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ANKITA MEHROTRA

MASTER'S THESIS

Vendor-led Open Source Consortia Motivation and Success Factors

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Abstract

In recent times vendor-led open source consortia are one of the leading and fast growing topics and it's a favoured and widely accepted concept with many organisations. The purpose of this thesis is to get further insights about the motivation and the reasons responsible behind companies joining consortium. Additionally, the challenges faced while joining and being a part of a consortium are also being discussed. The qualitative survey approach has been used during the study and the data sources are interviews. Using a qualitative survey research approach, this paper provides first-hand information from the people involved in a variety of roles in these organisations.

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1. Introduction

1.1 Thesis Goals

In simple terms, a vendor company is defined as a company that sells goods or services. In the supply chain it provides the services and goods to the consumers and is in turn paid for it. It is also commonly known as a supplier.

Schwab (2020) defines a vendor-led open source (now referred to as OS) consortium as “a synthetically created consortium of companies and also that Vendor-led foundations have proved popular in industries made up of companies developing software, where OSS can be used as a base for the company’s commercial offerings”.

There are some aspects related to vendor-led open source consortia which have been discussed in literature. Specifically, these are the various steps related to the establishment of the vendor-led OS consortia, its core properties and other important functions. However, there seems to be a gap in the literature about the motivations, problems and solutions which lead to success in this type of collaboration.

The focus of this thesis are these factors. The research questions are:

- RQ1: What are the motivations to join a vendor-led OS consortia?
- RQ2: What are the factors responsible for organisation's success in vendor-led OS consortia?
- RQ3: What are the problems encountered and solutions applied in vendor-led OS consortia?

To address these questions, I follow a qualitative survey methodology (Janson, 2010).

The structure of this thesis presented is as follows: Literature review is presented in section 2. Section 3 shows the applied research design. Data collection and research results are being presented in section 4 and 5, respectively. Section 6 discusses the results. Limitations have been described in section 7 and section 8 concludes the thesis.

2. Literature review

2.1. Vendor-led Open Source Consortia

In this section, the literature about vendor-led OS consortia is categorised into three sections: motivation (reasons to establish), establishing steps, and ecosystem.

2.1.1. Motivations

Companies have different motives to participate in vendor-led OS consortia. A motivation for companies to join vendor-led OS consortia is lowering development and operational costs (Schwab et al., 2020; Skerrett, 2011). Another is data and experience gathering from the collaboration. Companies have specific expertise in different areas. When they collaborate, all parties can benefit since they can expand their knowledge base (Schwab et al., 2020; Zhang et al., 2020). Lack of any resource could be a major setback for any organisation but being in a consortium helps them to get this missing resource (Schaarschmidt, 2011). In a community, the resources are shared, and this brings down the development costs and other related costs incurred during the development of any software. By collaborative investment, companies can increase their profits and reduce their operational costs. These savings could then be utilised at other places by the organisation (Schwab et al., 2020; Skerrett, 2011).

Netta et al. (2008) highlights the usability and UI design aspects. When open sourcing software, companies need to decide on the components which will be open sourced and which not. But there are certain parts which may remain closed. Usability and user interface are such components. These are the differentiating factors for any organisation while competing with other industries of its domain. Proper utilisation of these could provide a huge competitive advantage to the organisations. Because this gives them the freedom to hide certain information while being a part of any vendor-led OS consortia. This happens in a way where they share and use the services and technologies from the consortia but on the other hand can customise the aspects related to usability and user interface based on their own standards and ways (Netta et al., 2008).

A further motivation for joining a vendor-led OS consortium is cost savings. They can save on cost as it provides the option of getting access to a wide range of talent available worldwide without paying a hefty amount for that. This enables the recruitment of talented developers to get maximum talent available (Skerrett, 2011). Public sector organisations are quite similar and so is their software usage, sharing of open-source software enables cut down on cost (Kääriäinen, 2012).

Achieving business strategies is another motive. In such a consortium, there is the availability of various resources of different levels which assist the organisations in taking a step further towards achieving their business strategies. These resources include human resources like developers, various technological equipment and all other entities involved and required during the lifecycle of a project. Involvement of multiple companies stimulates

the probability of creating products with advanced technologies and helps companies take a step further towards accomplishing their business goals (Skerrett, 2011; Zhang et al., 2020).

Companies vary with respect to their objectives. Some might form an alliance and come together to provide a better version of existing services but some might have a completely different use case and are just making use of the technologies available (Skerrett, 2011; Zhang et al., 2020).

Another motive is accessing a wider addressable market. With increased access to various latest technologies and processes, exposure to a wider range of markets is possible (Skerrett, 2011).

Table 1 presents the motivations for joining into vendor-led OS consortia explained in literature.

Table 1. Literature analysis of motivations for joining into vendor-led OS consortia

	Schwab et al., 2020	Aslett, 2010	Skerrett, 2011	Schaarschmidt, 2011	Riehle, 2010	Kääriäinen, 2012	Zhang et al., 2020	Ivari, 2008	Joo, 2005
Large number of skilled resources	X				X		X		
Use of shared resources	X			X			X		
Risk sharing					X				
Cost saving	X	X				X			
Become dominant leader in the market									X
Gain access to wider addressable markets			X				X		
Customisation of usability and user interface using shared resources								X	

2.1.2. Establishing Vendor-led OS Consortia

This section summarises the three steps related to the foundation of the vendor-led OS consortia. Its core properties and other important functions are defined.

1) Defining requirements: The necessary preconditions for the consortium are mostly related to the software development process. Software vendors form an important part of the ecosystem. It is essential that all the member organisations are well informed about software development and other competencies required like project management skills (Schwab et al., 2020; Yamakami, 2010).

2) Defining collaboration structure: Collaboration among the members of the community has been defined as one of the key features or basis of the consortia. It is important that there is a well-defined structure followed by all the companies who are a part of consortia. This enables and encourages a more transparent and systematic approach. A certain structure or framework needs to be defined when companies collaborate. In the vendor-led they do so use the collaborative innovative model (Yamakami, 2010).

3) Deciding about revenue generating model: It is crucial for the companies to identify the services and products targeted for a particular group, only then they will be able to generate maximum revenues from it. Some customers might play a dual role of product users and project contributors. Some of them pay membership fees in order to attain some additional rights and privileges over the development process and this is how revenue is generated in consortia (Aslett, 2010). The number of maturing business models allows OSS companies to make a profit even when their product is distributed for free which in turn accelerates the whole process and dynamics of value creation. Based on the numerous interviews conducted the three factors consistently important in defining a vendor's adoption of a given business model. These are software licence choice, management of developer communities, and the unique features of the markets and product categories in which the vendor participates (Perr, 2010).

2.1.3. Ecosystem of Vendor-led OS Consortia

What kind of members are there? Are they only organisations, or do they accept individual developers? Do they have a community?

2.1.3.1. Core properties and dimensions of vendor-led open source consortia

For vendors (companies) to work together, management and support mechanisms are of utmost importance. Overall management of not only a single project but the whole community is the task of the community manager. It includes the organisational, technical and all types of management. The best possible utilisation of the resources is also of significant value as it will impact the overall cost. It is also management's duty to identify the problems and address the queries of the community (Schaarschmidt et al., 2011; Shaikh, Cornford, 2009).

A community functions well with the support of its members. Be it small or large, every contribution counts. Hence, they can assist in each possible way including the documentation work and creating training materials or guides.
The various aspects which are required to be managed in any consortium form its dimensions. They are related to the organisational issues, the compatibility and conformance among all participating units and the other software related factors. Organisational dimension deals with how things will be managed in between all the communities involved in consortium. Harmonisation talks about transparency amongst all in discussing project plans and dealing with concerns and queries. Software development process mostly includes the technicality, licensing and other details about the whole process.
The ecosystem comprises all these factors. In order to encourage more and more companies to be a part of consortia it is essential that there is no single dominance so that positive participation increases (Schwab et al., 2020; Yamakami, 2010).

2.1.3.2. Actors in a vendor-led OS consortium ecosystem

Software vendors, individual developers, consultants, adopters and users are the main actors in a vendor-led OS consortium.

- **Vendors** are the companies which either come together to form a consortium or join an existing foundation and become a part of a community (Skerrett, 2011).
- **Software suppliers and contributors** (also referred to as vendors) are the companies or individuals who work with the aim of continuous development and enhancement of the technologies and techniques involved. One of their primary goals is to reduce the overall development costs. This group is also the most varied among other roles and it is crucial for the success of the project (Schwab et al., 2020; Skerrett, 2011).
- **Consultants** are developers or vendor companies whose main motive is to sell the product (in this case software). Additionally, they are also the researchers who want to benefit from this association of companies and make it a learning experience for them. Doing so will assist these researchers in making it available to a larger audience in future and make them provide the opportunity to serve their users better (Schwab et al., 2020; Yamakami, 2010).
- **Adopters** are the organisations using the offered open source software for creating new products or using the code in their existing products. This implies that the technologies available could either be used for the existing applications for further improvisations or new services or products could be created using the same (Skerrett, 2011; Nelson, 2007).
- **Users** could be classified either as general users or business partners. General users use the project for their internal needs and to increase productivity. The business partner category comes with a membership fee where they enjoy certain privileges and rights over the development process. They differentiate from adopters in a way that their main motive is to use it for their internal purpose, it could either for an individual or organisation. However, adopters work towards using this as a platform to either create something new using all the technologies available or used in the existing project (Skerrett,2011).

3. Research Design

3.1. Methodology

Qualitative Survey
A qualitative survey (Janson,2010) is one which collects data and analyses data to get insights and findings about a topic. The data in this case is not numeric. The focus of this methodology is to use people's opinions, views, thoughts about any subject via interviews or surveys.

A qualitative survey is a method that focuses on building theories based on experiences and views of others. As a part of my thesis I followed qualitative survey methodology, and for data collection I conducted interviews.

Qualitative surveys are classified as open and pre-structured. I have used the pre-structured method, which is descriptive and wherein parameters and topics of the interview are predefined (Janson,2010). I created an interview protocol which contains questions to be asked to the interviewees. Interview protocol is attached in the Appendix.

The research questions to be answered are:
RQ1: What are the motivations to join a vendor-led OS consortia?
RQ2: What are the factors responsible for organisation's success in vendor-led OS consortia?
RQ3: What are the problems encountered and solutions applied in vendor-led OS consortia?

3.2 Sampling

In this section I explain the case selection strategy for this thesis and background information about the selected cases.

3.2.1. Sampling Strategy

As the first step of data collection, I listed samples of vendor-led OS consortia by performing a manual internet search. I looked at the projects on Linux Foundation, Eclipse Foundation and projects explained in the literature. In alignment with the research questions, I focused on choosing those which cover all the key elements of my thesis.
As the next step, I sent interview requests to projects mailing lists, and directly to the project members' email addresses and LinkedIn mailboxes.
I contacted 7 projects and 10 people. I received answers from four members of LF Edge Foundation and one member of the OpenStack Foundation. I performed interviews with five members of these two vendor-led OS consortia.

3.2.2 Background of LF Edge and OpenStack

LF Edge
LF Edge is an umbrella foundation founded in the year 2019 under the Linux foundation. It´s main task is to create a common framework for hardware and software standards and best practices critical to sustaining current and future generations of IoT and edge devices. Its driving force is edge computing, and it promotes innovation and collaboration across various industries (LF Edge, 2020).
LF Edge foundation, also referred to as the Directed Fund, operates under the guidance of the governing board and Linux foundation. The Directed Fund comprises premium, general, and associate members. The premium members get the extra advantage of being in the role of chairperson in committees. All members can participate in general meetings, events and initiatives. The governing board comprises various committees who are answerable to the board. LF Edge members are also part of these committees. The governing board is responsible for the overall management of the Directed Fund. Outreach committee, legal committee, budget committee and technical advisory council are other departments responsible with their own tasks and responsibilities (LF Edge, 2020)

OpenStack
Founded in 2012 under the openinfra foundation, OpenStack is the most widely deployed open source software in the world. It helps the organisations spread over various sectors to perform their workloads and largely impacts their businesses.
OpenStack is based on the concept of open design and development process (OpenStack, 2012).
The governance of the OpenStack is defined in the Bylaws. However, each Open Infrastructure Project is separately governed by the rules set up by board of directors. The foundation has 3 categories of members: Individual, gold and platinum. The rights of these members are defined in their individual policies. The board of directors have the authority to create a new class of members, but these will not be having same rights and power as the ones from the already defined categories (OpenInfra,2012).

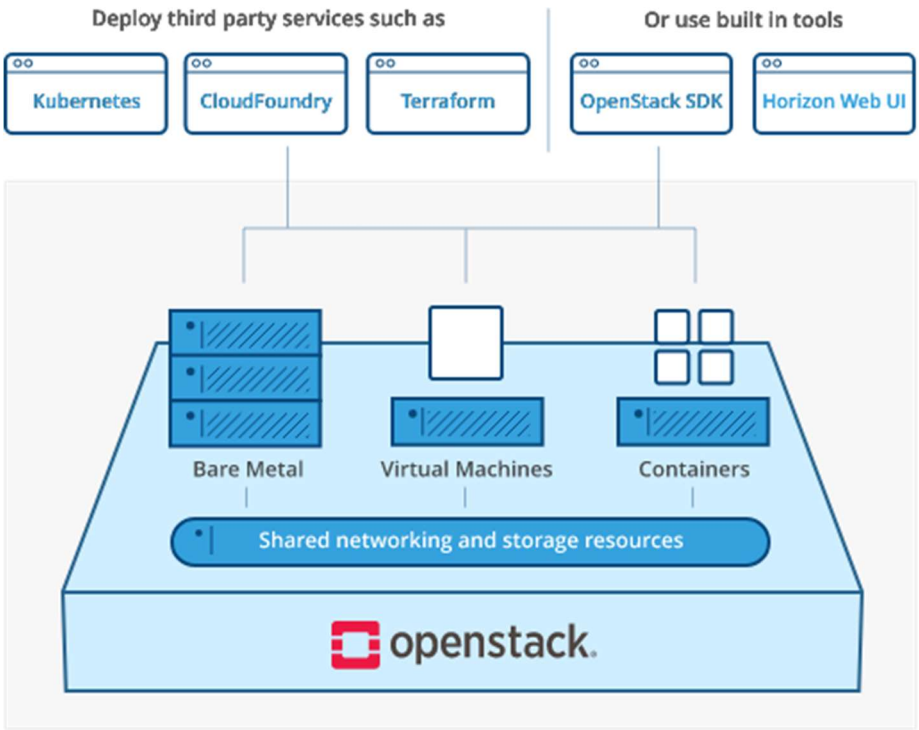

Figure 1. openStack Environment (Source: https://www.openstack.org/)

4. Data analysis

This section contains the details of the data collection process and data analysis.

4.1 Data Collection

Data collection method of this qualitative survey was conducting interviews.
Interviews were performed between 17th January 2023 and 3rd February 2023. They were conducted online, and the duration of each interview was between 45-60 minutes.
In total, five semi-structured interviews were conducted and all of them were performed in English.
In order to be better prepared for the interview, a basic prerequisite research was done using the websites of the corresponding Interviewee. They were useful for gaining general understanding about each case.
Interview protocol was prepared before conducting the interviews which included the questions to be asked for. After each interview, interview scripts were transcribed and sent to the corresponding person for review.

The goal of the interviews was to get first-hand information about the experiences of people involved in different roles and responsibilities in various organisations with the primary focus on motivation and success factors of the vendor-led open source consortium and the challenges faced while being associated with any consortium.

Table 2 presents the basic information about the interview partners. The identifiers of each interviewee are presented in brackets in the Interview Partner column. These identifiers are used in the results section of the thesis to present the sources of the results.

Table 2. Information about Interviewees

Interview Partner (Identifier)	**Organisation Consortium**	**Tenure in open source field**	**Roles and responsibilities**
Interviewee 1 (I1) 17.01.2023	OpenStack (Openinfra Foundation)	~7 years	Community Manager: OpenStack
Interviewee 2 (I2) 27.01.2023	LF edge (Linux Foundation)	~6 years	Executive director: LF edge Head: Networking edge iOt projects
Interviewee 3 (I3) 31.01.2023	IBM, LF edge (since 2019) (Linux foundation, Eclipse foundation (partially))	~7 years	Chair: Technical advisory council Chair: Documentation working group IBM & LF Edge
Interviewee 4 (I4) 01.02.2023	Aveva, OSI Soft (LF edge, LF energy Linux foundation)	~4 years	Senior technical program manager: Aveva Vice-Chair: Technical advisory council
Interviewee 5 (I5) 03.02.2023	IBM (Linux foundation)		VP Open Technology & Chief Developer Advocate IBM Chair: Cloud native computing foundation

4.2 Data Analysis

Using the guidelines proposed by Braun & Clarke (2006), I performed qualitative data analysis using QDAcity tool.
Thematic Analysis (TA) is the method used for performing qualitative data analysis. “TA is a method for systematically identifying, organising, and offering insight into patterns of meaning(themes) across a data set” (Braun & Clarke (2006)).
It provides the flexibility to view data from different perspectives and hence data analysis is possible at a much broader level. Flexibility and accessibility are two main reasons why TA is a commonly used method (Braun & Clarke (2006)).
The basic steps that I followed in the process are documented below.

Phase 1: Familiarisation with the Data
Based on the research question I familiarised myself with the data set content and prepared notes on the data set. The purpose of notes at this point was to summarise the key information and the observations made.
Phase 2: Generating Initial Codes
This phase marks the beginning of data analysis through coding in a systematic way. The main constituent of this analysis are these codes.
On identification of an extract of data to code, I wrote down the code and marked the text associated with it. More than one code could be associated with a part of data. I continued reading the data further until the next potentially relevant fragment was found. The new fragment found was mapped to the existing code (if it fits) or a new code was created. I repeated this process throughout each data item and the entire data set. Also updated the existing code to integrate the new material. This phase was continued until all the relevant data was coded.
Phase 3: Searching for Themes
With this step I started converting codes to themes. “A theme captures something important about the data in relation to the research question and represents some level of patterned response or meaning within the data set” (Braun & Clarke (2006)).
This was done by combining codes that exhibit common features together so that they narrate a consistent significant pattern in the data.
As a result of this phase I prepared a thematic table tracing the themes and combined all the data extracts relevant to each theme to be prepared for the next step of reviewing potential themes.
Phase 4: Reviewing Potential Themes
In this phase I reviewed the themes repetitively, with respect to the coded data and the complete data set. Also answered, some of the basic questions to identify the relevance of the themes with respect to my thesis.
Phase 5: Defining and Naming Themes
As a part of this phase, I mentioned the distinctive features and peculiarities of each theme clearly when defining and naming them. Sometimes there are sub themes within a theme. These are particularly useful in scenarios where there is more than one prominent structure within the data with respect to the question, but each could be interpreted in different ways. Next, I selected extracts to present and analyse.
Phase 6: Producing the Report
I created this report with the intent of providing a captivating story about the data based on the analysis. Arguments supporting each research question are a part of this report.
After the interviews were performed, I used a qualitative data analysis tool QDAcity. Using this tool, I generated basic codes corresponding to the research questions and a basic codebook. This was done for all the interviews conducted.

Below I have listed some screenshots from the QDAcity.

Figure 2 shows the 4 key themes created during the coding analysis. They are corresponding to the research questions and namely motivation to join a vendor-led OS consortia, problems encountered in vendor-led consortia, solutions taken to overcome the challenges faced and the success factors.

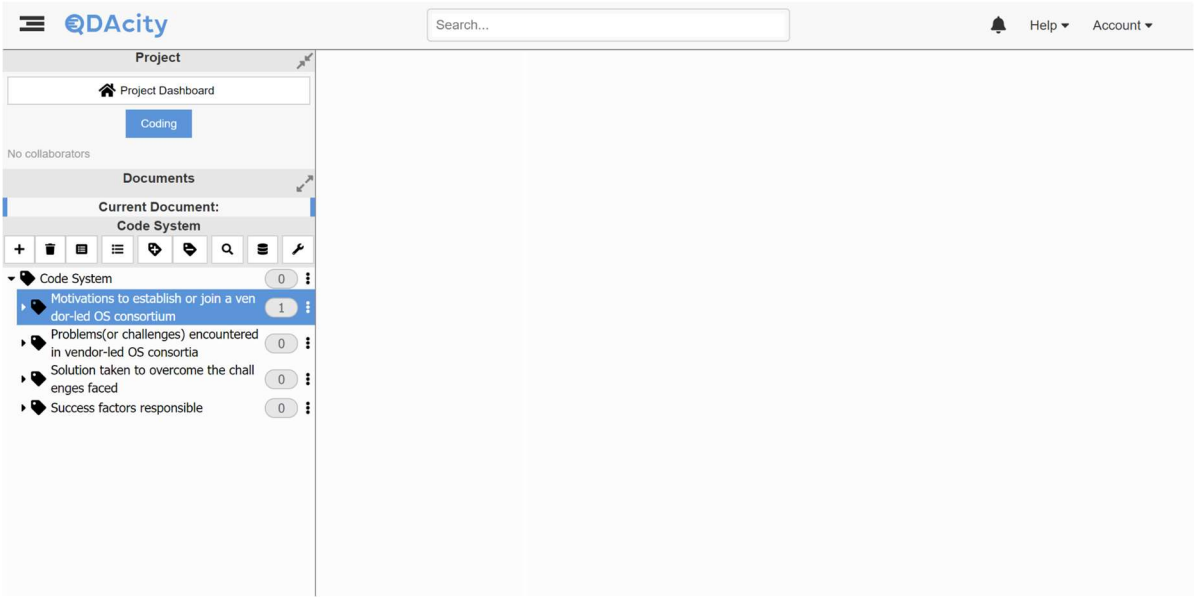

Figure 2. Qualitative Analysis 1 (Source: https://qdacity-app.appspot.com/Projects/PROJECT/5091970554789888/CodingEditor)

Figure 3 further elaborates and lists the motivations and shows their mapping to either the literature or interviews or both. For example, after reading the literature and conducting the interviews, it could be concluded that data and experience gathered from collaboration is one of the reasons why organisations are so keen on joining a consortia. For many it provides a foundation or a base on top of which further development could be easily done.

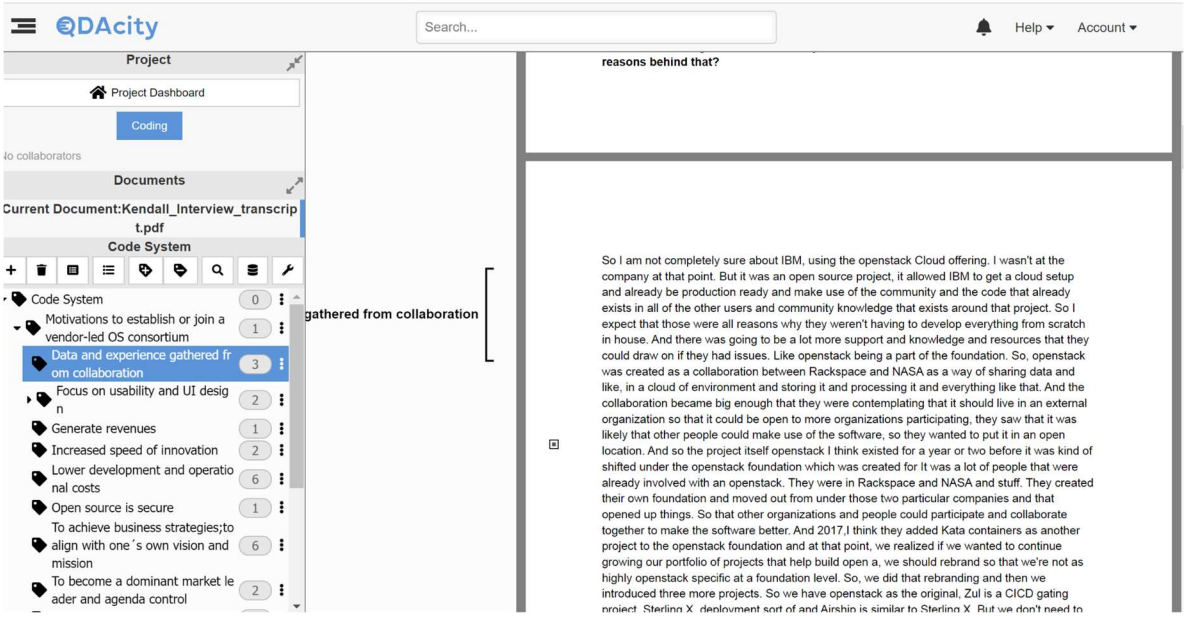

Figure 3. Qualitative Analysis 2 (Source: https://qdacity-app.appspot.com/Projects/PROJECT/5091970554789888/CodingEditor)

Figure 4 shows the problems encountered in vendor-led OS consortia. For example, the people challenge. Quite many organisations experience the issues related with people management when joining any existing foundation. This people´s challenge is visible at multiple stages, starting with the initial phase of joining and getting associated with the consortia up to the phase of learning the processes and procedures in the consortia.

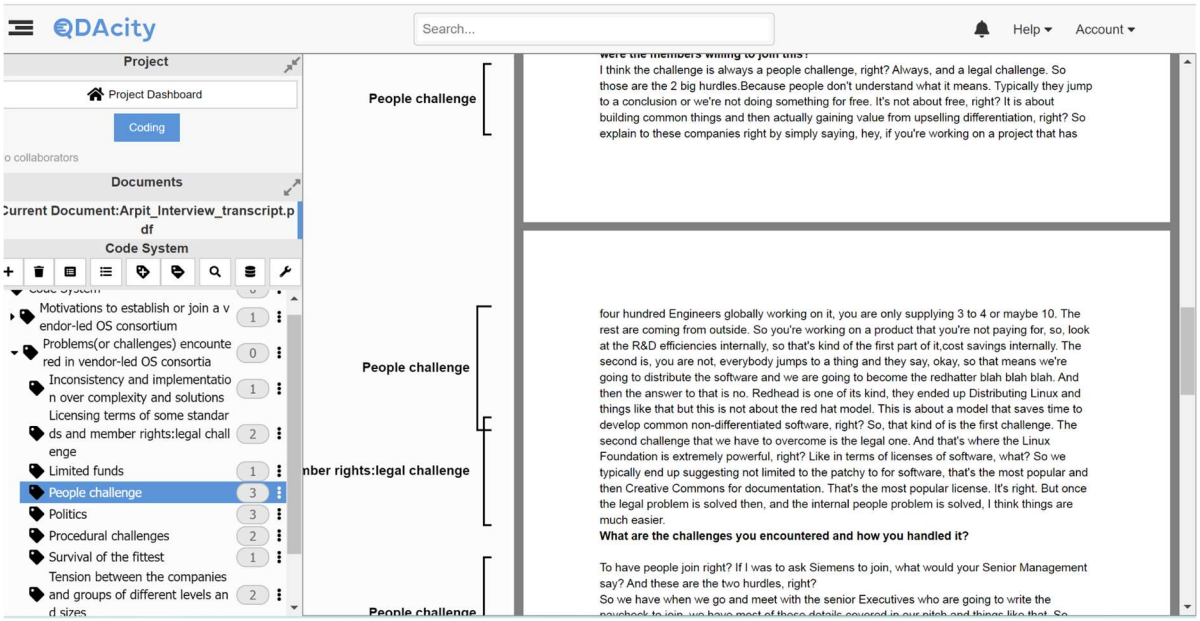

Figure 4. Qualitative Analysis 3 (Source: https://qdacity-app.appspot.com/Projects/PROJECT/5091970554789888/CodingEditor)

In figure 5, I have created codes corresponding to the solutions. Referring to the people´s challenge shown in figure 4, the following shows a probable solution to that. Connecting with the people already in the system and expanding the social network across various levels, might help to understand the system and procedures in an easy and quick way.

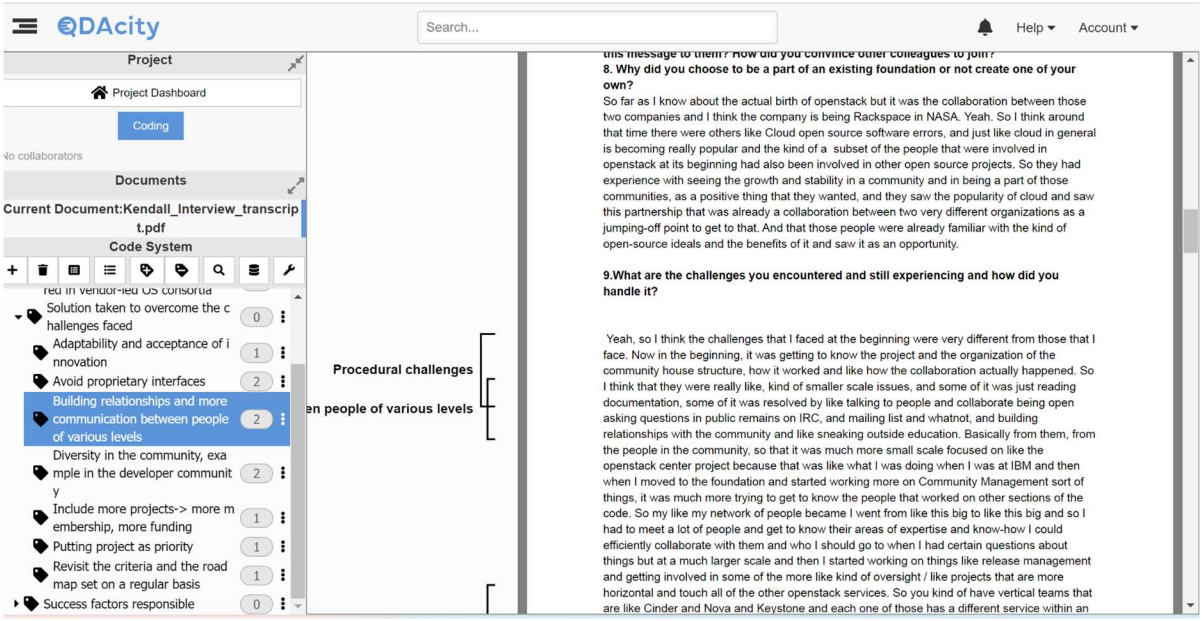

Figure 5. Qualitative Analysis 4 (Source: https://qdacity-app.appspot.com/Projects/PROJECT/5091970554789888/CodingEditor)

Figure 6 displays the success factors with the help of which organisations can sustain and grow in vendor-led OS consortia. To create one's own checklist helps them to keep a track of their own vision and map it accordingly with the goal of the consortia.

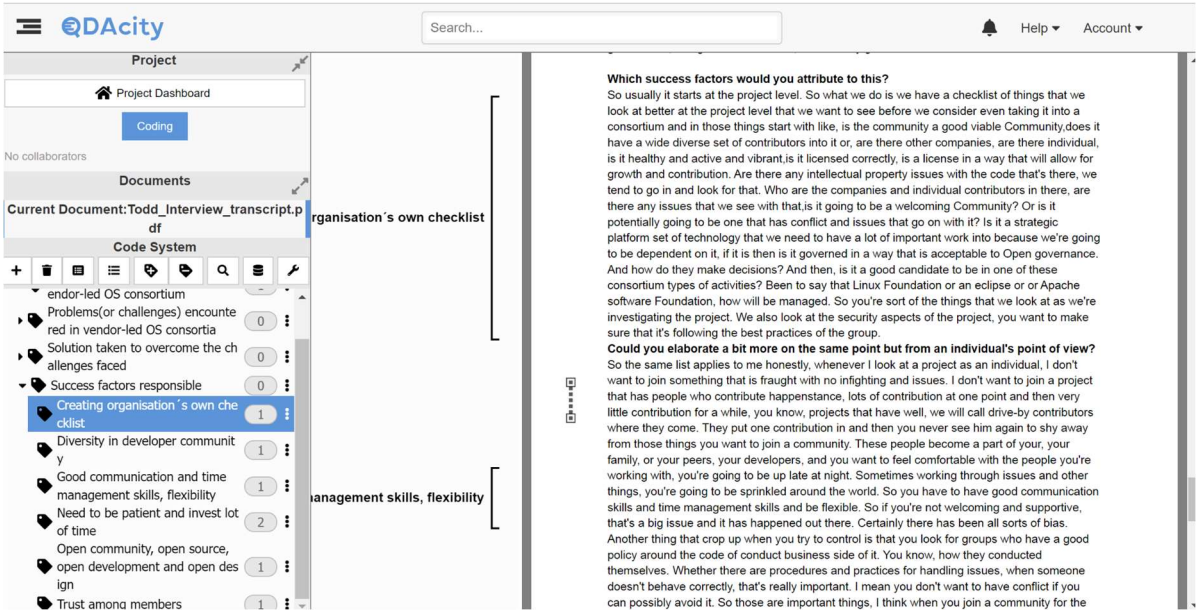

Figure 6. Qualitative Analysis 5 (Source: https://qdacity-app.appspot.com/Projects/PROJECT/5091970554789888/CodingEditor)

Further screenshots from data analysis are attached in the Appendix.

5.Results

This section presents the results of this research. While performing the coding analysis, the information was grouped based on the research question that it answered. Research questions are as follows:

RQ1: What are the motivations to join a vendor-led OS consortia?
RQ2: What are the factors responsible for organisation's success in vendor-led OS consortia?
RQ3: What are the problems encountered and solutions applied in vendor-led OS consortia?

5.1 Motivations to join vendor-led OS consortium

This subsection provides answers to RQ1.
The factors that drive an organisation to be a part of any consortium are different and vary at organisational and job profile´s level. One of the major reasons for companies to associate with an existing open source foundation is the ability to access widespread data and gather experience through collaboration (I1, I2).
The sharing of resources and skill sets also provides an economic advantage to the organisation. The operational and developmental costs are reduced. Both literature and interviews indicate the significance of this factor as a major factor motivating firms to join a vendor-led OS consortium. Interviewee 2 stated: „And then finally cost, it's definitely 30, 40% cheaper, not product as it may not be that big a deal. Maybe 10, 20% cheaper but to maintain it is definitely 10 to 40% cheaper."
The availability of vast data and knowledge on a single platform motivates them further as it expedites the speed with which any new technology could be developed or invention could take place since a lot of time in searching the required knowledge skills and resources is saved (I2, I4).
Interviewee 2 had explained it through an example: "So, if you look at Telecom right from 4g to 5g or 5g to 6g, right? It takes decades to standardise and then another three to four years to implement, but the 5G implementation happened much faster because of open source. And the reason for that is when you have competitors and end-users all in the open source foundation like LF networking, they would by default use the same frameworks to interoperate and test in the open. So, then you don't have to spend a couple of years testing interoperating, it gives you that same testing and interoperability right from day one, that's kind of the other reason, right? Which is the speed of innovation."
This factor is not yet known in the literature content available for the topic.
However, this furthermore improves the efficiency of an organisation as they can yield better and faster outputs (I1, I2, I5).
Another new finding observed from the interviews as a motivation is the power which organisations get to influence the code being developed. Open source doesn't imply that a code is freely available. In order to avail its benefits, to contribute to the code, organisations need to get associated with the consortium and based on the membership level the rights are distributed (I3, I4).
Involvement of a wide range of developers helps to improvise it further and deliver it as an updated version(I4). Interviewee 4 quoted: "So for example, a healthy diversity of contributions or community, versus real-time commercial production deployments. We think

that a successful product is one that has a community of developers. But mostly a good set of production examples, in real life is being used for something and that in customer, see enough value that are willing to pay for the commercial version of that. So far you won't find anybody that it's going to deploy an open source solution by themselves without any support of any company in a production environment in real life, especially industrial settings."

Table 3 summarises the motivations to join a vendor-led OS consortium.

Table 3. Organisations' motivation to join a vendor-led OS consortium

Motivations	Data Source	Literature
Data and experience gathered from collaboration	I1, I2	schwab-2020-ecosystem; Riehle-2010-single; zhang-2020-how
Lower development and operational costs	I2, I3, I5	schwab-2020-ecosystem; aslett-2010-differentiating; kääriäinen-2012-lifecycle
Increased speed of innovation	I2, I4	-
To improve efficiency and wider access to various resources	I1, I2, I5	schwab-2020-ecosystem; schaarschmidt-2011-exposing zhang-2020-how
To become a dominant market leader and agenda control	-	23kerrett-2011-best; zhang-2020-how; joo-2005-anatomy
To influence the development; be a part of open source consortium	I3, I4	-

5.2 Factors for organisation´s success in vendor-led OS consortium

This subsection provides answers to RQ2.
The idea to join a consortium looks more promising if it is aligned with the business needs and strategy of the organisation. It gives them that extra edge which takes them a step closer to their vision and mission (I3, I4, I5).
Interviewee 3 mentioned: "we're going to do something different this time and that's why it was critical that we get involved in LF Edge right from the beginning. So, we can help reinforce and it really helped that the mission of LF edge aligned perfectly with our goal, to

your goal which was to create an open Edge Computing platform comprised of these different projects that can then provide the foundation for everybody."
Interviewee 6 explained quite well the significance of certain soft skills like time management, flexibility, and communication skills in order to attain success in a consortium(I6). He quoted: "Sometimes working through issues and other things, you're going to be sprinkled around the world. So, you have to have good communication skills and time management skills and be flexible."
These are some of the new dimensions still unexplored in literature.

Table 4 summarises the reasons why certain organisations are successful being a part of an open source foundation.

Table 4. Factors why organisations´ are successful in a vendor-led OS consortium

Motivations	Data Source	Literature
To achieve business strategy; to align with one's own vision and mission	I3, I4, I5	skerrett-2011-best. zhang-2020-how
Create organisations 'own list and checking it on a regular basis	I5	-
Good communication and time management skills	I6	-

5.3 Problems encountered in vendor-led OS consortia and the solutions applied

This subsection provides an answer to RQ3.
One of the challenges faced being in a consortium is the inconsistency and implementation over the complexity and solutions which at times hinder the development of a new technology. To overcome this, it is important to have open standards, open source and open governance (I3).
Interviewee 3 highlights its importance: "And that's why it's important not only to have open standards, but to work together with other organisations to use those standards, implement those standards. So, it points to that open source, open governance and open standards, those would be the three key things."
The next is a legal challenge which talks about the dissatisfaction with certain licensing rights and terms and conditions (I2, I4). An organisation has been working for quite some time over a development but to take it to the next level, certain standards and approvals are required. The unavailability of these due to certain legal restrictions makes it annoying for them and ignites a spark of doubt in the existing standards and their capabilities(I4).
Interviewee 4 stated: "You're trying to speed up developments and you find these roadblocks that are sometimes really frustrating."

The people, procedural, and political challenges follow up next which were mentioned by all the interviewees. Being new to the consortium, people are often lost and confused about the correct way and procedures to follow. Introduction of training to educate people about the open source´s standards and processes and expanding their network by connecting with the people already in the system for some time could help overcome this problem. The political issue of one company having more power than the other is another one. However, companies need to understand that this is purely based on their membership type as the rights and power are accordingly distributed (I1, I2, I3, I4, I5). A change in their membership level will automatically make them eligible for extended power and additional rights.
Another issue arising due to the division of power and rights is the tension between the companies and groups at various levels. With the increase in the number of projects being associated with vendor-led OS consortia, there would be a parallel increase in funds resulting in modified membership standards(I3).
Interviewee 3 mentioned: „It would be nice to have more projects and along with that, not only will that help us plug the gaps and make our organisation bigger, I think it will also help us with funding because we are an open-source non-profit foundation, there can be an issue with saying, okay, we would like to do with these different things, but we don't have the budget for it. And one of the reasons for that is, that the only way we get funding right now is through memberships."

Below table 5 highlights the key points from the challenges faced and its probable solutions.

Table 5. Organisations' problems encountered in a vendor-led OS consortium and solutions applied

Problems encountered	**Solutions applied**	**Data Source**
Inconsistency and implementation over complexity and solutions	Follow open source, open governance and open standards	I3
Licensing terms of some standards and member rights: legal challenge	Building relationships and more communication between people of various levels fosters better understanding of the standards and encourages discussion about the possibilities to amend these standards	I2, I4
People challenge	Introduce training to educate people about the open source´s standards and processes. Connecting with the	I1, I2, I3, I4, I5

	people already in the network	
Procedural challenge	Connecting with the people already in the network	I1, I3
Political challenge	To get everybody together to discuss the strategy	I4, I5
Tension between the companies and groups of different levels and sizes	Increase in the number of projects further increases the revenues in the foundation, resulting in more satisfied members	I3

6. Discussion

The pivotal aim of this thesis was to find answers to the research questions and get insights from the literature about certain topics of vendor-led open source consortia. With this thesis, I focused on getting information about the motivations for the organisations to join vendor-led open source consortia, the success factors behind their successful journey in being a part of any consortium, the problems they faced, and solutions applied while being associated to any vendor-led open source foundation.
As a part of data collection, I had performed semi structured interviews. In the next step, I did qualitative data analysis using QDAcity which helped in mapping the common points from all the interviews and the literature review.
I observed that most of the factors behind the motivation to join a vendor-led OS consortia are covered in the literature content.
Based on the analysis and content available in literature, it could be derived that most of the companies get involved with a consortium because of the easy accessibility and availability to a huge number of resources(Schwab et al., 2020). It provides them with a platform to build their product and fasten the process of new inventions by fostering their needs(I2,I4).The readiness of certain resources helps in reducing the operational and developmental costs which in the end provides financial gain to the company(I2,I3,I5;Schwab et al., 2020).
It is a boon for an organisation, if its vision and mission is aligned with that of the consortium. This factor is considered and thought about while choosing the foundation to get associated with (I1).
However, there are some challenges too and the most common is the people's challenge. Employees encounter hindrances and issues on a regular basis in understanding the process being followed and getting familiar with the new environment.

Additionally, the feeling of superiority reflected in a premium member´s attitude in the consortia, often makes the others feel low. And sometimes they need to push hard to prove themselves capable of moving to the next level in their project stage (I4).

7. Limitations

Using the Guba´s (1981) trustworthiness criteria, including credibility, transferability, dependability, and confirmability, I discussed the limitations faced during the thesis.

Credibility is about truthfulness and validity of research findings. I performed semi-structured interviews to collect data. Before the interviews I created an interview protocol and strict it during the interviews. To ensure the credibility the transcripts generated from the interviews conducted were shared with the respective interviewees and their authenticity was confirmed.

Transferability talks about the context or the applicability with reference to a general term (or definition) given. The results have been associated with the findings from the literature review and are specific to the interviews conducted.
By connecting the findings from the interviews to the existing literature available for the motivation and success factors of vendor-led open source consortia, I was able to draw some similarities.

Dependability refers to the reliability of the information shared and mentioned in the paper and the process followed to get the information.

Confirmability verifies that the findings are moulded more by the participants (in this case interviewees), rather than the researcher. To assure this all the transcripts have been cross verified.

8. Conclusion

Vendor-led open source is a topic which still has many unexplored dimensions.
With this thesis I hope I can unfold some of those. But certainly, it is going to be the next revolutionary thing in the world of computer science and information technology. In this thesis I mentioned both the positives and negatives of vendor-led open source consortia. Wider accessibility to market trends, access to huge numbers of resources, continuous involvement and contribution in upcoming technology are some of the pros.
Although for small companies it will still take some time to carve a niche for themselves in the open source industry.
There are still some misconceptions about open source which need to be clarified and once it has been achieved more and more organisations will get associated with such foundations. This will boost their funding and will give them the opportunity to serve their members better.

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Appendix

Appendix A: Interview Protocol

Question Type	Question	Sequence for I1	Sequence for I2	Sequence for I3	Sequence for I4	Sequence for I5
Intro Q.	How long have you been working in the organisation?	1	1	1	1	1
Intro Q.	Could you explain your position and responsibilities?	2	2	2	2	2
Intro Q.	How did this organisation decide to join this consortium?	3	3	3	3	3
Intro Q.	When and how did you get involved with the consortium?	4	4	4	4	4
Transition Q.	What were the other reasons behind joining a consortia?	5	5	5	5	5
Transition Q.	How was this whole idea of joining a consortium be discussed within the company?	6	6	6	6	6
Transition Q.	Was it easy to convince other colleagues and what strategy you used to communicate this message to them? How did you convince other colleagues to join?	7	7	7	7	7

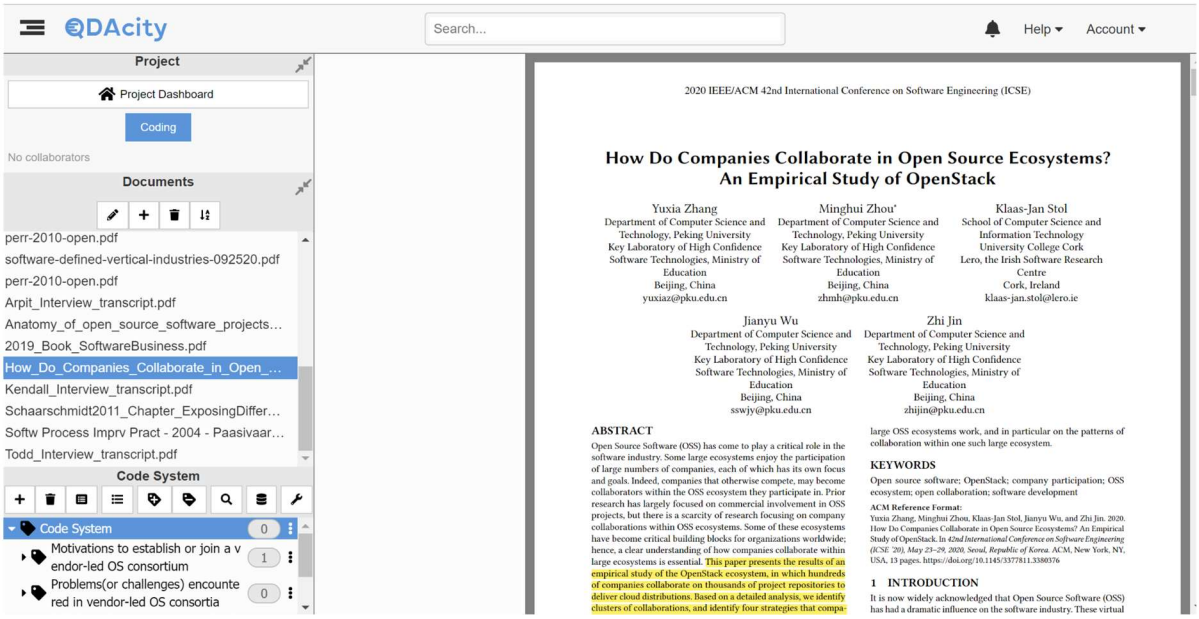
Key Q.	Why did you choose to be a part of an existing foundation or not create one of your own?	8	8	8	8	8

Key Q.	What are the challenges you encountered and how you handled it? What conflicts have arisen between the interests and priorities of driver members? How do you handle conflicts?	9 10 11	9 10 11	9 10 11	9 10 11	9 10 11
Key Q.	Which success factors would you attribute to this?	12	12	12	12	12
Key Q.	How much power or freedom do you have and is it sufficient?	13	13	13	13	13
Key Q.	As a member of this consortia, would you suggest some changes in member rights ?	14	14	14	14	14
Key Q.	Being a part of consortia, how do you manage to get that competitive advantage when most of the things are transparent?	15	15	15	15	15

Closing Q.	This is the end of my questions. Would you like to add something?	-	16	16	16	16

Closing	Thank you for your time. It has been a pleasure to meet you.

Appendix B: Data analysis(QDAcity)



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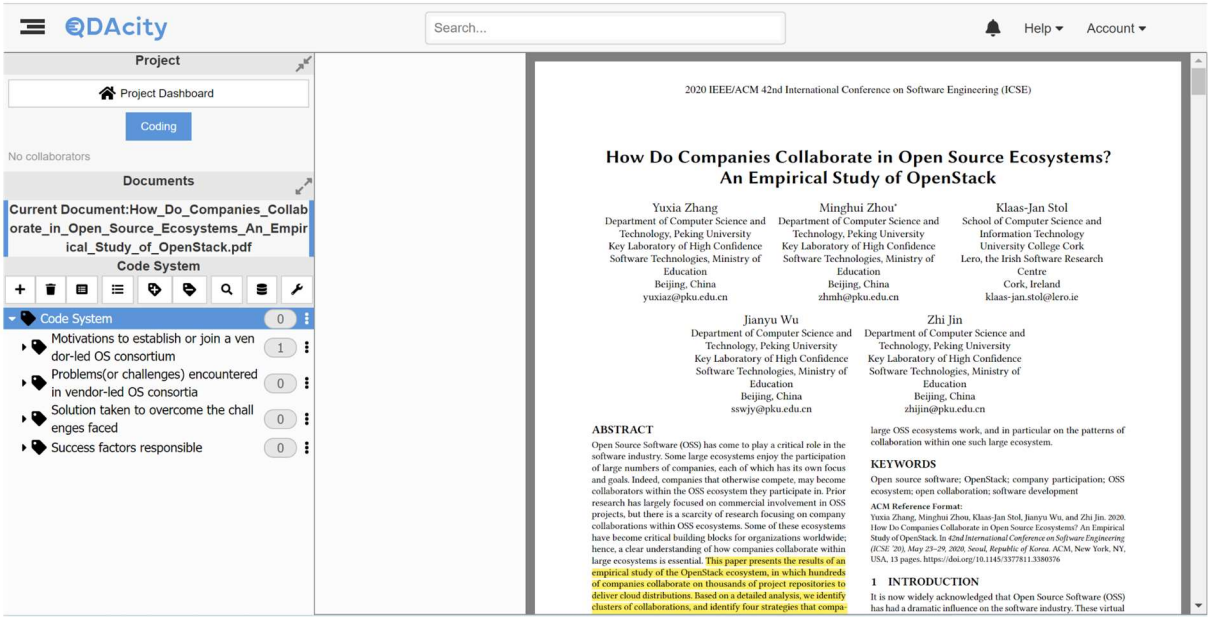

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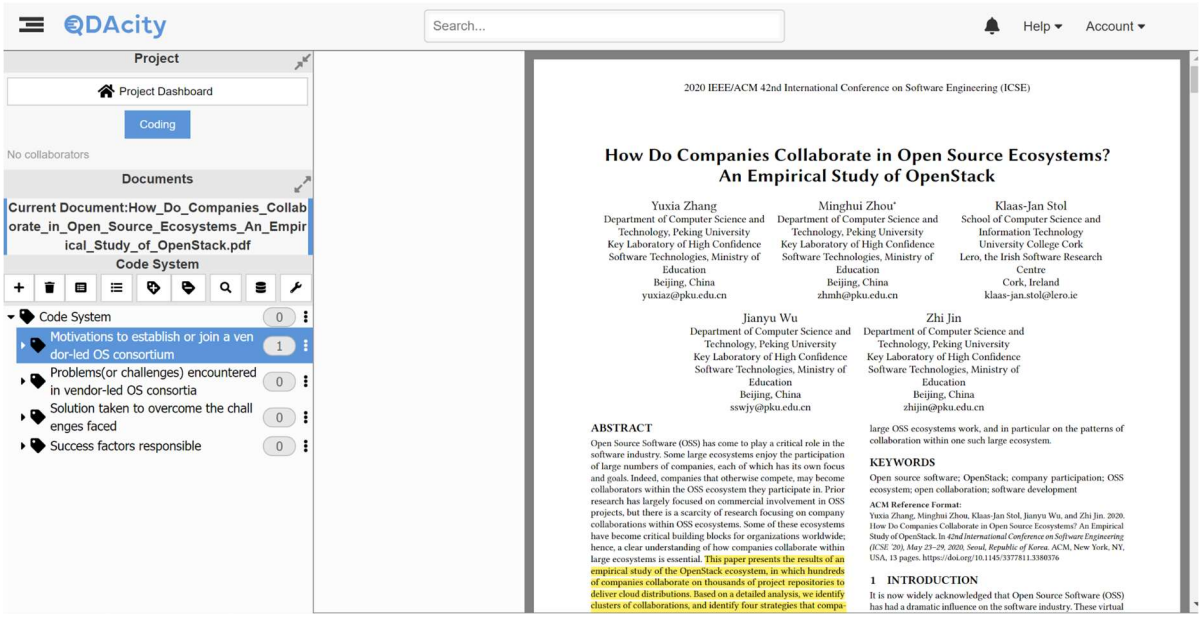

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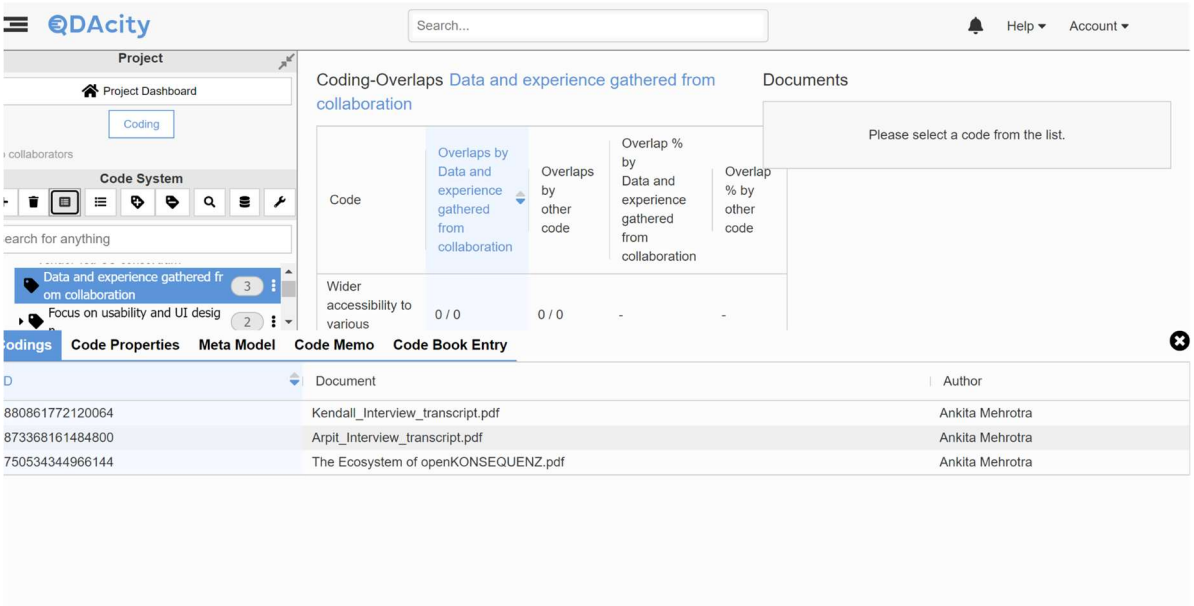

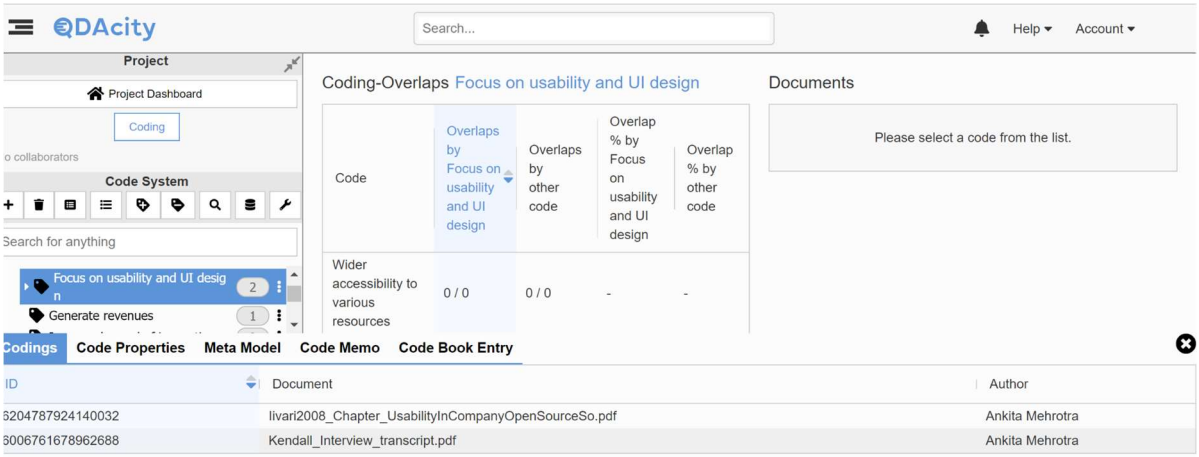
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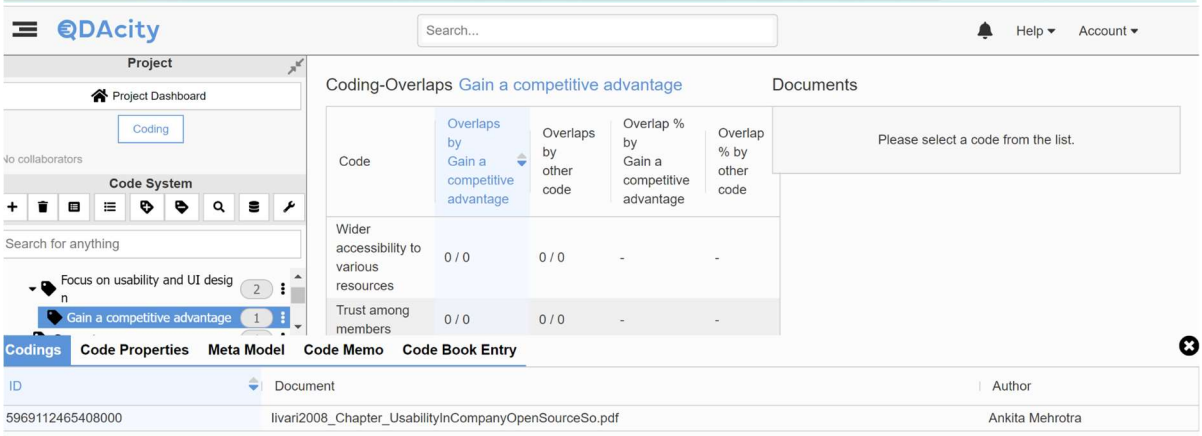
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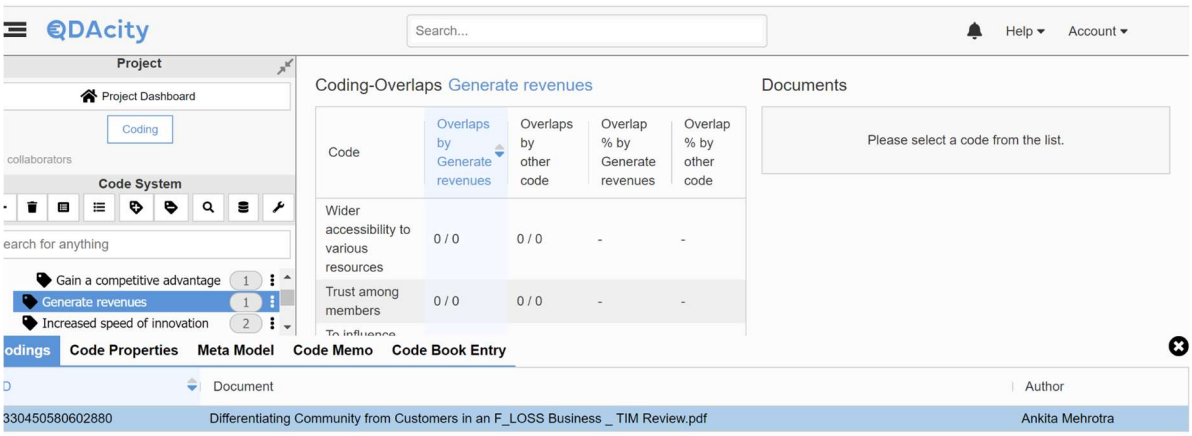
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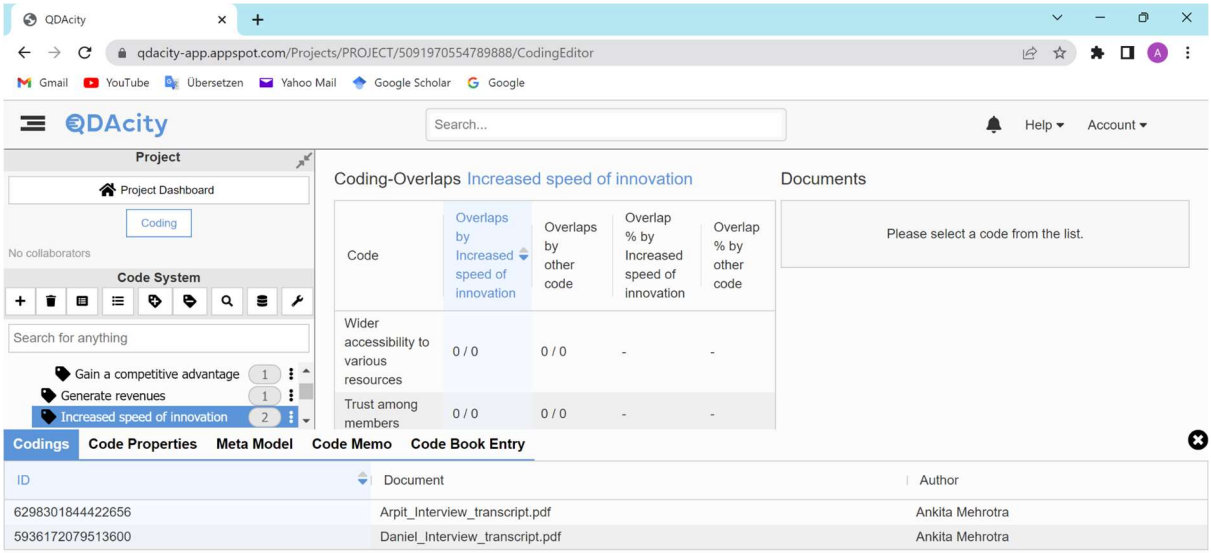
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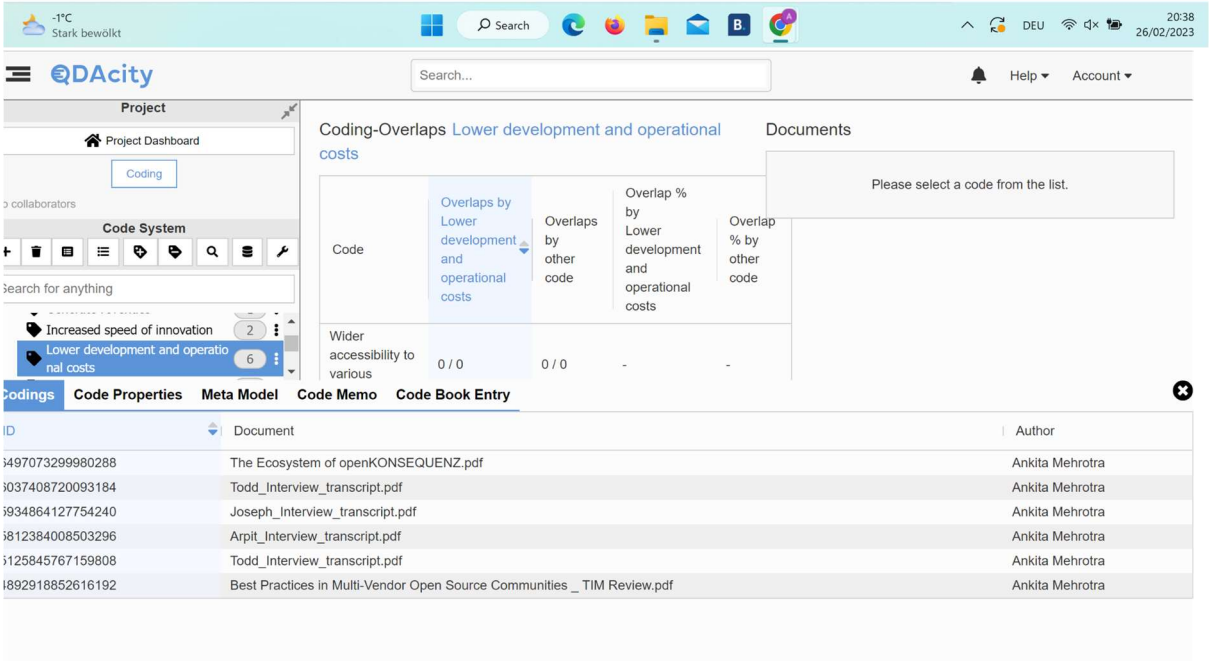
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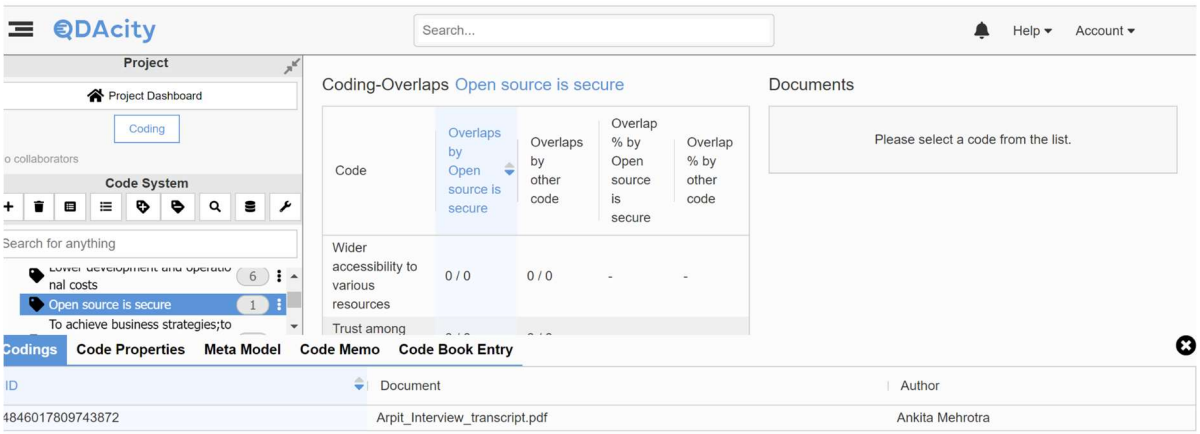
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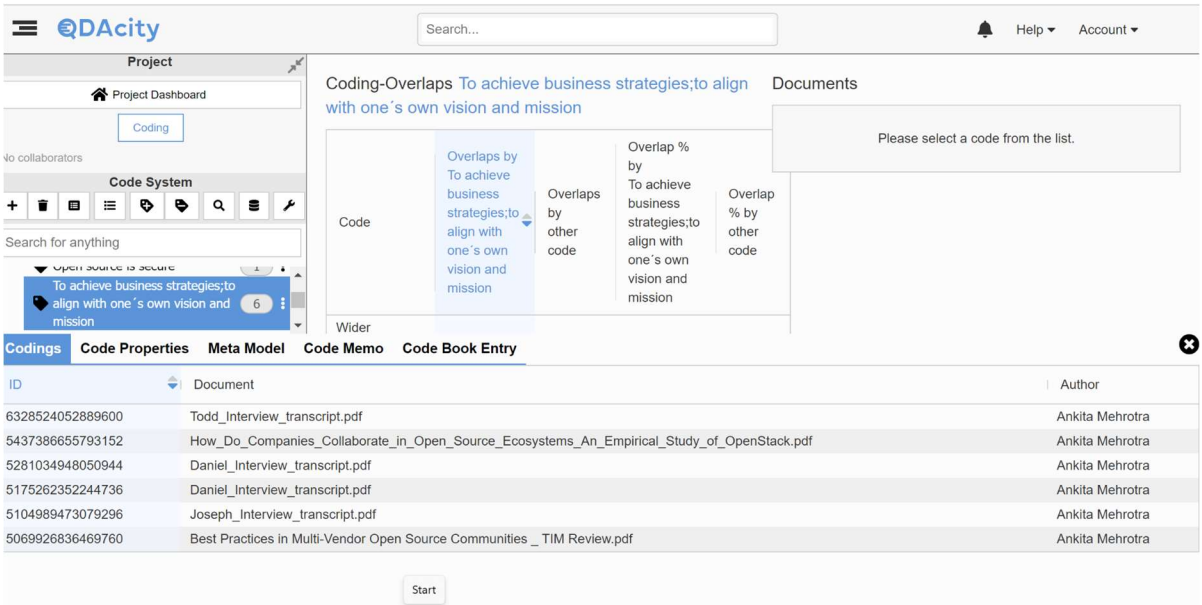
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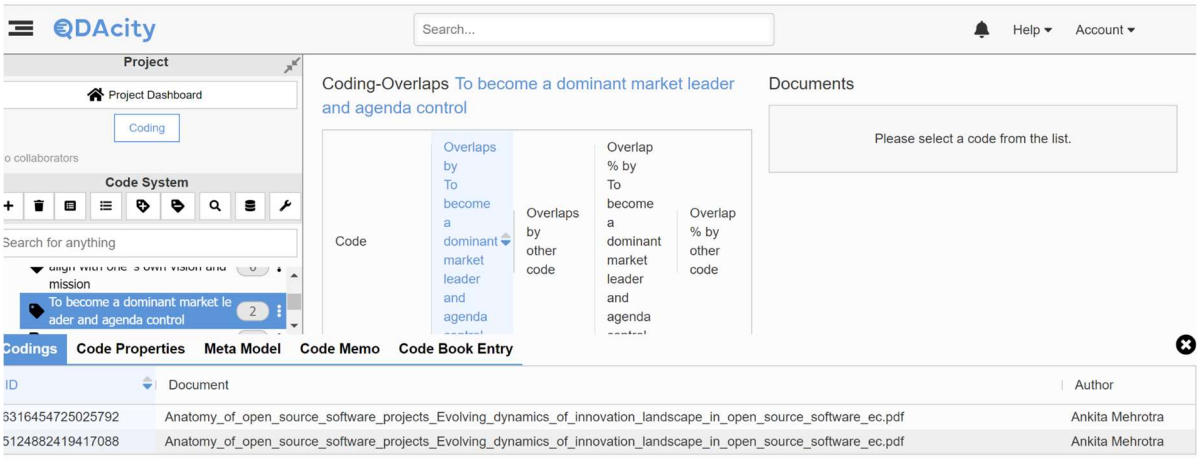
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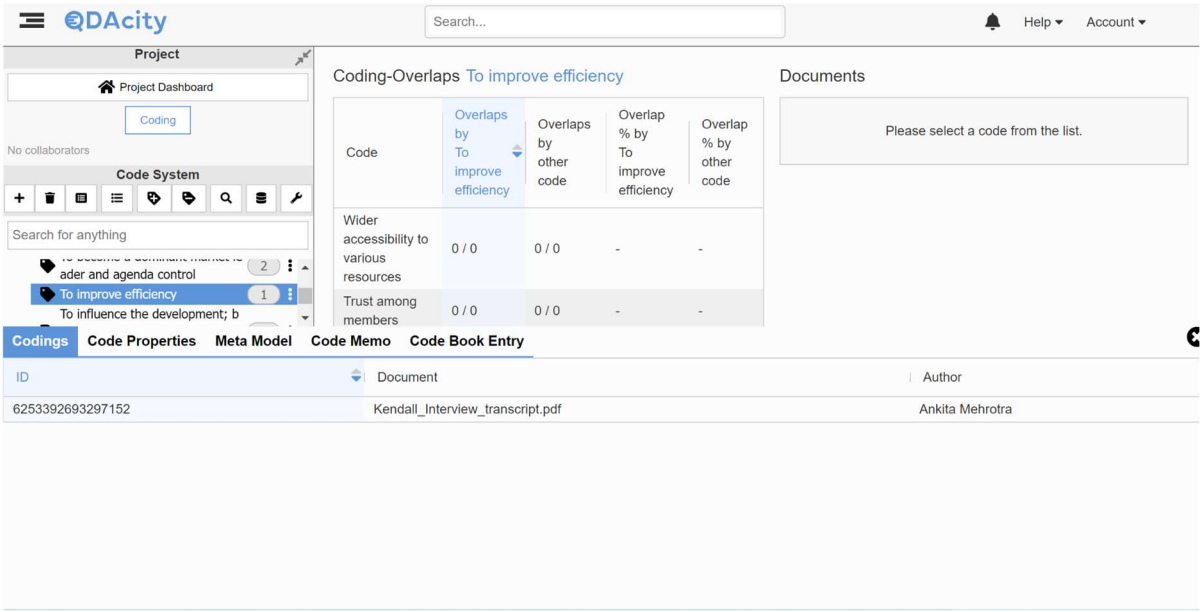
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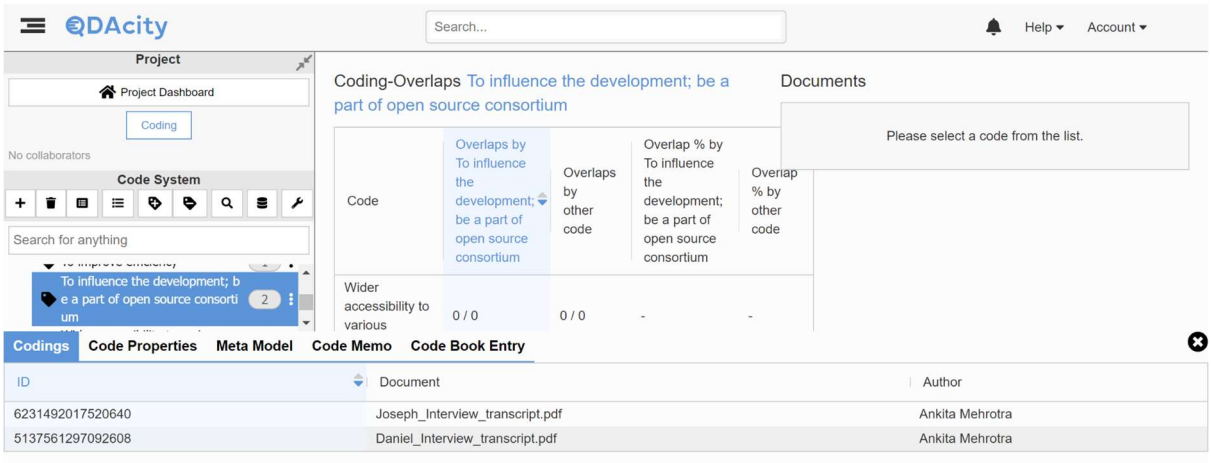
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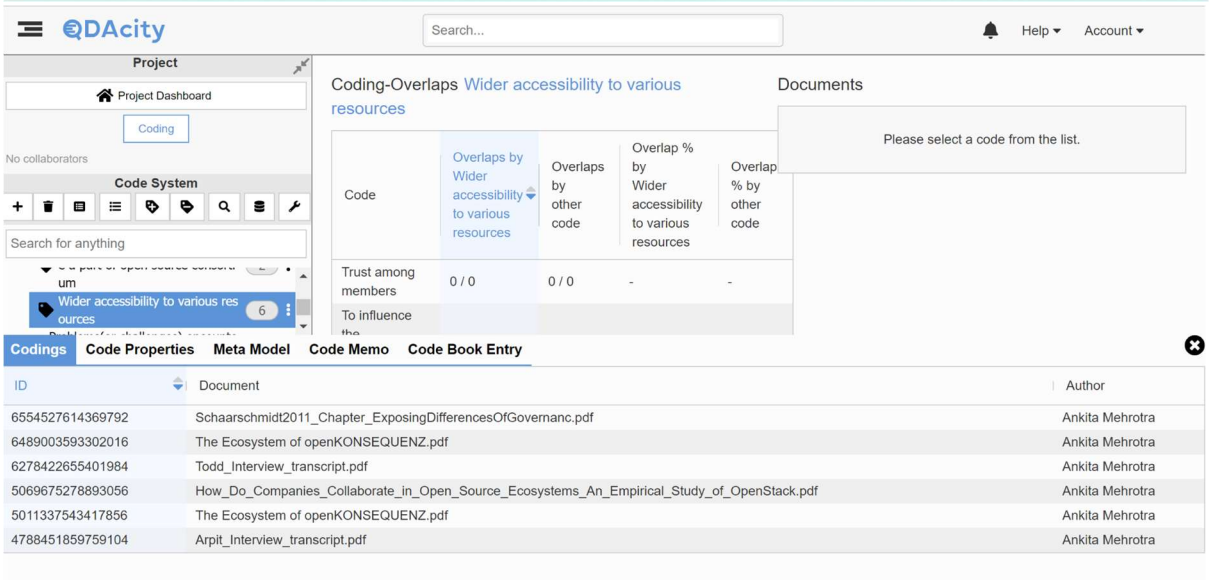
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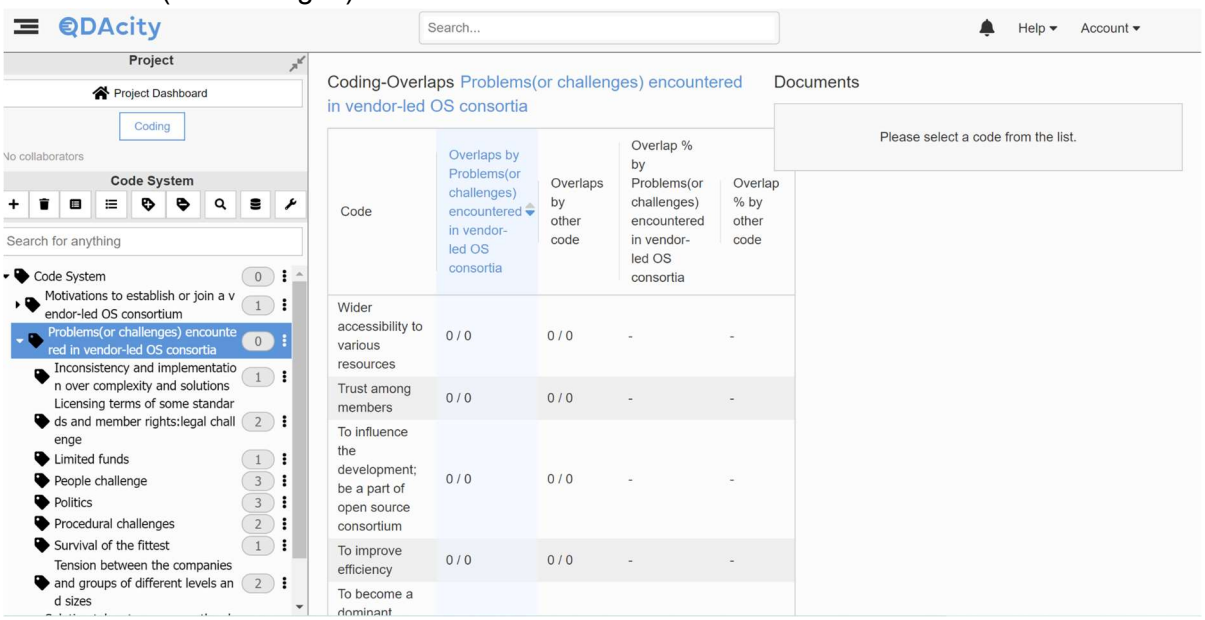
2.Problems (or challenges) encountered in vendor-led OS consortia



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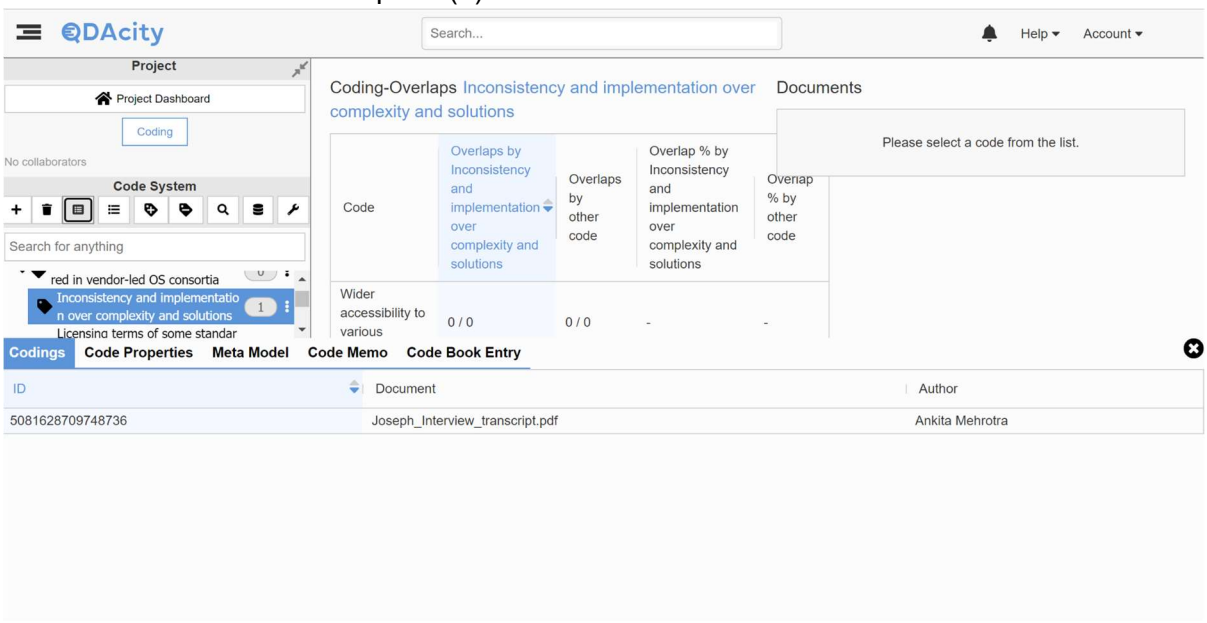

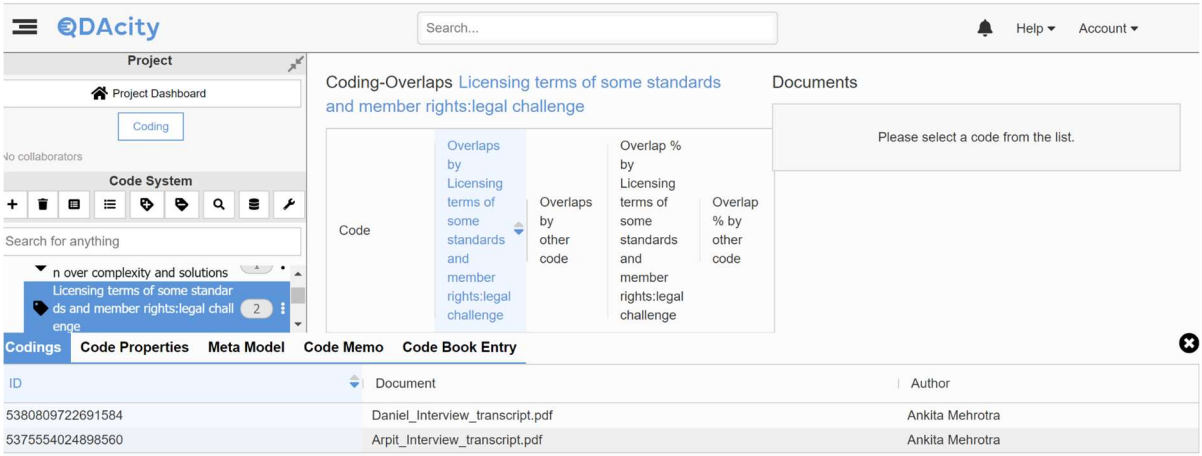
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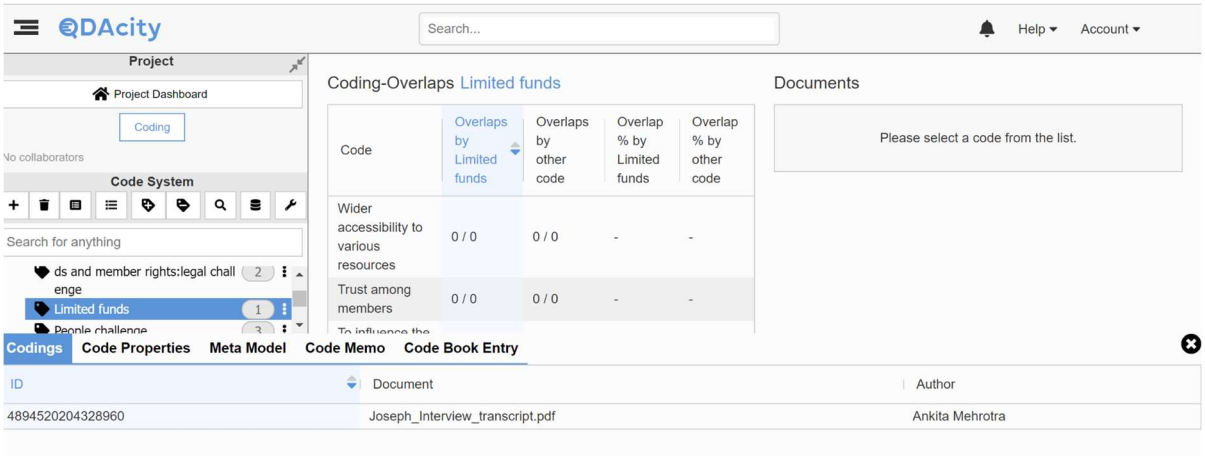
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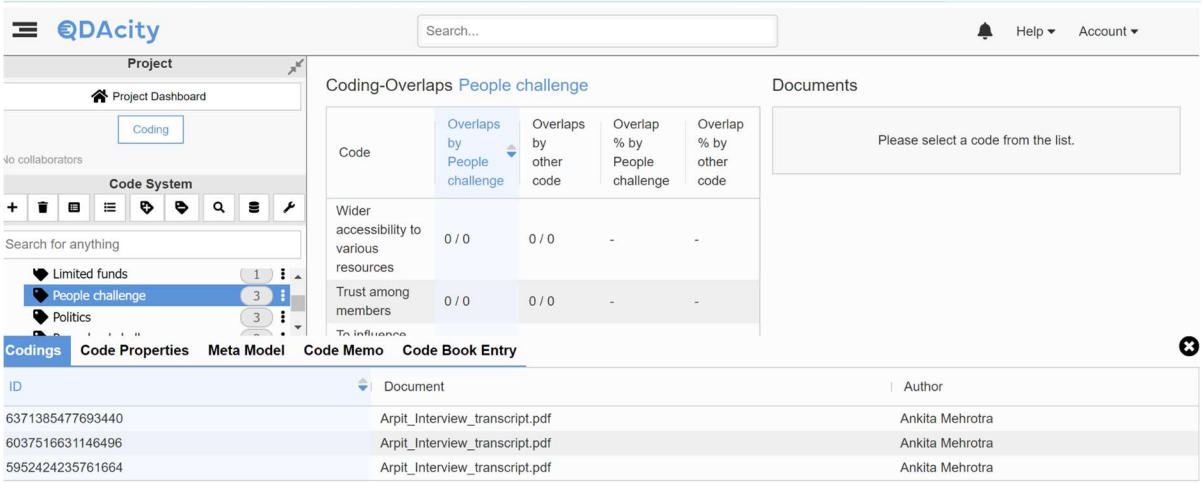
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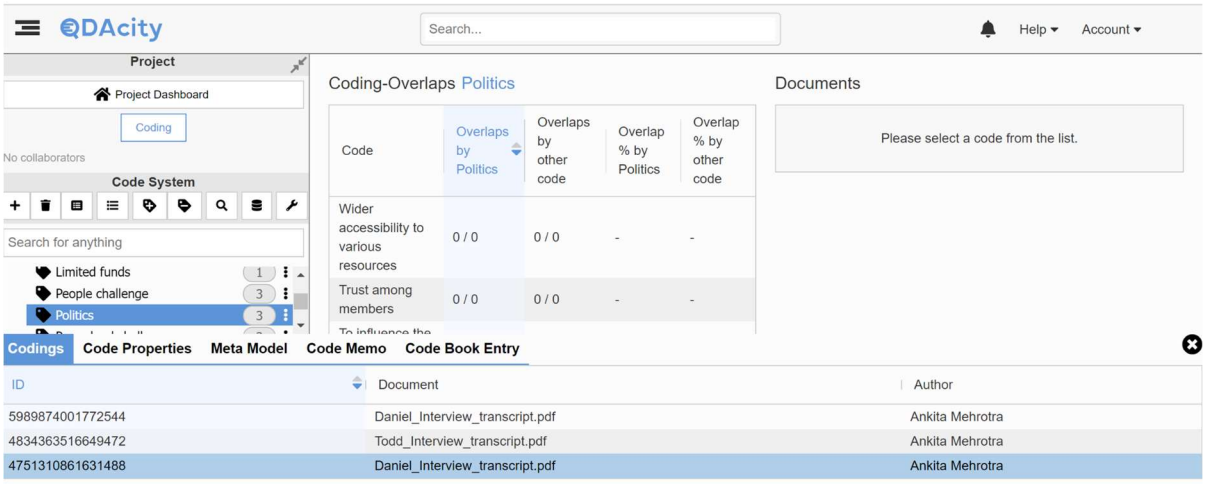
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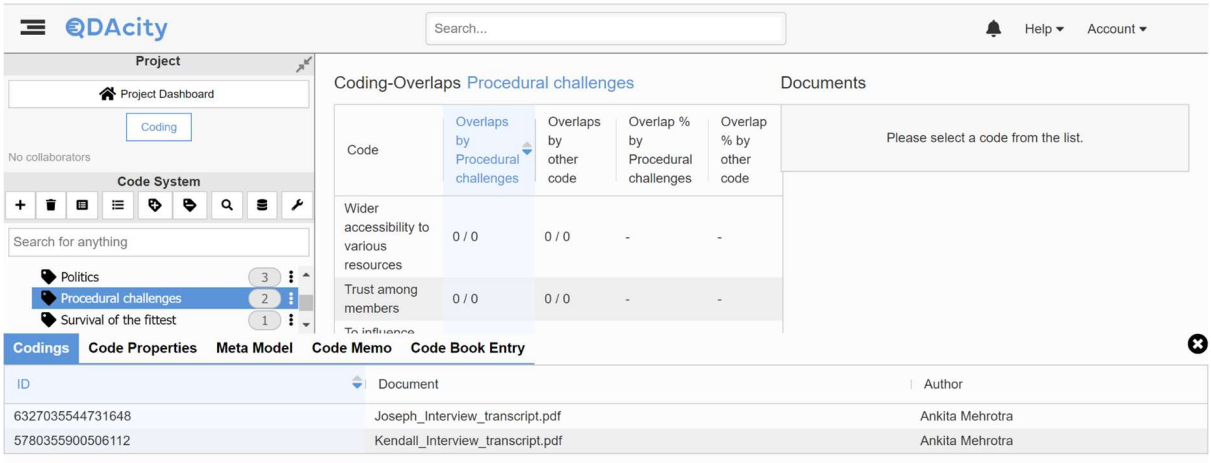
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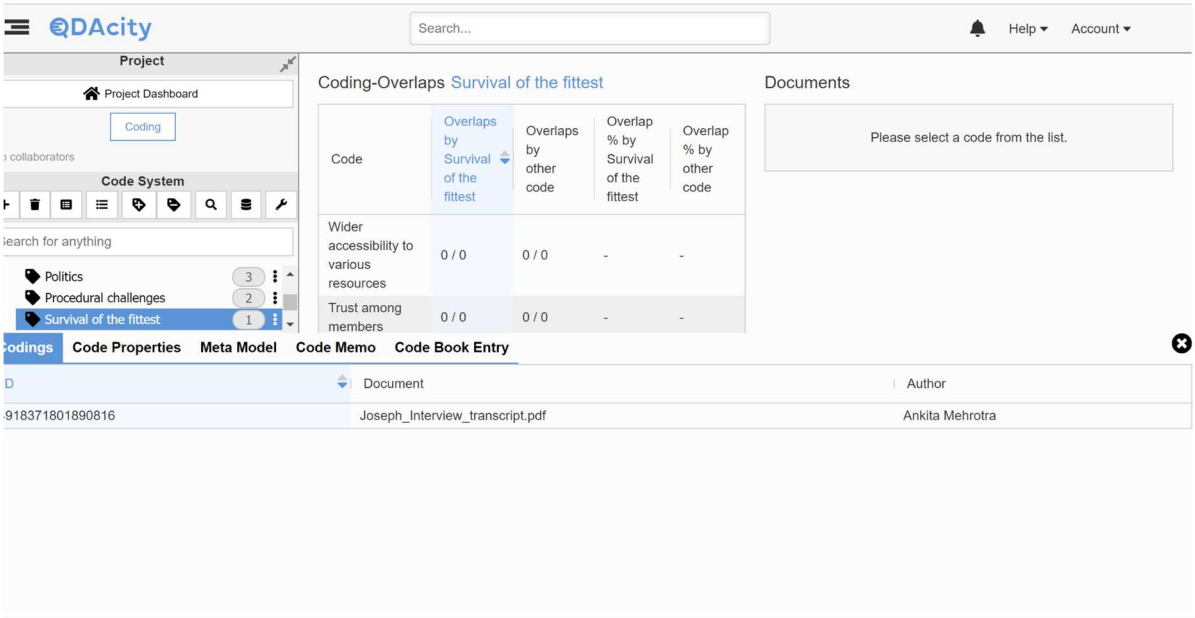
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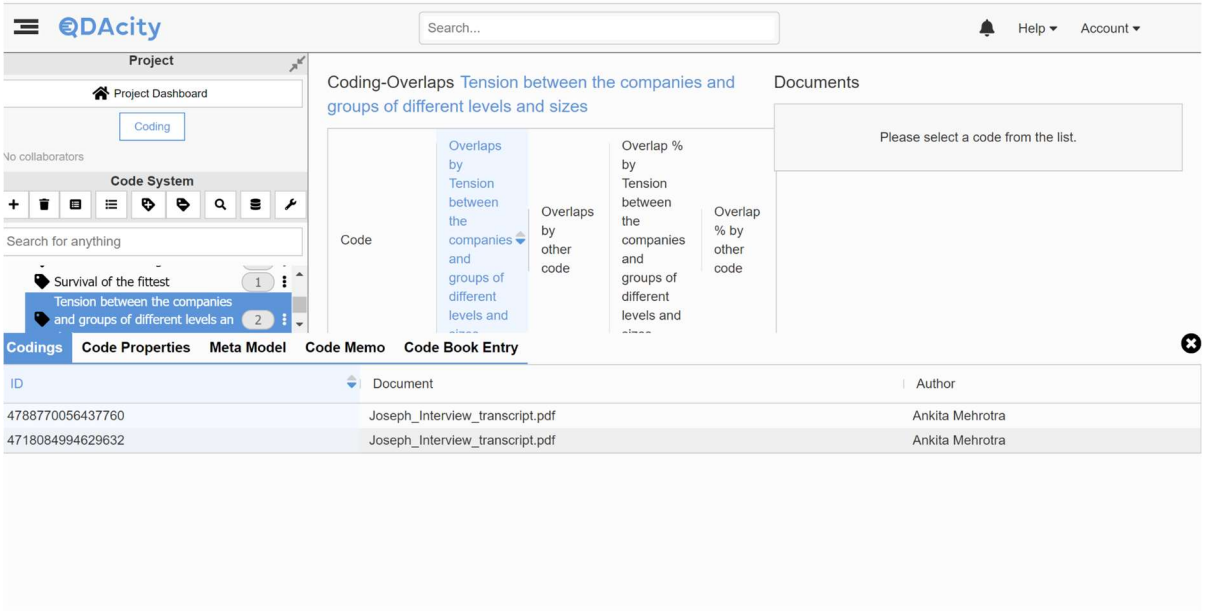
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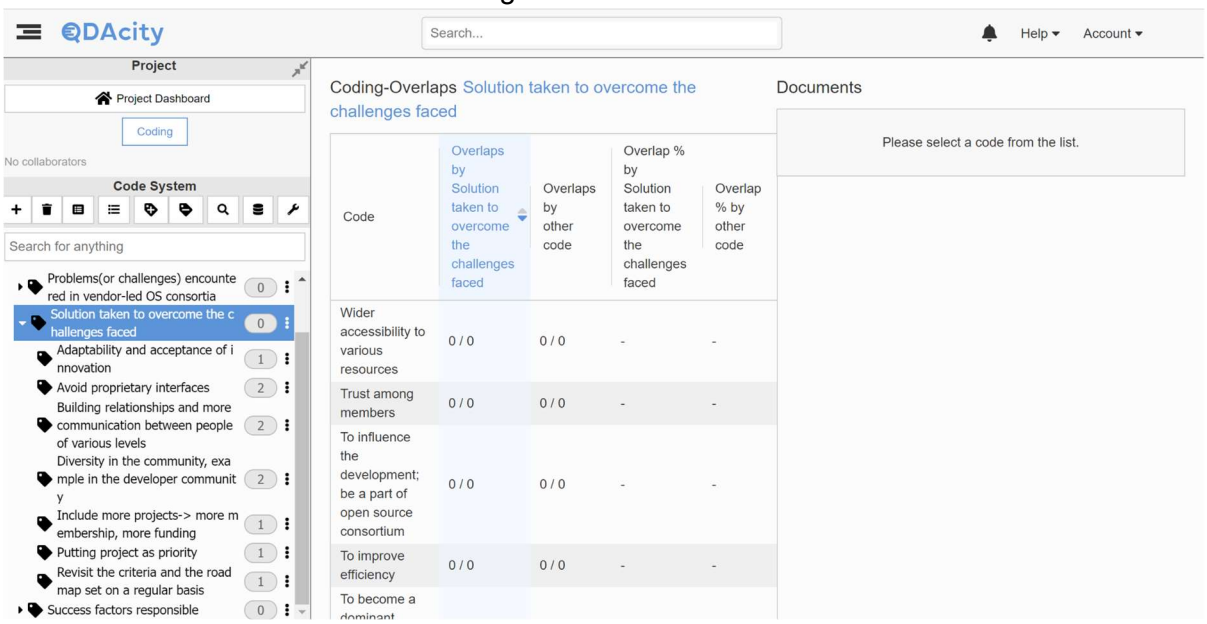
3.Solutions taken to overcome challenges faced



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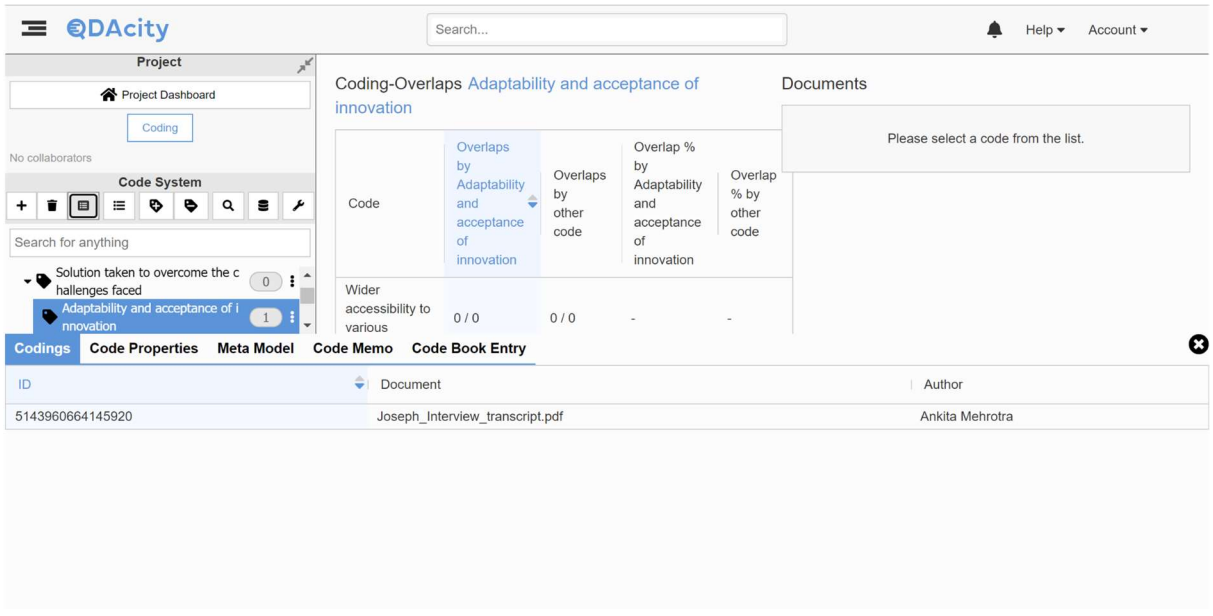

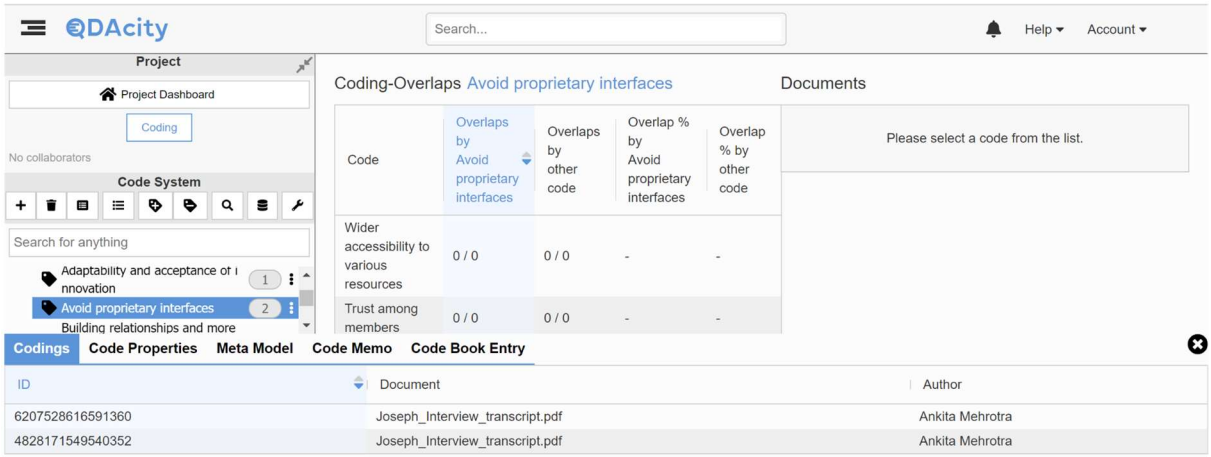
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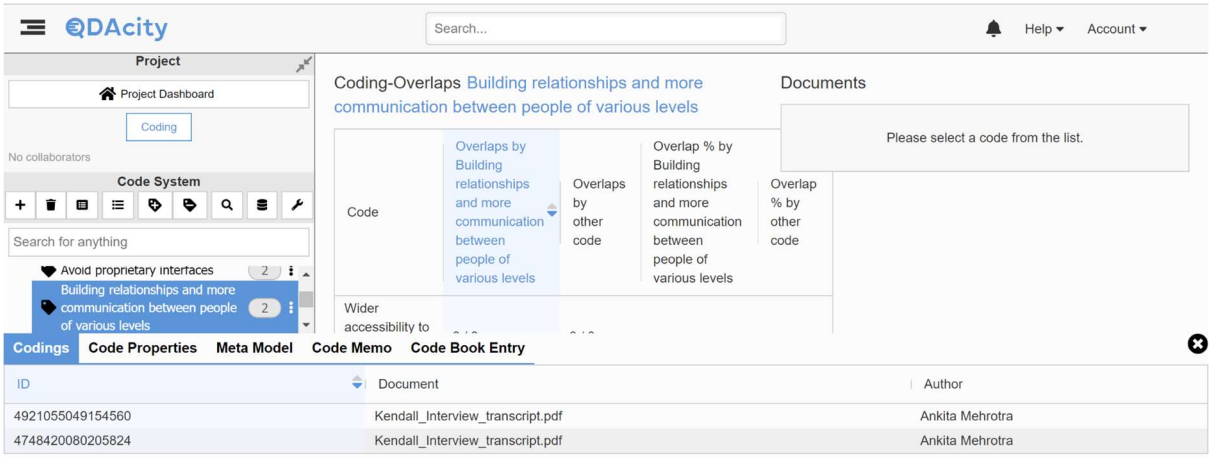
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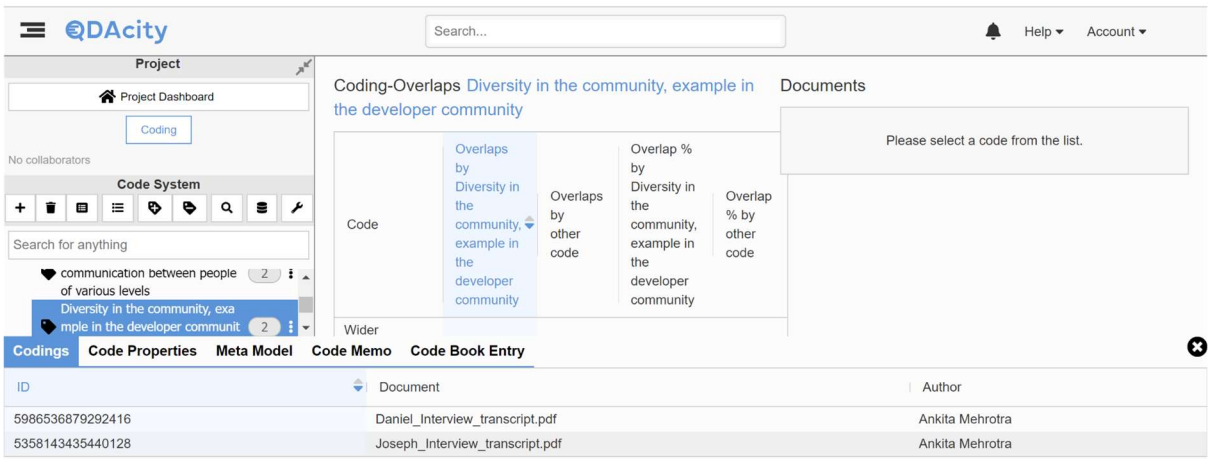
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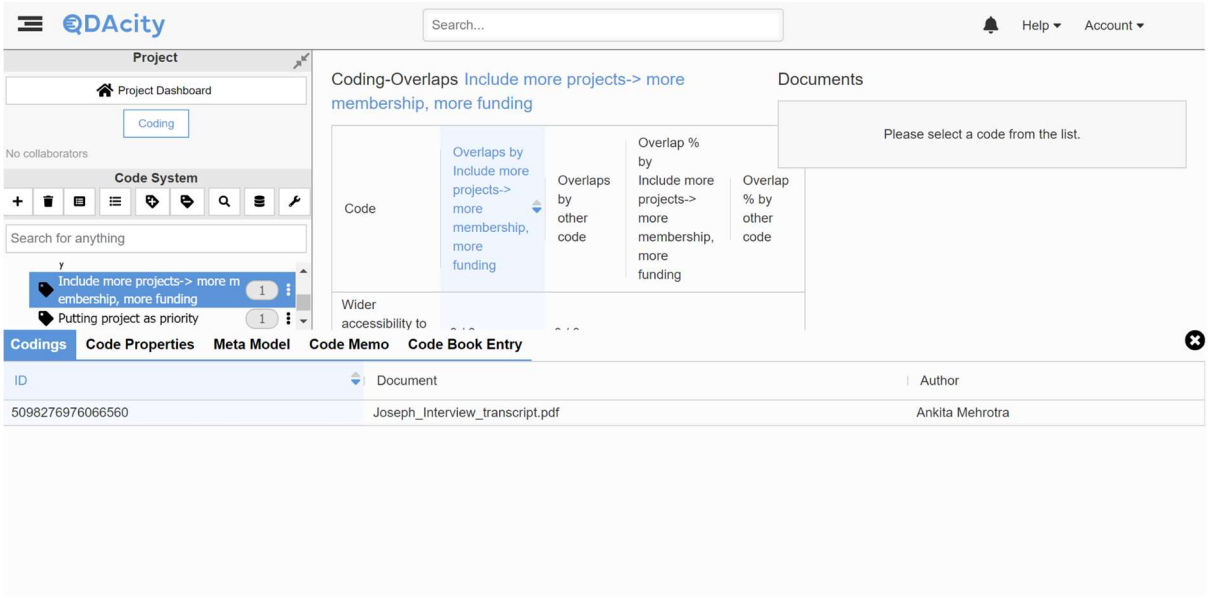
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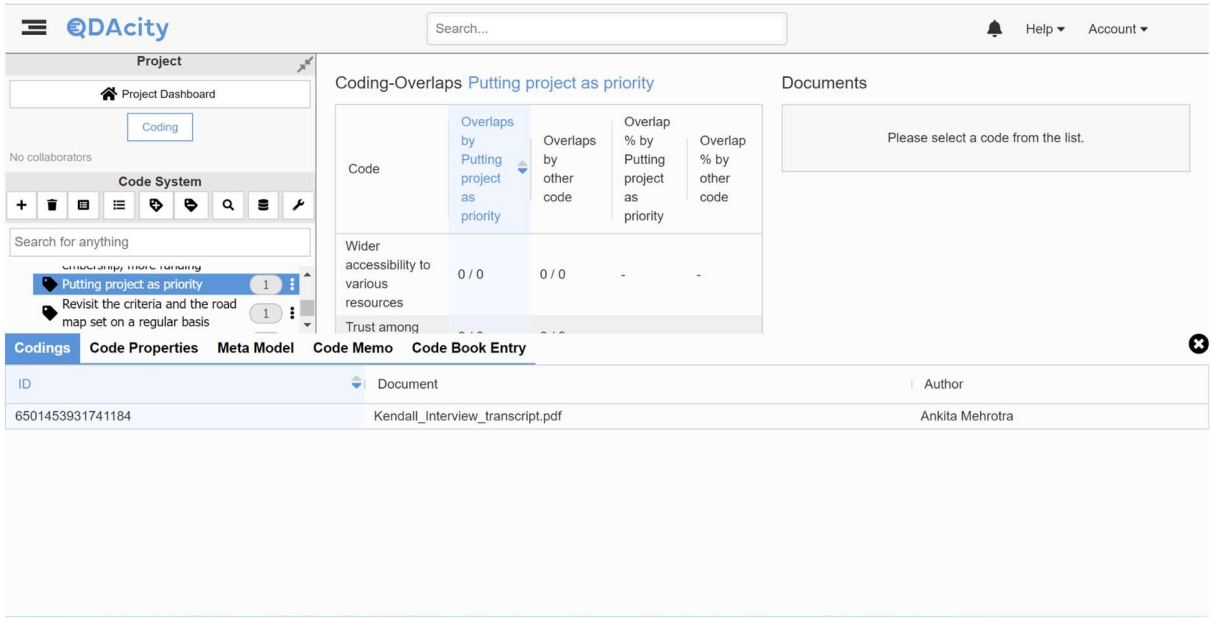
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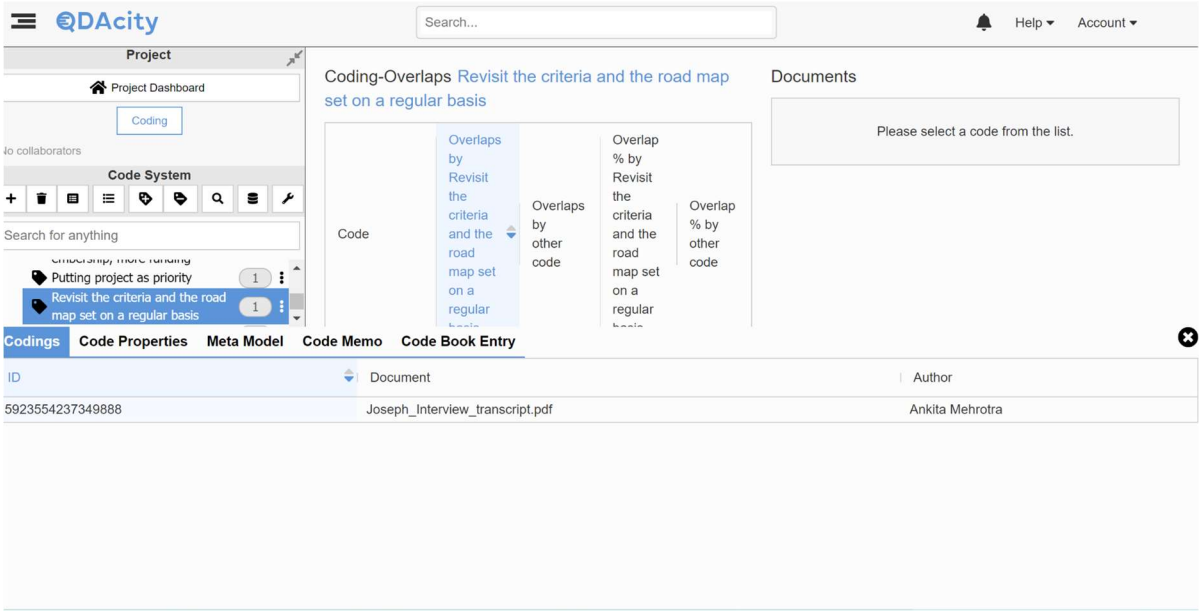
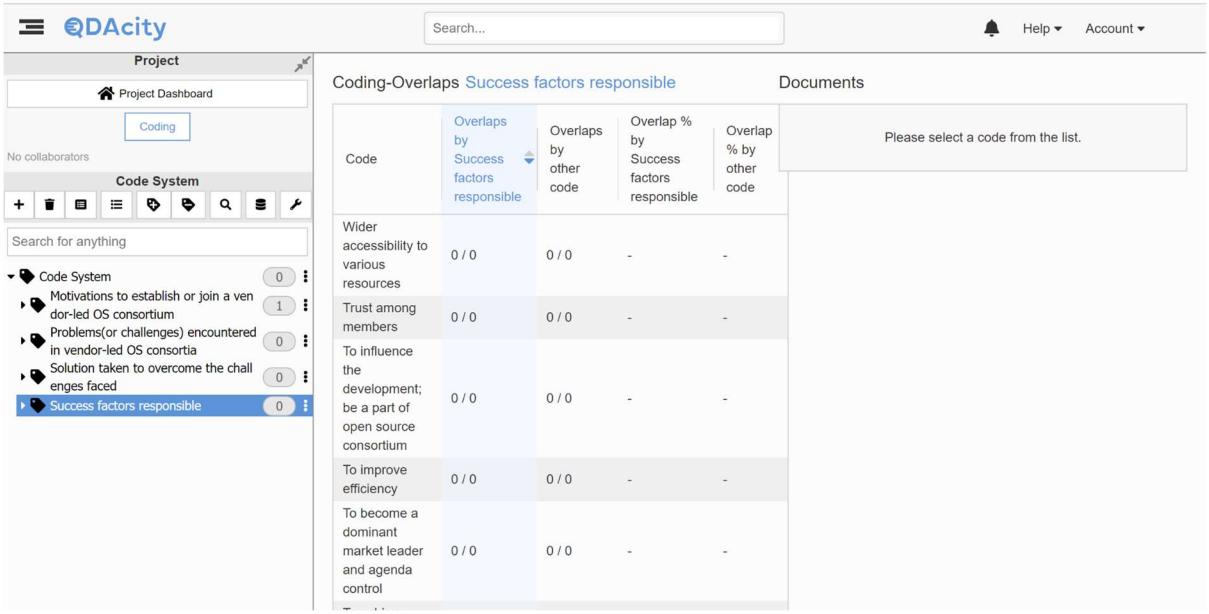


4.Success factors responsible



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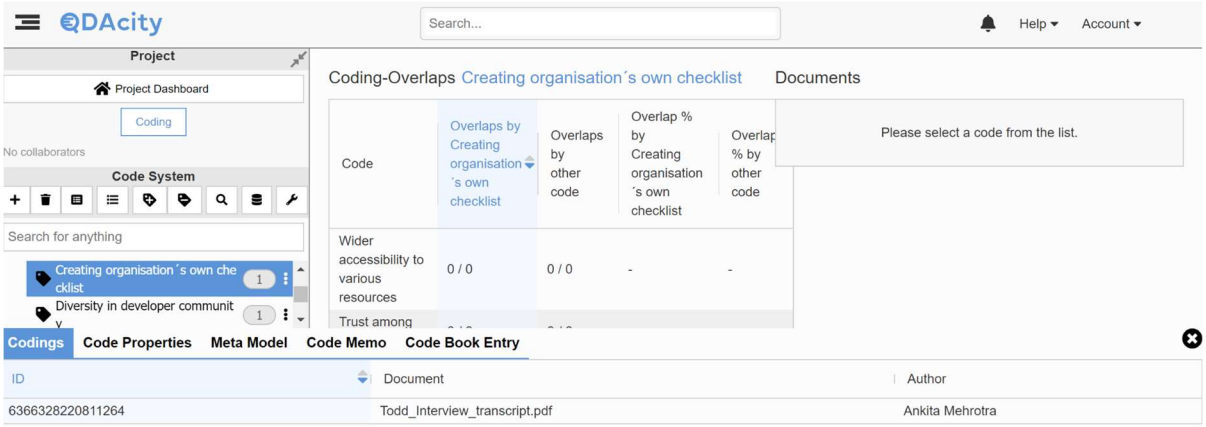

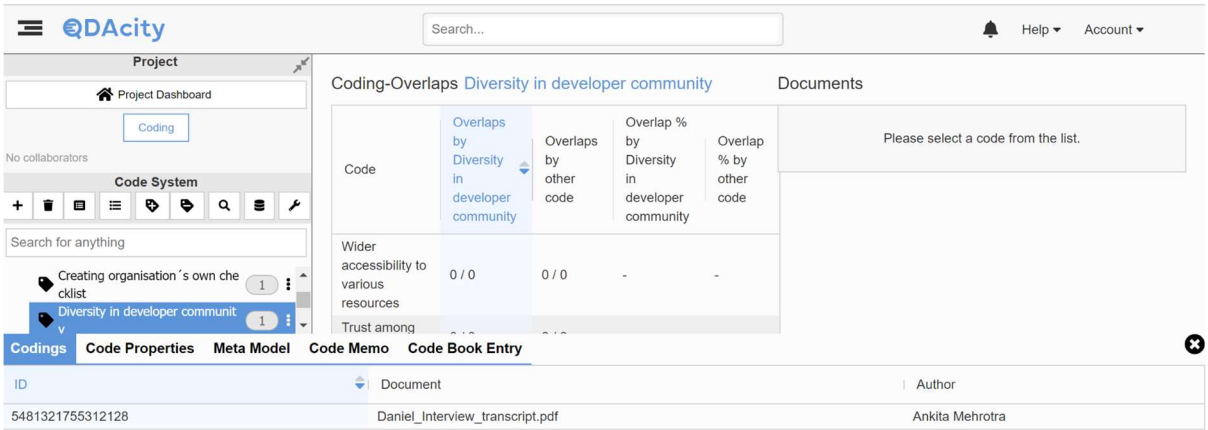

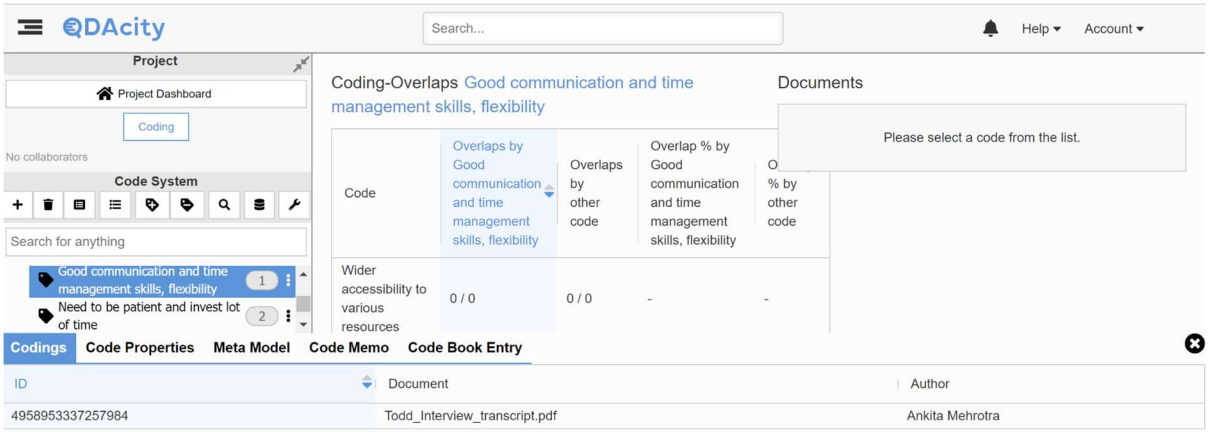
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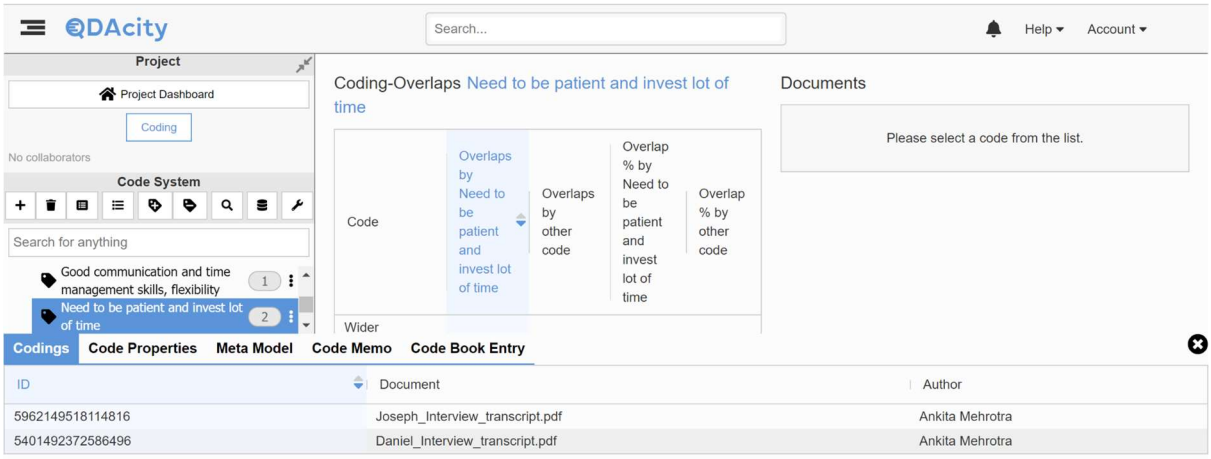
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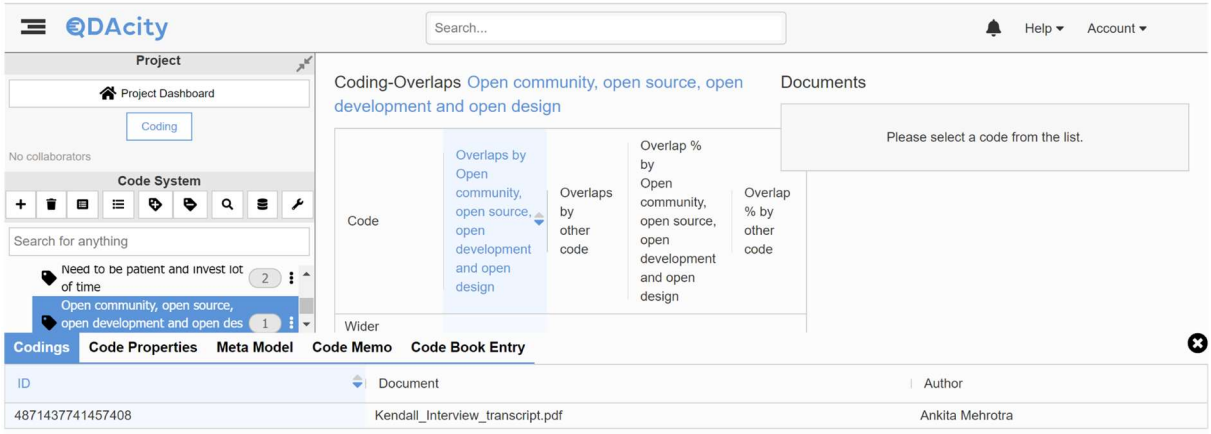
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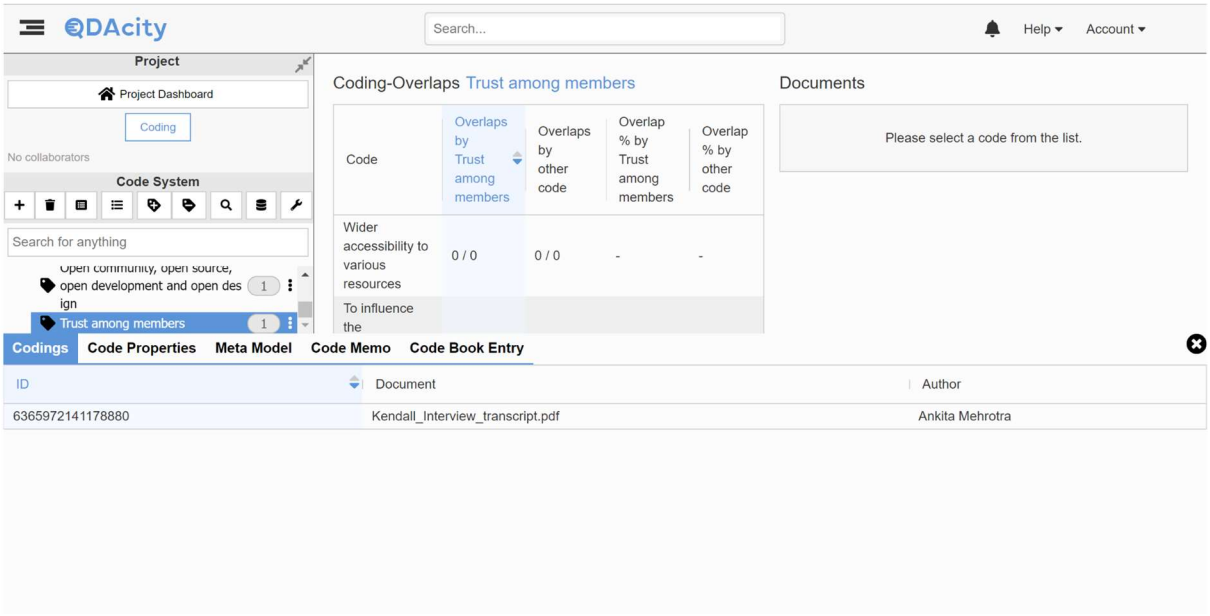
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