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Digitalisation of the Source-to-Contract Process: Evaluation and Proof of Concept

Abstract

This working paper examines the digitalisation of procurement in general and the evaluation of the digitalisation of the Source-to-Contract Process in particular as well as the key influencing factors and corresponding preconditions.
The elaboration is based on the question of research (QoR), whether there are opportunities and challenges arising from the implementation of a cloud-based tendering and supplier lifecycle management solution in the S2C process. In order to answer the QoR, an extensive literature research was executed and various findings in this field of research and applications were analysed in order to create a proof of concept.
As outlined in this working paper, electronic sourcing technologies have been available to support the S2C process for more than two decades and have achieved significant advancements to date. The development of applied technology in procurement led to the emergence of end-to-end sourcing suites and best-of-breed providers. More than one out of three procurement activities may be automated by taking advantage of existing technology, as shown by recent developments in the field. Especially in the S2C process there is a huge potential to automate almost 70% of the process.

Key Words:
digitalisation, procurement, sourcing, Source-to-Contract process (S2C), technologies

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1. Introduction

The specialization and the division of labor are constantly increasing, and with it the need for external supply and procurement. During the COVID-19 pandemic, remote education, remote employment, and remote health care came within the reach of many, resulting an increase in need of digital devices (Chen, 2021). As a result, total sales for example from the worldwide semiconductor industry reached $595 billion in 2021, up from the $470.89 billion recorded the previous year. Semiconductor market revenues are estimated to increase by 13.6 per cent in 2022 (Statista, 2022b).

This indicates the importance of procurement as most businesses spend more than fifty percent on average of their revenues on products and services obtained from suppliers (Bode et al., 2021b). In the car manufacturing industry, the share goes up to 80%. This reality has made effective and constructive supplier relationships a factor of financial success and long-term competitive advantage for businesses. Procurement has therefore moved from being purely tactical to becoming more strategic (Bode et al., 2021a).

The factory model adopted in the early 2000s and characterized by consolidation, compliance and process efficiency is expected to evolve further towards delivering value, quality and competitive advantage. At the same time, the unprecedented pace of technological development is eliminating human labor and pushing it offshore (Deloitte, 2016). Moreover, inside an organization, similar shifts affect every internal stakeholder, and all of them must reassess their role in the company, reprioritize tasks, and change their perceptions of what procurement is expected to deliver for (Dovgalenko, 2020).

Source-to-Contract (S2C) refers to the tactical procedures that begin with the identification of needs and requirements and end with the execution of supplier contracts (Schnellbächer & Weise, 2020). It involves short-term plans that are essential to the smooth running of the business. However, S2C process may be excruciatingly slow (Biltoft-Knudsen et al., 2018),

since it contains many manual activities and events, as well as a large number of repeated tasks that requires more time and effort and leaves possibility for human error (Närger, 2018). Furthermore manual processes include inaccurate information, low visibility and transparency for sourcing activities and require high effort to adapt if anything changes in the process (Soltmann, 2022).

To support the S2C process, electronic sourcing technologies have been available for more than two decades and have achieved significant advancements to date (La Bouleye et al., 2016). The development of procurement technology led to the emergence of end-to-end sourcing suites and best-of-breed providers (Archlet, 2022). More than one out of third of procurement activities may be automated by taking advantage of existing technology. Especially in the S2C process there is a big potential to automate almost 70% of the process (Jain & Woodcock, 2017).

Beneficial effects on procurement's process performance may boost value in procurement a variety of ways, including: process simplification by reducing non-value adding activities; finding suppliers with better prices/pressuring current suppliers to reduce prices; realization of substitution options; and reduced consumption through improved spend management and reduced maverick buying (Bode et al., 2021a).

Few studies are conducted on the extent to which the efficiency and flexibility of sourcing procedures may be enhanced by digitalisation and where the related challenges lie (Zafari and Teuteberg, 2018, p. 2070 cited in Bode et al., 2021b).

Consequently, further contextual research on digitalisation in purchasing processes is needed. It is important to identify the necessary parameters and concepts for digitalisation and ease of implementation in order to ensure effective sourcing processes.

2. Purpose of the Study and Research Questions

For companies to have a world-class category management process, it has become clear that processes such as maintaining supplier relationships and optimizing the supplier database need to be included in the sourcing process. However, some of these activities involve non-value-added and time-consuming tasks, manual steps with insufficient information visibility, including inefficient use of existing sourcing tools. For this reason, businesses need innovative digital solutions that will improve the efficiency of their S2C operations. This is the reason,

why proof-of-concept was initiated by this working paper to identify new and effective solutions to support the S2C process. The scope is defined in successfully digitalizing the S2C process as to enable cohesive, lean and tool-enabled process flow; to automate processes to reduce manual steps; to gain high reportability and data analysis capability; to collaborate efficiently through solution; to enable integration within other processes; to upgrade sourcing capabilities like offer analysis and TCO evaluation.

Based on the weaknesses identified in current S2C processes, this research aims to examine the capabilities of the sourcing solution to find the benefits and challenges of the tool-supported process to identify the improvement opportunities for the sourcing process. In order to comprehend the problem, this study first investigates an existing sourcing process in general, the purchasing organization, and difficulties encountered by the purchasing team throughout the S2C process. Further, study examines the capabilities of the selected sourcing solutions and to determine the solution's compatibility with a sourcing process in general. Based on the identified capabilities, the study discusses the possible impacts of implementing the solution to the S2C process on the procurement team, process compliance, and financial outcomes. Based on the purpose, following research questions were formulated:

- RQ1: Are there opportunities arising from the implementation of a cloud-based tendering and supplier lifecycle management solution in the S2C process?
- RQ2: Are there challenges arising from the implementation of a cloud-based tendering and supplier lifecycle management solution in the S2C process?

3. Theoretical Framework

To understand the digital S2C process and provide a conceptual basis for it, a literature review is conducted which covers, to some extent, the entire purchasing process. Both relevant academic and practitioner resources are reviewed to reflect the digital procurement issues covered in the study. Next, information from S2C software vendors (websites, conferences, and reports) is utilized to gather data regarding current trends in the digital procurement industry, Industry 4.0, and advances within this paradigm.

The literary databases Scopus, Web of Science, and Google Scholar are utilized to locate academic materials. 'Industry 4.0,' 'E-Procurement,' 'E-Sourcing,' 'Source-to-Contract,' 'eTendering,' and 'Supplier Lifecycle Management' were utilized as keywords. In addition,

these keywords will be coupled with 'digitalisation,' 'digital,' and 'automation' in order to discover more particular content.

3.1. Traditional Procurement

Procurement departments provide other divisions of the organization with the necessary materials to perform their duties. In practice, these organizational units are often known as consumers or internal customers (Krampf, 2020). A well-known statement defines the objectives of purchasing as: to acquire the right quality of material, at the right time, in the right quantity, from the right source, at the right price (Baily et al., 2022, p. 4). To ensure this, procurement analyses internal customer's needs, translate them into realizable requirements and cover them in such a way that a competitive advantage is generated for the organization (Büsch, 2019). Typically, the flow of goods through the supply chain begins with the procurement of raw materials, and may be followed by manufacturing, inventory, and shipment to the customer (Johnsen et al., 2014).

The importance of procurement management has increased over the years as corporate governance has recognized that procurement has a significant impact on company performance. Today, most businesses spend more than fifty percent of their revenues on products and services obtained from suppliers (Bode et al., 2021b), which indicates that fifty percent of every dollar of revenue earned on goods and services sales goes back to suppliers (Monczka et al., 2021). This reality has made effective and constructive supplier relationships a decisive factor of short-term financial success and long-term competitive advantage for businesses. Procurement has therefore moved from being purely tactical to becoming more strategic (van Weele & Eßig, 2017).

Terms commonly used to describe the procurement process include "procurement", "purchasing" and "sourcing", however their definitions vary among practitioners and scholars (Schoenherr, 2019). Nonetheless, a more nuanced distinction of some key terms can be seen in Table 1.

Table 1. Explanation of terms used in the procurement process collected from literature

Term	Explanation
Procurement	Management of a company's external resources with the objective of assuring the availability of all commodities, services, skills, and knowledge required to carry out, maintain, and control the company's core and supplemental operations at the most competitive prices (van Weele & Eßig, 2017).
Purchasing	Purchasing is the acquisition of materials required for the manufacture of a product or service. It includes actions like ordering and payment (Johnsen et al., 2014).
Sourcing	Sourcing is the search of suppliers for goods and services, which involves activities such as finding, selecting and contracting suppliers (van Weele & Eßig, 2017)
Strategic sourcing	Institute for Supply Management (ISM) describes strategic sourcing as "the selection and management of suppliers with a focus on achieving the long term goals of a business"(Schoenherr, 2019), which seeks to maximize the efficiency of the sourcing process (Johnsen et al., 2014).

The purchasing process identifies user requirements, accurately evaluates stakeholder needs, identifies suppliers who can meet those requirements, develops agreements with those suppliers, employs a mechanism to place orders with suppliers, ensures prompt payment, verifies that the need was met effectively, and drives continuous improvement. This method is also known as the P2P or procure-to-pay method (Monczka et al., 2021). However, the process of buying is not consistently defined among scholars. There are 73 buying process models (Bäckstrand et al., 2019) mentioned in literature.

Although this research focuses on the sourcing process, a broader perspective is required to comprehend the connections between the process phases, since all procurement operations are intricately interconnected, as shown in the following figure (Figure 1).

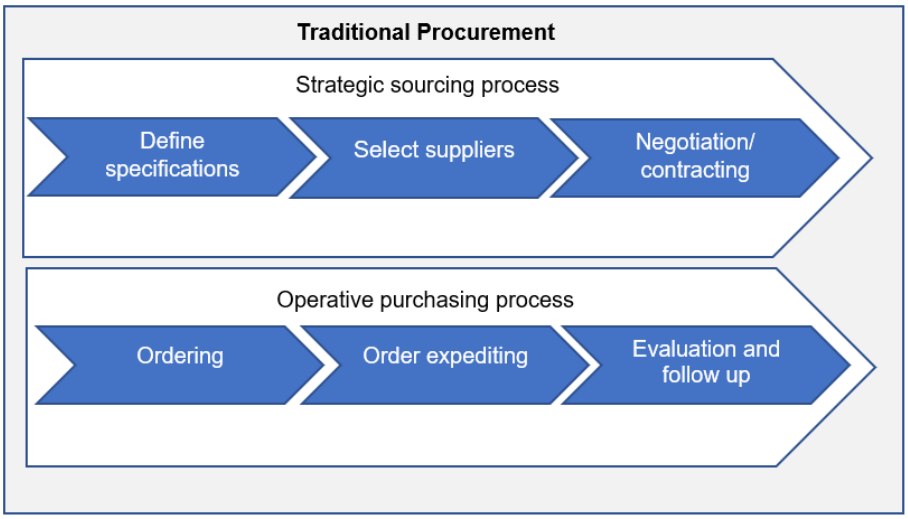

Figure 1 Traditional Procurement Process (adapted from v. Weele and Eßig (2017)

Commonly, the traditional procurement process starts with the internal customer giving the purchasing department the "signal" to start the procurement process in the form of a requisition. Ideally, the requisition in a company is done via a uniform IT platform to ensure a standardized process (Krampf, 2020). Based on van Weele and Eßig (2017)`s description of procurement and supply cycle, following steps are defined for buyers' activities in the traditional procurement process:

1. Identify new potential suppliers and business partners considering the company's changing procurement needs. Participate in new product development projects and early-stage investment projects to propose technical solutions and suppliers with proven expertise. Assist internal customers in defining specifications for procurement goods in an objective and unambiguous manner.
2. In cooperation with the internal customer, draw up a list of proven suppliers, formulate requirements of offers or tenders, together with stakeholders, evaluate the offers received, select the supplier.
3. Prepare and conduct contract negotiations, draft and review/revise contract content and terms and conditions.
4. Set up call-off and ordering procedures in such a way that the users can place orders themselves within the framework of the contractual conditions agreed with the suppliers. If users cannot place orders themselves, take over order processing, i.e. record and service internal call-offs; place orders with suppliers, maintain and monitor order and supplier files.

5. Monitor delivery dates and open orders to ensure timely delivery; monitor invoice receipt or open payables.
6. Follow-up and evaluate transactions, i.e., satisfy contractual claims, evaluate supplier performance, maintain and update supplier documentation.

3.2. Categorization of Purchase Products

There are several factors that determine the purchasing process. For example, the purchase of a complex product may proceed differently from the purchase of a more standard product (van Weele & Eßig, 2017). Strategic, leverage, bottleneck, and standard goods may be categorized to define a buying strategy, where the classification of a product is determined by the degree of supply risk and profit impact / purchase volume (Hofbauer, 2016). Strategic goods are those that have a strong influence on financial performance and contain a high supply risk. The approach for strategic items is value-added partnership, which entails an intimate relationship with the supplier in order to ensure win-win situation, long-term relationships, stability and relationship maintenance (Hofbauer, 2016). In contrast, low supply risk and high volume characterize leveraged goods. Due to the restricted number of accessible suppliers, the procurement of bottleneck items has a high risk, but does not have a significant financial effect on the organization. By seeking out new suppliers, repositioning on the market, or the development of different goods, the approach seeks to ensure supply while minimizing dependency on individual providers. The fourth product group consists of regular items, which have limited financial effect and low supply risk. In an effort to reduce complexity, the linked approach employs outsourcing or e-procurement solutions (van Weele & Eßig, 2017).

A differentiation of tangible goods can also be done according to their intended use (Brenner & Wenger, 2007). Direct products are production or manufacturing-related commodities that are either included into the final product or intended for resale. Raw materials, parts, components, and entire systems are typical examples of direct products, with correspondingly large procurement volumes and risks. Indirect procurement refers to the acquisition of materials and services necessary for the operation of the business itself (Sarferaz, 2022), and is distinguished by a high degree of standardization and a simplified market for procurement (Brenner & Wenger, 2007).

3.3. Source-to-Contract Process

There are several different interpretations of procurement activities. Sometimes, the first three stages are called as 'Source-to-Contract' whilst the final three stages are referred to 'Procure-to-Pay' (Johnsen et al., 2014). Schnellbächer and Weise (2020) divide the process into three main categories as strategic procurement also known as plan-to-strategy; tactical procurement known as source-to-contract and operational procurement known as procure-to-pay (Schnellbächer & Weise, 2020). Strategic sourcing refers to strategic processes that begin with planning the procurement process and end with defining the category strategy. On the other hand, it focuses on reducing suppliers, identifying critical suppliers, and preserving long-term partnerships with strategic suppliers by considering a higher total cost of ownership (TCO) perspective. This is the most significant sort of procurement since it addresses general strategic issues and has the most influence on cost savings (Biltoft-Knudsen et al., 2018; Layaq et al., 2019; Schnellbächer & Weise, 2020).

Tactical sourcing (Source-to-Contract) refers to tactical processes that start with defining individual projects and their needs and end with signing supplier contracts. This procedure refers to the short-term strategies (up to one year) and transactional operations necessary to maintain company continuity. This approach can still be used to make sourcing decisions, however in a smaller scope comparing to the strategic sourcing. This form of procurement is equally essential to the procurement process and consists of the following steps: requirement specification, tendering, negotiation (auctions), contract creation, contract management, supplier evaluation and awarding, supplier master data management, and claim management (Hofbauer 2021, Biltoft-Knudsen et al., 2018; Sarferaz, 2022; Schnellbächer & Weise, 2020).

Whereas operational sourcing (Procure-to-Pay or P2P) process includes buying an item or service, delivery, and payment. Operational procurement, often known as P2P or R2P (Requisition to pay), comprises requisitioning, obtaining, receiving, and paying for products or services (Biltoft-Knudsen et al., 2018; Soltmann, 2022).

For this study, examining the process steps of source-to-contract process is essential.

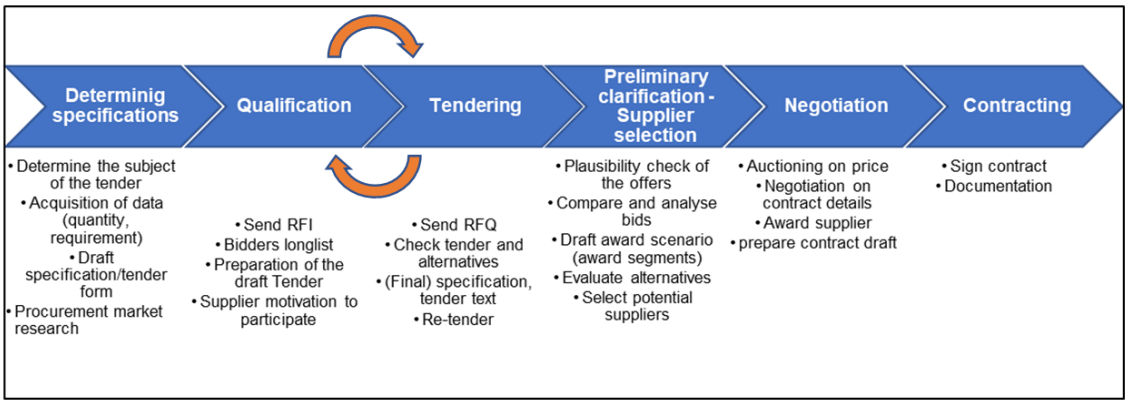

Figure 2. Traditional S2C process (adapted from Hofbauer, 2021; Büsch 2019)

Therefore, process steps of source-to-contract are illustrated in the figure below (Figure 2) and explained.

Determining specifications:

After the buyer receives purchase requests from internal customers, the specifications of the order need to be determined in cooperation with the requester (Bartezzaghi & Ronchi, 2015), An effective and value-added specification aims to define all "necessary" requirement in detail to minimize unwanted costs; communicate clearly with supplier to not let any confusion in sourcing; provide means for evaluating the quality; support standardisation for all quotation evaluations and enable a sustainable sourcing design (van Weele & Eßig, 2017). This challenge is a key source of potential added value because it is meant to cut down on wasteful variation, features, quality, service levels, and costs (Baily et al., 2022).

Preliminary enquiry – qualification:

Often, a preliminary enquiry is launched before an attempt is made to request a more or less final price with the tender (Büsch, 2019). The preliminary inquiry may be used to seek critical supplier data in advance (RFI Request for Information). With this it is possible to acquire an overview of potential suppliers and their capabilities. Here, a procurement team must work closely with specialist departments as specialist department's expertise and industry knowledge will help to create the information request and evaluate suppliers (van Weele & Eßig, 2017). The information acquired from this evaluation is utilized to cut down the pool of potential suppliers (van Weele & Eßig, 2017).

Tendering:

Tendering is a process in which a prevailing party chooses a tenderer to cover the need of supply products or services by requesting several tenderers to bid (Sunmola & Shehu, 2020). After selecting the potential suppliers for bidding, the purchaser issues a request for quotation (RFQ) or proposal (RFP), which contains all necessary information such as a technical description of the item, quality levels required, quantities wanted, dates needed, delivery locations and payment terms (Büsch, 2019). When creating the RFQ it is important to construct quotation in a such way that supplier bids can be compared transparently and objectively, however this process can be often very time-consuming activity of the purchaser (Schiele, 2019).

Pre-clarification and supplier selection:

After receiving supplier offers, the procurement team must now determine whether the supplier's offer surpasses the standard or offers value-adding options (van Weele & Eßig, 2017). There may be clarification talks with suppliers on the delivery scope, thus procurement must include as much extra information as feasible in the proposal process (van Weele & Eßig, 2017). If there are debates within the procurement team at this stage, a choice based on a total cost analysis (TCO) is often a smart approach to additionally consider all other monetary aspects in order to reach a more balanced conclusion (Büsch, 2019). According to the Hackett Group's Sourcing Cycle Time and Cost Measurement Study, in general, preparing and responding to the RFQ/RFP takes about 15% of the total sourcing cycle time, with half of this time spent equally on evaluating potential suppliers and preparing and negotiating contracts (Connaughton & Albertson, 2017). Meaning that if the total sourcing time is 120 working days, 60 of these days will be spent evaluating potential suppliers and finalizing contracts.

Negotiations and contracting:

Once a shortlist of possible suppliers is created, vigorous negotiations begin (Hofbauer, 2021), either through an iteration of RFQs by potential suppliers following a sealed-auction model or through real time electronic auctions following an open-auction model (Bartezzaghi & Ronchi, 2015). Once the negotiations have been concluded, supplier will be awarded and the contract will be drawn up, where all necessary regulations are to be laid down in the

contract. A contract always requires the creation of a purchase order in the ERP system to enable the payment of the invoices (van Weele & Eßig, 2017).

3.4. The Rise of Digital Procurement

In both, corporate and academic contexts, the word "digital procurement" often refers to electronic procurement. Wirtz (2021) summarizes digital procurement as the integration of network-based information and communication technology (ICT) to support operational activities and strategic tasks in the procurement department of a company. According to Deloitte, digital procurement is the deployment of innovative technologies that allow predictive strategic sourcing, automated transactional procurement, and proactive supplier risk management. (Deloitte, 2017). To comprehend the state-of-art of procurement, it is important to briefly examine its past and development. Nicoletti (2020) categorizes phases of procurement evaluation connected with the industrial revolution and can be categorized as follows.

Table 2. Procurement development phases (adapted from Nicoletti, 2020, p.18-21)

Procurement phase	Explanation
Procurement 1.0	This phase is linked to the beginning of the industrial revolution. There was no organizational structure and individual members were responsible for procurement. The objective of the manual work was to deliver the correct product to the correct location in the correct condition.
Procurement 2.0	The Second Industrial Revolution, which made possible major advances in communication and transport, was characterized by several discoveries, the most important of which was the invention of electricity and the second the invention of the telegraph. With the improvement in transport, purchasing has become capable of selecting its suppliers from a global scale. Organizations started to be supported by professional buyers with new skills and knowhow. The 'push' delivery model of production was used to purchase materials in large batches, and warehouses began to be automated.
Procurement 3.0	In this phase ERP (enterprise resource planning), WMS (warehouse management system), TMS (transport management systems), and other ICT solutions are utilized in procurement. Later, e-procurement became widespread and provided an integrated ICT procurement application support. Purchasing became an increasingly strategically important function.

Procurement 4.0	This new era of purchasing is strongly associated with the term industry 4.0, which has developed alongside the internet initiative. Besides ICT applications, Industry 4.0 takes the concept of automation based on the characteristics of the enterprise even further. The integration and connectivity required by Procurement 4.0 is expected to have a disruptive effect on all parts of procurement.

The evolution of procurement technology (fig. 3) can be summarized as follows: *"If we try to use the technical support of purchasing as an outline system, the basis would be traditional purchasing without any technological aids (Purchasing 1.0). Basic system support focused on individual tasks, such as "material requirements planning", forms the next development stage of common purchasing technologies (Procurement 2.0). Company-wide linking (as with ERP systems), automation of primarily operative processes and selective connection to external organizations (e.g. supplier interfaces via EDI) then describes the next stage (*Procurement 3.0). Their further development and increasing dissemination culminate technologically in Purchasing 4.0." (Kleemann & Glas, 2020).

3.5. Development of Sourcing Suites

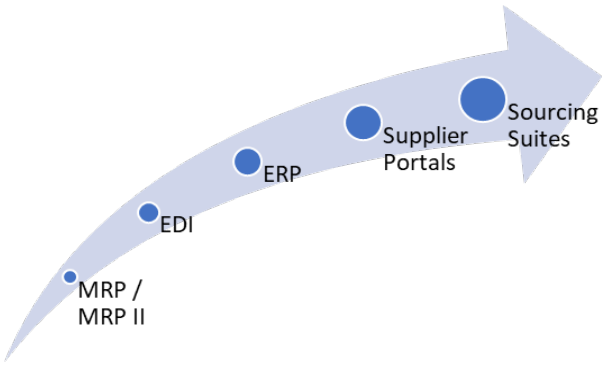

Figure 3. Development of procurement technology (adapted from Kleemann and Glas)

Sourcing was managed manually until computers supported the purchasing techniques. Respectively, with the development of Material Requirements Planning (MRP), EDI and Enterprise Resource Planning (ERP) systems, first demand for production materials are started to be structured in electronic systems. Followingly cross-company IT systems simplified the procurement and supplier performance management by transforming demand information into procurement requests and plans (Kleemann & Glas, 2020). And with the

development of EDI, interaction between supplier side and buyer side increased tremendously, increasing the visibility and transparency in the supply chain, making it a compelling way to electronically transfer business documents, including purchase orders, invoices and shipping notices, directly to a supplier's or other stakeholder's computer system (Schoenherr, 2019).

Existing ERP systems and EDI technology have, over the last two decades, laid the ground for digital supply systems that integrate supply chains from customer needs to demand planning and inventory management by digitizing operational procurement operations. However, there were several challenges to efficiently manage the sourcing process (Soltmann, 2022):

- Sharing demand information through an EDI connection was often accomplished by pulling data from the primary manufacturer's MRP/ERP system and setting it in Excel spreadsheets. Therefore, data flow was neither flawless nor dynamic.
- Prior to the widespread use of barcoding, products or services that were handled by a computerized system needed human entry upon delivery.
- Manual data input and updates was still necessary to keep a digital record that products or services were delivered or finished and to prevent mistakes in stock numbers and demand needs.

Baily et al. (2022), Präuer (2017) and (Bartezzaghi & Ronchi, 2015) classifies the key process of e-procurement models as follows:

- e-Sourcing supports tactical procurement with e-tendering, e-RFQs, e-auctions and e-SRM techniques
- e-Procurement supports operational processes with marketplaces using e-catalogues, e-payment, e-invoicing and self-billing
- e-Collaboration supports customers and suppliers to increase coordination and collaboration through the Internet

Sourcing is a business process in procurement that coordinates decision-making with the company's purchasing strategy: from which source will a future necessity be acquired and under what conditions? The objective is to find the most cost-effective option for the firm. If this approach is IT-supported, it's called "e-sourcing" (Soltmann, 2011). e-Sourcing can support the whole process of requirements definition, suppliers scouting and qualification,

request for bid and final negotiation and selection (Bartezzaghi & Ronchi, 2015); covering the whole source-to-contract process.

Schoenherr (2019) highlights the general features of sourcing solutions as; advanced capabilities as a result of dashboard features, ability to drill down deeper in the data, and ability to be hosted on the cloud, which enables specific module purchases and cloud data storage. However, McKinsey article also highlights that after nearly 20 years of technology deployment, most organizations still struggle to get a comprehensive view of their spend due to procurement's systems that are rigid, complex, and limited in their ability to solve procurement's requirements (Conde et al., 2018).

Many of these solutions use Software as a Service (SaaS) models, which means they may be put into action in as little as a few days and do not need extensive data or system preparation or long integration time (Deloitte, 2017), while some also offer on-premises or private cloud options (Fogarty, 2019). In SaaS model, a solution provider offers software applications over the Internet for the use of its customers, where based on the scale and scope of the offering, a fee is usually charged (Schoenherr, 2019). While the solution provider manages the data center, security, and networking for cloud solutions, on-premise solutions have their servers and associated software hosted within the customer company's own data center (Fu, 2018).

Figure 4 displays the technologies used in procurement in their respective core, mature, and emergent states and these stages will be explored in more depth in the next chapter.

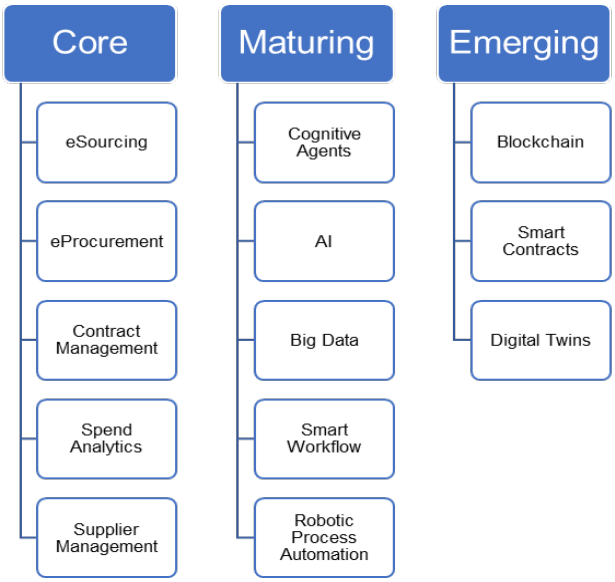

Figure 4. Digital solutions and technologies used in procurement, adapted from (Deloitte, 2017)

The phrase "S2C" is now often used to describe digital procurement technology that aims to enable strategic procurement and sourcing choices in a more efficient manner (Soltmann, 2022), focusing on reducing the procurement object costs and simplifying the work processes (Brenner & Wenger, 2007). Accurate and transparent analytical procurement data is a critical aspect of the S2C process (Basware, 2022).

Software named as "S2C suites" are becoming more popular for automating the S2C process (Gartner, 2022). Typically, they comprise capability for e-sourcing, spend analysis, contract management, and supplier relationship, frequently as independent software modules (Fogarty, 2019). According to Gartner (2022) and Forrester Wave (2019), major providers for compact S2C suites as well as best-of-breed solutions are Coupa, GEP, Ivalua, JAGGAER, SAP Ariba, Synertrade, and Zycus. However, the strength of each module, vertical specialization, coverage of different spending categories, market entry and pricing strategies, and AI and other technological features and plans, as well as the hosting options (cloud vs. on-premise) are the distinguishing features of these products (Forrester Wave, 2019).

Software-based sourcing solutions do not redesign the logic of the decision-making process, instead the purpose of the software is to accelerate, secure and log the established process and to take over activities that are recurring and deterministic (Soltmann, 2011). In this way, they not only create an opportunity to improve efficiency; they also pave the way for procurement teams to play a strategic role in accelerating innovation by automating purchasing processes as described by Radell and Schannon (2018).

3.6. Core S2C Solutions

Common systems and modules of electronic sourcing suites are shown in the below table 3 and will be explained in further. Schoenherr (2019) indicates that eSourcing-related functionality includes more strategic modules, while eProcurement-related functionality is usually more operational and connected to buy transactions or the triggers of material flow.

Table 3. Modules of electronic sourcing suites adapted from Schoenherr (2019)

Strategic modules	Operational modules
E-sourcing and reverse auctions	Requisition management
Spend analysis	Purchase order management
Supplier management	Catalogue management
Contract management	Invoice management

3.6.1. Spend Analysis

Spend analysis is the process of examining a company's past purchasing habits to learn details such as the types of products and services purchased, how much was spent on them, and their sources (Schoenherr, 2019, p. 89). This process is used to collect, integrate, analyze and distill usable information that can drive insightful outputs (CPO Rising, 2021). The data for this process can be collected from multiple sources/systems (often more than one) such as AP/accounting, ERP, eProcurement, etc., making it possible to obtain an up-to-date spend cube at the push of a button (Büsch, 2019). Analyzing the underlying data is critical to effectively controlling and minimizing the tail spend, therefore analysis tools depend on the right data set, however even leading companies still not able to operate with a structured, centralized data sets (more often data is stored decentralized) (Schoenherr, 2019). Spend analysis can also reveal options for improvement, such as supplier consolidation and spend pooling. This reduces administrative complexity and gives remaining suppliers a large spend package, enabling them to offer volume discounts to the buyer.

3.6.2. E-sourcing

Based on the Capgemini research (Michalak et al., 2021) conducted with 33 worldwide known procurement solution providers eRFx, eTendering, eAuction, bid evaluation, contracting and negotiation are revealed as the most common features of e-sourcing.

eTendering / eRFx:

This module provides buyers the ability to create RFI/RFP/RFQ events including the ability to construct the transmitted information from ERP systems like article master information, historical prices, budget values, drawings, data sheets, "supplier" material group assignments and purchase quantity authorities (Gabath, 2011). The solution then generates a pool of potential suppliers for the particular sourcing project based on the order information submitted to the system and the material category determined by the purchasing department (Gabath, 2011; Schoenherr, 2019). Whereas these services already impact both operational efficiency and quality, innovative solutions started to utilize AI to assess external information to suggest new potential suppliers for participation in the RFx process in addition to already known suppliers (Michalak et al., 2021). Furthermore, it is possible for the procurement team to set prerequisitions for suppliers to fulfill (NDA agreement, time frame for response),

increasing the control of procurement team on the sourcing event. The RFQ has now been published on the supplier site, making it accessible to the invited participants. The solution then automatically sends invites to the specified supplier, enable monitoring the status of the event and automatically update and alert changes. So that the system guarantees that all parties remain informed (Gabath, 2011; Qusef et al., 2019). After reviewing the request content, suppliers may logon to the site and indicate if they would respond. The request might go through many rounds until a group of suppliers is found with whom to negotiate and distribute the need. The software's round manager always logs process progress. Each new supplier's offer is added to the portal until the request is fulfilled. After first and second round of bidding, price reductions can be documented for reporting. Meanwhile all communication can be done via the tool enabling suppliers and buyers easy communication options (Gabath, 2011; Michalak et al., 2021; Schnellbächer & Weise, 2020).

Bid evaluation:

In strategic sourcing, crucial decisions depend on comprehensive evaluations. Therefore, the majority of providers offer weighted total scorings as well as evaluations of non-cost factors of suppliers based on their capabilities (Michalak et al., 2021). Each round's bids can be compared in an offer analysis dashboard and the optimal is determined by comparing specific characteristics and cost types (Schnellbächer & Weise, 2020). In addition, solutions provide functionalities for calculating overall savings when baseline costs are given (Michalak et al., 2021). The majority of vendors allow procurement units to conduct detailed assessments, with some systems capable of evaluating total cost of ownership, including volume discounts, quality, and service level indicators, lifecycle costs or decision-relevant scenarios for alternative amount structures (Qusef et al., 2019). However, few vendors use modern technologies such as AI to automate assistance for procurement operations such as risk assessment or optimum bid combination (Michalak et al., 2021).

Negotiation:

Many procurement divisions seek operational guidance and assistance during traditional supplier negotiations so that resources may concentrate on strategic tasks. While some solutions provide a negotiation database that stores target and prior prices as well as the bargaining approach for each supplier, others update the database based on real assessments. Besides traditional negotiating methods, e-auctioning is highly popular among

large companies (Gabath, 2011), which are widely applied across categories (Schnellbächer & Weise, 2020). E-auctions are internet-based price negotiations conducted simultaneously with various pre-qualified suppliers within a limited period of time, which suppliers can openly see the best bid and change their offer in any time. The process of auctioning includes configuration, approval, monitoring, evaluation and awarding (Jaggaer, 2021). For conducting an e-auction, it is required to invite at least 3-4 suppliers for an intensive competition, specifically determine negotiated product or service, have a high purchase volume (at least 1 Mio. €) (Büsch, 2019). Most popular types provided by sourcing solutions are example, English, Dutch, or Japanese auction setups (Schnellbächer & Weise, 2020). E-Auctions can increase the pace of automation, standardization and the speed of the process and to provide higher competition between suppliers enabling buying organization to realize considerable savings (Rotchanakitumnuai, 2013; Schoenherr, 2019). However, some disadvantages can be the cost of the operation and the loss of individual relationship with suppliers (Büsch, 2019; Gabath, 2011).

3.6.3. Contract Management System

This module simplifies and automates the entire contracting and contract administration process conducted within the S2C process (GEP, 2022). By using the contract management functionality built into S2C Suite, it is possible to reduce misplaced and mismanaged paper contracts, as well as the risks and lost savings that go with them (SAP Ariba, 2022). Contract management modules manage procurement and sales contracts, IP licenses, internal agreements; automate and accelerate the contract lifecycle; standardize and control contract development and approval; collaborate with internal stakeholders and trading partners, and integrate vendor master and contract data to and from other back-end systems (SAP Ariba, 2022). A contract management system offers visibility and facilitates accessibility and managing of the contracts, which in turn results in an increased fulfilment of legal requirements (Deloitte, 2017), however some concerns on security, restricted storage and supplier reluctance needs to be considered (Mack, 2021).

3.6.4. Supplier Lifecycle Management System

Actually, strategic supplier management and e-sourcing modules are offered in an integrated suite within the newest generation of software solutions (Michalak et al., 2021), since the supplier-buyer connection is vital to S2C processes (Bode et al., 2021a). Supplier Lifecycle Management (SLM) solutions cover the functions of registration, qualification, classification, performance evaluation and supplier development (Jordan & Darmstadt, 2015; Michalak et al., 2021). Procurement uses this module to onboard, assess, and monitor suppliers in coordination with internal functions such as engineering, manufacturing, quality assurance, and logistics. SLM systems, therefore, increase cooperation and systematic exchange of information between stakeholders and focus on the most competitive and reliable suppliers (Michalak et al., 2021; Schnellbächer & Weise, 2020). Electronic SLM process includes following steps:

Supplier onboarding:

This module comprises the functionalities of a supplier portal and assists buying in acquiring and managing supplier information. This is accomplished by providing the resources and location for supplier data collection, archiving, and organizing. The data sources include information obtained directly from suppliers through an interface (supplier self-registration), such as contact details, certifications, and manufacturing locations, whereas integrating information from external parties is also possible through online services or manual entry (Büsch, 2019; Schnellbächer & Weise, 2020).

Supplier evaluation:

This module is used for uniform, transparent, cross-functional and comprehensive supplier evaluation. A different set of evaluation criteria makes it possible to map the requirements of cross-functional stakeholders for suppliers to permit adjustments specific to product groups, to integrate the so-called hard facts, quality, delivery time and quantity reliability, and to support company-wide comparability of the evaluations. With this, it is possible to identify high-performing suppliers as well as weak ones, and to reveal cost-saving and improvement potential. The evaluations can be archived in an audit-compliant manner (Jordan & Darmstadt, 2015; Schnellbächer & Weise, 2020).

Supplier risk:

In order to mitigate negative impacts, solutions provide software-driven risk evaluations of all suppliers, where internal data may be augmented with external data, such as Dun & Bradstreet risk rankings, supplier news and press releases, social sentiment analysis, and more (Schoenherr, 2019). Depending on the identified risks, some solutions might recommend the replacement of suppliers, identify alternative suppliers, and advise on performance enhancement strategies (Michalak et al., 2021).

Supplier collaboration:

Furthermore, digital networking may lead to cooperation with suppliers becoming even more intensive and autonomous, especially at the level of information exchange, which is crucial for effective collaboration (Kleemann & Glas, 2020). Email is a typical method of communication, but it is performed manually, not continually, and outside the procurement system. The procurement software guarantees that communication channels are constantly open, allowing for the real-time exchange of data with many key parties.

Supplier classification and development:

The "Supplier Classification" module then uses the definitions stored to classify or categorize the suppliers, which are documented in the system. This status of the supplier influences the scope of the supplier development activities, which are managed via the "Supplier Development" module (Becker et al. 2017, p. 119). Suppliers who are not considered to have any future potential in a business relationship with the manufacturer must generally expect the business relationship to be terminated, unless there are constraints to the contrary, such as in the case of a monopoly supplier (Michalak et al., 2021).

3.7. Digitalisation Technologies

Digitalisation is the process of redefining models, functions, operations, processes, and activities by using technological advances to build an efficient digital business environment where operational and financial gains are maximized and costs and risks are minimized (Seyedghorban et al., 2020). Rapid advancements in digital technologies are improving supply chains and transforming how procurement delivers value (Baily et al., 2022, p. 468).

According to Jain & Woodcock (2017) from McKinsey & Co., it is crucial to have a thorough awareness of the roles that some new key technologies will play in the end-to-end digital buying processes. There are a number of important new technologies, and they may be mapped onto various steps in the digital source-to-pay process structure:

- **Bots (or Robotic Process Automation):** A bot (short for software robot) is designed to developed to execute and automate manual human activities, such as verifying an invoice against a contract, placing a PO or interacting with a user/supplier for resolving queries. Robotic process automation refers to the end-to-end transformation of the process (Baily et al., 2022, p. 475). This method is used to improve productivity and reduce execution risks by automating a series of repetitive processes (Jain & Woodcock, 2017).
- **Big Data and Predictive/Advanced Analytics:** Big Data is a collection of technologies that allow the administration, organization, and use of data in a variety of ways, including the processing of bigger amounts of data in less time and with more accuracy (Baily et al., 2022, p. 475). Analyzing methods like predictive analytics and advanced analytics combine modeling, statistics, machine learning, and artificial intelligence with multiple external data sources to forecast most likely outcomes of cost/price fluctuations, demand, supplier/country risks, etc., and thus facilitate preemptive decision making (Higgins, 2021).
- **Cloud Computing and Cloud Solutions:** Instead of a local server or computer, cloud computing stores, manages, and processes data utilizing a network of remote servers hosted on the Internet (Baily et al., 2022, p. 477). Also, cloud-based software as a service ("SaaS") is hosted, maintained, managed, and upgraded by cloud service providers, which makes it possible for enterprises to relieve the strain on their in-house IT infrastructure, invest less in IT and require a lower level of internal support to maintain systems (Jelassi & Martínez-López, 2020).
- **Artificial Intelligence:** In order to quickly classify unstructured spend, cost, contract, and supplier data and provide new insights and opportunities, AI uses pattern recognition software and iterative machine learning algorithms (Higgins, 2021). In contrast to robotic process automation (RPA), machine-learning algorithms are a technology that can automate more complicated decision-making circumstances involving more advanced logical principles and pattern recognition (Biltoft-Knudsen et al., 2018). Human judgment and context-specific analytical talents were formerly

necessary in such decision-making circumstances, but recent advances in AI and machine learning have increased the likelihood that such process steps may be automated (Adamopoulou & Moussiades, 2020).

- **Smart Workflows:** A technology that links tasks performed by individuals and machines into a cohesive process with well-defined responsibility handoffs. The system works accurately regardless of context, so it can perform risk management evaluations for supplier certification or guide specification tasks between R&D and buying (Jain & Woodcock, 2017).
- **Cognitive Agents:** Help desks and chatbots are cognitive agents which can be deployed whenever a comprehensive information base must be explored rapidly to decide the best course of action (Biltoft-Knudsen et al., 2018). But it is anticipated that cognitive agents in the future will account for more complex tasks such as making comparisons among supplier capabilities as basis for automatic recommendations for which suppliers to select in a S2C process (Schnellbächer & Weise, 2020).
- **Blockchain:** Blockchain is "a shared ledger for recording the history of transactions" (IBM 2017) that allows multiple online copies of the same information to interact. This enables the sharing of new database entries – the generation of new information "blocks" – with all stakeholders, while regular cross-checking ensures the integrity of existing entries. This cryptographic data format employs a trusted peer-to-peer network to generate digital transaction ledgers that may be used to verify and authenticate transactions in the P2P process, and trigger automatic payment (Deloitte, 2017).
- **Smart Contract:** Business contracts have changed not much over time, despite the widespread use of digital technology. Still, contracts are discussed, prepared, and agreed upon at considerable effort and expense, then filed away in hard form and soft copy, frequently to be reviewed only when a disagreement occurs (Baily et al., 2022). Smart legal contracts (SLCs), on the other hand, are "self-executing software programs that automatically fulfill a function" (such as make a payment, release documents, or transfer ownership) that add an additional level of automation on top of blockchain implementations. SLCs are legally binding contracts that combine normal language with smart clauses and are implemented digitally by code based on blockchain technology (Baily et al., 2022).

3.8. Digital S2C Process

There is increasing demand on procurement departments to acquire products and services at a faster rate as businesses go through their cycles much faster than ever (Schnellbächer & Weise, 2020). However, S2C and P2P processes might be excessively sluggish, particularly from the perspective of business partners (Biltoft-Knudsen et al., 2018).

Digitalizing the sourcing process might result in a decrease in time spent by up to 80% for less technically complicated commodities like office supplies and a reduction of up to 40% for more technically complex items like capital projects, as reported by Schnellbächer and Weise (2020). Therefore, purchasing managers are increasingly deciding to initiate digitalisation projects in order to establish a digital purchasing environment that can be effectively integrated to meet the needs of the business (Soltmann, 2022).

Today, strategic supplier management runs together within e-sourcing in an integrated suite based on the latest generation of software solutions. This covers the functions of registration, qualification, classification, evaluation and development in supplier management and controls the development of material group strategies, tendering options and contracting (Jordan & Darmstadt, 2015).

The buying department is responsible for coordinating needs with other departments and making recommendations to supplier management on which suppliers are most suited to meet those requirements based on material group and geographic location (Appelfeller & Buchholz, 2011). By having suppliers submitted bids in material-group-specific masks and by having the system automatically calculate total cost of ownership, the S2C system may serve as a decision-making foundation (Jordan & Darmstadt, 2015).

To comprehend the state-of-art of the S2C process in enterprises, it may be beneficial to examine a case study of the Hitachi group. Hitachi Ltd signed a group-level agreement with Jaggaer in 2018 to develop and deliver a configurable digital procurement system that will allow all Hitachi group companies to digitally link spend management, S2P, P2P and performance management processes. The reason for the company to take this step is the enormous amount of time and money wasted each year as a result of incorrectly linked procurement support systems (Soltmann, 2022). Together they developed a digital purchasing configuration infrastructure called Yui, as shown in the figure 5, which served the basis for integrating the solutions.

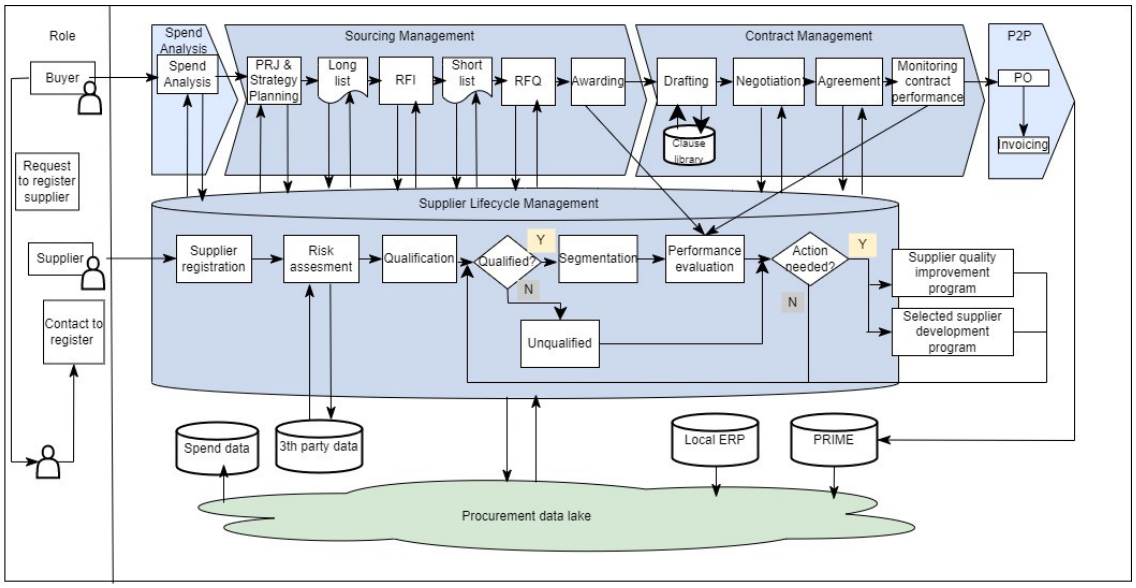

Figure 5. Jaggaer Digital Procurement Architecture, Hitachi Case Study, Soltmann (2022)

3.9. Potential Benefits of Digital S2C Process

According to the report of BME about the state of use and trends in electronic procurement (BME 2015), the top anticipated outcomes of e-Tendering adoption are as follows:

- Increase of process transparency and compliance,
- Increase of process stability/avoidance of errors
- Reduction of cost prices
- Reduction of process costs

Further benefits attributed to e-Tendering includes reduction in time spent for the tendering process, simplification of the tendering process, increased competitiveness of the tenderers' proposal, increased tender analyzing capabilities, improved medium of communication between the parties, enhanced response rate to inquiries, effective engagement of market mechanism, less corruption, reduced supplier collusion, consistent tendering practice and fairer assessment of tenders (Sunmola & Shehu, 2020).

However, in general, Bartezzaghi and Ronchi (2015) indicate the most recognized benefits of e-Sourcing as the reduction of the purchase price and the efficiency increase in the overall process. Präuer (2017) determines that e-sourcing solutions contribute to the widespread automation of data interchange and data processing by expediting the gathering and flow of information. The "acceleration of information flow", allows the time required for procurement

market research, investigations, document interchange, as well as the evaluation and comparison of both internal and external providers to be shortened through platforms. This saves considerable time by speeding up the processing and re-purchase of components or services and allows the buyer to focus on value-added tasks such as market analysis, supplier hunting, vendor evaluation and technical department cooperation (Präuer, 2017).

Additionally, e-Sourcing systems may increase accuracy and comparability of bidding information by allowing suppliers access to pre-designed offer templates (as input masks or downloaded files) before an RFP or tender is posted. This can reduce unwanted supplier information, and help to focus on valuable, decision- making data. Therefore, digitalized source-to-contract operations may be more up-to-date and cost-effective due to pre-defined information gathering methods and real-time data availability.

As e-sourcing directly facilitates tactical purchasing activities, transactional purchasing cost may decrease, however e-sourcing can also have indirect impacts on other purchasing costs (Bartezzaghi & Ronchi, 2015). Boer et al. (2002) states that as the direct costs of selecting suppliers drops, it seems to make sense to consider a higher frequency of tendering. The impact of e-tendering on the frequency of supplier selection can decrease the direct costs as more alternatives can be considered to select, whereas non-product related costs and strategic purchasing activity costs can rise as investments and management on more suppliers are needed (Boer et al., 2002).

Due to receiving more offers via platform compared to traditional sourcing process, a decrease in the purchasing price is expected. Findings show a 17% cost savings compared to the earlier sourcing operations (Bartezzaghi & Ronchi, 2015). According to Handfield et al. (2019) the capacity to acquire and exploit real-time data is a crucial source of added value. Utilizing data analytics to compile vital information and record features of a supplier market in real time, current sourcing technologies may help the category manager to take data-driven decisions. Existing digital procurement systems can aggregate all necessary information and transform it into analytical data that category managers may more readily analyze. Therefore, digital procurement procedures have the ability to assist businesses in achieving their financial goals and mitigating risk by giving smooth and extensive access to accurate and timely data. Net gains may be passed on to customers via competitive pricing, or they can be utilized to increase a company's profit margins (Soltmann, 2022).

Overall, as will be discussed in the following sections, IT solutions may initially appear to be tools requiring high investments and high operating costs, they are expected to provide

procurement departments sustainable productivity by reducing the total cost over time, analyzing and revealing important data, and optimizing processes (Kleemann & Glas, 2020).

3.10. Challenges and Adaptation Barriers of Digital S2C Process

While information technology has simplified many aspects of supply management, it has also introduced new obstacles (Bartezzaghi & Ronchi, 2015). Digital procurement solutions, despite many innovative features they bring with them, may not deliver the expected process efficiencies when they are first integrated and may even be perceived as cumbersome and as inefficient as the old ones (Schoenherr, 2019). It may not be possible to replicate previous analyses in the new system and users may need to perform these analyses outside the system (e.g. in excel). However, this is contrary to the purpose of the new system and will certainly reduce efficiency and lead to extra costs and work. Nevertheless, most of these negative aspects may be due to the user's lack of procedural knowledge (Schoenherr, 2019), resources and skills (Bienhaus & Haddud, 2018). Therefore, the shift to an electronic procurement system is often a significant task, not just from a technological and infrastructure standpoint, but also from a human and change management perspective, which may result in resistance to change (Belisari et al., 2020). According to the survey of PwC, change management is crucial to avoid these obstacles (PwC, 2022).

Furthermore, high purchase, implementation, and training costs can be seen as a barrier to adopt these systems, as this is also reported in the study of BME (2015), as the biggest challenge in adopting S2C solutions. Although the costs for buying the solutions are clear and represented in the price tag during the implementation phase, the actual implementation of the software and additional costs such as training, transferring records from the old system to the new system, and maintenance are further financial challenges (Schoenherr, 2019).

Bartezzaghi and Ronchi (2015) also state that there are other operational challenges. For example, the time required to set-up an RFx or auction is relatively high, and some managers consider this a major disadvantage (Bartezzaghi & Ronchi, 2015; van Weele & Eßig, 2017). Studies also mention that the number of suppliers invited to bidding process should be at least four or five in order to compete for the contract to cut price and bids should compete only on the basis of price with all other factors (i.e. quality, service level, reliability) as equal as possible, which requires a homogenous set of offers.

An important consideration when using enterprise solution for sourcing projects that requires high work process interdependence with stakeholders is mentioned in the study of Rai and

Hornyak (2013). According to the study, the use of a digital solution for supplier selection and management promotes memory orientation due to established layout and systems, which is advantageous for sourcing projects with more structured products (Rai & Hornyak, 2013). In addition, the supplier's point of view is important to bring up since it has been the subject of research discussions by a number of academics. Van Weele and Eßig (2017) state that the majority of suppliers do not particularly appreciate electronic auctioning, as they constrain their contractual power (Bartezzaghi & Ronchi, 2015). This contains a risk of reduction in quality, the excessive reduction in margins and the termination of consolidated relationship (van Weele & Eßig, 2017).

Overall, these obstacles may be the reason for the slow growth rate of the digital procurement market, i.e., there is a perceived lack of return on investment when procurement personnel are still required to carry out many critical aspects of the process (Soltmann, 2022).

3.11. Critical Elements for Ensuring Success in a Digital S2C Process

According to Rotchanakitumnuai (2013) e-Sourcing must be well-managed to accomplish the organization's performance objectives. It is also widely recognized in the literature that for an organization to be truly successful in any change, each stakeholder and process must work in harmony, as each individual and activity affects and is affected by the others (Croom & Johnston, 2003). Therefore, a holistic approach is needed to implement to assess the key drivers that affects ICT adoption in S2C process. A study conducted by Rotchanakitumnuai (2013) examines the factors impact sourcing solutions based on the balanced scorecard (BSC) model. The BSC is a formal management system that transforms an organization's goal and strategy into key performance indicators and offers the foundation for strategic assessment on four crucial perspectives: finance, customer, internal processes, and learning and innovation (Pirrone & Meyer, 2021). Accordingly, in the causal logic, the BSC shows what knowledge, skills and systems employees need (organizational learning and growth) to innovate and build the right strategic capabilities and efficiencies (internal processes) that deliver specific value to the customers. This in return leads finally to a higher shareholder value (finances) (Pirrone & Meyer, 2021). The balanced scorecard pushes management to take a broad view on ICT investments (Milis & Mercken, 2004).

Additionally, Croom and Johnston (2003) addresses importance of adapting an internal customer perspective to assess the impacts of e-procurement applications. Study argues that facilitating procurement processes using web-based solutions encourages users to comply

with the procurement procedure and internal customer satisfaction is intertwined with the advantages of compliance with the procurement process.

Both studies identify several key drivers that affect internal service performance. Whereas Rotchanakitumnuai (2013) reveals the categories of **technical capability of the e-procurement system** and **organizational factors** as the two factors of success in electronic procurement deployment. Croom and Johnston (2003) categorizes the factors that affect internal customer satisfaction, and consequently process compliance and costs as systems` **process capability, capacity, people** and **IT infrastructure**.

Technical capability of the system depends on service quality and system quality. Service and system quality can be assessed based on how secure, reliable, easy to use and accessible is the solution, whereas service capability can be assessed based on the responsiveness and flexibility of service (Croom & Johnston, 2003; Johnston, 1995; Rotchanakitumnuai, 2013).

Organizational readiness is a key factor in promoting internal process improvement, learning, and innovation, including buying personnel's computer skills, knowledge, and resources. Croom and Johnston (2003) point out that IT infrastructure is a critical success element for e-procurement implementation.

Table 4 provides an overview of identified criteria of service quality.

Moreover, Sunmola and Shehu (2020) emphasize the importance of user satisfaction for a successful e-tendering system in enterprises. According to Sunmola and Shehu (2020), an important factor affecting user satisfaction is the performance features of the software.

The model establishes a connection between an organization's product development and the internal customer satisfaction, giving a logical method for categorizing IT service features based on internal customer perception (Sunmola & Shehu, 2020):

- **Attractive** quality encompassing features that provide satisfaction when fully fulfilled without causing dissatisfaction when not fully fulfilled,
- One-dimensional quality (**performance**) encompassing features that results in customer satisfaction when fulfilled and dissatisfaction when not fulfilled,
- **Must-be** quality encompassing features that are taken for granted when fulfilled but results in dissatisfaction when not fulfilled,
- Reverse quality (**indifferent**) for features that incorporate dissatisfaction.

Table 4. Service quality criteria adapted from Croom and Johnston (2003)

Criteria	Description
Ease of use	Ease of use, which is the degree to which a person believes that the use of a new solution requires little effort (Nicoletti, 2020).
Accessibility	The system should be accessible worldwide, with just the provision of the internet (Sunmola & Shehu, 2020).
Speed	Speed is the response time of server of the software on different user`s activities (Sunmola & Shehu, 2020)
Flexibility	Flexible configuration for the user's unique way of working. e.g. accommodating various tendering formats and requirements (Sunmola & Shehu, 2020).
Reliability	The ability to perform the promised service dependably and accurately; consistency in the service delivery (Gunawardane, 2011)
Integrity	Capacity to preserve the flow of data through the system from origin to target recipients, and record exemptions (Sunmola & Shehu, 2020).
Communication	The richness of data flow between stakeholders (Croom & Johnston, 2003).
Availability	The characteristics of the IT service in which its elements may be accessed anytime, anywhere undisrupted whenever the user is connected to the internet, or cloud server.
Functionality	The serviceability and fitness for purpose (Johnston, 1995)

According to the study, most of the features are classified in the performance quality category. The performance features include document exchange, compliance, electronic evaluation, confidentiality, audit trails, security, management control, accessibility, feedback

reports, compatibility with different devices, setting criteria for the tenders, checklist for final review, and archiving. These features have the potential to elicit the satisfaction of internal customers using e-Tendering platforms (Sunmola & Shehu, 2020). They impact customer satisfaction when they are achieved and can cause dissatisfaction to customers when they are not fulfilled.

Features considered as attractive but not as performance features are live chat with participants, authentication & non-repudiation, unlimited auction duration, customizable time zones and currencies, free test auctions, real-time fast interface, automated notifications, supplier assessment questionnaire, pricing documents (Sunmola & Shehu, 2020).

According to the user group, customization features like multi-user, multi-language interface, auto-time extension, flexibility configuration, software update, complete control over participant visibility, issuing separate logins, were categorized as indifferent different features (Sunmola & Shehu, 2020), hence it is known that personalization can affect how users use software systems, with considerations for user interface, content and interaction processes (Zanker et al., 2019). Especially for more complex sourcing events, Rai and Hornyak (2013) highlight the importance of rich media interaction e.g., media that provides feedback immediacy, social cues, personalization, and language variety. Also Präuer (2017) states that systems are more likely to be used effectively when they are interactive and intuitively built, and when they can be personalized and adapted to the specific needs of each organization and individual buyers (Präuer, 2017).

3.12. Change Management

A change is the organization-wide effort, initiative, or solution that aims to enhance the way work is performed, address an issue, or seize an opportunity, whereas change management is used to fulfill project goals and organizational advantages by applying a systematic method for assisting people affected by change through their unique transitions (Prosci, 2022). Transformation as a radical change in the organization can mean influencing both the purchasing strategy, the structure of collaboration, the systems and the work processes (Büsch, 2019). Although, the success rate of procurement and supply chain transformation is directly related to the level of change management expertise (Ehap, 2019), the transformation of a purchasing organization is still one of the most challenging tasks for a purchasing manager (Büsch, 2019).

According to Büsch (2019) and (Ehap, 2019) there are three main reasons why organizations face failures in transformations:

- Transformation project implemented too fast, without specific change plan.
- Transformation project failed to address realities of the organization.
- Transformation project failed to involve people.

Therefore, to reduce the failure rate in digital transformation a six-step logic can be followed: (1) create pressure for change, (2) build supportive coalitions, (3) develop vision and strategy, (4) address cultural issues, (5) manage transition, and (6) sustain movement. For a successful transformation, also Prosci (2022) and (Ehap, 2019) suggest a combination of project management for the technical transformation and change management for the people side.
As shown in the following figure 6, this model summarizes the project management steps as Design, Develop and Deliver and emphasizes the change management phases of Engage, Adopt and Use.

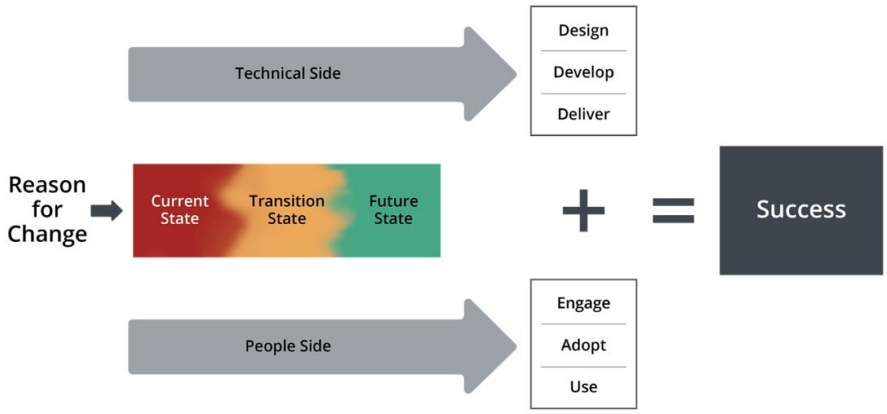

Figure 6. Project and change management process (adapted from Prosci, 2022)

Plan and Engage

Understanding the organization's present procurement procedures is the first step of the change management (GEP, 2022). Organization Readiness for change provides insight into the existing status of the organization relative to its intended position after the change (Ehap, 2019), where a SWOT Analysis is a beneficial exercise in assessing organizational readiness for implementing a new program (Ehap, 2019). Assessing the proposed change project's alignment with the organization's present vision, purpose, and strategic plan is the next step

(Ehap, 2019), since a powerful vision has the ability to motivate and inspire people to move (GEP, 2022). This activity is essential for addressing the question "why we need to change" posed by all levels of the business. It is the responsibility of the senior management team to formulate a compelling vision and secure procurement's full involvement (Ehap, 2019; Prosci, 2022).

Manage change

The next step is the implementation phase, which is a top-down method in which senior management must communicate effectively with procurement team members, where a knowledgeable, credible, and powerful change management team should be assembled with the proper qualifications (GEP, 2022). According to Ehap (2019), communications should primarily have two focal points: communications about the program (why and how we are changing) and communications about the final state and solution being provided. This involves communication with stakeholders, team members, support team members, functional group members, and end-users (both inside and outside the company) (Ehap, 2019).

Any reform needs cultural support (Ehap, 2019). Therefore, once the communication strategy is formed, it is necessary to implement a cultural support plan, which includes training sessions, demonstrations, buyer feedback on sourcing activities, and developing a sustainable procurement outsourcing.

Sustain outcomes

Regular assessment in the transformation program helps to evaluate current progress and predict future trends. Change management may continually monitor various performance parameters (Ehap, 2019). Savings per FTE, proportion of maverick expenditure (purchases not from contractual or cataloged suppliers), use of procurement tools, time per FTE, spend controlled, number of strategic projects, resolving business group problems, or milestones completed are some examples that will help evaluate the program and refine future objectives (GEP, 2022).These will show how successfully the outsourcing endeavor was handled and how to establish future goals. However, the sustaining phase is the most challenging phase of any transformation.

4. Summary of the Evaluation Concept

Figure 7 summarises the evaluation models of Croom and Johnston (2003), Rotchanakitumnuai (2013) and Sunmola and Shehu (2020) to assess benefits and challenges of adopting an ICT service to be used in sourcing.

Based on these studies' key drivers of the success element "internal customer satisfaction" are identified and categorized under four categories, as internal customer satisfaction is identified as the initial element that affects other elements of success in procurement.

In this research, functionality, intuitiveness, communication and documentation skills are categorized under process capability, whereas speed and flexibility are categorized under capacity. With the people category, communication, supplier perception, authority and help & support drivers will be considered. The IT infrastructure examines integrity and reliability of the S2C solution.

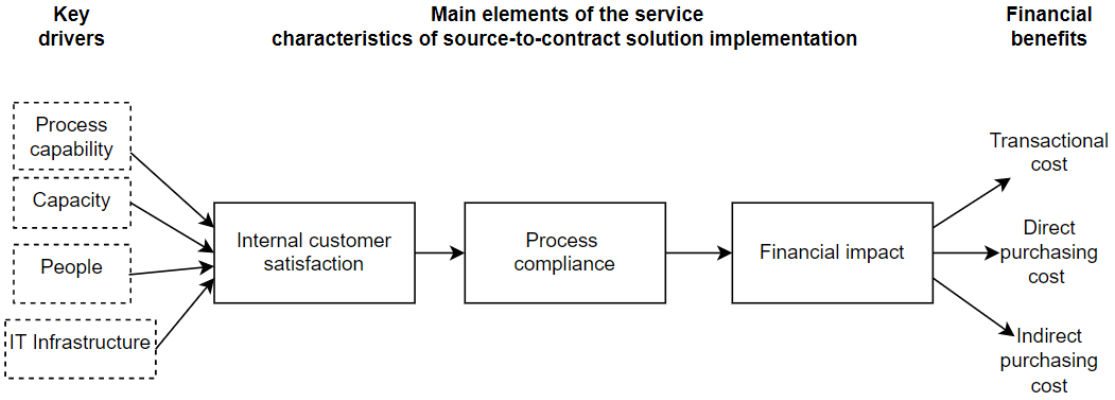

Figure 7. Causal relationship between internal customer satisfaction, e-sourcing compliance and procurement costs

5. Conclusion

Source-to-Contract (S2C) processes may be very slow since they include many manual activities and personally executed steps, as well as a large number of repeated tasks. This requires more time and effort and is error prone. Furthermore, manual processes include inaccurate information, low visibility and low transparency for sourcing activities and require high effort to adapt if anything changes in the process. S2C refers to the tactical procedures that start with the requirement management ends up with the execution of supplier contracts.

As outlined in this working paper, electronic sourcing technologies have been available to support the S2C process for more than two decades and have achieved significant advancements to date. The development of procurement technology led to the emergence of end-to-end sourcing suites and best-of-breed providers. More than one out of three procurement activities may be automated by taking advantage of existing technology, as shown by recent developments in the field. Especially in the S2C process there is a big potential to automate almost 70% of the process.

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