Towards a formal Description Language for Digital IT Consulting Products in decentralized IT Consulting Firms

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***Abstract*—Today IT consulting services are neither digitalized nor standardized widely. They are conducted with the help of consultants and are fully based on these professionals' knowledge and experience. Thus, the results of IT consulting initiatives often differ considerably. With the increasing demands of digitalization and globalization, new and relevant challenges arise within the IT consulting sector. Asset- or platform-based approaches can be considered as a possible means to address these challenges in the current consulting research literature. We believe that these approaches require significantly more research related to formal description of IT consulting services. Formally described Digital IT Consulting Products should be the foundation of computer-based interpretation and a future digital IT consulting service system based management and provisioning. This Ph.D. research project addresses this topic first by conducting a structured literature review to understand the state-of-the-art in IT consulting service digitalization and formal service description. This is followed by focus group interviews conducted with experts from the IT consulting sector in order to understand stakeholder requirements and to be able to design a formal description language. The formal description language is validated by implementation and testing of a prototyped digital IT consulting service system and its experimental analysis.**

***Index Terms*—digitalization of consulting, Digital IT Consulting Product, consulting virtualization, USDL, formal service description, consulting service, consulting platform, service system, asset-based consulting, platform-based consulting**

I. Introduction

A. Problem Context

THE service sector faces the effects of digitalization [13], [37], [40]. Literature discusses the impact of digital transformation to the various sub-domains of the service sector. One of these sub-domains is IT consulting. It is the business of telling clients, mostly other companies, how to conduct IT related activities in a certain systematic manner [37]. Rephrased, IT consulting companies advise their clients on how to handle and execute the digitization of their business models and processes. The IT consulting sector is often described as a "people business" [35], [44]. This means that the employees of a consulting firm directly talk to and interact with human representatives of a client firm. This is also true of IT consulting. Literature states that IT consulting has not been digitalized yet [34], [35], [44], [53]. Digitalization has mostly occurred in regard to used tools like laptops, smartphones, presentation techniques and for example the usage of Voice over IP (e.g. Skype) as new digital communication channel [21], [35], [52]. However, IT consulting services have not changed or evolved over time significantly. They are still based mainly on the personal interaction between consultant and client representatives [21], [35]. Hence, the consultants, remain still the most important, and at the same time, the most costly resource of a consulting firm. The consulting firm's potential is directly linked to the knowledge, the experience, the availability, as well as the current location of its employees. One could, therefore, say that these firms depend on intangible characteristics linked to the physical representation of the consultant and his or her current place of residence. Stating this, literature informs that clients are typically not interested in the consultant's person himself but in his knowledge [42]. In total, there is little evidence of the transformation of knowledge-intensive IT consulting services into digital representations [43].

In addition to the aspect of digitalization, IT consulting firms also face demands which arise from globalization. As their customers expand their businesses, consulting firms must also offer and provide their consulting services to them globally. Most commonly, the handover of services currently being provisioned between teams of IT consults, becomes difficult and susceptible to error. This becomes even more relevant in distributed project settings when working together or organized in virtual teams coming from on-, near- and off-shore locations. As the provisioning of classical IT consulting services is based on the direct interaction of consultants and client representatives, it becomes obvious that instruments are required to support IT consulting firms from this perspective.

B. Problem Statement

IT consulting services are often not standardized [34], and their provisioning relies on the service interpretation of the conducting consultants and the quality of involved client representatives or input provided by them (external factor) [8]. Hence, the results of consulting initiative instances can

2325-6605/19/$31.00 ©2019 IEEE
DOI 10.1109/EDOCW.2019.00037

differ to a high extent [23], [32], [34]. The global project contexts in which IT consulting services are rendered, the organizational changes in project staff (e.g. replacements), and the lack of standardization lead to more complex projects, longer project durations, and, therefore, to higher costs. In the current consulting literature [13], [34], asset-based and platform-based consulting strategies are considered as possible solutions. Asset-based consulting is focused on the modularization of consulting services and the "packaging of ideas, processes, frameworks, analytics and other intellectual property for optimal delivery through software or technology" [13, p. 111]. The term platform-based refers to web-based platforms hosted by a provider, the consulting firm [34]. Web-based consulting platforms can be understood as the basis for the provision, execution and delivery of asset-based consulting services. Together, both concepts "extend the reach of [service] providers" [34, p. 7], as distance and borders become irrelevant and consulting services are of better quality because of increasing consistency as well as repeatability [34, p. 7] of the offered service products.

We believe that an important prerequisite of asset- or platform-based consulting is to enable computer-based interpretation of the service definition itself. Hence, a standardized and formal description language to describe IT consulting services could be the basis of a comprehensive solution to elevate the domain to the next, the digital level. Such a language could be used to clearly describe what constitutes IT consulting services in general and what is unique to a particular one. Such a description could be easily managed using a corresponding repository, would be understandable for humans, as well as interpretable by a specialized digital IT consulting platform.

In general, we argue that these asset- and platform concepts, based on standardized and modularized, formally described service definitions, contribute to the stakeholder goals related to more cost effective service offerings, better utilization of existing resources and faster project conduction when compared to the current people-dependent and experience-based conduction of IT consulting service offerings.

II. Related Work

A. The term digitalization

As a foundation for the following paragraphs, we will first introduce the term *digital* and related concepts based on the literature. In the academic and professional literature, the terms digitization, digitalization and digital transformation are not used coherently and have different meanings [5], [24], [27]. Digitization denotes the conversion of analog representations to numerical (digital) representations [27] while digitalization is the process of technologically induced change. Digital transformation is the "non-reversible societal effect" of digitalization [27, p. 43].

B. The concepts of service, IT consulting and service life cycle

The main concept of this Ph.D. research project is *service*, as consulting is traditionally located in the service or tertiary sector [23]. Consulting can be classified as knowledge-intensive and highly integrative service [16], [23]. All types of services have a life-cycle. The term *life-cycle*, as we use it in this work, is based on the concept of Leimeister [30] and consists out of the nine phases: (1) analysis, (2) conception & scenario development, (3) modeling & specification, (4) test & piloting, (5) market entry, (6) management & operations, (7) performance & quality measurement, (8) improvement and (9) market exit. We distinguish these phases into *pre-market*, *on-market*, and *post-market* states. One could say that the phases 1-4 cover the pre-market states, phases 4-8 cover on-market states and phase 9 reflects a potential post-market state.

A preliminary literature review [6] has made clear that the understanding of the definition of service has changed significantly during the last 10 to 15 years. Coming from a goods-dominant logic, where products maybe come along with value added services [23], [32], the understanding has shifted to a service-dominant logic where everything is a service. In this understanding physical objects are now merely means to transfer a service between actors in the sense of *value-in-use* [1], [46], [47].

C. Digitalization of IT consulting

If we apply the concepts of digitization and service to the IT consulting sector, we come to the following understanding. Classical IT consulting services that were previously performed manually by the consultants are transformed into innovative, (semi-) automated, computer-aided, time and location-independent equivalents [21], [35]. The digitalization of today's businesses is provided, in particular, with the help and the support of IT consulting companies [21], [35], [40]. Regarding the understanding of consulting in general and how IT consulting firms can evolve their business, Overby provides helpful input with his Process Virtualization Theory (PVT) [41]. It describes what the differences are between traditional, virtual and digital processes. The PVT states that traditional processes are always related to a person-to-object physical interaction [41]. Virtualized processes eliminate this constraint to varying degrees using different means of virtualization. Information and communication technology is a means to virtualize processes [41]. Based on this, [36] suggest a *Decision Process for Virtualization of Consulting Services*. The first step of the process is to asses the virtualizability of a given consulting service based on *criticality*, *complexity* and *integrativity*. This is followed by a risk as well as profitability assessment of the resulting virtualized service [36]. Only if all phases indicate a positive result, then the authors will suggest conducting the virtualization. The necessities consulting and client firms are opposed to in the event that they want to create, offer and deliver virtualized services or want to co-create or consume are discussed in [35], [38]. These authors provide the Consulting Virtualization Maturity Model (CVMM) with the four levels (1) basic, (2) upward climber, (3) established and (4) master. The higher the level, the better consulting and client firms perform virtualized processes regarding initiation and service delivery [35], [38]. The PVT and the CVMM together

help to understand the situation at IT consulting companies regarding the possible digitalization of existing consulting services to Digital IT Consulting Products. Especially since all services can always be considered from a process point of view [23], [30].

We believe that the concepts of the Process Virtualization Theory of Overby and the Decision Process for Virtualization of Consulting Services as well as the Consulting Virtualization Maturity Model of Nissen and Seifert are important for the digital transformation of IT consulting services. However, we also believe that these concepts are only means that address parts of the overall transformation. We argue that a formal description language is required with the expressive power to describe all relevant parts of a consulting service and not only the service process itself.

D. Approaches to describe services

As this research is intended to digitalize classical, analog IT consulting services into Digital IT Consulting Products, we believe that it is necessary to describe these services and processes in terms that computer systems can interpret. The Unified Service Description Language (USDL) can be used in this context [3], [11], [39]. USDL is an ontology-based approach [22] to describe services from different perspectives in a formal way [3] using different vocabularies. The technical basis for USDL is the Resource Description Framework (RDF) which was invented by the World Wide Web Consortium (W3C) and is part of the Semantic Web initiative [51]. RDF aims at the ease of the data interchange on the internet. It uses the linking mechanism of the web to describe information and their relations based on Uniform Resource Identifiers (URIs) [50]. RDF structures the information as labeled graphs consisting of three elements (triple) of the form subject, predicate, object [51]. Some papers on the extension of USDL have been published during the last years [2]–[4], [11], [12], [15], [17]–[20], [26], [29], [39], [45], however dedicated work on USDL, with a focus on IT consulting services, could not be identified in the literature.

From IT service management (ITSM) (e.g. in IT Infrastructure Library (ITIL)), we know that IT infrastructure related services should be designed and structured in a Service Design Package (SDP) [25]. An SDP contains all relevant information on a specific technology service, like for example life-cycle plan, service level agreements and transition related information. The usage of a SDP is therefore helpful to standardize and structure technology-based services. In comparison to infrastructure and technology services, IT consulting services represent a business-related perspective. Several different approaches exist to gather business-related process knowledge and store it in a standardized and formalized manner (e.g. Business Process Model and Notation (BPMN) or Unified Modeling Language (UML)). Transferring this knowledge to the research problem in addition to considering USDL as a foundation might be helpful regarding the digitalization of IT consulting services and their transformation into Digital IT Consulting Products.

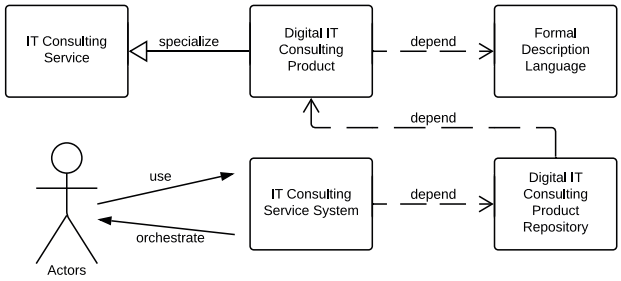

Fig. 1. Conceptual model of the central concepts

E. The concept of service system

Current literature provides no solid solution to the question of how Digital IT Consulting Products ought to be handled or provisioned [33], [37], [53]. Multi-actor processes involving human and technical actors working together in different phases and in changing combinations have rarely been researched [7]. Only a few examples exist. For example, the prototyped implementation of the "eConsulting Store" of Werth et al. [54] which offers digital IT consulting services using a self-service platform and integrates back-office activities like disposition of work and consultants as well as basic status management. Another example is the "eService Store" which was created by the author as part of his master thesis. It focuses on the service system supported provisioning of SAP consulting services [6]. Hence, the concept of service systems is relevant in the sense of this work. The term service system can be interpreted in several ways. It can be regarded as a socio-technical system [7], [31] but also as a system which consists out of actors, goals, roles, processes [11] which together co-create value for the beneficiary [11], [40]. From the perspective of this Ph.D. research project, an IT consulting service system represents an information systems (IS) artifact which is a complex socio-technical system that can contain, interpret, structure, present, customize, deliver and monitor the life-cycle of Digital IT Consulting Products based on their formal descriptions. The overall conceptual model of this work is depicted in Figure 1.

III. Research Objectives and Questions

A. Research Objectives

The main aim and the central design problem of this Ph.D. research project are to improve the IT consulting business by transformation of IT consulting services into Digital IT Consulting Products to become more effective and efficient in globally distributed project settings in worldwide operating IT consulting firms. To reach this we split the overall research aim up into the following subsequent objectives:

Research Objective 1: *To design a formal description language (FDL) that has the expressive power to describe requirements which arise from the digitalization of IT consulting services*

and their transformation into Digital IT Consulting Products.

The first step to digitalize IT consulting services is to be able to describe them in a formal and, therefore, computer interpretable form. One way to facilitate this could be a formal description language.

Research Objective 2: *To organize formally described Digital IT Consulting Products in the form of a repository and to make them easily accessible to relevant stakeholders within distributed IT consulting firms.*

For stakeholders, the availability and accessibility of service descriptions at IT consulting firms is crucial. All stakeholders must have a solid understanding of which services are being offered, how they are structured, what their deliverables (value) are, what the costs and prices are, whether there are different versions of the same service available, how a service can be customized to a customer's needs and how they have to be instantiated as well as provisioned. A Digital IT Consulting Product repository would support these requirements and would bring transparency to the stakeholders.

Research Objective 3: *To facilitate the orchestration of human as well as technical actors with regards to the provisioning of Digital IT Consulting Products in distributed project settings, the work will propose and implement a provisioning environment for Digital IT Consulting Products.*

In order to be able to exploit the potentials of Digital IT Service Products, these must be managed via an appropriate digital service system [7]. The system would have to utilize the Digital IT Consulting Product repository containing the formally described service products. It would orchestrate the required actors during the provisioning of the products. Actors could be human stakeholders (e.g. sales persons, product managers, consultants or clients) as well as other computer systems (e.g. ERP systems). With the help of the system, client-specific customized representations of the Digital IT Consulting Products would be created and managed throughout their life-cycle. As all required information on the provisioning of the services product instances would be available within the service system, IT consulting firms and client companies would benefit especially with regards to globally distributed project settings.

B. Research Questions

Respecting the previously stated research objectives, we define the research questions to be answered by this Ph.D. research project as follows:

Research Question 1: *How can IT consulting services be formally described and transformed into Digital IT Consulting Products?*

Research Question 2: *How can Digital IT Consulting Products be organized and managed regarding their pre-market life-cycle states in distributed IT consulting firms?*

Research Question 3: *How can the on-market and post-market states of Digital IT Consulting Products be managed, and how can human and technical actors be orchestrated who are involved during these states ?*

IV. Research Process and Methods

A. Overall Research Process

To reach the research objectives of this proposal, the following activities within the research process are planned. In general the research will be based on the design science approach described by Wieringa [55]. The overall research process will yield three main artifacts. These are (1) a formal, ontology-based, description language to specify Digital IT Consulting Products, (2) a proposed architecture of a provisioning environment for Digital IT Consulting Products and (3) a proposed runtime environment to manage and deliver Digital IT Consulting Products (see Table I).

B. Complementary Research Methods

During the research process the following activities will be conducted:
(1) For *problem investigation*, a systematic literature review (SLR) on the topic of the digitalization of IT consulting services will be conducted following the proposed trajectory of [28], [48], [49]. Based on the results of a SLR conducted by the author [6], we will conduct a delta review of the state of the art research related to the topic aforementioned. The SLR will provide a comprehensive understanding of the topic and reveal relevant insights for the research methods which will be conducted subsequently.
(2) For a more in-depth *problem analysis and investigation*, we will conduct focus group interviews (FGI) [9] with experts from the field of IT consulting and clients to collect relevant insights into the domain. First, it is necessary to gather insights into the IT consulting services from practitioners and understand who the stakeholders are, what issues they face today and what would be their requirements related to the digitalization of classical IT consulting services.
(3) As the outcome artifacts of the *treatment design* phase, we will develop prototypes [10] of the formal description language, the Digital IT Consulting Product Repository and the IT Consulting Service System that can offer formally described Digital IT Consulting Products.
(4) To *validate the treatment*, it is required to test the utility and effectiveness of the prototyped artifacts in experimental settings. Conducting several Single-Case Mechanism Experiments (SCME) [55] seems to be appropriate in order to provide evidence.
As of now we are focused on experimental validation of the yielded artifacts and therefore we ground our research on the design cycle only.

TABLE I
EXPECTED RESEARCH CONTRIBUTIONS

Contribution	Type	Research Domain
A new conceptual model of Digital IT Consulting Products	T	Consulting Research
A formal, ontology-based, description language for Digital IT Consulting Products	T, P, M	Semantic Interoperability, Consulting Research
New knowledge related to the life-cycle of Digital IT Consulting Products	T, P	Service Science, Consulting Research
A proposed architecture for a Digital IT Consulting Product repository and a corresponding prototyped service system.	T, P, M	Service Systems Engineering, Service Science, Consulting Research
A proposed architecture for a provisioning environment for Digital IT Consulting Products and a corresponding prototyped service system.	T, P, M	Service Systems Engineering, Service Science, Consulting Research
New knowledge related to multi-actor orchestration in distributed IT consulting firms	T, P	Service Systems Engineering, Service Science, Consulting Research

Types: T = Theory, P = Practice, M = Main Contribution.

V. EXPECTED CONTRIBUTIONS

By conducting this Ph.D. research project, we haven taken a multi-disciplinary perspective on the research domains: consulting research, service systems engineering, semantic interoperability and service science. We expect to be able to yield contributions to both theory and practice in these domains as indicated in Table I. The second column of this table indicates whether the contributions are aimed to theory (T) or practice (P) and whether we consider them to be a main contribution (M). The third column indicates the specific research domain to which each contribution will be made.

VI. CURRENT RESEARCH PROGRESS

Currently, we are preparing the SLR as we believe that this is the necessary basis for the overall research project. Based on the results of a SLR conducted in [6], which was founded on [48] and [14], we are continuing our search of relevant literature in addition to [49] as well as dedicated guidelines on literature reviews in information systems research in general [28]. The rationale behind our decision is that for a Ph.D. research project, we believe, a more sophisticated method is required to ensure procedural rigor and to achieve better quality results. Following [49] we plan to conduct a systematic review to identify the state-of-the-art knowledge in the field of digitalization of IT consulting services. The review process will be iterative as this is also true for the underlying engineering cycle. The next planned steps are:

(1) Define a search log to document all steps and phases during the conduction of the SLR as described in [14], [49].
(2) Validate the SLR results of [6]. Do the search terms fit? Do the databases still exist, and can they still be used? To what extent are the results still relevant for the Ph.D. research project, and when yes, why?
(3) Based on the research questions and objectives as well as the results from step (2), follow the taxonomy of Cooper [14] to define the process, the sources, the coverage and the techniques for the SLR. The search terms used in [6] enriched by additional identified terms during the preliminary review.
(4) Conduct the first iteration of the SLR.
(5) Document the results, adjust the search as required.
(6) Conduct the next iteration, or exit the cycle.
(7) Synthesize the findings in a dedicated paper.

As of now we do not know when the results of the SLR would be suitable enough to stop the process once we have reached the saturation point [49] to end our search. As the next overall step of our research project is to prepare of focus group interviews in order to collect requirements and validation criteria on asset- and platform-based IT consulting from experts in the field, we need to build a sound understanding on the state-of-the-art in consulting digitalization, asset- and platform-based consulting and formal description of IT consulting services.

The following databases and sources are intended to be used: AISEL, BASE, EBSCO, Google Scholar, Scopus and Web of Science.

ACKNOWLEDGMENTS

The main supervisor of this Ph.D. research project is Dr. Marten J. van Sinderen, and the daily supervisor is Dr. Maya Daneva. Both are with the Services & CyberSecurity research group (SCS), University of Twente, The Netherlands.

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