

# Assessing the Importance of Various Dimensions of Data Quality in Open Banking Processes

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**Abstract:** Data is considered the most crucial element in open banking processes and services. Therefore, it is necessary to pay attention to various aspects of the quality of this data in order to provide appropriate and expected services to customers. In this research, various dimensions representing different aspects of data quality were investigated in the field of open banking. This research has been conducted in two main steps: The Delphi method and the pairwise comparisons method. In the first step, various dimensions of data quality in open banking were extracted based on the Delphi method. In the next step, the importance of each of these dimensions was assessed relative to each other using the pairwise comparisons method, and the most crucial dimensions were determined. Based on the results obtained from these two methods, the significance of eleven dimensions of data quality in this field was determined. The best overall weighted averages were related to dimensions such as accuracy, accessibility, relevancy, timeliness, consistency, security, interpretability, reputation, believability, ease of understanding, and value-added, respectively. Banks and fintech companies offering open banking services can consider these dimensions

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when evaluating the quality of their data to enhance the provision of superior services.

**Keywords:** Open banking, Data quality, Delphi method, Pairwise Comparisons

## 1. Introduction

Due to the rapidly evolving information and digital technologies, the world is moving towards an open data economy (He, Huang, & Zhou, 2023). Open data can be used as a tool to foster innovation and enhance financial services. Customer data sources in open banking can help fintech companies provide more innovative financial services and better facilities to customers (O’Leary et al., 2021). On the other hand, these data can also be used as a tool to increase customer trust and reduce fraud rates in the financial industry (Zachariadis, 2020). Therefore, it is critical to maintain the accuracy, integrity, and privacy of this data. For the effective utilization of open data in open banking, solutions have been proposed to manage and uphold quality and privacy. Some of these solutions are (Sullivan, Miller, & Montes, 2021).

- ◇ The use of modern technologies to protect the customers’ privacy, such as information encryption and cloud servers;
- ◇ Creating detailed and transparent policies for managing open data and protecting customer privacy;
- ◇ Providing training to banking employees and fintech companies regarding customer privacy and open data management;
- ◇ Creating effective systems for managing customer consent in open banking and maintaining privacy;
- ◇ Creating effective systems to manage access to open data and control access to this data;
- ◇ Creating effective systems to manage security risks and maintain the security of open data;
- ◇ Creating effective systems for managing and maintaining the quality of open data and ensuring the accuracy and correctness of these data.

Since data quality has various dimensions beyond accuracy and privacy, each dimension holds its own significance. This research takes a comprehensive approach by considering different aspects of data quality in the realm of open banking. In fact, the problem we aim to investigate and solve in this research is the neglect and lack of attention to the various aspects of data quality in the field of open banking. This oversight can lead to improper performance in providing services within this sector. In other words, the services provided in open banking may be acceptable in some aspects of data quality, but the lack of attention to other aspects of data quality makes the overall performance of the services unacceptable. For instance, a service may offer highly accurate data, but this information may not be current for the intended activity, or it may be accurate but lack acceptable consistency. Therefore, it is necessary to investigate the issue of data and its quality comprehensively in the field of open banking. Different dimensions of data quality should be considered in this context.

Accordingly, one of the most well-known and cited frameworks in the field of data quality, Wang and Strong's framework (1996), has been used as the basis for investigating the dimensions of data quality in the field of open banking. In this framework, fifteen dimensions of data quality are defined across four categories. In Table 1, these fifteen dimensions are presented along with their definitions and corresponding categories.

**Table 1. Dimensions of data quality, their definitions and categories (Wang & Strong, 1996)**

Category	Dimension	Definition of the dimensions
Intrinsic	accuracy	The extent to which data is error-free, correct, and reliable.
	objectivity	The extent to which data are unbiased.
	believability	The extent to which the data is believable.
	reputation	The extent to which data are trusted or highly regarded in terms of their source.

Category	Dimension	Definition of the dimensions
Contextual	value-added	The extent to which data are useful, and using them has an advantage.
	relevancy	The applicability of the data for the task at hand.
	timeliness	The extent to which the age of the data is appropriate for the task at hand.
	completeness	The extent to which the data in terms of scope, breadth, and depth is sufficient to perform the desired activity.
	appropriate amount of data	The extent to which the volume or quantity of available data is appropriate.
Representational	conciseness	The extent to which the data is presented compactly but completely.
	consistency	The extent to which data is always displayed in the same format.
	interpretability	The extent to which data are in appropriate units and language
	ease of understanding	The extent to which data are clear without ambiguity and easily comprehended.
Accessibility	accessibility	The extent to which data are available, or easily and quickly retrievable
	access security	The extent to which access to data can be restricted.

The main goal of this research is to investigate various dimensions and aspects of data quality in the field of open banking and to identify the most crucial ones. To achieve the goal of this research, two main objectives need to be considered: (1) Identifying different dimensions of data quality in the field of open banking, and (2) Comparing data quality dimensions with each other to identify the most important ones in the field of open banking. Therefore, the following research questions need to be addressed:

- ◇ What are the dimensions of data quality in the field of open banking?
- ◇ What are the most important dimensions of data quality in the field of open banking?

This paper is organized as follows: The theoretical background is reviewed

in the next section. In the research methodology section, the main steps of the study are introduced in detail. In the data analysis and findings section, the output results of the Delphi method and the pairwise comparisons method are presented. In the discussion section, the answers to the research questions and a comparison of the research results with previous studies are presented. The last section of this article includes a conclusion and presentation of theoretical and practical implications.

## 2. Background

In the era of the digital economy, the most valuable asset is data. Data plays a significant role in the financial market. Many countries have implemented measures to encourage fintech companies to leverage data for innovating financial products (Wang, 2023). The provision of innovative financial products and services depends on the use of data that is suitable in various aspects of quality. For this purpose, various research studies have been conducted on data quality in the field of new financial services and open banking, exploring different dimensions of data quality. In the rest of this section, some of these studies will be presented.

In a study, the researchers investigated the limitations of open government data (OGD) in terms of disclosing data without quality control and its negative impact on citizen participation. Based on this, they developed a framework to measure indicators for assessing the quality of open government data across various dimensions of data quality at a granular level. The results of this study have shown that creating a common data quality model framework for open data and defining a set of applicable criteria is an essential tool for improving data quality (Vetrò et al., 2016).

In Leong's (2020) research, two different frameworks regarding open banking have been considered and analyzed. Accordingly, the first framework is a duty-oriented framework that focuses on maintaining data protection. The second framework is a customized rights-based framework that grants customers more control over their banking data in open banking. The results of this study have shown that the concept of data ownership and control is a fundamental issue in the development of open banking.

In a research study, four fundamental indicators of open banking and open data in Europe were analyzed. These four indicators include: (1) facilitating open banking to increase competition in the banking sector; (2) strict data protection laws; (3) expanded reporting requirements that followed the global financial crisis; and (4) the legal framework for digital identity. Analysis of the indicators has shown that Europe has a strict approach to data privacy in open banking due to its robust legal environment. The results of this study also emphasize the positive impact of open data banking on innovation and product quality (Arner, Buckley, & Zetsche, 2021).

In another study, open banking innovation and shared data communication between traditional financial institutions and third-party financial service providers were examined. The results indicate that the quality of open data is crucial. In an open banking system, it is essential that the information freely exchanged between the primary financial institutions and third-party financial service providers is accurate and reliable. Therefore, in open banking, the quality of open data, based on accuracy, completeness, and reliability of information, plays an important role in ensuring the success and acceptance of this new model of data economy (Zeller & Dahdal, 2021).

In a research study, the relationship between open banking and competition was analyzed. This article has also highlighted the significance of balance in fostering innovation and sustaining financial stability. The results of this study have emphasized the role of open data quality in increasing trust, promoting innovation and competition, making better decisions, and preventing risks (Palmieri & Nazeraj, 2021).

In another study, a thorough analysis of the development of open banking has been conducted. For this purpose, the authors have documented open banking policies in different countries using an innovative dataset. The results of the study have shown that the significance of open data in banking is extremely important. The analysis revealed that the implementation of open banking policies leads to a 50% increase in automatic investments in the fintech sector. This result shows that access to customer data by emerging financial technologists helps to expand and develop their activities (Babina et al., 2024).

Polasik and Kotkowski (2022) investigated the factors influencing customers'

selection of open banking services. Accordingly, a Pan-European survey involving more than 5,500 people from 22 countries was conducted. The results have shown that attitudes toward privacy and uncertainty in data sharing have a negative impact on the experience of open banking services. In addition, trust in both banking and non-banking providers also plays a crucial role in customers' decision to utilize banking services. The study has shown that the quality of open data in open banking plays a significant role in increasing trust, market development, risk management, and improving processes and services. Providing data and information to customers is one of the fundamental challenges and responsibilities of financial institutions and information technologies in the realm of open banking.

In a research, the implementation of the Payment Services Directive (PSD2) in the Netherlands was analyzed. In this study, the researchers used the method of semi-structured interviews. They interviewed 30 representatives from banks, fintechs, NGOs and customers and then analyzed these interviews. The results have shown that PSD2 has not been fully implemented in the Netherlands due to technical and cultural barriers. Also, this paper has shown that PSD2 can significantly improve the financial education of individuals and small businesses through digital advisors, virtual agents and financial education. Also, the results of the study have shown that excellent user interface design is very important and can reduce the need for financial education (Preziuso, Koefer, & Ehrenhard, 2023).

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In a study, the attitudes and fears of digital native consumers towards open banking were assessed using structured questionnaires. The results have shown

that open banking has an impact on customers' trust in banks. Most of the participants have stated that they are against granting access to their information to companies not affiliated with the bank. Banks must, therefore, ensure that customer data is shared with third parties in a safe and secure manner. The results also indicate that the stronger the user authentication, the more consumers are inclined towards accessing open information and open banking (Bylykbashi, Fitamant, & Lee, 2023).

Mutambik (2023) has attempted to comprehend the factors associated with the experience and level of loyalty towards open banking brands and applications. Based on this, researchers have developed a model that includes six emotional and cognitive factors that influence customer experience and loyalty intention. This model was developed using data collected through a quantitative method (survey) with the participation of open banking users in Saudi Arabia. The results of the study have shown that the customer experience was influenced by several factors, including ease of use, perceived value, quality of support, reliability, perceived risk, and ability to innovate. These factors have consequently influenced customer loyalty.

In a research study, the impact of granting data control on data quality and competition in the lending market has been investigated. The results of this study demonstrate that the data collected from customers regarding their engagement in open banking and their selective choices about sharing data directly influence data quality and, consequently, competition in the lending market. As a result, the article suggests that customers' control over their data in an open banking environment can have a significant impact on data quality and competition in the lending market. It also plays a crucial role in the decisions made by customers and fintech companies in this field (He, Huang, & Zhou, 2023).

The literature review has shown that recent research in open banking has largely investigated various aspects of data quality, but some aspects of quality have received less attention. Previous studies have addressed accuracy, reliability, security, and privacy, but some other important dimensions such as data consistency, relevancy, timeliness, and accessibility have received less attention. To fill this gap, in this research, fifteen different dimensions of data quality in the field of open banking are investigated and the importance of each of them in this field is determined.

### **3. Research method**

This study has been done in two main steps. In the following, each of the main steps is explained.

#### **3-1. Delphi method**

In the first step, various dimensions of data quality in the field of open banking have been extracted using the Delphi method. Based on this method, six main steps have been completed (Alidousti, 2006).

##### **1. Identification of experts**

In this step, an attempt was made to incorporate the insights of experts with ample knowledge in the field of electronic banking and data quality. Based on this, ten experts were identified, four of whom possessed sufficient knowledge in the field of electronic banking and data quality through their work and research. Additionally, three individuals possessed adequate knowledge in the field of data quality, while three others demonstrated sufficient expertise in information technology and open banking. It should be noted that the selection criteria for experts included knowledge and expertise in the field under study, work or research experiences in this field, and interest and motivation to participate. Therefore, experts have been selected using the purposeful method based on these criteria. Out of the ten experts selected for this research, four individuals hold a PhD degree (three in the field of information technology management and one in industrial engineering), while the remaining six have a master's degree in information technology engineering.

##### **2. Determining consensus criteria**

In this research, four criteria including mean  $\geq 6$ , standard deviation (Rossouw, Hacker, & de Vries, 2011), coefficient of variation  $\leq 0.4$ , and the score of 70% of the members  $\geq 5$  (Alidousti, 2006) were considered as consensus criteria of the Delphi method.

##### **3. Preparation of the first round questionnaire**

Based on fifteen dimensions of data quality, a questionnaire containing fifteen questions was prepared. For each question, the importance of each dimension was determined using a seven-point Likert scale ranging from "very low importance" to "very high importance". At the end of the questionnaire, an open-ended question

was included asking the experts if they had any additional data quality dimensions in mind that were not listed but are important in the field of open banking.

#### **4. Sending the first round of questionnaires to experts**

The designed questionnaire was sent to the experts and eight out of ten experts completed the questionnaires.

#### **5. Sending the second round of questionnaires to experts**

In this step, a questionnaire was sent to eight experts based on their opinions in the first round, their consensus and lack of consensus on data quality dimensions, and the suggestions provided in the initial round.

#### **6. Analyzing the responses and extracting the list of final dimensions of data quality**

In this step, the adequacy of the Delphi rounds was announced based on high consensus and the absence of new dimension proposals. Subsequently, the final list of data quality dimensions was extracted according to consensus criteria. Based on this, every dimension that met at least three of the four criteria defined in the second step was included in the final list.

### **3-2. Pairwise comparisons**

In the second step of this research, the finalized dimensions in the first step were evaluated based on the AHP method and pairwise comparisons. Based on this and since the final list obtained from the Delphi method includes 11 dimensions of data quality, a questionnaire containing 55 comparisons were compiled. These questionnaires were sent to five experts for completion. Four of the experts whose knowledge, expertise, and experience were used in this step were the experts of the previous step along with another expert whose opinions were used in this step to complete the questionnaire. At this step, three experts have a PhD degree and two have a master's degree in information technology.

## **4. Data analysis and findings**

In this section, the findings of the two main steps of the research are analyzed. In the first step, the opinions of experts were collected and analyzed using the Delphi method regarding the dimensions of data quality in the field of open banking.

The results of the first and second rounds of the Delphi method are presented in Table 2. The analysis of these results shows that the experts have reached a consensus in the second round on 11 out of the 15 existing dimensions of data quality. In the second round, compared to the first round, members' opinions have shown a positive change in the dimensions of consistency, believability, and ease of understanding, while there has been a negative change in the dimension of the appropriate amount of data. In both rounds of this method, no new data quality dimensions were proposed by the members.

In cases where certain dimensions have not reached a consensus to be included in the final list of the most important dimensions, it is important to note that these dimensions may not have met certain criteria by only a slight margin. For example, in terms of the completeness dimension, the standard deviation obtained was 1.06. If it was less than or equal to one, three criteria would be met, and it would be included in the final list. However, not including dimensions such as completeness in the final list of the most important dimensions should not lead to its neglect.

**Table 2. Results of the first and second rounds of Delphi and consensus or lack of consensus on dimensions**

No.	Data quality dimension	The results of the first round of Delphi		The results of the second round of Delphi		Consensus or not
		Coefficient of variation	Number of consensus criteria	Coefficient of variation	Number of consensus criteria	
1	Accuracy	0.051	4	0.051	4	Consensus
2	Timeliness	0.161	4	0.078	4	Consensus
3	Completeness	0.211	2	0.197	2	
4	Accessibility	0.166	3	0.116	4	Consensus
5	Value-added	0.125	4	0.089	4	Consensus
6	Consistency	0.230	2	0.134	3	Consensus
7	Interpretability	0.089	4	0.109	3	Consensus
8	Conciseness	0.313	1	0.155	2	

No.	Data quality dimension	The results of the first round of Delphi		The results of the second round of Delphi		Consensus or not
		Coefficient of variation	Number of consensus criteria	Coefficient of variation	Number of consensus criteria	
9	Security	0.164	3	0.117	4	Consensus
10	Appropriate amount of data	0.160	3	0.118	2	
11	Objectivity	0.335	1	0.148	2	
12	Reputation	0.078	4	0.078	4	Consensus
13	Believability	0.290	2	0.162	3	Consensus
14	Ease of understanding	0.320	2	0.125	3	Consensus
15	Relevancy	0.116	4	0.081	4	Consensus

The status of all 15 dimensions of data quality obtained from the results of the second round of the Delphi method concerning each of the consensus criteria is shown in Table 3. This table shows the four consensus criteria used in this method and the evaluation results of these criteria for each dimension. Based on this, a checkmark is placed in the corresponding column for each dimension that meets the criterion. Eleven dimensions' accuracy, timeliness, accessibility, value-added, consistency, interpretability, security, reputation, believability, ease of understanding, and relevancy were qualified as the final dimensions of data quality from the Delphi method.

In the second part of the analysis of the findings, the importance and comparison of the eleven dimensions of data quality, which are the outputs of the previous step, are considered. In Table 4, the weights obtained from the pairwise comparisons of data quality dimensions in the field of open banking are presented according to each expert. Also, based on the pairwise comparisons, experts have been compared with each other, and the weight of each has been calculated and shown in this table. Based on the calculations, the best overall weighted averages were related to dimensions' accuracy, accessibility, relevancy, timeliness, consistency, security, interpretability, reputation, believability, ease of

understanding, and value-added with values of 0.2728, 0.1356, 0.1291, 0.0962, 0.0888, 0.0839, 0.0638, 0.0459, 0.0293, 0.0268, and 0.0265, respectively. Also, in Table 4, the calculated values of consistency index (CI), consistency ratio (CR), and  $\lambda_{\max}$  are presented separately for each expert's pairwise comparisons questionnaire.

**Table 3. Different dimensions of data quality and consensus criteria**

No.	Data quality dimensions	Consensus criteria			
		Mean $\geq 6$	Standard deviation $\leq 1$	Coefficient of variation $\leq 0.4$	The score of 70% of the members $\geq 5$
1	Accuracy	✓	✓	✓	✓
2	Timeliness	✓	✓	✓	✓
3	Completeness			✓	✓
4	Accessibility	✓	✓	✓	✓
5	Value-added	✓	✓	✓	✓
6	Consistency		✓	✓	✓
7	Interpretability		✓	✓	✓
8	Conciseness		✓	✓	
9	Security	✓	✓	✓	✓
10	Appropriate amount of data		✓	✓	
11	Objectivity		✓	✓	
12	Reputation	✓	✓	✓	✓
13	Believability		✓	✓	✓
14	Ease of understanding		✓	✓	✓
15	Relevancy	✓	✓	✓	✓

**Table 4. Calculation of weights and importance of each dimension of data quality based on pairwise comparisons**

Criteria	Experts					The overall weighted averages	Ranks
	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5		
	The weights of the experts themselves						
	0.4269	0.2354	0.1111	0.1534	0.0729		
The weights of the criteria related to each expert							
Accuracy	0.3043	0.2883	0.1272	0.2946	0.2166	0.2728	1
Timeliness	0.0746	0.1091	0.1201	0.1103	0.1167	0.0962	4
Accessibility	0.1205	0.1604	0.1405	0.1610	0.0843	0.1356	2
Value-added	0.0251	0.0185	0.0565	0.0182	0.0325	0.0265	11
Consistency	0.0739	0.0939	0.1486	0.0905	0.0660	0.0888	5
Interpretability	0.0671	0.0648	0.0628	0.0632	0.0448	0.0638	7
Security	0.1072	0.0501	0.0544	0.0544	0.1640	0.0839	6
Reputation	0.0417	0.0369	0.0605	0.0355	0.0996	0.0459	8
Believability	0.0304	0.0287	0.0287	0.0282	0.0285	0.0293	9
Ease of understanding	0.0298	0.0208	0.0256	0.0207	0.0444	0.0268	10
Relevancy	0.1248	0.1281	0.1747	0.1230	0.1023	0.1291	3

  

Calculations of Consistency Index (CI) and Consistency Ratio (CR)							
	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	RI	1.51
$\lambda_{max}$	12.4689	11.8194	12.4669	12.0218	12.3185		
Expert questionnaire Consistency Index (CI)	0.1468	0.0819	0.1466	0.1021	0.1318		
Expert questionnaire consistency ratio (CR)	0.0972	0.0542	0.971	0.0676	0.0873		

According to the findings of the first and second steps of this research, a framework of the most important dimensions of data quality in the field of open banking is presented in figure 1. In this Figure, the most important dimensions are shown in order of priority from the highest score to the lowest score.



Figure 1. A framework of the most important dimensions of data quality in open banking

## 5. Discussion

Although various research studies have been conducted in the field of open banking (Ramdani, Rothwell, & Boukrami, 2020; Laplante & Kshetri, 2021), and numerous applications of it are being implemented, the data used as the primary

element has not been thoroughly evaluated in terms of quality. In a field like open banking, where data forms the foundation of operations, it is crucial to focus on different aspects and dimensions of data quality to deliver optimal services. Based on this, and in accordance with the main objectives of this research, two research questions were mentioned in the introduction section. In this research, the dimensions of data quality considered in one of the most important and comprehensive frameworks of data quality, the framework of Wang and Strong (1996), were studied using the Delphi method. In order to answer the second question, the dimensions extracted from the first step were weighted using the pairwise comparisons method, and the most critical dimensions of data quality were identified.

Comparing the previous research and the results of this study, it should be noted that those studies only considered limited aspects of data quality in the field of open banking (Polasik & Kotkowski, 2022; Bylykbashi, Fitamant, & Lee, 2023; Sullivan, Miller, & Montes, 2021). In this research, various aspects of data quality that are effective in providing open banking services were comprehensively considered. Some dimensions, such as consistency, relevancy, and timeliness, were less considered in previous research. However, in the current study, they were investigated along with other dimensions. The comprehensive assessment of open banking data quality will enhance the delivery of data-driven services in this sector in various ways, ultimately resulting in higher customer satisfaction. For example, in the processes and services of open banking, if data accessibility is efficient and prompt, but the data lacks sufficient quality in terms of timeliness or accuracy, this quick accessibility alone cannot generate added value. As another example, if the quality of the data collected from different sources is appropriate in terms of timeliness, but lacks proper consistency, it cannot be expected to provide adequate services using them. Therefore, it is necessary to consider data quality from various perspectives in this field.

## **6. Conclusion and future works**

In the field of open banking, as in other fields, the role of data is critical. The quality of the data utilized in open banking has various aspects. To assess the quality of this data, one should consider not only aspects like privacy and security

but also other factors. It is certainly true that aspects of privacy and security are very important in this field, but other aspects of the quality of these data should also be considered. In this research, eleven dimensions of data quality in the field of open banking were investigated using Delphi and pairwise comparison methods. These dimensions include accuracy, timeliness, accessibility, value-added, consistency, interpretability, security, reputation, believability, ease of understanding, and relevancy. Based on the results obtained from the pairwise comparisons of these dimensions and their weights according to importance, dimensions such as accuracy, accessibility, relevancy, timeliness, and consistency were determined as the most important. Additionally, dimensions such as security, interpretability, reputation, believability, ease of understanding, and value-added were ranked next according to their respective weights. Based on this, banks and fintech companies that offer open banking services need to address all aspects of data quality. If there is a limitation in terms of resources, they can focus on more important data quality dimensions.

Regarding the limitations of this research, it should be mentioned that there may be challenges in accessing experts with adequate knowledge and experience in the areas of open banking, electronic banking, and data quality.

One of the practical implications of this research is that the open banking services offered by various banks can be assessed through case studies, focusing on the data quality dimensions examined in this research. One of the theoretical implications of this research is that the dimensions of data quality are weighted and prioritized based on other methods.

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