Accept Me as I Am or See Me Go: A Qualitative Analysis of User Acceptance of Self-Sovereign Identity Applications

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Abstract

Self-sovereign identity represents a novel phenomenon aiming to innovate how entities interact with, manage, and prove identity-related information. As with any emerging phenomenon, user acceptance represents a major challenge for the adoption of Self-sovereign identity. Since previous initiatives for digital identity management solutions have not been successfully adopted while at the same time their benefits are largely driven by network effects, user acceptance research is of particular importance for Self-sovereign identity. Therefore, we investigate the user acceptance of Self-sovereign identity by conducting a qualitative interview study. We contribute novel variables to existing theory and offer guidelines for building Self-sovereign identity systems.

Keywords: Digital identities, adoption, TAM2, theory building.

1. Introduction

Currently, managing identities and their associated attributes poses a challenge for citizens in the digital space (Cameron, 2005). Therefore, organizations such as Meta, Microsoft, and Google offer proprietary Identity Management Systems (IdM) such as Single-Sign-on (SSO) services. These services bundle user data and provide the data to other services upon the user's request. While this solution aims for high user comfort, it also comes with drawbacks regarding lock-in effects and data privacy: since one's data is bundled by one provider and shared in the background without sufficient transparency, users' are not in control over their data (Tobin et al., 2017). As more and more interactions shift to online environments, the need to enable citizens to transfer their identities to digital representations and to present themselves online in the same way as they do in the physical world, i.e., to present reliable certificates, increases (Cameron, 2005).

To offer an alternative to centralized identity providers, Allen (2016) introduced the concept of Self-Sovereign Identity (SSI). Its basic idea is to move the transaction paradigm of the analog world into the digital world. Portable and reliable digital identities in the form of verifiable credentials should lie under the end user's control (Preukschat & Reed, 2021). As such, the concept of SSI aims to decrease complexity for the involved parties as well as provide high reliability, data security, and privacy.

However, SSI is not the first identity solution aiming for data security paired with high usability. For example, the electronic Identification (eID) was introduced in Germany in 2010. However, only about 7% of citizens have used the eID so far (Rederer et al., 2021). The perceived user-friendliness and a low number of use cases represent the core reasons for the limited uptake (Felden et al., 2020).

This example shows that user acceptance of identity solutions must be studied before large-scale rollouts. If user acceptance is not taken into account when introducing SSI, adoption may be at risk (Rieger et al., 2022).

While we can rely on a plethora of existing research examining user acceptance of technology (Benbasat & Barki, 2007), SSI represents a novel phenomenon, offering features such as higher control and privacy, which requires investigating its user acceptance in more detail (Cabinakova et al., 2019). At the same time, research on user acceptance of SSI is scarce, and little is known about the driving factors for acceptance of this new concept (Sartor et al., 2022). Thus, building on existing work, we pose the following research question:

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Which attributes, features, and characteristics of Self-Sovereign Identity Systems influence the acceptance of the Identity System?

While mostly quantitative studies observe technology acceptance, we follow a qualitative approach to address this research question, as SSI represents a novel phenomenon. We follow the research design proposed by Vogelsang et al. (2013) to allow for the emergence of new and unknown theory constructs. In specific, we conduct a qualitative study with 13 users. This allows us to contribute novel variables to existing theory, which are not yet represented in TAM2. Our results also guide in building SSI systems by providing relevant criteria for implementation.

2. Background

2.1. Self-Sovereign Identity

Digital identities are defined as "digital representation[s] of the information known about a specific individual, group, or organization" (ITU, 1993). Online, however, an inherent layer to identify, authenticate and control users' access to digital resources does not exist. To date, managing identities and related attributes within the digital space remain a challenge. For this reason, digital identities are usually handled by proprietary (IdM). For example, in federated approaches like SSO, a centralized instance enables users to share their digital identities with other providers. Services such as SSO are primarily offered by large organizations in an effort to make identity services more convenient. However, these solutions come with two major drawbacks. First, users' activities are entirely transparent to identity providers. A central intermediary having access to a user's identity data bears risks regarding data privacy and controllability, especially since identity data is highly sensitive (Preukschat & Reed, 2021). Second, centralized approaches usually provide limited portability of the digital identity (Stockburger et al., 2021) as the digital identity information is usually not transferable and lacks interoperability. Thus, identity-related information is lost upon leaving one federation and registering at another, resulting in lock-in effects (Sedlmeir et al., 2021).

To address these problems, Allen (2016) introduced SSI to enable entities to become completely independent of central identity providers, issuers, and verifiers by putting users in the center of any interaction related to their data (Sedlmeir et al., 2021). Specifically, Allen (2016) aims for controllability, privacy, security, and portability: First, users must be able to create, use and manage their own digital identities across multiple sites while having full control over them. Second, providers requesting user information must provide transparency to the user about how, why, and for what their identity data is processed. Last, identity data must be handled minimally and only through explicit consent by the user (Mühle et al., 2018).

Within the concept of SSI, issuance and verification of data follows the "trust triangle" (Preukschat & Reed, 2021) of three entities: issuers, holders, as well as verifiers. Holders represent users and can not only be individuals but also organizations and machines.

SSI-based interaction processes start with the users' request for their necessary claims from an issuer. Standardized decentralized identifiers (DID) allow the opening of secure, bilateral communication channels (W3C, 2021a). The requested claims may be any data related to the user, such as licenses, certificates, or authorizations. Issuers then issue this data in the form of secured digital credentials, referred to as verifiable credentials (VCs). In particular, VCs consist of claims and metadata. Digital signatures ensure the tamper-proofness of claims and allow to identify the issuer (W3C, 2021b). Public identification information of the issuer, such as public keys, is listed in a public registry.

After issuance, VCs can be managed independently by the holding entity using a digital wallet (O'Donnell, 2019). Additionally, proof of its issuance is written in a trusted registry, referred to as a verifiable data registry (VDR) (Mühle et al., 2018). To date, SSI implementations often rely on distributed ledgers for VDRs.

A user can hold credentials from different issuers within their wallet and use them independently (O'Donnell, 2019). If users wish to prove some of their information, they present verifiers with a verifiable presentation (VP). VPs follow a scheme pre-defined by the verifier (Nauta & Joosten, 2019) and a proof of their correctness. The latter typically includes a cryptographically verifiable proof of its validity, backed by an entry in the VDR, and the signature of the issuing organization (W3C, 2021b). Thus, a VP can be verified without relying on direct contact between verifying and issuing parties. Overall, the verification follows the scheme of established Public Key Infrastructure (PKI). At the same time SSI does not rely on a centralized registry, identity providers, and certificate authorities (Mühle et al., 2018). Besides its decentralized governance, SSI builds upon additional cryptographic concepts such as zero-knowledge proofs (ZKPs) to allow users to disclose information selectively (Schellinger et al., 2022). The latter aims to further improve users' privacy.

2.2. Technology Acceptance Research

Technology acceptance research assumes that a potential user's overall attitude towards using a particular system is important in deciding to use it (Davis, 1985). On this basis, Davis (1985) developed the technology acceptance model (TAM) to improve the understanding of user acceptance processes. In addition, the TAM provides a theoretical basis for a practical user acceptance testing methodology for the evaluation of new systems prior to their implementation (Davis, 1985).

According to TAM, a user's attitude toward use depends on two constructs: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). PU is defined as "the degree to which an individual believes that using a particular system would enhance his or her job performance" (Davis, 1985, p. 26). High PU reflects a user's belief in the presence of a positive use-performance relationship. At the same time, the system may be too difficult to use, and the performance benefits may be outweighed by the effort required to use the system, which is why PEOU complements PU. PEOU is defined as "the degree to which an individual believes that using a particular system would be free of physical and mental effort" (Davis, 1985, p. 26). PEOU does not only directly affect a user's attitude but does directly affect PU. As a result, if a user uses two systems under the same conditions and perceives one of them to be easier, they are more likely to prefer that system (Davis, 1985). Finally, both constructs are assumed to be influenced by external factors relating to the system's design features.

Subsequent phases of experimentation allowed to refine the model. As a result, Venkatesh and Davis (2000) introduced TAM2, which enriches PU with additional determinants to increase the model's accuracy in predicting behavior. They extended the TAM with constructs on social influence (Subjective Norm, Voluntariness, and Image) as well as cognitive instrumental processes (Job Relevance, Output Quality, Result Demonstrability, and PEOU) (Venkatesh & Davis, 2000).

TAM and TAM2 represent the most used acceptance theories. Through their low complexity they are adequate for this explorative (qualitative) research approach in contrast to other, more complex models setting too many constructs as default e.g., Unified Theory of Acceptance and Use of Technology or Resistance Models. Thus, we follow Vogelsang et al. (2013) and use the TAM2 as a basis for our research. However, while TAM is generally considered a robust, powerful, and simple model for predicting user acceptance (Lee et al., 2003), researchers also point out that its strength in simplicity represents its greatest weakness, too. In particular, researchers criticize that assumptions about moderators and constructs usually lack sufficient theoretical justification. Bagozzi (2007) notes that study after study has reaffirmed the importance of PU, while very little research has examined what makes a system truly useful. Accordingly, PU and PEOU are treated as "black boxes" by researchers (Benbasat & Barki, 2007).

Furthermore, quantitative studies based on TAM dominate in acceptance research (Wu, 2012), with only three out of 101 TAM papers including qualitative data (Lee et al., 2003). More than 90 percent of the acceptability studies used questionnaire-based field studies. This over-reliance on the survey method entails three problems in particular (Wu, 2012). First, the questionnaire-based data collection means that the TAM measures variance in self-reported use rather than system use (Legris et al., 2003). Self-reports are prone to biases related to acceptability, social desirability, and non-response. Second, quantitative data analysis commonly follows the principle of data reduction, which often prevents authors from providing a comprehensive analysis of the complex interrelationships (Vogelsang et al., 2013; Wu, 2012). Third, researchers may overlook unexpected but potentially important new findings as quantitative studies are inflexible to ad hoc changes during the research process (Wu, 2012).

The few studies investigating acceptance using qualitative methods demonstrate that results can be obtained going beyond known theories (Vogelsang et al., 2013). Specifically, in the case of exploring relatively new software products, Vogelsang et al. (2013) highlight that qualitative data collection allows taking new, unknown constructs into account.

3. Method

As qualitative research serves to answer open research questions (Suri, 2011), we use the former to identify the previously unknown but relevant factors for the technology acceptance of SSI systems.

3.1. Case description

The interviewer went through an SSI demonstrator based on an exemplary use case in each interview to gain a common understanding of SSI applications. This allowed our interview participants to put themselves in the role of end-users shortly before answering the interview questions. The demonstrator was based upon a software pilot developed in a project of the German tax authorities, which demonstrates the issuance and use of an SSI-based income tax certificate (ITC) in the form of a VC. We chose this case for demonstration purposes as proving taxable income has many applications, i.e., loan applications, and is known to a large share of the population. Firstly, an ITC-VC is stored in a user's local wallet. They can then apply for a loan at a credit institution, which acts as the verifier. The user actively shares their data from the ITC-VC with the credit institution as a VP, selectively disclosing only the necessary data. After verification of the VP, the credit institution finishes the process with the final decision. The demonstrator consists of one web-based user interface for each institution and a wallet app.

3.2. Data collection and analysis

In total, we conducted 13 interviews with potential end-users of the system (referenced as I-01-I-13). Following, we used purposeful sampling to involve particularly meaningful subjects for the research question. Therefore, we interviewed researchers who already had a basic understanding of the SSI concept through research or other projects. On the one hand, the respondents are possible end-users of the system. On the other hand, they also bring domain knowledge, enabling them to provide high-quality contributions.

The interviews were conducted with a guide developed based on a preliminary theoretical analysis and lasted 40-65 minutes. We divided the interview guide into four sections. First, we asked the interview partner to briefly introduce themselves and describe their prior knowledge of the role as end-user of SSI systems. This ensured that the interviewee had a basic knowledge of the SSI concept, guaranteeing a consistent understanding of SSI. Second, we ran through the demonstrator with the interview partner. Third, we continued with open questions. We also instructed the respondents to explain the system's positive and negative features. Fourth, the respondents were requested to name their relevant acceptance factors and assign them to the main categories "Individual", "Instrumental", and "Institutional". According to Vogelsang et al. (2013), the main categories guide the interviewees to structure their experiences described in the previous section. In addition, we asked the interview partner to evaluate the factors mentioned concerning their relevance for the acceptance measurement as either "irrelevant", "largely unimportant", "important", or "indispensable". We recorded and transcribed all interviews for data analysis purposes. For a detailed presentation of the interview guide please refer to the Appendix (https://doi.org/10.5281/zenodo.7044146).

We analyzed the data with the help of the computer-assisted qualitative data analysis software MAXQDA. We applied qualitative content analysis, characterized by theory-guardedness provided through referring to the TAM research string in general and the TAM2 theoretical model in specific, rule-guardedness in collecting the data with a structured interview guide and analysis of the data with a written-out coding scheme, and methodological controlledness by following strict qualitative content analysis and therein basing our study on methodology proposed by qualitative researchers to answer our research question (Corbin & Strauss, 1990; Flick et al., 2010; Mayring, 2014). Furthermore, we applied the techniques of structuring and summarizing the interview transcripts, which constituted the study's unit of analysis. We used the variables of the TAM2 model as the main categories (theory-guardedness). Following the approach of Vogelsang et al. (2013), each category was defined and provided with an anchor example (methodological controlledness). In addition, we have described and delimited the categories with coding rules (rule-guardedness). As the compilation of all categories, the category system serves as the essential analysis tool. Thereafter, we screened the material, marked the relevant statements, and assigned them to the initially defined main categories. According to Ruin (2017), a combination of deductive and inductive category formation is highly profitable. As unexpected results may appear, the initially deductively developed category system can be refined by adding new categories. As such, additional added value can be generated, adding to the existing knowledge base. Not all statements could be assigned to the existing categories, so we revised the category system and developed new categories inductively. We repeated the procedure until all relevant text passages were assigned to the categories.

4. Results

4.1. Overview of the results

We identified fourteen categories based on the interviews, five of which originate from the TAM2 model. Nine other categories were inductively developed from the material. The identified categories can be aggregated into three main categories: *Framework Conditions*, *Software Characteristics*, and *User Characteristics*.

Figure 1 shows the developed model. The four TAM2 variables *Image*, *Subjective Norm*, *Job Relevance*, and *Voluntariness* are not included herein, as respondents did not state them as relevant for the acceptance of SSI. We chose the *Use* of the SSI system as the target variable of acceptance, which is described directly by intention to use (IU) in accordance with TAM2. IU is measured by a respondent's self-reported statement.

4.2. Explanation of the variables

4.2.1. Direct influencing variables

Perceived Usefulness. In correspondence to TAM2, *PU* represents a direct influencing variable in our model. All statements that express whether the user finds the software useful were assigned to this category which was addressed by all interviewees.

Overall, the prevailing opinion of the respondents is that it is of great importance to make the advantages of the software clear to the user so that they perceive it as useful. "*That's the be-all and end-all. If I as a user am to accept it, I have to notice the added value quickly, and it has to be really huge" (I-12)*. Accordingly, people who do not recognize the benefits of the software are more likely to be tempted not to use it (I-02). Understanding the benefits of the software has a significant influence on the final decision to use it. This point is especially important if other alternatives exist for completing the task in question. Therefore, we state the following hypothesis:

H1: PU positively influences the IU of the SSI System.

Perceived Ease of Use. *PEOU* also is a direct influencing variable that originates from the TAM2 model. *PEOU* means that users perceive the effort to learn the software as low and the use as easy. The respondents especially noticed "*the simplicity [of the demonstrator]. So that was the thing that stood out the most for me*" (I-05). The convenience of use impacts the decision to use the software (I-04): "*Convenience is Key*" (I-02). Thus, "[t]*he process must involve as little effort as possible on the part of the user"* (I-11). Furthermore, it was mentioned that the IU depends on available alternatives. If the user has several options, they will choose the one that requires the least effort, in their opinion (I-01, I-02, I-09). Thus, users perceive the system as useful if it is perceived as easier to use than the available alternatives. *PEOU* is, thus, a predictor for *PU*. Resulting in the following two hypotheses:

H2: PEOU directly positively influences the IU of the SSI System.

H3: PEOU directly positively influences PU.

Trust. We include *Trust* as a direct influencing variable in the model. *Trust* means that the user trusts the software and involved parties.

Various factors influence *Trust*, including *Regulation and Operation, Privacy, Output Quality,* and *Comprehensibility*. According to the interviewees, trust can be built by the parties involved. *"[T]he question is, who is the publisher of the wallet? If it comes from the state, then I trust it more, or is it from a third party, where I would be more skeptical"* (I-09). Also, the software's technical functionality influences trust. The absence of trust "*would, in any case, have a strong negative impact*" (I-03), indicating a direct relationship between *Trust* and the target variable *Use*:

H4: Trust directly positively influences the IU of the SSI System.

4.2.2. Indirect influencing variables

Regulation and Operation. *Regulation and Operation* refers to all aspects determining the software's implementation, operation, and marketing.

Firstly, the software should be tested sufficiently before implementation, and potential complications should be thought through (I-01). Furthermore, it matters by whom and in which form the implementation is organized. According to the interviewees, users' acceptance would increase if government authorities rolled out the software (I-01, I-09, I-11). One respondent also said their trust would be strengthened if wallets were preinstalled (I-05). Regarding marketing, *"a coordinated advertising offensive should take place, so that the topic reaches the social discussion"* (I-06). It also becomes clear from respondents' statements that trust increases if the software is subject to appropriate regulations. Suggesting "*that one should strive for seals, which somehow enjoy a relatively high level of trust among the population*" (I-01). These statements show a clear link between the variables *Regulation and Operation* and *Trust*. Thus, we propose the hypothesis:

H5: Regulation and Operation directly positively influences Trust.

Privacy and Data Protection. *Privacy and Data Protection* means that only necessary data is requested and stored, and users' data is sufficiently protected. Interviewees' statements show that trust increases if only necessary data is requested: "a*nd I think they would also increase acceptance if they only asked for the necessary data*" (I-03). Furthermore, it is demanded that data is not stored longer than necessary (I-05), and companies communicate data security to users (I-05, I-11). These findings are contrasted by several respondents, stating that privacy and security are not important to many users (I-02, I-06, I-10). Since there is still a prevailing opinion among the interview partners that *Privacy and Data Protection* influence acceptance, we formulate the hypothesis:

H6: Privacy and Data Protection directly positively influences Trust.

Output Quality. *Output Quality* is a construct of the TAM2 model. In the context of this work, it means that the technical functionality of the software is given, it is always available, and data is transmitted correctly.

Interviewees emphasized that technical requirements must be guaranteed in any case, meaning that the software is always available (I-05, I-09, I-13) and functions correctly. It is thus a prerequisite that all data is transmitted correctly. If this is not the case, the software does not add value to the user (I-03, I-09). They will not perceive it as useful. Furthermore, if "*the technical features do not work, the user loses trust in the system*" (I-03), which in turn affects use. Thus, we put forward the following two hypotheses:

H7: Output Quality directly positively influences PU.

H8: Output Quality directly positively influences Trust.

Educational Work. *Educational Work* implies the clear communication of the software's availableness and benefits. Measures that can be classified in this category precede the actual use of the software.

A first step is informing potential users about the possibility of using SSI for their use cases (I-05, I-12). "*If the users are not aware of the system, it will not be accepted*" (I-03). The second step is making the advantages of the concept visible (I-01, I-10, I-12, I-13). Before initial use, users must be convinced of the system (I-02). Interviewees suggested that educational measures could be provided by the state or companies (I-03). Finally, educational communication creates an understanding of the software (I-02), increasing users' comprehensibility. We propose the hypothesis:

H9: Educational Work directly positively influences Comprehensibility.

Support. *Support* means that corresponding use cases are explained understandably. All process steps are transparently communicated to users, and they have the opportunity to ask for help.

According to the respondents, providing suitable explanations for respective use cases plays a central role. "*It is important to take users by the hand right from the start, as this can reduce perceived complexity*" (I-07). Suggestions include a document explaining the process from beginning to end (I-01) and short videos that support the user (I-03). Interviewees also noted that explanations should be simple and preferably in several languages (I-01, I-10). A service button is also suggested to allow users to ask a real person for help (I-04). Thus, the influence of *Support* on *Comprehensibility* becomes apparent.

H10: Support directly positively influences Comprehensibility.

Result Demonstrability. *Result Demonstrability* originates from TAM2. Here it means that submitted data can be checked afterward. It, thus, refers to the results achieved and is temporally downstream of the actual use.

In our interviews, respondents praised the transparent list of all transmitted data at the end of the conducted process (I-04). "*What I find exciting is that you really have an overview of who you've shared data with [...] and maybe it becomes easier to ask if they can delete the data*" (I-12). Respondents consider it important that users can check and understand at any time afterward which data was transferred. "*That is also very good: data persistence. So that I can re-read it in retrospect. I think that is also very important*" (I-05). Hence, we assume a direct relationship between *Result Demonstrability* and *Comprehensibility*.

H11: Result Demonstrability directly positively influences Comprehensibility.

Comprehensibility. *Comprehensibility* means that users can understand all process steps and the software's benefits before, during, and after use.

Comprehensibility can be achieved through good communication. "*Only if I communicate it properly, it will become comprehensible*" (I-02). It is necessary to inform potential users about the software before use. During use, it is required to provide sufficient support through instructions and transparent

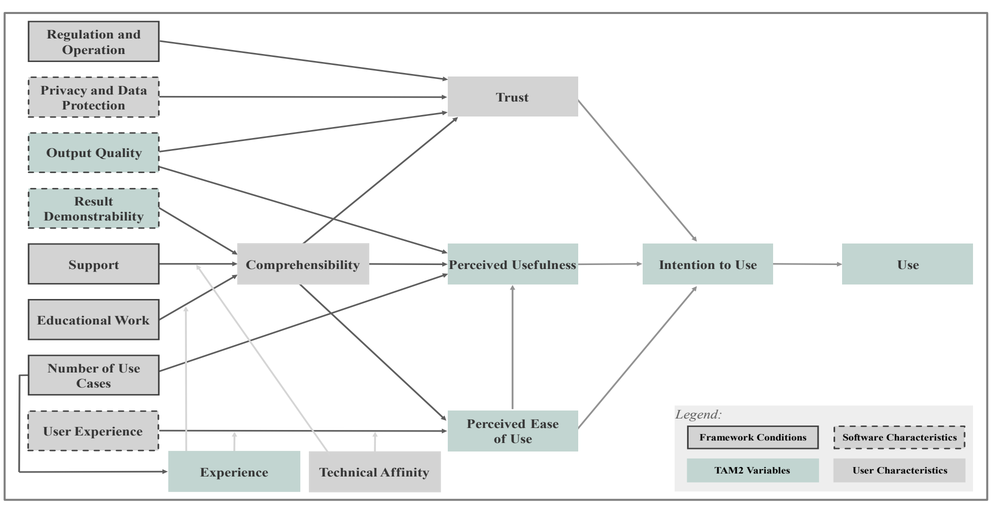

Figure 1: Self-Sovereign-Identity Acceptance Model

explanations of all steps. Moreover, allowing users to review all steps taken after use. In this context, *"meaningful naming"* is important since "*otherwise it is difficult to understand what is happening" (I-08).* Thus, *Comprehensibility* has an impact on all three direct influencing variables of *IU*: If users understand all process steps and the advantages of using the software, they perceive it as easy to use, and their trust increases (I-01, I-03, I-05). Therefore, we hypothesize the following:

H12: Comprehensibility directly positively influences PU.

H13: Comprehensibility directly positively influences PEOU.

H14: Comprehensibility directly positively influences Trust.

Number of Use Cases. The *Number of Use Cases* indicates the number of situations where a user can use the software.

Respondents suggest that companies should acquire more collaborating companies to expand the SSI ecosystem (I-01). As the number of participating companies increases, so do the number of use cases and the frequency of possible uses (I-04), creating added value: *"I believe that the SSI system will only be accepted when end users see that it can be used everywhere"* (I-06). In addition, the increasing number of use cases and the resulting, more frequent use of the software positively affect the experience: "*I think the most important thing [...] would be that there are use cases. So that you can really use the software and that the user gains experience with it*" (I-03). Therefore, the *Number of Use Cases* predicts *Experience* (see below). We propose two hypotheses:

H15: A high Number of Use Cases directly positively influences PU.

H16: A high Number of Use Cases directly positively influences Experience.

User Experience. *User Experience* includes all software characteristics leading users to perceive it as intuitive and user-friendly.

According to all participants, user experience plays an important role in keeping the software's learning effort low. Various software features can enable a pleasant user experience. The software should be built to suit the use case and its interface should be designed intuitively and pleasantly so that it is always clear what to do next (I-02, I-08). Interviewees also noted that the software should work device-independent to be used on mobile phones, tablets, and computers (I-01, I-11). In addition, it is appreciated if the process avoids any media breaks, keeping the user's effort low (I-01, I-11). Furthermore, the software's speed impacts the perceived user experience (I-08). "*It should be able to run at an adequate speed; this is indispensable*" (I-05). Settings could be provided to make the system even faster, such as an option to auto-accept invitations (I-08). Thus, we propose the hypothesis:

H17: User Experience directly positively influences PEOU.

4.2.3. Moderating variables

Technical Affinity. We identified *Technical Affinity* as moderating variable, describing a user's positive attitude toward new technologies.

Participants stated, that "*a positive attitude towards using the system" and a certain "curiosity*" favor the software's first IU (I-01). IU also requires an affinity for technology (I-03). If there is a lack of technical affinity, a respective user has more concerns regarding the software's use (I-12). In addition, it is more difficult for less tech-savvy people to comprehend the process steps and benefits. Therefore, they have an increased need for information. "[*Y]ou would definitely have to do a lot of education and communication to bring them an understanding that they can somehow comprehend what is happening*" (I-05). *"The learning effort and the aversion to new things are far greater for them"* (I-07). Conversely, tech-savvy people have a lower need for information (I-02). Thus, we assume the following:

H18: Technical Affinity moderates the effect of Educational Work on Comprehensibility.

H19: Technical Affinity moderates the effect of User Experience on PEOU.

Experience. *Experience* is a moderating variable and refers to the experience gained with SSI so far.

According to interviewees, previous experience with the software influences future use: "*my previous experiences will definitely shape how I continue to deal with it*" (I-05). First, the question is whether a user has had any prior experience at all. The process seems less intuitive for people without previous experience with the software (I-03). Thus, *Experience* moderates *User Experience*. Users with prior experience in SSI can better comprehend the process. Thus, the process needs to be explained in detail to people without such knowledge. They require high-quality support when using the software (I-02). Thus, *Experience* moderates the variable *Support*. We state the following hypotheses:

H20: Experience moderates the effect of Support on Comprehensibility.

H21: Experience moderates the effect of User Experience on PEOU.

5. Discussion

Our assumption that Venkatesh and Davis' (2000) TAM2 model cannot be simply applied to the study of user acceptance of SSI has been confirmed. In addition to verifying existing TAM2 variables, we have identified several new influencing factors affecting the acceptance of SSI in order to answer or research question "*Which attributes, features, and characteristics of Self-Sovereign Identity Systems influence the acceptance of the Identity System?*"

We identified *Trust* as a direct influencing determinant of *IU*. In IS research, trust has emerged as an important research objective (Benbasat et al., 2010; Völter et al., 2021). McKnight et al. (2011) state that the complexity of technology requires trust in the technology itself, which represents beliefs about the characteristics of the technology. Accordingly, the users expect functionality, helpfulness, and reliability from a technology (McKnight et al., 2011). Therefore, companies need to take specific actions to strengthen trust in the SSI system. For example, McKnight et al. (2011) propose seals that certify the security of systems as a trust-building measure when the user has little experience with the system. This observation is in line with the statements of our interviewees.

Also, we find that not only *Output Quality* influences *Trust*, but also *Privacy*. While *Privacy* is not included in TAM2, the effect of *Privacy* on *Trust* is a prevalent topic in IS research (Dimodugno et al., 2021). Additionally, our interviewees indicate that privacy affects trust. Thus, we hypothesize that a high degree of privacy is directly associated with a high level of trust. Our interviewees furthermore name privacy a relevant aspect when interacting with SSI-based systems. In specific, SSI can counter privacy concerns by offering the possibility of selectively disclosing data. The credential holder can decide which attributes to disclose (Preukschat & Reed, 2021), resulting in individual control over personal data (Affinidi, 2021) and a high level of trust (Dimodugno et al., 2021). As trust increases, they are in turn more willing to disclose personal information and thus use the system. However, while most interviewees pointed out the aspect of privacy, previous research has also emphasized the inconsistency of privacy intentions and behavior. In specific, the information privacy paradox refers to the phenomenon that individuals are highly concerned about their online privacy while giving up personal information for small rewards (Kokolakis, 2017). As privacy represents a major pattern in existing SSI implementations, further research is required to investigate the existence and strength of the privacy paradox in using SSI systems.

Our interviews revealed that *Comprehensibility* plays a critical role in whether users adopt or reject SSI systems. Comprehensibility can be influenced before initial use, during use, and after use, which is not considered in TAM2. Comprehensibility specifically plays a role in SSI-based systems as the SSI paradigm is based on complex technical constructs. It seems that individuals who study the technical components in depth are convinced of its benefits. They perceive SSI as useful and have trust in the technology. Thus, a higher level of comprehensibility implies lower technological uncertainty, leading to higher trust in the technology. Educational measures can contribute to clarifying the benefits to people without this knowledge. In addition, comprehensibility can be achieved by providing a detailed explanation of the process, so that users can follow the process steps and perceive the system as easy to use. *Comprehensibility* is, therefore, closely related to *Trust*, *PU*, and *PEOU*.

In TAM2, *Experience* is included as a moderating variable. In addition, we have also identified *Technical Affinity* as a moderator in our model. According to Franke et al. (2019), personal resources have a twofold influence on successful coping with technology. First, skills and knowledge in dealing with certain systems play a role, corresponding to *Experience*. Second, users' personality characteristics, specifically the affinity for technology interaction, also have a decisive influence. Affinity for technology interaction describes whether users actively approach the task of intensively engaging with new technology systems or avoid interacting with new systems. From our results, it appears that the need for information is particularly high among the less technology-affine users. This can be addressed by *Educational Work*.

Another major difference compared to TAM2 is that we classify the variables into three main categories: *Framework Conditions*, *Software Characteristics*, and *User Characteristics*. In TAM2, Venkatesh and Davis (2000) distinguish between cognitive instrumental and social influence constructs. *PEOU*, *Output Quality*, *Result Demonstrability*, and *Job Relevance* affect PU as cognitive influence variables. In contrast, *Voluntariness*, *Subjective Norm*, and *Image* are social influence variables. As we outline above, all three social constructs have, according to our data, no particular relevance for describing the acceptance of SSI systems. Therefore, the distinction of Venkatesh and Davis (2000) does not apply to our developed model. Moreover, the division into the three main categories proposed in this article simplifies the derivation of recommendations for action. Institutions involved can be given recommendations for the variables classified in the *Framework Conditions*. For the developers of SSI systems, the recommendations for *Software Characteristics* are of particular interest. Therefore, this type of subdivision may also be applied to the acceptance research of other technologies.

6. Conclusion

Our work provides a detailed elaboration of the factors affecting the acceptance of SSI. We identified fourteen categories influencing technology acceptance of SSI systems by conducting qualitative semi-structured interviews. TAM2 served as a basis, of which we found five constructs to be important. In addition, we identified nine categories not previously considered in TAM2. It can be concluded that *Framework Conditions*, *Software Characteristics*, and *User Characteristics* play a relevant role in accepting SSI systems.

The newly identified influencing variables highlight the need for researchers to think beyond the established TAM2 model to study the acceptance of new technologies. Through qualitative methods, entirely new insights are gained, underscoring the relevance of qualitative studies in technology acceptance research.

User acceptance is a necessary prerequisite for the successful establishment of new technologies. Since user acceptance of SSI has not been studied in-depth, our work contributes substantially to research and practice. Our results provide guidelines for organizations and developers when developing, implementing, and marketing SSI systems. Moreover, the model presented in this work can serve as a starting point for further research by building on this work and exploring the hypotheses raised.

Although we followed a rigorous research approach, our study is subject to limitations, offering opportunities for future research. First, within the general limitations of qualitative research, the sample of interviews conducted is relatively small and homogenous. We are also limited to a single demonstrator which may additionally influence the derived model through context dependency and may also have an impact on the relevance of eliminated social influence variables. Second, our interviewees were familiar with the concept of SSI and the use case of income data, thus not representing the totality of users. While this allowed us to obtain high-quality contributions, it may also have led to aspects being disregarded due to prior knowledge. Third, while qualitative studies allow for detailed data, the generalizability of results is limited. Finally, based on our results, further opportunities for research emerge. Other theories than TAM2 could be employed as a baseline for future qualitative studies. The formulated hypotheses could be additionally validated and evaluated through quantitative analysis. This should especially address limitations regarding sampling and context dependency of the artifact. Investigating the acceptance for data of varying degrees of sensitivity, could also reveal additional acceptance factors and other insights into their interrelationships. Lastly, future research could more explicitly investigate the influences leading from *IU* to actual *Use*.

Despite this, we expect that our findings on the newly identified factors provide a valuable contribution to research and practice for increasing the acceptance of SSI systems.

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