serve various purposes, such as benchmarking, training language models, or providing market insights. The commoditisation of data through this marketplace empowers data owners, including private individuals, to control and potentially profit from their own data. As a trusted facilitator, a European Open Web Index can ensure a secure and equitable data trading environment through its data marketplace – especially with the strong focus on European values and privacy implemented "by design".

For this marketplace, the market potential needs to be separated into direct monetisation and indirect benefits of the data providers and data consumers. Direct monetisation happens through a revenue-share model, where for each data transaction on the market-place a low two-digit percentage of the paid amount remains at e.g. Open Web Search EU (as an appointed entity). Indirect benefits play out through various observables, as explained below.

[14] This uncertainty does not compose a major problem, since the overall effects of value-added services on the overall market potential are well under control.

Another aspect of this is that – driven by regulation and EU directives – search engine operators across Europe are required to obtain usage rights from press publishers for the reproduction and display of press publications in their search engines and to remunerate them. The declared goal of e.g. the German “Presseleistungsschutzrecht” (Press Publishers' Rights Law) (PLSR) is to grant press publishers an appropriate share for their contribution to the value creation of digital platforms[15]. With regard to this, a data marketplace could

Direct Impact of OWS.eu over Time

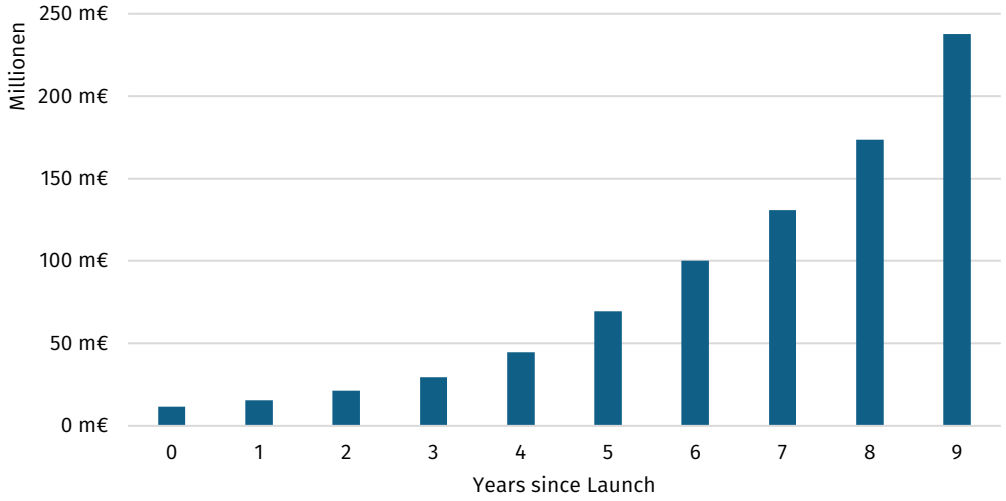

Figure 10
Direct impact resp. benefits of the OWI

present an interesting opportunity to monetise press information (in the form of data) in a direct and transparent way[16]. Both, the data marketplace and value-added services benefit from current and future EU regulations, like the EU AI act, so that even higher adoption and take rates are possible and plausible.

In total, the impact of direct benefits (“direct impact”) within a 10-year scope account to approximately 800-1,000 million €, as can be seen Figure 10.

Indirect benefits

To measure the wider, indirect economic impacts, network and scale effects need to be taken into consideration to assess the market potential properly. Namely, although if no financial currency is exchanged directly, the OWI on top of its direct benefits, creates value for its customers and users.

[15] The appropriateness of the remuneration level is still disputed in European and non-European countries that have also decided on remuneration for press publishers through statutory regulation: In countries such as Germany, France, Italy, and Switzerland, the appropriate level of remuneration is still being negotiated with the platforms, while in other countries settlements have been reached.
[16] This could also help to estimate the overall potential of such a data marketplace with volumes of renumerations being of the magnitude of double- to three-digit millions EUR amount. E.g. in Canada, based on the so-called "Online News Act," the Canadian government has agreed with Google on an annual remuneration of around CAD 100 million for the entire market. In Australia, Google and Meta have agreed with a portion of the market on an annual remuneration of around AUD 200 million in the context of the News Media Bargaining Code.

The network-like nature of the Open Web Search ecosystem alone multiplies the potential number of people reached within the EU. Figure 11 shows the number of people who are in contact (directly or unknowingly, indirectly) with an OWI, which is very conservatively estimated at ~5% of Internet users in Europe.

Number of People Reached by OWS.eu over Time

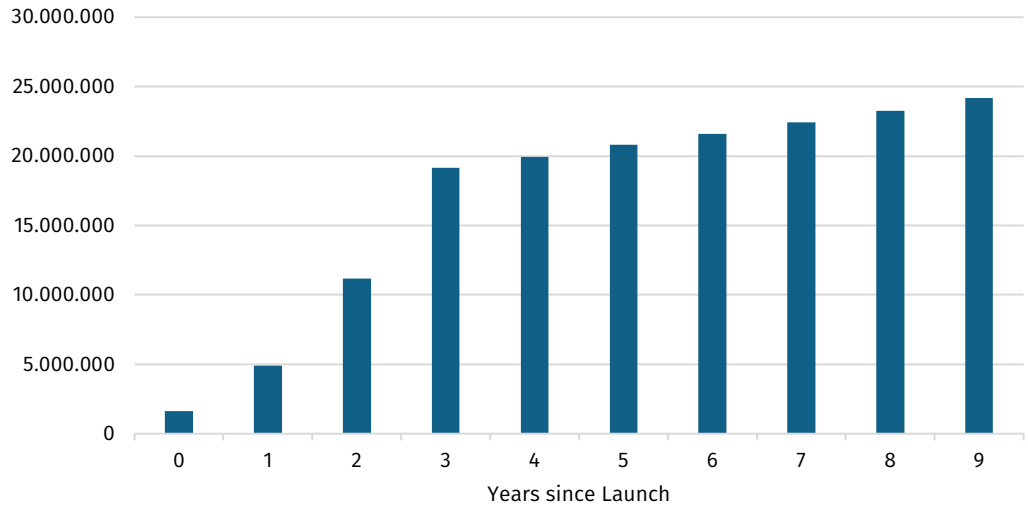

Figure 11
People reach of the Open Web Index, including people in direct or indirect contact

In the context of the Open Web Index, the Cobb-Douglas function is adapted to consider the number of customers (an input) and their engagement duration, or 'customer tenure' (another input), to predict the overall impact (the output). This method assumes that the value generated by the OWI is not simply additive but synergistic, with the duration and scale of customer engagement jointly influencing the potential benefits. Thus, it captures the essence that sustained customer interaction and increasing adoption rates are pivotal to realizing the full scope of economic (and later societal) benefits.

Excerpt: Cobb-Douglas function
The study utilises a model reflective of the principles of the Cobb-Douglas function, traditionally used in economics to describe the relationship between two or more inputs and the level of output. This could be e.g. the production output in dependence on capital expenditure and invested work (measured in person days).

Indirect benefits arise in parts from these and provide broader economic efficiency and are modelled along two levers: increase of tech market share and better value creation through data, information and insights.

For the first lever, the main effect is bolstering of the EU's stance in the Tech / IT / Data / etc. sectors, leading to widespread economic uplift. This could be due to the relatively strict and demanding regulation for EU-based players, who then can enter new markets with lower standards at relative ease. Non-EU customers might also perceive this as an advantage over other competitors without this background, or this could hinder the emergence of new non-European players due to the relatively high regulation barrier(s). This shows that, while focusing primarily on the EU area, possible benefits extending beyond this region.

To quantify this contribution, the relative share of OWI customers on the global tech market (MGI Research, 2023) is estimated (see Figure 7 for the overall number of customers). Overall, the quantified impact is shown in Figure 12, where the absolute contribution is small compared to the other economic impacts. Here, due to an uplift of market share of tech companies worldwide, the contributions to the potential are proportional to the number of OWI customers.

Indirect Economic Impact from the Tech Sector over time

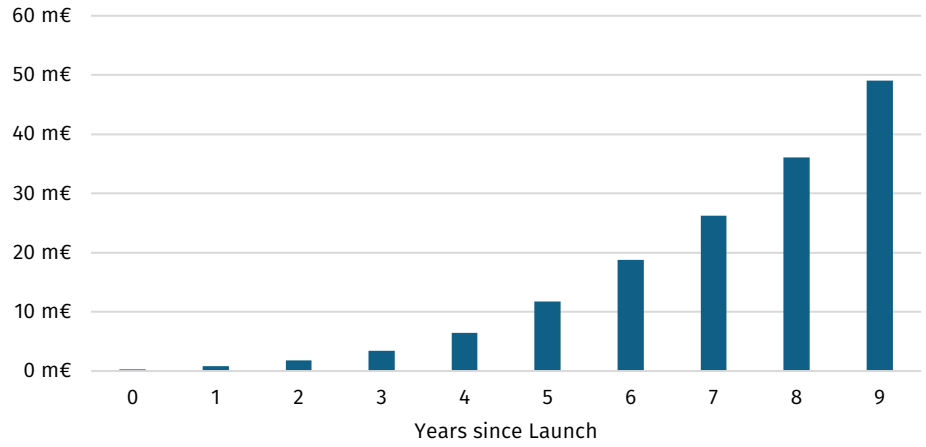

Figure 12
Indirect economic impact from the tech sector over time (Million Euros, Years)

The second lever is based on the fact, that OWI data can help customers achieving "more" within existing processes and value chain steps (i.e. "making existing value creation better"). Our semi-quantitative estimates and insights from our work with companies predominantly from the German 'Mittelstand' (Mücke Roth & Company) indicates that especially data-based, data-enabled or data-driven value generation can profit from OWI data, which is the reason why the so-called data-value chain is used to estimate the second building block of the indirect benefits. Here, we base our market potential assessment for the macroeconomic impacts on the combined top-down and bottom-up approach, where a bottom-up estimation of the potential is carried out on selected-use-cases level, to the top-down extrapolation of industry potential and extrapolation to other use cases.

The quantification of top relevant use cases is carried out for each of the six key industries along the following funnel to estimate the individual value creation contribution:

1. Selecting of most value creating use cases for the total (business) value creation
2. Estimation of relative share for each use case on total value added
3. Definition of base uplift through data relative to estimated share for each use case
4. Derivation of improvement by the Open Web Index on use case-level, on top of/relative to data uplift
5. Quantification of benefits in absolute numbers for each use case
6. Summation of benefits over all selected use cases

An overview of selected use cases in the key industries is shown in Table 4.

Industry	Use Case
Manufacturing	Machine Downtime More accurate forecasting Inventory-holding cost Cost-of-quality
Financial Services and Insurance	Sales and Marketing Operational Cost reduction through increased productivity Labour productivity increase
Human Health and Social work activities	Total op. cost savings through productivity increase
Wholesale and retail	Total OpEx savings through productivity increase (esp. Purchase)
Construction	Total cost savings through productivity increase
Professional, scientific and technical activities	Total cost savings (incl. labour, professional fees, technical equipment, etc.)

Table 4
Selected use cases for data value generation improvement through OWS.eu

Since data about the industries' value generation is from the past, an extrapolation to future points in time is necessary for our assessment (which include time periods – and not only a point in time). For this, two quantities are combined through a (mathematical) convolution: an industry-specific growth rate for the total (data) value generation and an assumed market penetration of the OWI use cases, yielding the indirect economic benefits from a macro-economic perspective. The market penetration of the Open Web Index encodes sustained added value due to increasing usage of the OWI and is modelled by the Copp-Douglas like function.

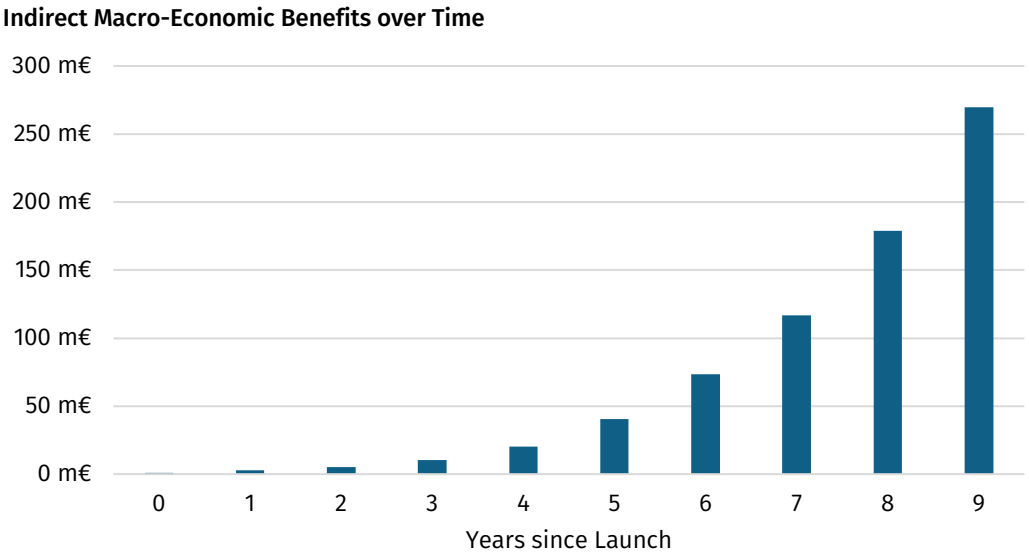

Figure 13
Macro-economic indirect economic benefits from OWI

The results can be seen in Figure 13. Here, macro-economic effects tend to become only relevant for later times after launch, exhibiting polynomial growth for intermediate time scales and then rise almost linearly to almost 270 Mio. € in the 10th year. This linear rise can be explained by sustained usage of existing users and network-like interaction, even with smaller customer growth at later time scales. The greatest benefit comes from the manufacturing industry, followed by the industries “Financial Services and Insurance” and “Human Health and Social work activities”.

As a cross-check, the macro-economic contribution of a European Open Web Index is conservatively estimated to be ~0,06% of the EU turnover.

For shorter times (up to ~ year 4) the ramp-up of the Open Web Index has visible effects on the maximal achievable economic impact. Only after this, significant growth is expected, rising up to ~600 Mio. € per year, see Figure 14.

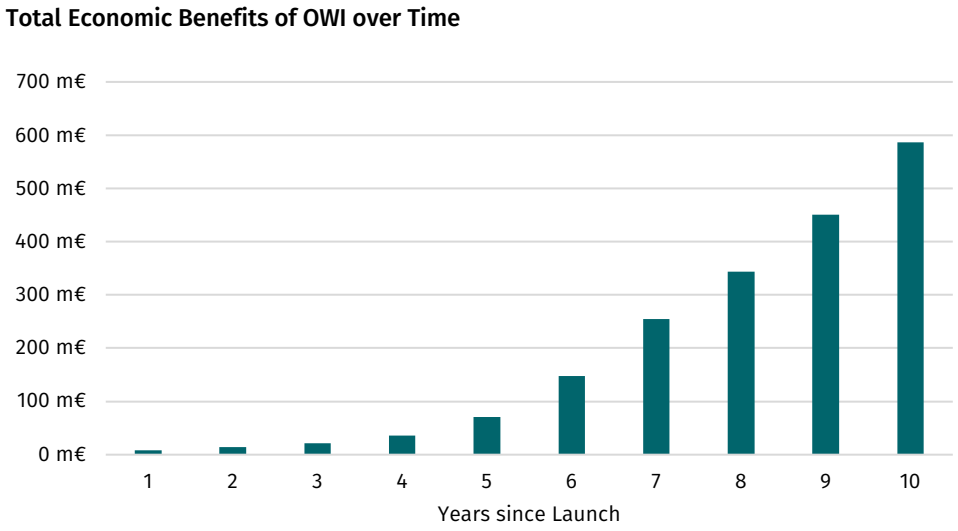

Figure 14
Total economic benefits of the Open Web Index over time

As can be seen from Figure 15, the economic impact is mainly driven by two components: from the OWI and by the macroeconomic impact. Initially, the latter is negligible due to the limited range and market penetration of a European Open Web Index, but becomes more and more relevant for later times.

Also, subsuming indirect and direct economic impacts in Figure 16 yields the same picture, with direct monetisation being more relevant around the timely launch of the OWI. Similar initiatives like Open Data Initiatives (see e.g. (Bundesministerium des Innern f. B., 2023)), report comparable ratios.

Importantly, this could enable “intermediate financing” of macroeconomic effects in the sense that the earned money from direct economic impact can be spent to sustain and strengthen the indirect benefits.

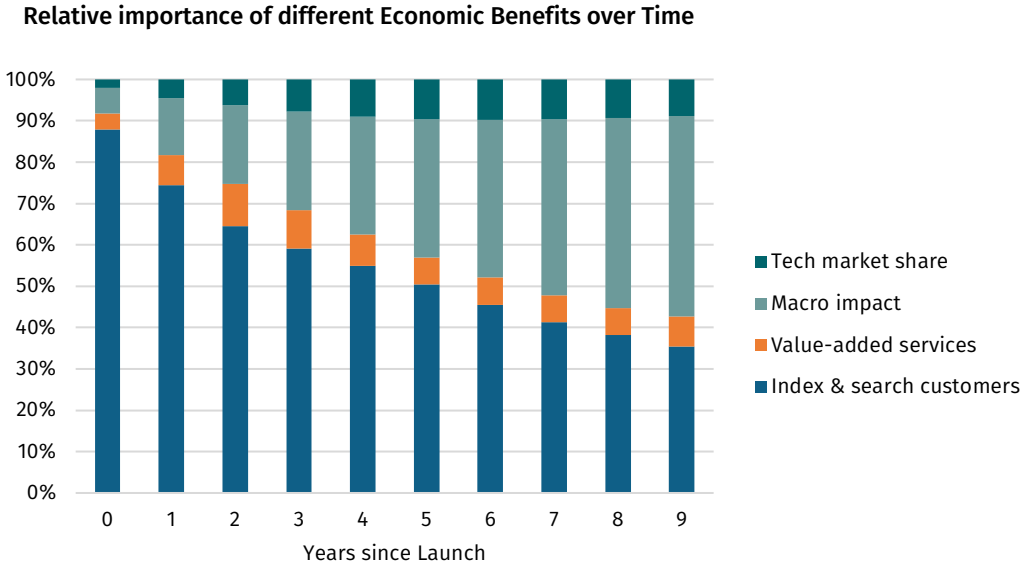

Figure 15
Economic benefits by lever – relative contributions

In summary, the economic impact analysis of a European Open Web Index project reveals a nuanced landscape of benefits. As a recall, direct benefits within a 10-year scope are estimated at approximately 800-1,000 million €. Indirect benefits are projected to hold comparable value. Cumulatively, the economic gains are forecasted to reach around 1,700 million € over a decade.

At this point, it is noteworthy that business models, like Google's, are built around maintaining and strengthening positive-reinforcing network- and scale effects to create and leverage value for every ecosystem participant. By providing "free" search engine capabilities to users (and beyond), data is gathered which helps businesses and content providers to earn money by Google's offerings (like AdWords and AdSense).

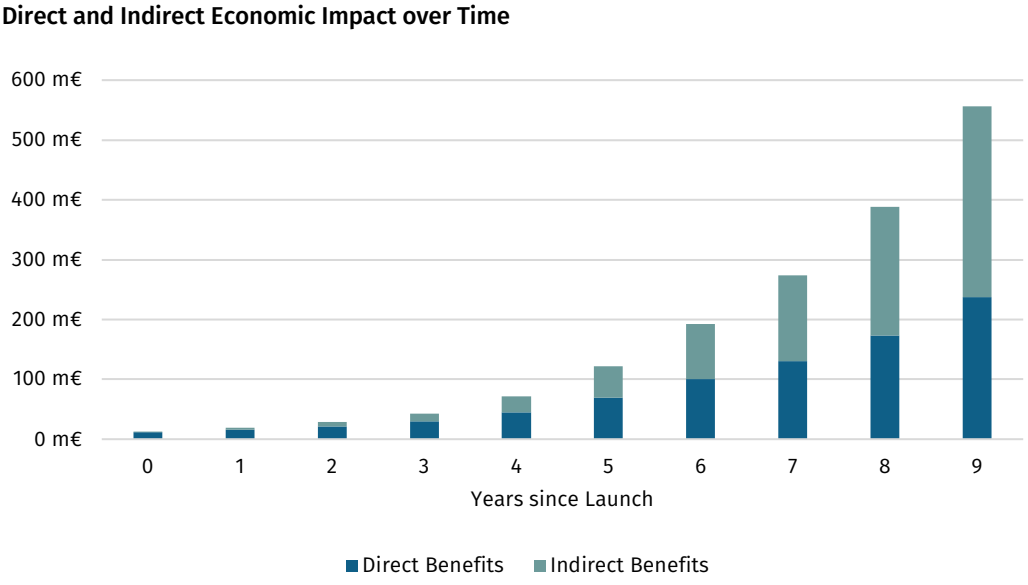

Figure 16
Share – Direct vs. indirect benefits over time

For the OWI it is also crucial from a direct economic impact perspective to have a business model with built-in network- and scale effects. In contrast to Google's hidden revenue model, here a combined Freemium-Marketplace revenue model, augmented by add-ons, is used. Since Google covers more steps of the customer's value chain, going beyond a simple web index, it is essential for sustained value to have its own self-enforcing "flywheel" for OWI interaction.

Societal impact

Assessing the societal impact within the OWI infrastructure involves analysing the non-economic benefits. This is done across six impact areas, with significant contributions to the overall benefits.

The analysis of societal benefits is grounded in specific use cases, with potentials calculated from foundational principles or derived from estimated efficiency gains relative to public budgets or quantities. These methods are used to quantify the societal value attributed to the topics, supporting the rationale for public funding or subsidies. The Cobb Douglas Impact function is utilised as a mathematical means to integrate these aspects, providing a quantified measure of societal impact that the EU could realise through the OWS initiative.

In detail, to determine the societal impact of the Open Web Index, a robust methodology was adopted: Categories were derived from a combination of use cases (see Table 3), insights and from a meta-analysis of third-party studies.

Subsequently, a detailed gap analysis was conducted for each subcategory to assess potential changes that the implementation of the Open Web Index might bring about. This helps to grasp the effects of societal contributions and is inspired by causal inference, where "counterfactuals" allow to quantify (in average) the impact of certain treatments (Pearl, Glymour, & Nicholas P., 2016), i.e. effects caused by the OWI. By identifying the gaps, societal implications of the OWI on the European region become transparent, highlighting e.g. significant uplift in digital sovereignty. This analysis uses the current state as a baseline, assuming no future improvements without the OWI, and considers changes such as productivity impact due to digital addictions.

The meta-analysis is based on similar EU- or government-backed initiatives, like Open Government Partnership (Partnership, 2024), Gaia-X (GAIA-X, 2022), Galileo (Galileo, 2023), Open-Data-Strategy (Bundesministerium des Innern, 2021) and Copernicus (Copernicus, 2023).

In detail, the key areas and subcategories are:

DIGITAL SOVEREIGNTY

- Autonomous Digital Infrastructure: Technological sovereignty over European data. Value from better data through offered services
- Independence from Dominant Digital Platforms: (More) Independence from foreign tech giants through availability of alternatives
- Innovation and Open-Source Development: Facilitation of innovation through reduction of (data) entry barriers
- Minimisation of Vendor Lock-in Effects: Added value through more choices

ENVIRONMENT

- Sustainable Digital Ecosystems: Efficiency gain for e.g. EU data centre electricity usage through OWS, avoidance of 'double work' for index creation
- Alignment with Green Policies and Energy Efficiency: Better decision making through better information in green policies
- Support for Eco-friendly Digital Solutions: Reduction in electricity usage through more efficient usage through better data and decentralised computing

SOCIAL

- Digital Knowledge Democratisation: General accessibility of information to end users and broader audiences
- Empowering Education through Open Access: Improvement in educational efficiency through better data usage and insight generation
- Advancement of Open Science and Research: More and better science through better access to data
- Traffic efficiency and safety: Faster response times and more efficient traffic management

CULTURAL

- Promoting Digital Diversity and Inclusion: Improvement of cultural exchange and representation of diversity and inclusion in data
- Representativity of European Languages: Value of specialised Large Language Models for small languages and/or other language-related contexts
- Preservation and Accessibility of European Digital Heritage: Digitalisation and increased access to cultural heritage, better preservation / representation / etc.
- Enhancing Cultural Connectivity and Integration: increased access to cultural heritage through better information

COMMUNITY & COLLABORATION

- Collaborative Digital Governance: Increase in 'data-related' job creations through OWS or joint initiatives; better leverage of skills and capabilities required for the "future"
- Public Sector Digital Transformation: Saving in annual administration budget, of EU, through open data, and better searchability
- Fostering Community-driven Digital Innovation: Improvement of innovative product and service creation

SECURITY & HEALTH

- Digital Health Innovations and Accessibility: Bias and error reduction in healthcare through better data availability
- Health Care Improvements: Better care through efficiency gain in health care system, by e.g. identifying beginning flu epidemics
- Combating Misinformation and Enhancing Digital Safety: News and information detection through better transparency
- Intelligence and Data Analytics for Peacekeeping: Cross country policing
- User-Centered Security Protocols and Standards: Improvement of efficiency in civil security, resilience, etc.

Quantification of societal benefits

Quantifying societal benefits is not straight forward. Key is to find quantities that are affected by the non-economic impact of the OWI and to choose suited metrics for attributing this impact.

For us, quantification involved a measured approach using analogies and assumptions, often inspired by other EU initiatives or the OWI infrastructure's economic impact side. For instance, the societal value of a more equitable search market was benchmarked against fines collected from major search engines (based on income and/ or revenue) for unfair practices. This valuation then serves as the maximum potential impact that can be generated by the initiative. Following this, the Cobb Douglas Impact function is applied to determine a quantified measure of societal impact, with realizing more and more synergies over time.

Another approach (also used synergistically) is to benchmark the societal value that the EU asserts to aspects such as Open Science by a budget allocation on the supra national/ EU level, such as the volume of budget dedicated to the "Horizon Europe program". This serves as the maximum potential gain.

Due to the missing direct relation between societal impact and quantified potential, societal impact has large inherent uncertainties, with the presented values being our best case-scenario.

Societal contributions

The societal benefit is depicted in Figure 17. In the first years, the overall contribution is comparatively small, but grows significantly from year 3 onwards. For early times, "digital sovereignty and trust" is the sole driver, while for later time scales the contributions from other impact areas become more relevant.

For the key impact areas, “minimisation of vendor lock-in effects”, “innovation and open-source development” as well as “more independence from digital platforms” are the largest societal benefits. For example, for “more independence from dominant digital platforms”, a gap analysis yielded that more self-sovereignty through the OWI translates into less digital-dependency, which in turn can be measured by more distributed and heterogeneous (indirect) value generation in the web search and digital platform landscape (away from e.g. established “gatekeepers”). Non-European gatekeepers would consequently not profit as much as before from gaining financial value out of European internet users.

Societal Impact of an OWI by Key Impact Area over time

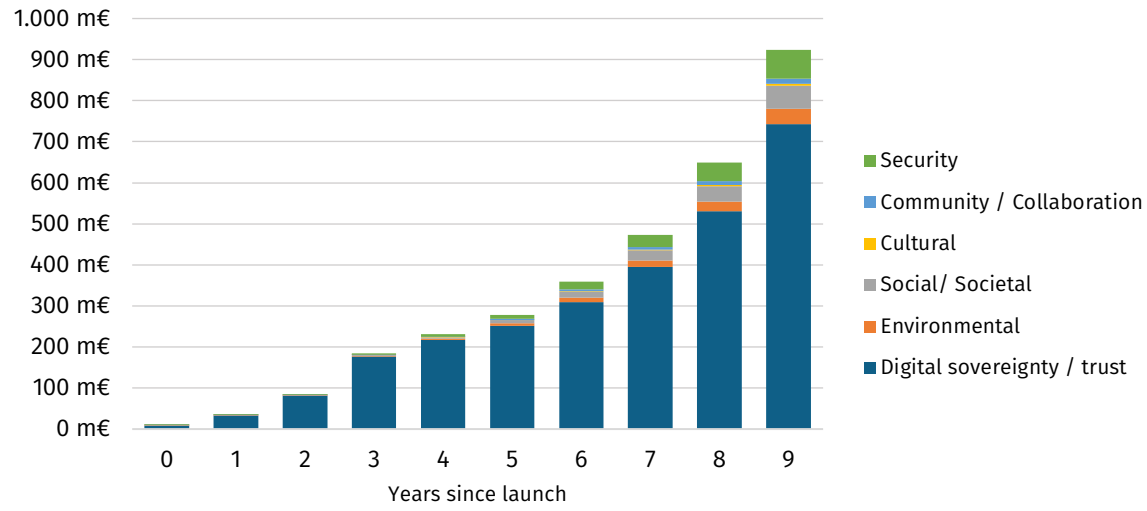

Figure 17
Societal impact and benefits by impact areas over time

“Less customer vendor lock-in effects” are contributors to digital sovereignty and scale with the number of OWI customers. Over 10 years, these benefits – quantified (and accumulated) to be around 3.5 - 4 billion € – can be leveraged.

Separability and relationship to economic impact

One intricacy of our chosen approach for determining economic and societal impact is that of clear separability: namely, while our approach assumes a unique decomposition between the two impacts, reality could be more complicated with no clear procedure of separating both; benefits might be of both types – economic and societal impact, which could lead to double- or over-counting in our market potential assessment.

To account for that, we explicitly estimated the overlap between economic and societal impact, as shown in Figure 18. Here, the economic side captures direct value, like company and data value chains, and indirect value through efficiency improvements and market share increases. Societal impact spans digital sovereignty, the environment, and social, cultural, community, and security dimensions. While there is potential overlap, such as tech innovation influencing societal aspects, this assessment focuses on the distinct categories without actively deducting for potential intersections. The benefits are gauged separately with respect to economic quantities and societal qualities, respectively

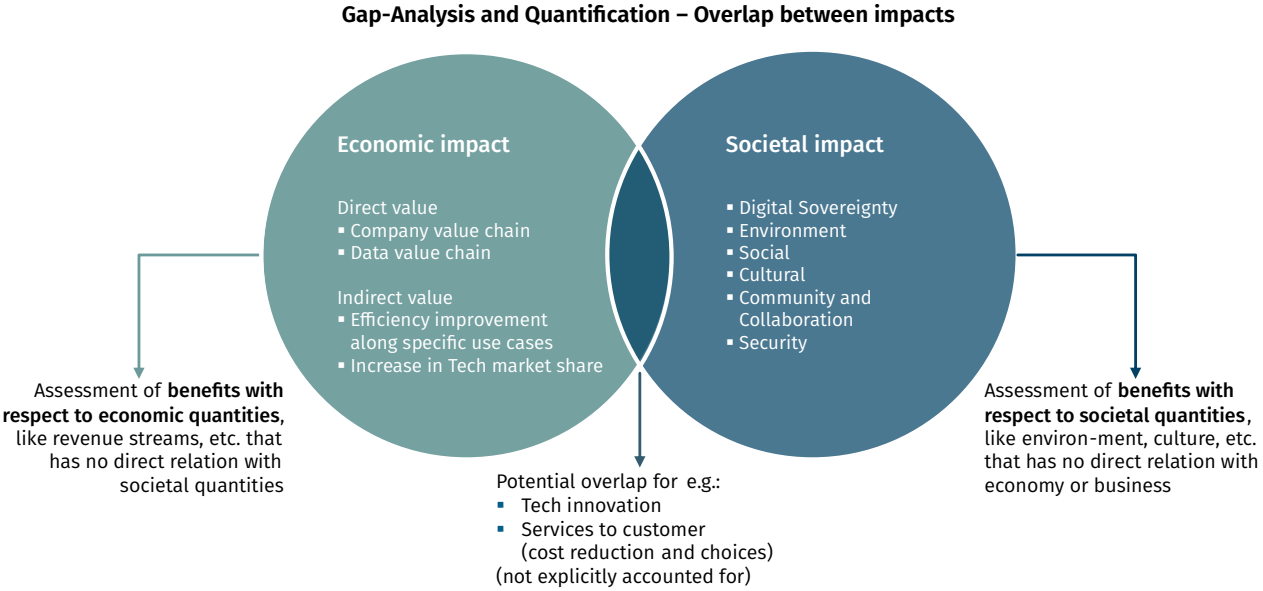

Figure 18
Separability of economic and societal impact based on the gap analysis and quantification of the respective impacts.

Cost structure of a European Open Web Index

The cost side is important as well for our assessment, since it allows a holistic view on required investments and possible self-sustainability of OWS.eu.

Costs of the OWI can be broken down into the following categories (Granitzer, Private exchange, 2023):

1. Storage
2. Data transfer
3. Crawling
4. Data & analytics
5. Serve index

supplemented by other costs, like personnel and marketing.

For better traceability, these categories (with each sub-position) were divided into a Capital Expenditure (CapEx) and an Operating Expenditure (OpEx) part, and modelled to be of variable and step-fixed cost type. Sub-positions in costs are quantified and scaled based on the ramp-up of the web index (with increasing number of web pages) and the number of customers consuming the web index. Back-feeding into the costs happens e.g. through additional transaction costs with the marketplace model.

In total, an asset-light cost approach is followed with small CapEx, mainly due to the shifting of computing power and storage to OpEx. Additionally, a classic “overprovision scheme” is assumed for peak load performance in serving the index, where maximal capacity led the decision on the required capacity of serving.

All CapEx and OpEx costs over time can be seen in Figure 19, with a large increase rate of costs for earlier times since launch and almost constant costs afterwards.

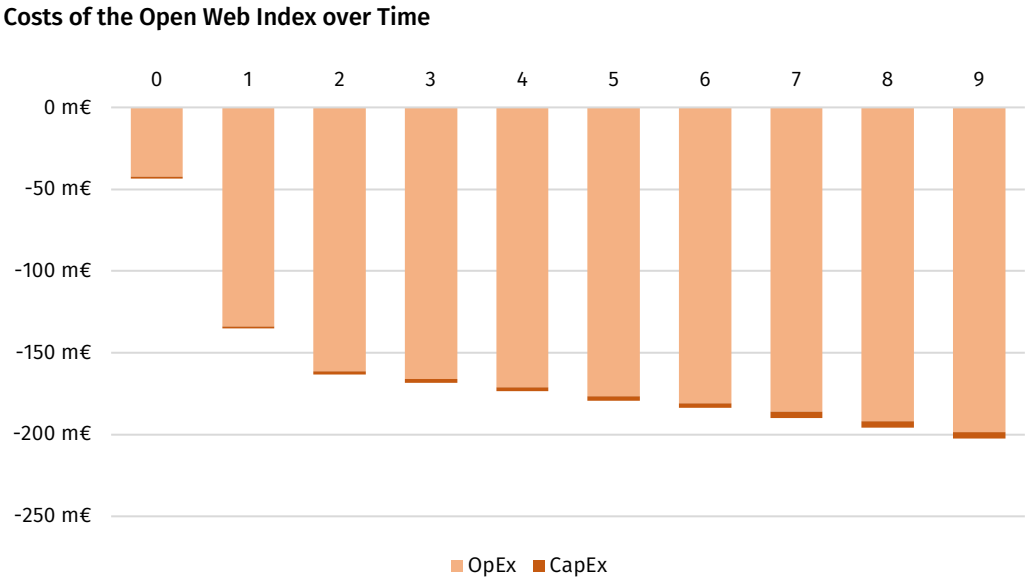

Figure 19
Costs of the OWI: capital expenditures (CapEx) and operating expenditures (OpEx) over time

Total impact and discussion

For the impact and costs, discounting of future monetary value was considered in the form of a discounted-cashflow calculation. However, quantities do not change significantly (with e.g. the net benefits differing by approximately 3,8 % summed over 10 years), which is the reason why such effects are not explicitly reviewed in-depth in this report (but in our analysis).

By combining economic and societal benefits with the calculated costs, insights about net benefits (i.e. cashflow) and return-on-investment (ROI) become possible. The cashflow denotes here the movement of money into and out of the investment over a period of time, which helps to evaluate the financial "health" and potential for ROI.

But first, let us focus on the benefits: The societal impact benefits are identified as the most substantial portion of the total estimated benefits from the Open Web Search Initiative. These benefits are observed to grow in tandem with the project's expansion and the increasing number of its users. Notably, areas like digital sovereignty, as well as security and health, stand out as key sectors with significant impact, aligning with the projected expectations. Figure 20 shows the total impact, as the sum from economic and societal impact, going up to almost 1.7 billion € in year 9 since launch.

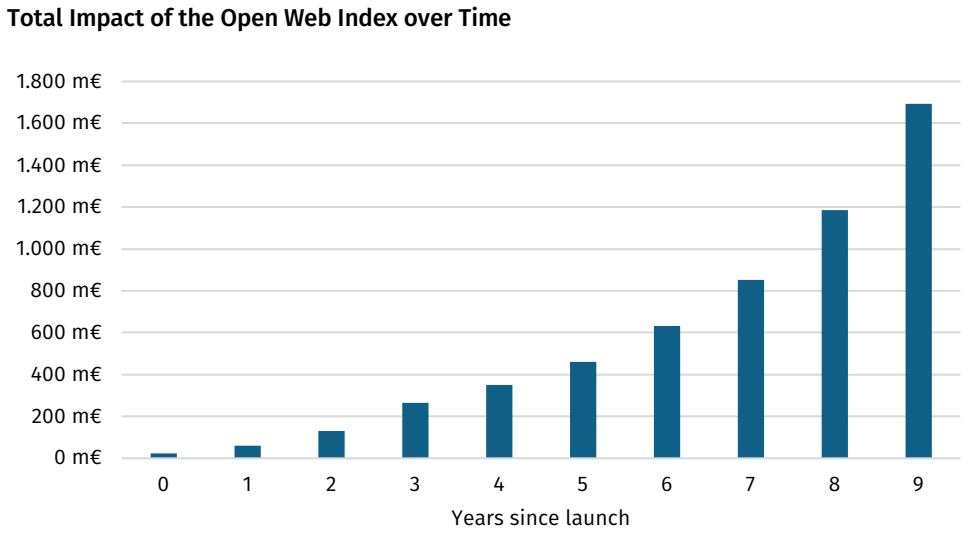

Figure 20
Total Impact of the Open Web Index over time with contributions from economic and societal impact In million Euros

Looking at the relative shares, a temporary decrease in economic benefits is noted during years 2-4, reflecting the complex interactions between economic and societal impacts as the project goes through its initial ramp-up phase, see Figure 21

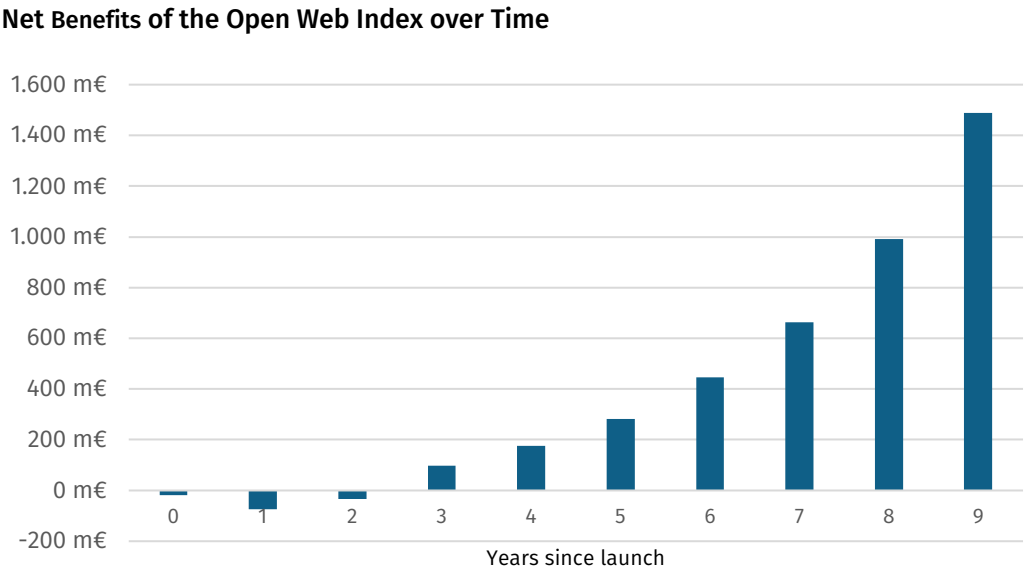

Figure 22
Net benefits (cashflow) of the Open Web Index in million Euros over time

In total, the OWI is netting a cumulated 4 - 4.5 billion € profit over 10 years' time projection horizon, also evident in the net cashflow of the Open Web Index in Figure 22 and distribution of relative share in Figure 23. During the early and intermediate time period, a shortfall of maximal ~150 million € exists, with positive net earnings expected from year 3. The return on investment is anticipated by year 4[17].

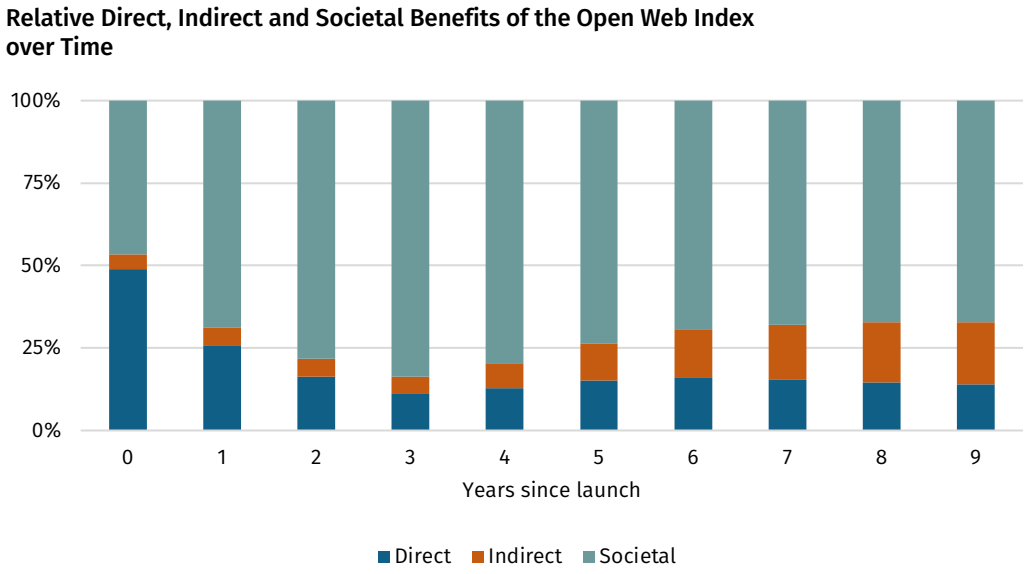

Figure 21
Share of economic vs. societal benefits over time

[17] Only for combined economic and societal impact; either of them alone is not sufficient to reach ROI, as we will see later on.

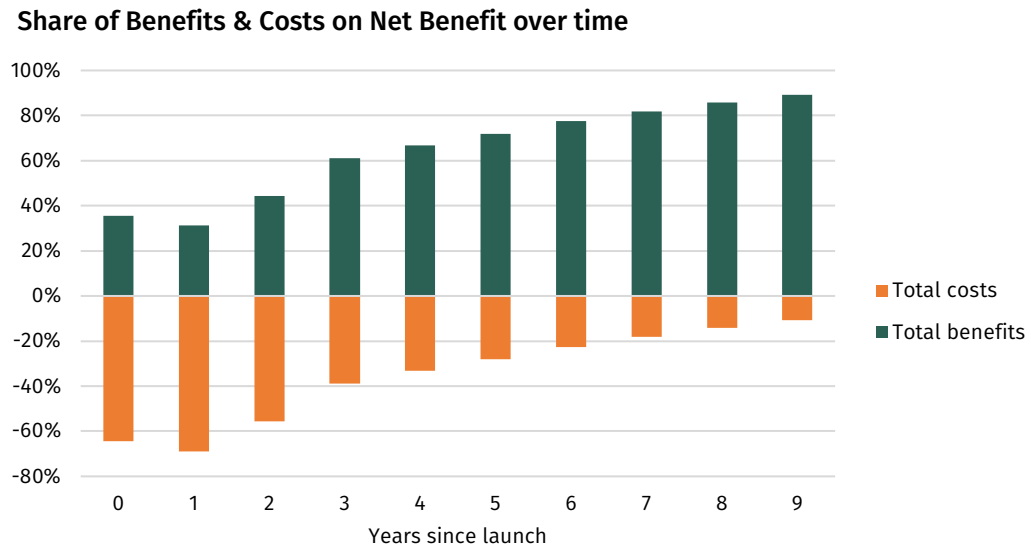

Figure 23
Share of benefits and costs on net benefits

In addition, to evaluate the influence of our model's assumptions, we conducted a scenario analysis with a best-, realistic- and worst-case setup. Within the analysis, several combinations of parameters in our model were tested with regards to the sensitivity on essential quantities, like benefits, costs, ROI, etc.

Selected key categories were for the

- **economic impact**: "Customers and users" with "search engine users", the "OWI business model", "Industry maturity", and "Pricing points"

- **societal impact:** "digital sovereignty", "environmental", "social", "cultural", "community/collaboration", "security & health", and "others/extrapolation".

Subsequently, parameters were scaled by scale factors (×0.5, ×0.75, ×1.25, ×1.5), our calculations were re-performed with these and change in central outcomes was evaluated.

If we restrict ourselves in such an analysis to the benefits and the costs as the sole scaled parameters[18], insights about cashflows and return-on-investment can be investigated. By doing so, even for an increase of costs by +50% and a halving of expected benefits, still a cumulated net-positive benefit is achievable over 10 years. This is driven by the combined interplay of economic and societal benefits; only direct economic benefits would not be sufficient for this case to realise net-positivity with a (cumulated) gap of almost -1,8 billion €. In the most attractive scenario, with halved costs and by +50% increased benefits, an increase of factor 1.8 in net benefits is observed. Similar results are found in our extended analysis with scaling of additional parameters.

These outcomes are consistent across various scenarios, indicating that the project's financial success is likely within the first decade, regardless of e.g. the monetisation strategy (freemium, subscription or pay-per-use) employed.

[18] Even, if being fully aware that this is an oversimplified model of our performed calculations, and more sophisticated sensitivity analyses were conducted.

The overall market potential of the Open Web Index was estimated in our study, as shown above, and exhibits a promising outlook. However, our framework also allows to reverse the decision-making process and give answers on how business success needs to look like to be at least cost-neutral, i.e. financing the required costs to build an OWI by concerted measures and acquire a minimum number of paying customers over e.g. 10 years.

With an average assumed revenue per customer of ~30k € per month 19 for the first year, and at year 9 an average of below ~5,000 € per month, break-even is still possible within 10 years. Although smaller marketing spending than required for customer acquisition20 in years 3 - 6 is prevalent in this calculation, positivity of the business case is feasible. This underscores the robustness of the chosen lean cost-approach, and the order of magnitude of the benefits arising from the Open Web Index.

[19] Note that this ratio is a (time-dependent) mixture between small, medium and large customers, and may be lower, if the number of customers is higher. Initially, higher values were assumed due to early adopters with higher payment acceptance.

[20] In detail, a higher number of paying customers is required for cost neutrality than possible through marketing-led customer growth, since the required (averaged) customer acquisition costs are higher than the available marketing budget. In our market potential assessment, this mismatch of budget was addressed by assuming availability of funding, which can be invested in marketing and pays-off at later times in the holistic evaluation of the OWI.

3 Market validation of potential

Even though the market potential assessment is quite robust, the developed framework has some built-in uncertainty due to the "arbitrariness" of some of the chosen model parameters.

To minimise uncertainty and therefore lower the risk of (in-)validity of our results, various measures were taken to narrow down the value of the model parameters to "realistic" values. This is done by incorporating a combined subject matter experts-, benchmark- and market-perspective into our approach:

- **Subject matter** experts' perspective: integration of several subject matter experts into our study and majority vote from their views on key assumptions and parameters for "best" values.

- **Benchmark perspective:** use of existing benchmarks and facts, like from other similar business models to e.g. gauge the assumed adoption rates, or from public authorities, such as the Federal Statistical Office(s) about e.g. potential reach.

- **Market perspective:** conduction of interviews with potential users and customers to validate critical assumptions and hypotheses, like payment acceptance or price points.

The first was done within a selected group, consisting of members and university partners of OpenWebSearch.eu, the Open Search Foundation e. V., Mücke Roth & Company. Here, the expert domain knowledge was integrated on a consensus base into our market potential assessment through a majority vote on the parameters. In detail, this was accomplished for the economic and as well for the societal impact separately, including varying participants.

Secondly, all the market potential assessment was conducted from the beginning, having a "benchmark-driven design" in mind (where possible). This includes, for example, referencing each value and assumption with sources and studies, or using analogies and own calculations to deduce certain values, so that full transparency in links to market and benchmark data is achieved.

Thirdly, qualitative interviews were conducted with potential customers. The aim of these interviews was to integrate qualitative insights and feedback for the OWI from a diverse mix of potential customers and users, see Table 4 for a (pseudonymised) overview. The interviewees were selected in close consultation with OpenWebSearch.eu and were approached on a cold-call basis or through existing contacts. Interview preparation included filtering and selecting critical assumptions and translating them into (measurable) hypotheses.

Interview no.	Interviewee position	Industry
1	Head of Digital Transformation	Retail & Wholesale
2	Co-Founder	AI infrastructure provider
3	Head of AI	Financial and insurance services
4	COO	Search engine
5	Head of Communication	Car manufacturer
6	Development	Car manufacturer
7	Chief Procurement and Product Officer	Retail
8	Head of Data Engineering	Retail
9	Senior Analytics Manager	Telco
10	Chief Technology Officer	Advertisement provider
11	Business Development Manager	AI service provider

Table 4 *Overview of interviews (pseudonymised)*

In these interviews, assumptions and hypotheses were tested and validated. New insights and aggregated information were integrated into the above market potential assessment, e.g. through inputs about the price points or adjustment of adoption rates for certain customer segments. The interview conduction was inspired by lean-startup methodology (Ries, 2011) and based on the interviewees' status quo (in terms of search/data analytics/etc.), budget considerations or by becoming aware of new innovative means through OpenWebSearch.eu or more specific through the Open Web Index.

The majority viewed the European Open Web Index as a viable alternative to established gatekeepers, but dependent on the respective core business of the interviews (e.g. search engine vs. non-search engine) different importance and benefits were perceived from an Open Web Index. The remaining interviewees were indifferent against an Open Web Index or perceived no added value.

*For search engine*s, our interviews confirmed the high or even exclusive dependency on existing major search engine providers, but also our assumed price points for the OWI and the derived societal impacts from the sovereignty side. A clear need for holistic support – not just from an OWI, but complemented by end-to-end search engine capabilities – was expressed, which could underline the importance of value-added service add-ons from the OWI or within the Open Web Search ecosystem. In this vein, other value-added services such as a knowledge graph were also seen as interesting.

In general, the enrichment of search data with e.g. slotting signals or metadata information is seen as beneficial by respondents and could be a driver for sustainable pricing of the Open Web Index. Furthermore, unbiased results, as would be provided by an open web index, are of high importance.[21]. Selected interviewees did not see a high willingness to pay for the data marketplace, although such a system was considered important from an overall attractiveness perspective[22].

[21] Historically ownership was centralised with selected providers.
[22] Since our assumptions of marketplace potential is driven by the numbers of shared data, and not by proprietary or quality, this result is no contradiction but remains important to be evaluated in the future.

General Interest in a European Open Web Index – Number of Answers by the Interviewees

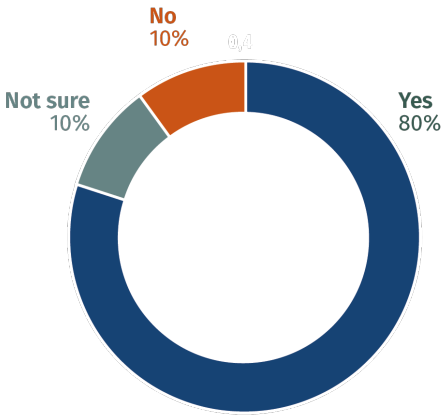

Figure 24
Results of the validation interviews with selected potential customers. Results of validation interviews with selected potential customers. General interest in an Open Web Index is shown as the number of interviewees.

From an LLMs and AI infrastructure providers' perspective, an open web index could benefit in GDPR compliant data-preparation and training, and the procurement of proprietary and/or unique data. Furthermore, a well-functioning search infrastructure and competitive landscape was viewed of economic and societal importance for Europe. Due to the current efforts and regulations, possible solution-fit was indicated for an OWI.

Especially knowledge graphs (in a Retrieval Augmented Generation context) were perceived as a benefit by value-added services; it was also noted by an interviewee that data is getting harder to procure for AI applications. Since AI may be an enabler technology for diverse services and business models, it was vocalised that an Open Web Index could be (from their estimations) used on a large scale over a variety of customer segments or size etc., which could mean that our take rates might be too pessimistic. Nonetheless, also from these exchanges, it was clear that B2B marketing is essential for a broad reach and sustained adoption of an Open Web Index.

From non-search engine and non-LLMs resp. non-AI providers, effectively enterprise customers, the Open Web Index was relatively unknown, but during the interviews, benefits were recognised for a diverse range of applications. One retailer perceived multi-modal search data as important, such as required for uploading a picture of a to-be-searched item and having relevant matches returned. Another use case was confirming greater independence from search engine providers with e-commerce shopping results being placed in a more independent way.

Additionally, an Open Web Index could be the foundation for new AI-led shopping experiences for e.g. better product recommendations based on the retailer's stock items. For the OWI price points, retail was estimated to be more on a conservative side with the majority subscribing to the free or small premium packages of the OWI. As a sidenote, B2C and B2B online advertisement was another use cases mentioned, but here also Google's de-factor monopole was deemed too powerful (in terms of benefits through reach, targetability, customer data, etc.) to be circumvented or be replaced by alternatives. For financial and insurance services, an OWI was an interesting possibility to be a valuable complementary data source to existing data, like helping to gauge risks through e.g. reports about rising infections in (near-) real time or about previously reported flooding areas.

One of the non-search engine resp. non-LLM/non-AI companies saw no added-value through an Open Web Index for their digital offerings. This might potentially be related to the outsourcing of AI-driven services to third parties, which are in turn responsible for

procuring suited training data for the delivered AI algorithms (which could potentially be coming from an OWI), or the focus on other topics not related to digital sovereignty (where in this constellation – anyhow – the risk would be on the third-party side), or existing certain relationships with established US tech giants.

In general, this could mean that the perceived benefits are better communicable for companies with a certain degree of digital maturity and a sense of digital sovereignty (highlighted e.g. by a multi-cloud strategy instead of relying on just one provider), which could be a key customer segment to focus on at launch. Summarizing, the interviews confirmed most parts of our assumptions or hypotheses. In detail, interviewees regarded an OWI as viable, and also saw effects modelled under the economic as well as under the societal impacts. Details are listed in Table 5 (with outcomes been already integrated in our market potential assessment after conducting the interviews).

Assumption	Consensus	Comments
The OWI is of general interest for the interview partners	All, except two interview partners fully agreed; one was indifferent against this statement and the other perceived no added-value.	–
Payment acceptance for the OWI	Full consent on general payment acceptance for data of an OWI	Also Freemium was discussed, but main focus was on general payment acceptance for premium package(s)
Revenue model	Consent for the freemium model, but also other models like pay-per-use would be perceived agreeable	
Price points	Largely agreement, but exact price-value model was not seen yet, so that estimation was difficult for selected enterprise partners	Added value still not 100% clear for enterprise customers, so that price points were not perceived in relation to added-value
Market dynamics	Agreement about rising relevance, but in detail no unique market development was projected. There was consensus about the general search engine landscape and data value generation	
The OWI extend (number of websites, number of domains, meta data, etc.)	Requirement that an OWI need to be comparable to other commercially available web indexes, like Bing's. Additional benefits, like e.g. slotting desirable	
Economic and non-economic impact	Full agreement, that besides direct monetary impact also other forms of impact can be leveraged by an OWI	

Table 5 *Interview results – Key outcomes*

4 Conclusion and Outlook

This study assesses the impact and market potential of the OWI and an OWI infrastructure, focusing on both economic and societal aspects as well as providing an understanding of benefits and costs. One key ingredient in achieving this, is the quantification of the benefits along different levers through fact-based, hypothesis-driven modelling, ensuring transparency and comprehensibility. Especially on the societal impact side, (monetary) quantification is non-obvious, like expressing the saving of human lives as a “hard” financial performance indicator, but analogies and estimations were developed to determine corresponding estimates.

Another important goal of this study is the cost-benefit analysis, which offers insights into the viability and overall value of the project by taking existing cost estimates and integrating the benefit side to an overall assessment.

Through this approach, the study provides a robust framework for evaluating the broader implications and potential of the OpenWebSearch.eu initiative, yielding the base for fact-base decision making and transparency for all share- and stakeholders.

This study has been conducted as a combined top-down and bottom-up approach, focusing on practical use cases to provide a comprehensive view. This dual approach allows for detailed insights from specific scenarios while ensuring an overall understanding of the broader implications of the project. By extrapolating from these use cases, the study aims to achieve a more holistic perspective, capturing both the micro and macro aspects of the impact of the European Open Web Index. Scenarios are included in the analysis to assess the range of outcomes under different hypotheses and assumptions.

The scope of this study encompasses a thorough market model and a dynamic cost model that aligns with the project's scale, reflecting its potential benefits. While focusing primarily on the EU area, the study acknowledges possible benefits extending beyond this region. It's important to note that this study is not a detailed business plan; it is based on certain assumptions that may change over time, such as market growth rates, pricing strategies, and the evolving nature of web search technology.

“The projected benefits are substantial, with around 4 to 4.5 billion € in accumulated net benefits. By the final year of the study's timeframe, it is estimated that the project will generate up to 1.5 billion € in net benefits annually.”

The study shows a return on investment for the Open Web Index by year 4, highlighting its potential. The projected benefits are substantial, with around 4 to 4.5 billion € in accumulated net benefits. By the final year of the study's timeframe, it is estimated that the project will generate up to 1.5 billion € in net benefits annually. These results encompass all study aspects – direct, indirect, and societal impacts – and include costs associated with scaling the project. The study separates the individual components in order to allow for different levels of analysis, such as understanding a need for public financing. This tends to be in line with (or lower than) other studies, such as those from the European Data Portal or Gaia-X, stating benefits of close to 100 billion € but at much higher investment costs. As such, this study is based on conservative assumptions and realistic growth and impact assessments.

Combining all costs and all benefits over a decade, 1 € invested into the future OWS.eu infrastructure is estimated to result in up to ~5,5€ of economic and societal benefit for Europe. In this regard, these results represent a lower bound for this project, such that it

can be expected, with a high level of certainty, to result in an overall positive return on investment. Details including made decisions should be evaluated in a separate business case. Depending on the future strategic direction of the Open Web Search initiative, the ability of the project to become cashflow-positive (and therefore be self-funded after some time) can be dedicated for further investment for expansion, or for returning the initial capital to the public and/or other shareholders.

The direct benefits of the Open Web Index alone are expected to become cash flow positive between years >10, although it is not projected that these cash flows will fully repay the initial investment within the first 10 years. The total direct benefits over this period are estimated to be in the range of €800 - 1,000 million. Despite this, the overall cost-benefit analysis (including societal and indirect economic impacts) remains positive, demonstrating the relevance of societal impacts in the Open Web Index.

"With the Open Web Index and Open Web Search and Analysis Infrastructure, stakeholders across various sectors can harness these tools for insightful analysis, operational efficiencies, and cost reductions."

In general, the benefits of the OpenWebSearch.eu initiative with a European Open Web Index are multifaceted, exceeding the basic dynamics of price and quantity, largely due to network- and scale-effects present in such an open search ecosystem. With the Open Web Index and Open Web Search and Analysis Infrastructure, stakeholders across various sectors can harness these tools for insightful analysis, operational efficiencies, and cost reductions. These capabilities foster the development of innovative opportunities, significantly benefiting the European community[23].

Based on the positive ROI and broad benefits from economic and societal perspective, an Open Web Index enables digital sovereignty and increased independence from digital gatekeepers with economic viability and feasibility. Thus, such an initiative is strongly favourable from a market potential view.

The study could be extended in different ways; starting from validating our results on an even broader base with more customers, to going in greater level of detail for e.g. introducing country-specific adoption rates in the existing framework, or to complement our chosen approach by specific in-detail models for e.g. the adoption for certain customer segments, which could be a complex function with various input and output streams and/or allow for a more "distribution-inspired" answer for the market potential (like possible in Bayesian modelling).

Due to the high market dynamics and potential disruptive trends for search engines, Open Web Search EU (or any other entity related to the Open Web Index) should regularly assess its business model and adjust it to changed market realities. This could for example entail the provided features, price points or the go-to-market approach, but always should focus on achieving the best customer centricity and a "test-and-learn" mentality. For this, it is recommended to have clear milestones to gauge the adoption of the business model of the Open Web Index at different times through e.g. lean start-up methodology and with customer centricity in focus.

In terms of direct monetisation, pricing strategies present a delicate balance. Adjusting prices can directly influence the trade-offs between immediate revenue & financing and broader usage. Lower prices may diminish short-term financial returns but can drive

[23] Affordable pricing can be seen as a potential lever to increase infrastructure adoption, thereby amplifying the initiative's economic and societal returns, but details need to be discussed on business case level.

increased usage and the development of new opportunities atop the infrastructure. This dynamic is particularly relevant for AI and IT infrastructures that, while scalable, often incur significant initial setup costs and require a certain scale to operate efficiently. A decision here may need to invoke aspects of how much governments or (public) bodies are willing to subsidise a European Open Web Index (as an infrastructure case) or to which degree self-sustainability of the Open Web Index is required for business viability (with a positive business case).

Different business models, such as the discussed Freemium, Subscription, and Pay-as-you-go (API access) models can be important to the success of the project, as they are key for the project's ability to monetise effectively and sustain its growth. The Freemium model is particularly notable for its potential to drive widespread adoption, laying the groundwork for significant indirect benefits. The Subscription model offers steady revenue, while Pay-as-you-go aligns costs directly with user consumption, offering flexibility. However, from our estimation, most costs are of a fixed nature and scale primarily with the size of the index and the frequency of updating it. This is typical for digital businesses and infrastructure, in that the marginal cost of an additional user is extremely small. The choice among these models will ultimately shape the project's financial foundation and its capacity to deliver on both its economic and societal benefits.

"By encouraging a broad range of stakeholders – from government entities to private sectors – to integrate and utilise this open web search framework, its impact can be multiplied across various facets of society and industry."

The outlook remains promising yet depending upon several factors. Crucially, the widespread adoption of this platform is pivotal. By encouraging a broad range of stakeholders – from government entities to private sectors – to integrate and utilise this open web search framework, its impact can be multiplied across various facets of society and industry. This widespread adoption will also be a proof for the Open Web Index's relevance and trust, ensuring that it becomes a foundational element in Europe's digital infrastructure. Regulatory frameworks will inevitably shape the trajectory of the OpenWebSearch infrastructure. As digital sovereignty becomes more and more a paramount concern, regulations that bolster the security and privacy of data while promoting open and fair digital ecosystems will enhance the Open Web Index's standing and integration into the digital market.

Continued innovation and improvement will be essential to maintain Open Web Index's competitiveness and relevance. As technology and market dynamics evolve, so too must a European Open Web Index adapt to new challenges and opportunities. This involves ongoing development to enhance its capabilities, scalability, and efficiency. These elements will collectively determine the future landscape of the European Open Web Index. From a B2C perspective, the established players, like Google, will still capture relevant value creation in web search and thus it may be beneficial to have a clear view on the relevant target segments and e.g. prepare an Open Web Index benefit argumentation aimed at relevant B2B segments to enable a clear differentiation. Direct competition with established players may not be winnable for OWS.eu, but complementary positions could be achieved in mutual ways[24].

Especially, maintaining a vivid and open web search ecosystem can contribute to the future success of the Open Web Index. For this, OpenWebSearch.eu should position itself as an orchestrator, centralizing collaboration and fostering synergies among diverse stakeholders to

[24] This will, of course, depend on the relevance of OWS and the reach of created de-facto standards in the market.

drive innovation and create value within the ecosystem. For example, this could entail conducting events for certain industries, or providing (basic) support in exploring the potential through the Open Web Index in form of use cases[25]. Furthermore, ecosystem governance – as a central part in maintaining qualitative interactions within the ecosystem – should be a major focus for OpenWebSearch.eu and the ecosystem participants, so that no degradation of e.g. data quality happens over time, and frequent interaction is ensured in the search ecosystem.

Additionally, establishing standards or norms with regard to the Open Web Index or the search ecosystem could be a further benefit for industry players; especially with the upcoming European AI Act (Artificial Intelligence Act, 2024) any automatism to lower bureaucracy around certification, development and launch of AI-based products could help to foster innovation and make times-to-market faster. For example, if OpenWebSearch.eu could provide some pre-certification so that the use of OWI data could significantly reduce bureaucracy, this would be of great benefit and better (competitive) cost structures for customers and users of the Open Web Index. However, this should be subject to further evaluation and may involve a variety of different stakeholders.

"Both, from search engine but also from non-search engine business perspective, promising added-value can be addressed through the Open Web Index – also, from a societal viewpoint an Open Web Index helps to strengthen Europe and creates added benefits."

The findings of this study clearly show the potential of the Open Web Index for Europe. While being conservative in our estimations, significant benefits with positive ROI are found. Both, from search engine but also from non-search engine business perspective, promising added-value can be addressed through the Open Web Index – also, from a societal viewpoint the Open Web Index helps to strengthen Europe and creates added benefits. Since our study depends on the importance of being aware of network- and scaling-effects, it is crucial that these need to be thoroughly integrated into the Open Web Index and supported by dedicated efforts like B2B marketing.

[25] E.g. based on the use cases presented within this study.

Appendix

Working definitions and explanations

Definition	Explanation
Economic benefit – Direct	Benefits/ impact resulting from the core business and value-added services. These are directly monetizable, i.e. money flows to the OWI. Important for cash flow analysis and determines the need, or lack thereof, for subsidies to sustain the project.
Economic benefit – Indirect	Benefits/ impact from improved efficiency in the economy and a stronger position of the EU in the Tech/ IT/ Data sectors. Impact benefits stakeholders other than the OWI. Gives an indication of the economic impact that the EU would benefit from due to the OWI. Justifies potential public funds and subsidies for the project.
Societal benefit	Benefits/ Impact of non-economic nature, from six different sectors and which are quantified within this study. Gives an indication of the societal impact that the EU would benefit from due to the OWI. Justifies potential public funds and subsidies for the project.
Customers	Business customers (B2B), directly interacting with the OWI to use offered products and services and/ or build products on top of Open Web Index. Directly paying money to OWS. For example, a car manufacturer using OWI data to enrich their integrated navigation/ points of interest search.
Users	Business or individuals using products and services built upon the OWI. Follows a B2B2X logic: The OWI provides data to a company, which in turn creates a product or service that is sold to businesses or individual (retail) users.
Freemium	Business model, in which up to a certain level of usage of the index is offered for free. Higher usage or full access requires payment.
Subscription	Business model, in which any access is dependent upon regular payment.
Pay as you go	Business model, in which the customer accesses the index on an individual request basis, for example through an API.
CapEx	Capital expenditures (CapEx), Involve long-term investments in assets for business growth.
OpEx	Operating expenditures (OpEx), Cover day-to-day costs essential for running a business, excluding long-term asset investments.
B2B Customers	Businesses purchasing goods or services for use in their operations. Examples of B2B customers of the OWI could be Mercedes-Benz, Bosch, Ecosia, etc.
Index & Search customers	B2B customers buying access (through a subscription, freemium, download) to the index and building an offering based on OWI data.
B2B2X Users	End-users in a Business-to-Consumer market. Not direct paying customers of the original product / service (here: OWS) but secondary usage of B2C offerings through B2B paying customers' offerings.
Macro Impact	An economic event, occurrence, impact that has a broad effect on the general economy / economic impact of a project.

Industry Maturity	Current stage of a company in the industry life cycle. A mature industry, as an example, is an industry that has passed the introduction stage, growth stage, and shake out stage, but has not yet reached the declining stage.
Take Rate	Percentage that is taken from a previously defined or modelled input number to calculate a new value. Usually based on rational and research.
Market Penetration	A measure of how much a product or service is being used by customers compared to the total estimated market for that product.
(Data) Marketplace	Also known as a data exchange, is an online transactional location or store that facilitates the buying, selling, or sharing of data.

Table 6 *Qualitative assumptions for assessing the market potential*

Qualitative assumptions for assessing the market potential

Assumption	Description
Inflation Rate	No inflation is assumed for simplicity purposes
Segmentation of industries	Segmentation of industries with greatest potential (6 largest EU27 industries)
No country focus	No specific country focus, analysis is conducted cross-country for EU27
Legal disputes not considered	Legal enforceability is presumed for entire analysis
EU27 companies' data share	European corporations are more willing to share data with a European provider
Focus on OWS-Index	Market potential does not exclusively revolve around search use cases
Indirect and direct value added	Value addition through the Open Web Index can be generated directly and indirectly
Marketing as key lever	Marketing budget is considered essential for gaining enough reach and traction

Table *7 Qualitative assumptions for assessing the market potential*

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This study was carried out as part of the EU project OpenWebSearch.EU as a third-party partner project. Mücke Roth & Company (MRC) was commissioned following a call for tenders. The report was produced in close co-operation between Mücke Roth & Company (MRC) and the Open Search Foundation e. V.

OpenWebSearch.EU is the first EU-funded project, which aims to get tomorrow's web search up and running. 14 renowned European research centres kicked-off the project in September 2022. Over three years, the researchers develop the core of a European Open Web Index (OWI). They aim to set the foundation for an open and extensible European Open Web Search and Analysis Infrastructure (OWSAI), based on Europe's values, legislation and standards. The project receives funding of 8,5 million Euros from the European Union's Horizon research and innovation programme under grant agreement no. 101070014.
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The Open Search Foundation e. V. (osf) is a European movement of people and organisations that work together to create the foundation for independent, free and self-determined access to information on the Internet. In cooperation with research institutions, computer centres and other partners, it is committed to a web search that benefits everyone. The osf is consortium partner of the EU project OpenWebSearch.eu.
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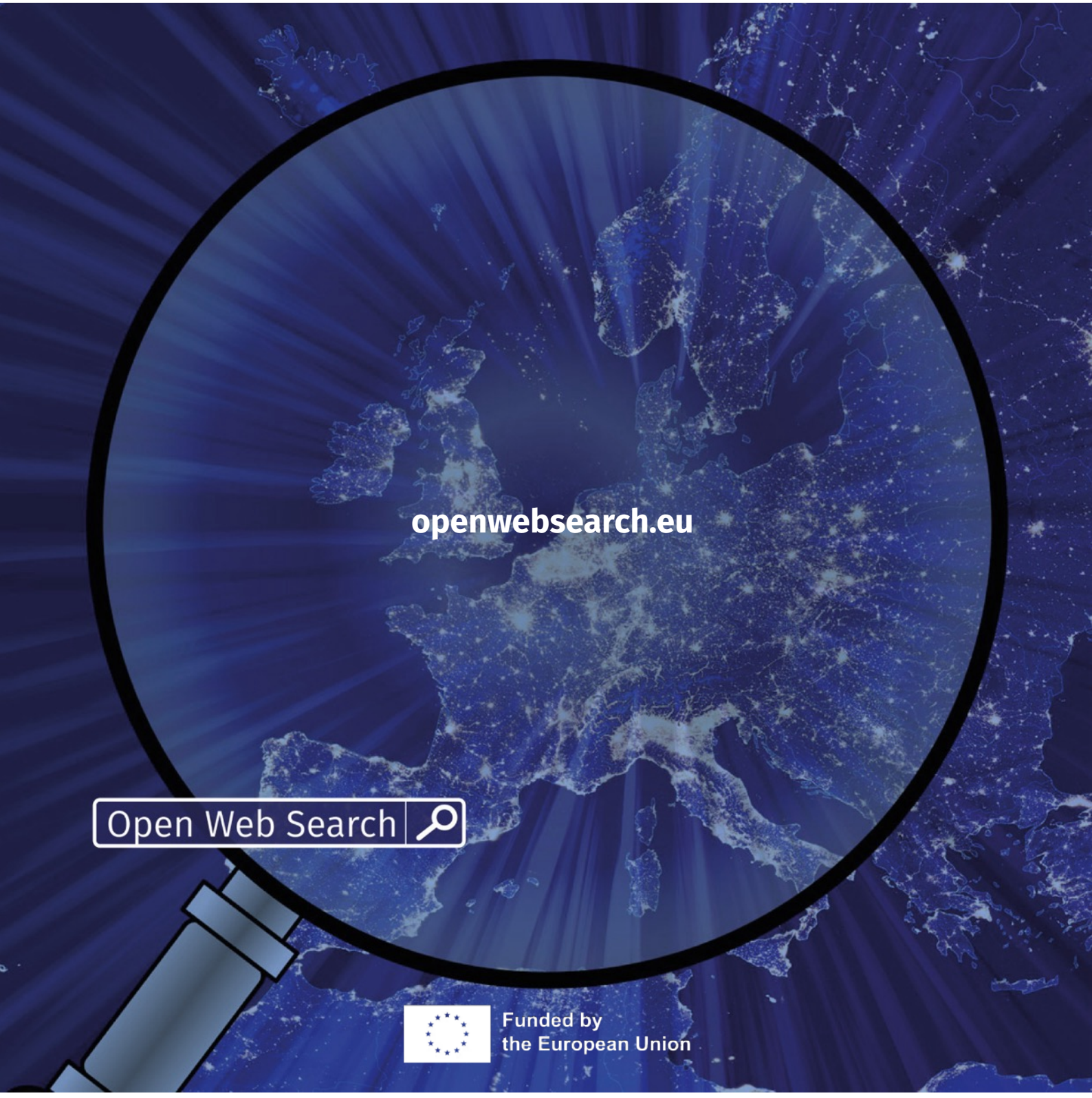

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