# Towards Trust in Digital Services Advertisements - Buying Experts' Opinions on USDL-Trust

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**Abstract.** The digitalization is changing the way businesses work and interact. Concepts like Internet of Things, Cloud Computing, Industry 4.0, Smart Production, Smart Homes or Smart Cities are based on linking systems to an online network. The online data access provides potential to optimize processes and cost reductions, but also expose sensible data to a risk for inappropriate use. Fake news in social media is another example for problems with untrustable online data. Data security and trust in data is thus a major concern today. The speed in digitalization makes it even a greater challenge for future research. This paper therefore deals with a concept to evaluate the trust in data. Specifically, it is about the trust assessment in e-commerce data of businesses in the industry domain. Therefore, this article introduces interviews with buying experts and provides insights into the trust evaluation as integral part of the transaction process when conducting e-commerce. This research introduces an evaluation of USDL-trust, which is a novel concept that standardizes the description of trust signals in service advertisements.

**Keywords:** Digital Trust, Service Markets, Trust, USDL-trust, Trust Signals, Service Procurement, Service Description.

## 1 Introduction

Several reasons exist, that the share of services in the GDP increases dramatically in industrial countries, resulting in a structural change toward a service society, while the industry sector drifts to emerging and developing countries [1]. Increased competitive pressure caused by the globalization of markets [2], low labor costs in developing countries, the outsourcing of activities, market requirements to provide customized solutions rather than simple mass products and the digitalization of the industry are such reasons that cause the trend toward services being increasingly supplied to-

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gether with physical products. This phenomenon is described as 'servitization of manufacturing'. It changed industrial purchasing from focusing on product demands to the need to procure complex product-service bundles, also known as industrial-product-service-systems (IPSS) [3]. Services in the business domain are the *"... application of competencies and resources to solve specific customer problems"* [5]. So, a service could be any company process, that is triggered by a customer input and requires the utilization of company capabilities, i.e.: resources and competences, to provide a specific tangible or intangible solution. Services examples are: the delivery and installation of a steel plant, the provision of a consultancy service for a production company, the delivery of casting parts produced according to customer drawings, or a system development and industrialization process of a motor, a car, etc. Those services are unique, they cannot be stored and produced in advance.

Especially, the individuality of a service implies an unpredictability of the outcome of the service provision process. Studies of risk on goods and service purchases conclude that the perceived risk at service decision making is higher than for goods, due to mainly the implications of intangibility and heterogeneity, which causes uncertainties [4]. Information asymmetry between buyers and sellers creates strong incentives for sellers to cheat on services. In the literature different kind of frauds are labelled by the use of an example of a car repair service as: overtreatment, overcharging or under treatment [5]. Services are difficult to assess, which is one reason that service risk perception is increased compared to products [4]. Especially in industrial environment, inappropriate service performance could result in high follow-up costs, e.g.: poor quality of services required during the product development and industrialization process of an automotive part could lead to a line stoppage at the OEM car manufacturer. Consensus is present within the literature that trust is required whenever risk, uncertainty, or interdependence exists [6]. Trust is important for increasing cooperation between parties to overcome these risks and to engage in assistive actions in environments characterized by uncertainty [7]. That is why, the evaluation of trust signals is required in order to reduce the perceived risks caused by uncertainties. Signaling is a strategy of sellers in situations with information asymmetry to increase trust. Signaling theory is applied to scenarios that occur in a range of disciplines not restricted to micro economy [8]. In the case of a car seller, signaling would be the offering of an inspection by a certified garage to provide additional information, showing that the offered car is good. A researcher signals his abilities by showing the list of publications in high graded journals. Those additional trust signals need to be described at service advertisements by electronic systems.

Information systems provide potential benefits to increase the transparence of information of services available within a market aiming to increase the reach of sellers and buyers and as a result it can improve matching of the buyers and sellers. However, the service industry is at a surprisingly low level of digitalization [10], electronic markets that provide an overview about services are rarely used in the B2B domain [11], although Internet plays an important role when deciding where to buy and what to pay for a product or service. Reason for the reduced acceptance of online trade of services are the perceived risk in service purchasing and a lack of concepts that describe services in a standardized way necessary for the use with information systems. Although, the Unified Service Description Language (USDL) has been created to

capture the business and operational nature of services and align them with the technical perspectives [12] aiming to empower online systems to trade all kind of services, researcher face a lack in trustworthiness description necessary in electronic markets [13–18].

Service buyers look for signals of trustworthiness of the provider to assess the reliability of the promised service [15]. The need to support this trust assertion process and the description of the required trust-content limits the Linked USDL model, which was identified recently by researcher who proposed an extension of USDL to close this gap [13]. However, the proposed concept is based upon an analysis of trust data published on service providers' websites, so the concept is based on an analysis of the marketing perspective, the structuring of data the sellers provide. This research paper introduces the buyer's opinion on the suitability of the proposed trust description concept. Therefore, this research study demonstrates expert interviews, which provide insights to their view to trust signals description. This study contributes to the digitalization of the service industry, it extends the existing knowledge base.

## 2 Methodology

Face to face expert interviews were chosen to validate the USDL-trust concept. Interviews are very popular in social science, many empirical studies refer to interview-based knowledge of experts [19]. In exploratory research situations like this study, which may require detailed explanations during the interview, it is recommended to conduct oral one-to-on interviews. Open or even semi-standardized interviews are rarely performed in written form, because interviewees are more willing to provide verbal utterances than to prepare written elaborations (essays, discussions, etc.) [20].

Expert interviews are always different, they must be adapted to the context of the study. So, several aspects of the data collection had to be prepared first, like the interview guideline, the sample selection, the sample size or the role of the interviewer. This preparation process will be introduced in the chapter "Data Collection", which will be followed by the "Data Analysis and Results" chapter. Data analysis is the attempt by the researcher to summarize collected data and interpreted it as a next step [21]. Qualitative Data Analysis (QDA) are processes and procedures that moves the researcher from having collected qualitative data to synthesizing a form of explanation, the final aim is often to deduct answers to the research questions by comparing various materials or several cases. Aim of these expert interviews is to verify, if the concept of USDL-trust describes trust content that is relevant for buying experts. Furthermore, the completeness of the concept will be reviewed.

## 3 State of the Art

In regard to service discovery and selection, a great amount of work is being carried out on Internet service description and standardization, especially in the area of Service-oriented Architecture (SOA) and Web services. Examples of work in this directions are WSDL/UDDI, SoaML, OWL-S, WSDL-S, SAWSDL [22]. Those languages

disregard the fundamental socio-economic context of real-world services (e.g., value chains and offerings), and does not cover the widespread manual services (e.g., consulting) [23].

Literature surveys classify the efforts in service description languages [22, 24, 25] and clearly show, that the focus is rather on Web service and SOA description, cloud service description and software as a service (SaaS) description as studied by informatics academics. Only a view approaches exists that try do describe comprehensively business relevant concepts and properties. This strand of service description research is driven by the schools of business administration and focuses on capturing the purely economic aspects of. A major contribution in this regard is O'Sullivan [26] who describes non-functional properties (NFPs) of services. He describes a comprehensive set of business related NFPs, but trust or qualitative descriptions are not formulated, which limits this research.

The Unified Service Description Language (USDL) is the latest attempt to provide a (multi-faceted) description aiming to enable the commercialization of (business and technical) services over the web to enable the trade of business services by the emergence of internet marketplaces [12]. The roots of USDL are already a decade ago, the latest official version is USDL 4.0, which is also called Linked USDL. The advantage of Linked USDL is that it uses the principles of Linked Data, so it is easy extensible and researcher are still refining it for different purposes. Linked USDL is divided into different levels that have different maturity. Each module is a set of concepts and properties. Following five modules exist:

- USDL-core: describes the operational aspects of a service.
- USDL-price: describes the price structure of a service.
- USDL agreement: describes the quality of the service provided, such as response time and availability.
- USDL-sec: describes the security properties of a service.
- USDL-ipr: describes the rights to use a service.

- USDL-trust: describes the process of trust assertion and content that provides trust signals of service providers. USDL-trust is the latest extension, it was published in 2019 aiming to provide a comprehensive vocabulary for sharing rich trust descriptions for services, to support the trading of services over the Web [13]. As basis concept it makes use of the Trust Assertion Ontology (TAO) [27]. The TAO was developed in the context of Online Social Networks, where personal data is stored, managed and shared with other people. The TAO ontology describes trust judgments made by users applied to entities that request personal information. TAO describes the subjective measurement of trustworthiness of the requesting entity by the use of different factors like identity-based trust, profile similarity, reputation in trusted networks, relationship-based and interaction-based trust [28]. TAO is a light-weight vocabulary, which is the reason that it is useable to also describe the trust assertion processes in business service interactions. Similar to Linked USDL, the TAO ontology is modeled in RDF. Both concepts apply Linked Data principles and make use of external vocabularies like FOAF or GOODRELATIONS.

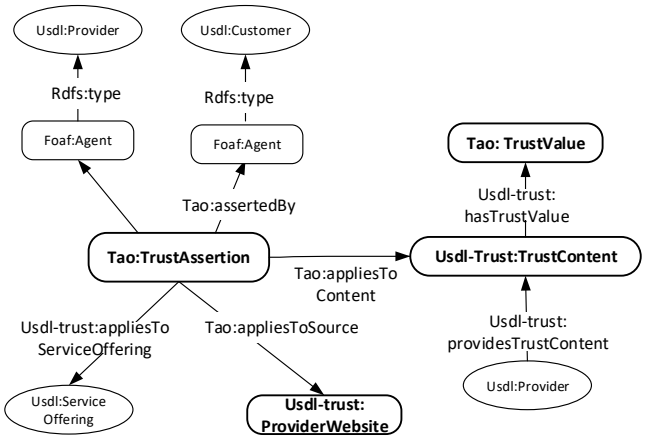


**Fig. 1.**

The TAO ontology is created around the main subject Tao:TrustAssertion, which is the process of a customer who asserts a subjective trust value to a provider based on different contents. The tao:TrustAssertion applies to an foaf:Agent and is asserted by another foaf:Agent. Here the linkage to USDL is obvious the USDL:Customer who asserts trust to the USDL:Provider, which are types of foaf:Agent. Although, trust evaluation in business environments applies to other information contents than in social networks, the process of trust assertion is the same, information content of a specific source is evaluated, and a subjective trust value is asserted to each trust aspect. The trust assertion in business service interactions applies to the content of USDL-trust:TrustContent, which is part of the proposal of USDL-trust [13].

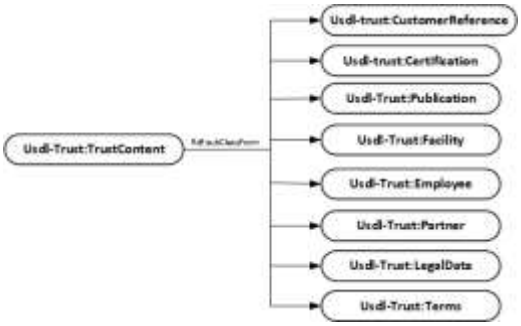


**Fig. 2.**

The proposed description of this USDL-trust:TrustContent is derived from an analysis of unstructured data that is published on service provider websites. Therefore, it correlates to the trust signal description that is provided by marketing experts, the sellers. This paper focusses on the validation of the suitability of this description by the buyers. Buying experts were asked how important the provided information is for their use with electronic markets at service discovery and about it's completeness for making online systems usable to discover and evaluate service advertisements.

# 4 Data Collection

## 4.1 Preparation of Interview Guideline

One speaks of standardized interviews, when all questions are preformulated and are used in the interview as well. In the case of non-standardization, there is only one topic and the discussion is open [20]. A partial standardization exists, if questions are pre-formulated, but the interviewer adds additional non-formulated supplementary questions or omits questions, if it appears that it is sufficiently answered previously. According to [29], the advantage of partial standardization over more open forms of interviewing is the better comparability of the data due to the structuring elements of the interview. In such semi-structured expert interviews the guideline should help, that the expert does not thematically deviate and delivers relevant information limited to the research subject [20]. Better than with standardized interviews, the partially standardized interview can combine theoretical assumptions with an openness to a different view of the actor [20]. [29] recommends choosing the semi-standardized interview, if expert knowledge should be requested, as in this case. Semi-standardized interviews should include open questions, openness refers to the degree of freedom of respondents [30].

The manager's work situation involves asking questions and answering them [31]. Therefore, the beginning of the interviews would correspond more to a closed version of a standardized interview than the second part. The expectation of breaking a question-and-answer situation by conducting instead an open interview is an obstacle in expert surveys among corporate decision-makers and would require time and social skills [31]. The authors developed a semi-structured interview guideline including open and closed questions; however, the interview guide leaded from closed questions to a more open conversation. Closed questions can be combined with open ones, e.g.: a predefined answer can be enhanced by an “Other” or “Comment” category, leaving room for participants to explain their response. It exists different kind of closed questions, such as predefined answers, dichotomous questions or scaled questions. Scaled questions are used to measure people’s opinions and attitudes, which can also be more explored by a comment [32], where the Likert Scale is very famous. Another type of closed scaled question is the MoSCoW rating, which is a way to prioritize requirements often used in information systems and correlates to “must have”, “should have”, “could have” or “won’t have”. In the accomplishment of the interview some questions were omitted during the interviews setting, whereas some other additional questions arose out of the discussions. The interview was prepared to take one hour. Nevertheless, some settings took almost two hours. On the other hand, one interviewee only had a free time frame of about 40min during the work hours, so that the author had to skip some time for the open discussions.

## 4.2 Sample Selection

The search for the expert should not primarily focus on the maximum knowledge of the expert, but also on the relevance of his knowledge and experience in regard to the

research question [19]. According to [33] the expert should not only be differentiated from the layman, but also from the specialist. The specialist has a distinct workspace in terms of relevant problem solving, while the expert has an overarching view. Experts are acting actors and not necessarily experts in the sense of reviewers or observers. An expert has responsibility for solving problems and has privileged access to information about groups of people or decision-making processes. Experts should not necessarily come from the top corporate level, such as the board. According to [33], the second and most detailed information on structures and events is available on the second level of an enterprise.

Because of these reasons, the researcher tried to get interviews with persons that obtain management positions in industrial purchasing departments, assuming, that those persons have advanced access to information. However, it was difficult to convince procurement managers to spend one hour of their time for an interview. So finally, 50% of the interviewed persons were managers, who lead in average ten buying specialists. In average the interviewed managers have an experience in their field of 11 years. On the other hand, 50% of the interviewees were procurement specialists with an average experience in buying industrial services of 14 years. All respondents work in the field of industrial purchasing. Except one interviewee, all respondents are Austrian citizenship. Two of the respondents work abroad, one in Germany, one in Czech Republic. More than 75% of the respondents work in company's within international organizational structures. All respondents are male. The respondents worked at that time of the interview in following branches: car manufacturing, automotive systems supplier, intralogistics automation, electrical power supply, metal industry (knife production) and electronic systems development and manufacturing.

### 4.3 Sample Size

How many qualitative interviews are enough? The rule is to reach the saturation point. The notion of theoretical saturation is derived from Glaser and Strauss's article "The Discovery of Grounded Theory" in 1967 [34]. The interviews will be continued until no new answers from respondents are received. It depends on the number and type of questions. [35] examined research studies with expert interviews and found out that 92% of the total results they ultimately developed came in the first 12 interviews. But 12 is not a magic number, because these are just the results of a study in a particular context. In many ways, as in survey research, the problem depends on basic variability of the population. In other words, if there are many different viewpoints on the topic, more interviews are needed to achieve saturation in the sense of redundancy. Alternatively, if the population is relatively homogeneous (i.e., low variation), the interviews will repeat faster. It exists no pattern or justification for a sample size [36]. At the end, the researcher were able to interview ten experts, which provided insights that are provided in the following chapter.

# 5 Results of Data Analysis

This chapter introduces the results of the data analysis. The researcher collected qualitative data in form of open questions and comments, but also quantitative data by measuring the opinion of the respondent by using the MoSCoW Prioritization. Such a combination between data collection methods is a variant of method triangulation, which is so dominant that some authors define it as the only form of triangulation [37]. The used strategy for qualitative data analysis was the framework analysis [38], which consists of organizing data into frameworks and interpret findings of frameworks [39]. In fact, the framework structure was predetermined by the USDL-trust:Content, which provided the structure for the interview guideline. All interviewee statements will be provided in italic in the following section. If two or more respondents commented in common sense, then only one of those comments is documented in this section. The coding of the quantitative data involved assigning a numerical value to each response, e.g. 1=must have and 4=not recommended, so that a statistical average was used to analyze experts' opinions [40, 41]. Also, the mode, the most frequent answer will be provided.

## 5.1 USDL-trust:CustomerReferences

Customer Descriptions: Mode=Should; Average=1.6;
Product and Service Delivered: Mode=Must; Average=1.6;

Most respondents valued information to customer descriptions as part of customer references, like the logo of the customer or customer name as "Should" be described on online services advertisements. Customer descriptions received an average value of 1.6. Following comments were recorded:

- *The logo of the company catches someone's eyes*
- *The customer name is supportive*

Product and Service References e.g.: picture or text description were valued as "Must" be described with an average value of 1.6. Following comments were added:

- *The suitability of a picture to describe product and service reference of the provider depends on the product or service itself, e.g. at plastic parts, an image is an important description. On the other side a printed circuit board (PCB) always looks the same, a picture does not work.*
- *A picture would be fine and text descriptions as further information after clicking on the picture*
- *Text descriptions are difficult, often such information is not allowed, because of non-discloser agreements. A textual detailed description would be very important, but in the automotive domain seldom possible*

## 5.2 USDL-trust:Certifications

Certification descriptions: Mode=Must; Average=1.8;

Certification descriptions e.g.: Picture and text descriptions were valued as “Must” be described with following comments:

- *Certain certifications must be described, like the ISO9001, whatever text or picture*
- *No matter how this information will be displayed, but it is a must have.*
- *As former quality manager, i want to see the certificate as a picture*

### 5.3 USDL-trust:Publications

Publication descriptions: Mode=Should; Average=2.4;
Publications e.g.: Press articles or internal company news feeds were valued by most respondents as “Should” be described with an average of 2.4 including following comments:

- *Only articles from professional journals are of interest, no newspaper articles like “Kronenzeitung”*
- *Internal newsfeed does not have expressiveness*
- *Newsfeed is not a trustable source*
- *Newsfeed only, if very relevant, no news about the 60s birthday of an employee for example.*

### 5.4 USDL-trust:Facility

Facility descriptions: Mode=Should; Average=1.8;
System descriptions: Mode=Should; Average=2.0;
Facility descriptions e.g.: facility address, picture, KPI (no. of employees, annual turnover) of facility and foundation year were valued by most respondents as “Should” be described with an average of 1.8 including following comments:

- *The location is decisive but not how many locations the company has, e.g.: sometimes (in the case of more complex parts) it is necessary to find a company that has local headquarters (Europe) with global production (Asia), providing a close contact in Europe to handle problems, but delivering directly from their Asian facility to our Asian subsidiary. In the case of more simple parts, no European headquarter is needed.*
- *Beside address, picture and contact to the facility, some KPI of those facilities would be interesting, such as the size of the production area*
- *In addition to no. of employees or annual turnover, the yearly investments are indicating health and prosperity of the company*
- *The annual turnover does not give us a correct indication for the health of the supplier; our suppliers must provide in addition detailed financial data including profit and loss calculation. I know that this is specific for our branch (car manufacturer)*

Another descriptive part of the facility is the description of the applied systems, which is valued as “Should” be described with an average of 2 and following comments:

- *Machinery park description is important by pictures including text descriptions*
- *Machine descriptions are an indication for the vertical integration, showing, if someone is producing or buying the necessary manufacturing parts. The more vertical integration of the company the more know how exists.*
- *Pictures of machines, how they are installed in the production facility makes a better impression, than only a picture of the machine from a sales catalogue*
- *Having machines of recognized machine builders of e.g. Europe makes better impression than owning cheap Asian machines, so the name of the machine produce is a relevant information.*
- *Size of production area is an interesting KPI*
- *The used ERP system is interesting to understand, if an EDI interface could be installed*
- *Detailed information about how they organize their production like Kanban (pull) vs. MRPII (push) system is too detailed and not of interest for the buyer*

### 5.5 USDL-trust:Employee

Employee descriptions: Mode=Must; Average=1.4; Employees descriptions e.g.: picture, name, contact details, job position, academic title, were valued by most respondents as “Must” be described with an average of 1.4 including following comments:

- *Contact persons are often not on websites, which is a big hassle*
- *Nothing is worse than only providing a contact form on the website, without direct contact to the persons of interest.*
- *The name, contact and job position is the most important information, after the picture of the person. The CV is only of interest, when the owner of a company or upper management is described*
- *The human resource is frequently a topic. Not only the description of the contact person itself is of interest, but how the company handles the problem, that human resources are the most important, most expensive resources and at the same time the tightest resources, e.g.: how does the company ensure, that the project leader has sufficient capacity for our project.*

### 5.6 USDL-trust:Parner

Partner descriptions: Mode=Should; Average=2.0; Partner descriptions e.g.: logo, name, social media profile link like Facebook, LinkedIn were valued by most respondents as “Should” be described with an average of 2 including following comments:

- *Service production should be in-house at the provider, so it indicates that the contracted company obtains the know-how, so used partners seems important*
- *If a caster uses a standard partner, for example for vertical processing like machining of the raw part, it is an important thing to know, which should be described on the website*
- *Usually, we are not interested in the sub-supplier of the provider.*
- *Social media information is absolutely unimportant*
- *Social media are pseudo friends, this information will not be evaluated.*

### 5.7 USDL-trust:LegalData

Legal data: Mode=Must; Average=1.2;
Data according USDL-trust:LegalData like VAT no. or company registration number and legal status was valued by most respondents as "Must" be described with an average value of 1.2 including following comments:

- *Primary, the VAT No. is of interest.*
- *The company registration no. is required for credit assessment to evaluate supplier risks*
- *Frequently, the data is necessary to request a credit information of the company.*
- *The legal status is of interest, because we prefer supplier, who are leaded by owners, so that the management has influence on determining decisions. For us, the description of organizational and group structure is important.*
- *Legal status and transparency of corporate integration is important.*

### 5.8 USDL-trust:Terms

Terms descirptions: Mode=Could; Average=2.8;
Data according to USDL-trust:terms like the "General Terms of Condition" was valued by most respondents as "Could" be described with an average of 2.8 including following comments:

- *I am not interested in the terms of the supplier. The supplier has to accept my terms.*
- *Displaying terms in general makes a professional impression, but i don't read them in this stage.*
- *Sometimes policies are interesting, if you check a company in far east, for example in India. If someone has the policy to give benefits to employees with children, this could be a good sign for less employee fluctuation, which is there a big problem.*
- *When working with companies in far east, we demand a sustainability report, which are about 10 pages, where companies have to explain e.g.: how to assure, that they and their sub-suppliers do not use child labor, or how they assure that they dispose their waste water properly*

– *The look and feel of a website, if it looks professional, is an additional important factor to evaluate trustworthiness of a provider. Therefore, the e-market also has to describe the website address of the service provider.*

### 5.9 Open Discussion with Experts

The experts were asked, if the provision of the USDL-trust:TrustContent would increase the trustworthiness of service advertisement provided by online systems and thus, if buyers would increasingly accept such systems. Experts responded, that the data is relevant, but it's usability depends on the trust in the system and added that the marketplace as a mediator needs to ensure the correctness of user's data such as the identity, otherwise the marketplace and it's data is not trustable. Therefore, the question emerged, how a system can guarantee the correctness of the provided data. The discussions indicated that the identity check of the system users is of major importance considering expert's trust into the system, which is especially perceived problematic in global market environments. Although, data like the VAT number can be easily checked by a web service that provides corresponding name and address of the company that belongs to the number, that does not guarantee, that the person who pretends to possess this identity, it really is. So, most of the provided information can be fake. A kind of two-factor authorization would be necessary, like sending a postal letter to the postal address consigned to the VAT number with a PIN registration. Another proposal an expert made, was the identification of a user by a kind of A-Trust service, which is usually used in Austria for personal online access to sensible data like tax data. This third party authentication service also provides an add-on to link a corporate identity to the personal identification called "a.sign business". During the conversations it turned out, that a trustable identification of the users will be a determining factor for the trustworthiness of the data and the marketplace. Experts proposed to implement a service that checks some of the provided data by a trustable certificate authority to increase the trust into the provider data and so into the service advertisement. Two respondents suggested that a provider credit information can be used to prove someone's identity in regard to address, name, legal status and somehow the dimension of the business activities of a company. A credit information service provided as a feature of a service marketplace would be perceived very positive. Experts proposed to use credit reference companies like KSV or DMB as a certificate authority.

The researcher raised the question, if a reputation system of an e-market, where users rate their service providers could help to increase the trust into the identities of the providers. But, the majority of experts expressed skepticism toward ratings, they don't trust ratings by other market participants, unless it exists a transparent mechanism by verifying contracts by independent third parties. Another mentioned strategy to increase the trust in the rating mentioned, is to show the profile of the rater, but they mentioned that nobody will share their supplier ratings with competitors. One respondent said, if there would be a trustable rating, it would be a "must have" on e-markets, however he cannot imagine a trustable rating functionality for e-markets in professional industry environments. Many companies wouldn't provide their experi-

ences to competing companies in an online environment, together with the problem that ratings could be faked.

The researcher asked in that context, if system data such as number of profile clicks the provider received, or the date of the profile activation would be used to evaluate the trustworthiness of the data and the provider. The opinions in this regard spread, while some persons find an analytic feature interesting, others won't use it.

Experts were asked, if they miss specific information that should be included into the USDL-trust:TrustContent. Some missing trust signals could be exposed like: historical information about the company, organizational information like organigram, the membership of facilities to organizations, all other ideas are already documented at the "comments".

## 6 Conclusions

The expert interviews confirmed that the USDL-trust:TrustContent is a generalized description of trust signals particularly published by providers at service advertisements. Although, trust is a very subjective matter, experts valued the different categories of trust signals similar. The variance of the rated answers is low. It is important to note, that all respondents did rate the questions, but only some responded to the comments section.

| USDL-Trust:TrustContent | Mode (Mean) |
|---|---|
| Customer Reference | S (1,6) |
| Certification | M (1,8) |
| Publication | S (2,4) |
| Facility | S (1,8) |
| Employees | M (1,4) |
| Partner | S (2) |
| Legal Data | M (1,2) |
| Terms | C (2,8) |

Table 1.

Although, experts provided qualitative information about requirements of specific descriptive aspects of trust signals, the study is restricted to expert opinion's in the manufacturing domain, which may differ to other B2B domains. For example, nowadays, digital marketing and marketing in social networks is perceived very important by researcher and practitioners. However, the interviewed experts do not have interest in information provided by social networks. They don't follow a possible supplier or even check their social media channels. This seems to be specific for the manufacturing domain. Experts stated that they like to know about strategic partners of the provider, when those partners have a significance in the provider's value creation process. But also, different opinions can be observed, due to one expert stated, that in his business environment, sub-suppliers of providers are not questioned. In total, most experts valued the partner category as "should" be described on e-markets, which corresponds exactly to the average rating. A similar example can be observed, where one expert stated, that the VAT No. is the most important legal information for him,

whereas other experts responded to need the business registration number to order a credit information or others said, that the concern structure is the most important legal information.

It can be concluded that different business settings and subjective perceptions are the reason for varying prioritizations of trust signals. Alongside, those varying requirements, the experts confirm that the USDL-trust:TrustContent is a set of provider descriptions that are necessary during the evaluation of the trustworthiness of a service advertisement in business environments.

## References


[1] H. Meier, O. Völker, and B. Funke, "Industrial Product-Service Systems (IPS2): Paradigm shift by mutually determined products and services," Int J Adv Manuf Technol, vol. 52, 9-12, pp. 1175–1191, 2011, doi: 10.1007/s00170-010-2764-6.

[2] M. Becker and S. Klingner, "Formalisierung von Regeln zur Darstellung von Abhängigkeiten zwischen Elementen von Product-Service-Systems," Abteilung Betriebliche Informationssysteme, Universität Leipzig, 2011.

[3] O. Mont, "Clarifying the concept of product-service System," Journal of Cleaner Production, 2002.

[4] C. Perez-Cabanero, "Perceived risk on goods and service purchases," EsicMarket, no. 129, pp. 183–199, 2008. [Online]. Available: http://www.esic.edu/documentos/revistas/esicmk/080114_153323_I.pdf

[5] U. Dulleck and R. Kerschbamer, "On Doctors, Mechanics, and Computer Specialists: The Economics of Credence Goods: Where are the Problems with Crerdence Goods," Journal of Economic Literature, vol. 44, no. 1, pp. 5–42, 2006, doi: 10.1257/002205106776162717.

[6] R. C. Mayer, J. H. Davis, and D. F. Schoorman, "An Integrative Model of Organizational Trust," The Academy of Management Review, Volume 20, No. 3, pp. 709–734, 1995. [Online]. Available: www.jstor.org/stable/258792

[7] N. Luhmann, "Familiarity, Confidence, Trust: Problems and Alternatives," in Trust: Making and breaking cooperative relations, D. Gambetta, Ed., New York, NY, USA: B. Blackwell, 1988, pp. 94–107.

[8] R. Bliege Bird and E. A. Smith, "Signaling Theory, Strategic Interaction, and Symbolic Capital," Current Anthropology, vol. 46, no. 2, pp. 221–248, 2005, doi: 10.1086/427115.

[10] T. Greff and D. Werth, "Service Digitization in the Consulting Domain - Classification and Serivce Implementation for a Digital Consulting Front Store Pilot," in Proceedings of the 5th International Conference on Serviceology - Short papers and posters, pp. 115–122.

[11] C. Pedrinaci, J. Cardoso, and T. Leidig, "Linked USDL: A Vocabulary for Web-Scale Service Trading," in Presutti (Hg.) – The semantic web, 2014, pp. 68–82.

[12] J. Cardoso, A. Barros, N. May, and U. Kylau, "Towards a Unified Service Description Language for the Internet of Services: Requirements and First Developments," in LNCS sublibrary. SL 3, Information systems and application, incl. Internet/Web and HCI, vol. 8465, The semantic web: Trends and challenges : 11th International Conference, ESWC

2014, Anissaras, Crete, Greece, May 25-29, 2014. Proceedings, V. Presutti, Ed., 2014, pp. 602–609.

[13] W. Bauer, N. Kryvinska, J. Dorn, and O. Sacco, “Extending Linked USDL by Trust Assertion,” in Proceedings of the 21st International Conference on Information Integration and Web-Based Applications & Services, 2019, pp. 377–384. [Online]. Available: https://doi.org/10.1145/3366030.3366057

[14] W. Bauer and J. Dorn, “Modeling Trust for Service E-Marketplaces: Case Study in the Manufacturing Domain,” IIWAS 2017, 2017.

[15] W. Bauer and J. Dorn, “Requirements for product-service description at e-marketplaces in the manufacturing domain,” Procedia CIRP, pp. 406–411, 2016.

[16] W. Bauer and J. Dorn, “Enhancing Electronic Markets for Industrial Services by Trust Features,” in Advances in Business Marketing and Purchasing (ABMP), Trust in B-to-B contexts: antecedents, processes, and consequences, H. Akrout and K. Raies, Eds., Bingley, West Yorkshire: Emerald Publishing, 2018.

[17] W. Bauer and J. Dorn, “Trust in Service Purchasing,” in Proceedings of 5th International Conference on Serviceology., D. Bork and E.-T. Miron, Eds., Vienna: OMiLAB Publication Series, 2017, pp. 199–202.

[18] W. Bauer and J. Dorn, “System Design of E-Markets for IPSS Purchasing,” Procedia CIRP, vol. 64, pp. 211–216, 2017, doi: 10.1016/j.procir.2017.03.074.

[19] A. Bogner, B. Littig, and W. Menz, Eds., Das Experteninterview: Theorie, Methode, Anwendung. Wiesbaden: VS Verlag für Sozialwissenschaften, 2002.

[20] J. Bortz and N. Döring, Forschungsmethoden und Evaluation: Für Human- und Sozialwissenschaftler ; mit 87 Tabellen, 4th ed. Heidelberg: Springer-Medizin-Verl., 2006.

[21] S. Marley, Qualitative Data Analysis and Interpretation. [Online]. Available: www.unm.edu/~marley/methppt/fall06/day13.ppt

[22] L. Sun, H. Dong, and J. Ashraf, “Survey of Service Description Languages and Their Issues in Cloud Computing,” in 2012 Eighth International Conference on Semantics, Knowledge and Grids, 2012, pp. 128–135.

[23] H. Akkermans, Z. Baida, J. Gordijn, N. Peiia, A. Altuna, and I. Laresgoiti, “Value Webs: Using ontologies to bundle real-world services,” IEEE Intelligent Systems, vol. 19, no. 4, pp. 57–66, 2004, doi: 10.1109/MIS.2004.35.

[24] K. Kadner et al., Unified Service Description Language XG Final Report. [Online]. Available: https://www.w3.org/2005/Incubator/usdl/XGR-usdl-20111027/## (accessed: May 15 2019).

[25] H. Benfenatki, C. F. D. Silva, A.-N. Benharkat, P. Ghodous, and Z. Maamar, “Linked USDL Extension for Describing Business Services and Users’ Requirements in a Cloud Context,” IJSSOE, vol. 7, pp. 15–31, 2017.

[26] J. O'Sullivan, “Towards a Precise Understanding of Service Properties,” Dissertation, Faculty of Information Technology, Queensland University of Technology, 2006.

[27] O. Sacco, Trust Assertion Ontology (TAO). [Online]. Available: http://vocab.deri.ie/

[28] O. Sacco, “Trust-aware privacy preferences for information sharing on the web of data,” NUI Galway, 2015. [Online]. Available: http://hdl.handle.net/10379/4928

[29] U. Flick, Qualitative Sozialforschung: Eine Einführung, 4th ed. Reinbek bei Hamburg: Rowohlt-Taschenbuch-Verl., 2006.

[30] P. Mayring, Einführung in die qualititative Sozialforschung: Eine Anleitung zu qualitativem Denken, 5th ed. Weinheim, Basel: Beltz, 2008.

[31] R. Trinczek, “Wie befrage ich Manager?,” in Das Experteninterview: Theorie, Methode, Anwendung, A. Bogner, B. Littig, and W. Menz, Eds., Wiesbaden: VS Verlag für Sozialwissenschaften, 2002, pp. 209–222.

[32] G. Law, Types of Survey Questions. [Online]. Available: https://infoactive.co/data-design/ch04.html

[33] M. Meuser and U. Nagel, “ExpertInneninterviews — vielfach erprobt, wenig bedacht,” in Das Experteninterview: Theorie, Methode, Anwendung, A. Bogner, B. Littig, and W. Menz, Eds., Wiesbaden: VS Verlag für Sozialwissenschaften, 2002, pp. 71–93.

[34] B. G. Glaser and A. L. Strauss, The discovery of grounded theory: Strategies for qualitative research, 4th ed. New Brunswick: Aldine, 2009.

[35] G. Guest, A. Bunce, and L. Johnson, “How Many Interviews Are Enough?,” vol. 18, pp. 59–82, 2006.

[36] B. Marshall, P. Cardon, A. Poddar, and R. Fontenot, “Does Sample Size Matter in Qualitative Research?: A Review of Qualitative Interviews in is Research,” vol. 54, pp. 11–22, 2013.

[37] M. Hammersley, “The relationship between qualitative and quantitative research: Paradigm loyalty versus methodological eclecticism,” in Handbook of Qualitative Research Methods for Psychology and the Social Sciences, J. T. E. Richardson, Ed., Oxford: BPS Blackwell, 2002, pp. 159–174. [Online]. Available: http://oro.open.ac.uk/20450/

[38] A. Srivastava and B. Thomson, “Framework Analysis: A Qualitative Methodology for Applied Policy Research,” JOAAG, Vol.4. No.2, pp. 72–79, 2009.

[39] T. N. Haregu, Qualitative data analysis. [Online]. Available: https://de.slideshare.net/tilahunigatu/qualitative-data-analysis-11895136

[40] I. Izonin, R. Tkachenko, N. Kryvinska, P. Tkachenko and M. Greguš "Multiple Linear Regression based on Coefficients Identification using Non-Iterative SGTM Neural-Like Structure". In: Rojas I.,Joya G., Catala A. (eds) Advances in Computational Intelligence. IWANN 2019. Lecture Notes in Computer Science, vol 11506, 2019, Springer, Cham, pp 467-479 doi.org/10.1007/978-3-030-20521-8_39

[41] Fedushko, S., Ustyianovych, T., Gregus, M. (2020) Real-time high-load infrastructure transaction status output prediction using operational intelligence and big data technologies. Electronics (Switzerland), Volume 9, Issue 4, Article number 668. DOI: 10.3390/electronics9040668