

Consumers' Information Systems
Managing Consumption within Households
and in Interaction with Digital Firms

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Abstract

This dissertation investigates the information systems underlying consumption by shifting the analytical focus from firms to private households. While traditional Information Systems research has extensively examined how digital technologies support organizational processes within firms, the complementary domain of consumption—where individuals coordinate, manage, and enact market transactions—has remained comparatively underexplored. Building on the premise that consumption is not a passive act but involves substantial managerial, coordinative, and cognitive effort, I conceptualize these activities as consumers’ work. This work unfolds within the household as an economic unit as well as at its boundary to the market, where consumers interact with firms under conditions of bounded rationality, information asymmetries, and an increasing digitalization driven by the platform economy and a growing “everything-as-a-service” subscription paradigm.

The theoretical foundation integrates perspectives from sociology, (New) Home Economics, as well as New Institutional approaches, and synthesizes them to be examined through a socio-technical IS lens. Sociological research highlights the often invisible, unequally distributed, and cognitively demanding nature of household labor, particularly its managerial and administrative dimensions. Economic perspectives reconceptualize households as productive units and emphasize the costs of coordination inherent in market transactions. Complementing these views and following prior empirical research on money work within the CSCW and HCI communities as well as theoretical considerations on technically intermediated markets, IS research provides a newly socio-technical understanding of consumers’ work systems and mechanisms.

Methodologically, the dissertation follows a retroductive design inquiry grounded in critical realism and abductive reasoning, moving iteratively between a problem space (consumers’ work) and a solution space (emerging work-supporting technologies). It combines inductive empirical exploration with theory-building across four interrelated studies conducted in Germany, each addressing a specific research objective. Study 1 follows the artifact “invoice” through 17 households to reconstruct domestic accounting as a spatio-temporal practice. Study 2 develops a taxonomy of twelve administrative task categories and quantifies temporal workload, mental workload, and satisfaction in an online survey with 617 socio-demographically distributed participants. Study 3, drawing on the same dataset, maps the devices, tools, specialized software, and physical workplaces consumers appropriate for this

office-like work at home. Study 4 employs interviews and a week-long field study with five intermediary firms in finance, insurance, utilities, health, and general administration to investigate how intermediaries mediate and partially take over consumers' work in market coordination. Together, the studies provide a mixed-method, multi-level, and multi-perspective understanding of consumers' work across different tasks involving different kinds of technologies.

The dissertation's outcome advances both theory and practice by conceptualizing consumers' work as a boundary practice situated between households and markets, articulated through a socio-technical framework that captures the interplay of structures, people, tasks, and technologies. Empirically, the findings demonstrate that consumers perform substantial, often underestimated and unseen labor in managing consumption. Invoice handling, for example, unfolds as a fragmented spatio-temporal practice across paper-based and digital media. The identified twelve administrative task categories differ considerably in mental workload and satisfaction, with tax affairs, problem management, governmental affairs, long term contracts, and insurance emerging as priority pain points for design. Emerging digital services, from financial management tools and contract managers to intermediary platforms, already intervene in and reshape these work practices.

Conceptually, the dissertation contributes (I.) an integrated chain of consumption management that links intra-household administration with market-directed activities across five phases (anticipating, identifying, deciding, monitoring, and modifying); (II.) the introduction of heteronomy imposed by external institutions as a design variable that work supporting technology must explicitly address rather than ignore; and (III.) a reframing of intermediaries as a socio-technical infrastructure of market cooperation that bridges social and technical interoperability gaps through its own socio-technical measures, such as "adversarial" or "backward" interoperability. In doing so, the dissertation provides an empirically grounded conceptualization of theories such as intermediation or Vendor Relationship Management while also generating new empirical evidence and concepts.

By positioning consumers as active agents who perform essential economic work, this dissertation opens a new line of inquiry for IS research and contributes to a broader understanding of digital transformation that encompasses not only firms but also the everyday practices of individuals in the economy. It thereby extends the traditionally firm-centered focus of Business Informatics with a complementary consumer-centered perspective and positions Consumer Informatics as an essential site of inquiry within IS research.

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Related Publications

This dissertation presents research that has already been published in academic journals, where it underwent peer review:

- Study 1) Dethier, Erik; Dean-Robin Kern; Gunnar Stevens; and Alexander Boden. (2024). Making Order in Household Accounting - Digital Invoices as Domestic Work Artifacts. *Computer Supported Cooperative Work (CSCW)*, April 2024. <https://doi.org/10.1007/s10606-024-09495-w>
- Study 2) Dethier, Erik; Gunnar Stevens; and Alexander Boden. (2024a). The Burden of Administrative Household Labor—Measuring Temporal Workload, Mental Workload, and Satisfaction. *Social Sciences*, vol. 13, no. 8, July 2024, pp. 404. <https://doi.org/10.3390/socsci13080404>
- Study 3) Dethier, Erik; Gunnar Stevens; and Alexander Boden. (2024b). Digitalization of administrative work at home. *i-com*, October 2024. <https://doi.org/10.1515/icom-2024-0035>
- Study 4) Dethier, Erik; Alexander Boden; and Gunnar Stevens. (2026). Bridging Work of Intermediaries: A Qualitative Study on how Five Intermediary Firms Implement Interoperability in Cross-Boundary Infrastructures of Consumer Markets, *Computer Supported Cooperative Work (CSCW)*, April 2026. <https://doi.org/10.1007/s10606-025-09534-0>

Furthermore, the following publications have contributed to the topic of this dissertation, even though they were not included as part of it. They are, however, occasionally referenced or cited:

- Dethier, Erik. (2023). Verbraucherschutz und Empowerment durch Software – Die Bedeutung von VRM für die Position des Verbrauchers im Markt. In *Verbraucherforschung zwischen Empowerment und Verletzlichkeit: Verbraucherrelevante Zukunftsfragen aus der Perspektive der Wissenschaft und Praxis*. Springer. https://doi.org/10.1007/978-3-658-41247-0_7
- Dethier, Erik; Paul Bossauer; Christina Pakusch; and Dirk Schreiber. (2024). Digitaler Haushalt und Markt. In A. Boden, G. Stevens, L. Recki, P. Bossauer, and D. Schreiber (Eds.), *Verbraucherinformatik*. Berlin, Heidelberg: Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-662-68706-2_3

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Preface

This dissertation is submitted in fulfillment of the requirements for the doctoral degree in the discipline of “Wirtschaftsinformatik” at the University of Siegen, Germany.

The title of this work is a deliberate allusion to the well-known foundational textbook by Laudon and Laudon, “Management Information Systems: Managing the Digital Firm”, which has already reached its 17th edition (Laudon and Laudon 2022). Their book addresses core questions of how digital transformation reshapes firms’ business processes and consequently transforms their business models employing IT systems. The textbook was translated and adapted by Laudon, Laudon, and Schoder, into a foundational work for German readers under the title “Wirtschaftsinformatik” (Laudon et al. 2016).

The German term “Wirtschaftsinformatik” is usually—and mostly accurately—translated as “Business Informatics”, which overlaps with the neighboring, Anglo–American–influenced scientific communities of “Information Systems” (IS) and, more specifically, “Management Information Systems” (MIS). Traditionally, Business Informatics has focused strongly on the analysis and design of socio-technical information systems within business contexts, as considered in the textbooks by Laudon and Laudon, and by Schoder.

However, the German term “Wirtschaft” in “Wirtschaftsinformatik” denotes the economy in a broader sense and is not limited to corporate settings. While Laudon and Laudon examine the digital firm, this dissertation investigates information systems for managerial purposes in likewise increasingly digital private households. These households can be seen as the complementary market counterpart to this digital firm, in that individuals must coordinate their consumption with its offerings.

As research communities increasingly converge across national and disciplinary boundaries, terminological distinctions—especially through English translations—have begun to blur. In recent years, however, the traditional focus of the German framing of this scientific community has expanded to include a broader societal perspective on digital transformation in both the economy and individuals’ everyday lives, a perspective that this dissertation aims to follow.

At the University of Siegen and the Bonn-Rhein-Sieg University of Applied Sciences, a small but growing research community has for several years examined the effects of digital transformation on individuals’ (digital) consumption practices. This interdisciplinary work is framed by the concepts of “consumer informatics” and “digital consumption”, addressing

domains such as mobility, nutrition, finance, and data privacy (Stevens et al. 2019; see Boden et al. 2024).

Following my master's thesis on a topic closely related to this dissertation, I joined the University of Siegen in 2021 with a formal education and professional background in traditional German Business Informatics, characterized by a business process-oriented perspective. My research interests in a consumer-focused approach, which I further developed at the University of Siegen and the Bonn-Rhein-Sieg University of Applied Sciences, found fertile ground. Initially, I sought to transfer concepts from the business (informatics) context to consumer contexts. Over time, however, I increasingly enriched my work by incorporating theories and methods from sociology and consumer sciences, strongly influenced by the research community in Siegen.

This community is shaped by user-centered and participatory approaches in Human-Computer Interaction (HCI), particularly the Scandinavian tradition of Participatory Design (see Bødker et al. 2022) and the Siegen school of “Socio-Informatics” (see Wulf et al. 2018). The community also strongly draws on perspectives from the field of Computer Supported Cooperative Work (CSCW), which considers the various “C’s” of group work and interaction: cooperation, coordination, collaboration, communication, et cetera.

In this dissertation, I adopt a consumer-centered perspective on information systems within consumption practices of private households, focusing on the activities required to satisfy needs through market transactions for goods. This approach aligns with the broader definition of “Wirtschaftsinformatik” and extends the traditional business process-oriented view by emphasizing practices of consumption—a perspective that has so far played a smaller role in German-shaped IS research.¹

Although this prologue may appear to refer to a small, growing research community or to theoretical orientations and concepts that could be considered recently fashionable or even a niche within the scientific community, I would like to emphasize through the following quotation that this academic topic has been regarded as both practically and theoretically relevant since the earliest scientific considerations and writings:

¹ While the German term “Wirtschaftsinformatik” linguistically encompasses both the business and consumer context, this dissertation will hereafter use the more general term “Information Systems” rather than “Business Informatics”.

From Xenophon's *Oeconomicus* (390–355 BC):

“(1) I once heard him discourse on the management of the household as well, in about these words.

‘Tell me, Kritoboulos,’ he said, ‘is management of the household the name of a certain kind of knowledge, as medicine, smithing, and carpentry are?’

‘It seems so to me, at least,’ said Kritoboulos.

(2) ‘Then just as we are at no loss to say what the work of each of these arts is, can we also say what the work of household management is?’

‘It seems, at any rate,’ said Kritoboulos, ‘that it is the part of a good household manager to manage his own household well.’

(2) But if someone were to entrust another's household to him,’ said Socrates, ‘could he not manage that, if he wanted to, as well as he does his own? For the one who knows carpentry can do equally for another what he does for himself; and so too, presumably, can the skilled household manager.’

‘It seems so to me, at least, Socrates.’

(3) ‘Is it possible, then,’ said Socrates, ‘for one who knows this art, even though he happens to have no wealth himself, to manage another's household, just as a builder can build another's house, and earn pay for it?’

‘Yes, by Zeus, and he would earn a lot of pay,’ said Kritoboulos, ‘if on taking over, he were able to do what's necessary and, in producing a surplus, increase the household.’

(4) ‘But what in our opinion is a household? Is it just the house, or is whatever one possesses outside the house also part of the household?’

‘To me, at any rate,’ said Kritoboulos, ‘it seems that whatever someone possesses is part of his household, even if it isn't in the same city as the possessor.’ [...]”²

² “The *oikonomikos* is the ‘skilled household manager’ [...]” (Strauss 1970 p. 3). The term “*oikonomikos*” is here translated as “The *Oeconomicus*”. Another common translation is “The Economist” (Ruskin 1876). The cited passage is from Xenophon's *Oeconomicus* (390–355 BC), as quoted in Leo Strauss, *Xenophon's Socratic Discourse: An Interpretation of the Oeconomicus*, trans. Carnes Lord (Ithaca, NY: Cornell University Press, 1970), pp. 3–4; German version in (Wächter 2020), 49, based on A. Zeising's translation (Xenophon's *Oekonomikus* oder über die Haushaltungskunst, Stuttgart: Krabbe, 1866, 13–14).

“Smith’s distinction between productive and unproductive labour is probably the most maligned concept in the history of economic doctrines” (Blaug 2006, p. 54).

1 Introduction

Everyday life is shaped by consumption. Whether aimed at satisfying basic needs such as eating, sleeping, or housing, or at fulfilling personal growth and self-actualization (cf. Maslow 1943; 1958) consumption is a pervasive element of human life.

From this perspective, individuals—acting as consumers—meet their needs through essential goods such as food, beds, shelter, or clothing, as well as services including medical care for health, mobile phone contracts for communication, music or movie streaming for entertainment, insurance for financial security, and utilities for electricity and heating needs.

A long-standing view, predominantly rooted in (neoclassical) microeconomics, conceives of the economy as the industrialized production of goods and the creation of value within firms. Within this framework, the consumer appears as a rather passive counterpart at the end of the value chain. Consumers are assumed to satisfy their needs solely by acquiring goods on markets through transactions with firms (Piorkowsky 2011, pp. 75-105; Piekenbrock and Hennig 2013, pp. 85-186).

This understanding is reflected in legal definitions. According to § 13 of the German Civil Code, the consumer is defined as a rather non-productive subject who enters transactions without pursuing commercial or self-employed activities. Similarly, the U.S. Code defines the consumer as “an individual who obtains, through a transaction, products and services which are used primarily for personal, family, or household purposes [...]” (15 U.S. Code § 7006). In both cases, the consumer is implicitly framed as a passive counterpart to productive firms.

However, consumption is not a passive act. It involves a series of economic activities that take place within the household. Here, the household can be understood not only as a physical living space but also as an economic entity where goods and services are not only coordinated and procured but also produced and maintained.

(1) Household production. First, these activities involve household labor, including physical tasks such as buying groceries, preparing meals, and cleaning the kitchen. Already in the 1960s and 1970s, influential economic theories proposed a new approach to consumption, most prominently by Lancaster (1966) and Becker (1965; 1981), characterizing the household as a site of production. They described it as a “small factory” (Becker 1965) or a “family firm” (Pollak 1985; Williamson 1989, p. 165), thereby establishing the stream of New Home Economics. According to this view, consumers purchase only semi-manufactured goods on the market, which are subsequently transformed within the household into consumable goods. For example, a potato bought at the supermarket cannot be eaten in its purchased state. It must be prepared, cooked, served, and the utensils used must later be cleaned. Cooking and washing therefore constitute physical and productive labor.

Although productive household labor has often been marginalized as devalued “housewife work” in industrialized societies (Toffler 1980; DeVault 1987; Ciciolla and Luthar 2019) production within firms has dominated economic discourse. New Home Economics reintroduced the household as a unit of production, drawing on long-standing practical insights of home economics documented for centuries in manuals with a strong focus on physical chores as well as financial matters (Germershausen 1783; Scheibler 1823; Beecher 1846; Frederick 1921; Löffler 1977; Piorkowsky 2000; Beeton 2020).

(2) Household management. Furthermore, within their household, individuals must coordinate their needs and resulting activities, either solely for themselves or together with others, such as family members or cohabitants. In other words, the household must be managed.

In recent decades, sociologists have drawn attention to the cognitive dimension of household labor, namely the managerial work that coordinates physical household tasks in order to realize consumption needs. This cognitive dimension is itself a form of labor. It includes anticipating needs such as groceries, gathering information about where to obtain them at the best price, making decisions, completing transactions, and monitoring outcomes (Damingier 2019). It is referred to in sociology as “household management” (Daniels 1987; Hochschild 1989; Damingier 2019), a term that echoes the wording already used in ancient economic writings such as Xenophon’s.

This managerial labor is ubiquitous in everyday life and often remains invisible even to those who perform it. Its constant presence can cause mental strain (Offer 2014; Robertson 2017; Damingier 2019; Dean et al. 2022). It can create a double burden for individuals who perform it after returning home from paid employment (Hochschild 1989), particularly women, who still carry a larger share of household labor compared to men (Coltrane 2000) and frequently

act as the “captain of the household” (Ciciolla and Luthar 2019), comparable to a chief executive managing an organization.

(3) Market transactions. Furthermore, at the boundary of the household, the consumer interacts with firms through market transactions when purchasing semi-manufactured goods and services. The perspective of Transaction Cost Economics has shown that transactions involve more than paying the price of a product. They also generate additional costs associated with searching, negotiating, contracting, monitoring, adapting, and enforcing agreements (Coase 1937; Williamson 1981; Picot 1982; Williamson 1989; Clement et al. 2019, pp. 158-160).

In countless everyday transactional activities, consumers are confronted—consciously or unconsciously—with offers, conditions, and agreements when buying food at the supermarket, opening a checking account, enrolling in a pension plan, watching a movie, visiting a doctor, downloading a (free) smartphone app, creating a social media account, or simply accessing a website. These activities generate economic costs, that is, effort or labor that takes place within the household (as an economic entity).

At the same time, consumers engaging in market transactions are widely regarded as weaker and more vulnerable actors due to their human and structural limitations in relation to firms.

On the one hand, Behavioral Economics has shown that consumers do not act fully rationally. Rather, they are boundedly rational, relying on heuristics and being influenced by cognitive biases and limitations (see foundational theories such as Simon 1955; Tversky and Kahneman 1974; Simon 1978; Kahneman and Tversky 1979; Simon 1982). On the other hand, insights from New Institutional Economics emphasize structural characteristics of consumer markets, such as asymmetric information, power imbalances, and hidden actions on the firm side, which may produce adverse outcomes and even market failure (see foundational theories such as Jensen and Meckling 1976; Akerlof 1978; Akerlof and Shiller 2015). A prominent example in this context is the persistence of gym memberships that consumers fail to cancel even when they are no longer beneficial, thereby generating profits for firms whose business models capitalize on such behavior (Akerlof and Shiller 2015). This occurs because consumers often fail to rationally engage with the associated transaction costs, such as monitoring or adapting agreements, as these require additional time and effort.

If consumers fail to review and manage their consumption, for example subscriptions, they may remain in disadvantageous arrangements, potentially leading to unnecessary overconsumption. In combination with ineffective household financial management, this can overstretch the household budget and contribute to indebtedness. According to the German

Debt Report 2025, “uneconomical household management” ranks as the third most frequent cause of over indebtedness, behind causes such as unemployment or illness, addiction, and accidents.³

Reintegrating the sociological perspective on everyday household labor, scholars such as Emens (2015) describe this administration of everyday consumption as bureaucratic and “office-like” work that consumers must perform.

(4) Digital transformation and ubiquitous consumption. Finally, with the ongoing digital transformation of society and the economy, both consumption and its management are increasingly shifting into the digital world. Technology and consumption coevolve as digital infrastructures, digital customer interactions, and digital products and services reshape consumer markets and everyday practices.

Markets that were once dominated by physical goods are moving toward digital products and subscription-based services that are accessed, paid, and managed digitally. The phenomenon of “servitization” or “everything-as-a-service” (Riasanow and Krcmar 2020; Favoretto et al. 2022) describes this shift from single transactions to a growing number of ongoing contractual relationships or subscriptions that require continuous monitoring and thus management.

Everyday life is therefore increasingly permeated by work related to consumption. Consumers manage online purchases on laptops or tablets, conduct digital banking through smartphone apps, and arrange medical appointments by phone or via chatbots across time and space. They perform these tasks while commuting on the subway, lying in bed before sleep, or during short breaks “at work”.

Unified perspective on consumers’ work. Taken together, the four arguments outlined above show that (1) consumption involves productive activities requiring time, (2) household needs require ongoing management, and (3) market transactions for purchasing goods entail additional effort in coordinating and managing consumption. These demands further intensify in (4) an increasingly digital and subscription-based society and economy. In describing the management of the economic household, the respective research traditions use terms such as “time and effort”, (household) “labor”, or (transaction) “costs”, often closely linked to households’ economic and financial matters. Consequently, the different perspectives discussed above ultimately point to a form of work performed by consumers. This work often remains

³ See SchuldnerAtlas Deutschland 2025, Creditreform Boniversum und microm, Neuss, 2024, p. 18. Accessed via: <https://www.creditreform.de/aktuelles-wissen/schuldneratlas> (last accessed August 2025).

neglected and devalued, yet it is burdensome and highly influential for everyday economic behavior and decision making.

In this dissertation, I refer to this phenomenon as consumers' "work". With this term, I build on related conceptualizations in prior research, such as Dujarier's (2016) notion of "consumer work" as "[...] the productive activities carried out by consumers [...] in the market economy". By consumers' work, I mean the managerial, coordinative, and cognitive dimensions of household labor that are intertwined with market related activities. This characterization is grounded in, yet extends, the traditional understanding of the consumer as the counterpart to producing firms. It moves beyond this narrower conception by acknowledging that consumers themselves perform productive work—as private individuals producing for their own consumption. Consumers' work takes place within the household (as an economic unit) and at its boundary to the market. It is essential for everyday consumption.

1.1 Motivation for examining the information systems underlying consumers' work

If the challenges outlined above are understood as work within the consumer's economic organization—namely the household—the question of alleviating this work arises.

In this context, different research communities may approach this issue from distinct perspectives. From a sociological perspective, the focus may lie on the fair distribution of this work within the household (among many others Hochschild 1989; Coltrane 2000; Baxter and Tai 2016; Ciciolla and Luthar 2019; Aviv et al. 2025). From a market economic perspective, it may be framed as a tradeoff between perfect need satisfaction (utility) and the effort required to achieve it (Simon 1955). From a home economics perspective, it may offer practical guidance may be offered for accomplishing household tasks more efficiently (among many others Beecher 1846; Löffler 1977; Emens 2019; Beeton 2020).

From a technological perspective, however, machines have facilitated physical household labor for centuries by supporting tasks such as washing clothes (e.g., washing machine, iron), preparing meals (e.g., stove, oven, refrigerator), or cleaning the home (e.g., vacuum cleaner, dishwasher). Today, smart home technologies increasingly extend this support by automating routines within the household (e.g., smart vacuum robots). Sensor-based information enables digital monitoring, and the connection of devices to the internet provides access to digital markets (e.g., the concept of the smart fridge). Extending this technological perspective to consumers' predominantly cognitive and managerial activities highlights that this work, which

is largely information based, can likewise be reduced, supported, or improved through the design of information technologies.

Socio-technical systems lens. Given the highly information-based nature of consumers' cognitive work, Information Systems research (IS research) offers a valuable perspective for examining how such work systems can be supported and improved through design. Its socio-technical lens understands information systems as comprising (a) social aspects, including people interacting within social structures, and (b) technical aspects related to tasks and task supporting technologies (Emery and Trist 1960; Bostrom and Heinen 1977). This perspective provides a fruitful analytical framework for examining such work contexts, particularly within the related communities of Computer-supported Cooperative Work (CSCW) and Human-Computer Interaction (HCI) design.⁴

IS research, especially within the (German-shaped) tradition of Business Informatics, has extensively studied business processes in companies. These processes are conceptualized as relying on manifold systems for “[...] collecting, structuring, processing, providing, communicating, and using [...] information [...]” (Krcmar 2015 p. 22). Over time, this research has generated a substantial body of theoretical and practical concepts for designing work systems and supportive technologies. But what are the corresponding concepts on the consumer side that parallel well-established concepts developed within areas such as Customer Relationship Management (CRM) or Enterprise Resource Planning (ERP) in the (digital) firm?

Some studies within CSCW and HCI community on private households have already revealed the presence of various coordinative (information) systems or mechanisms (Piorkowsky 2000; see Kaye et al. 2014; Vyas et al. 2016, among others; Sannon et al. 2020). These studies illustrate how consumers utilize basic tools such as calendars, sticky notes, coin jars, envelopes, budget books, and software to plan, share and monitor household finances as part of their “coordination mechanisms” or “organizing systems”. Building on this line of inquiry, the emerging field of Consumer Informatics (Boden et al. 2024) can be understood as a growing response to the traditionally strong business focus of Business Informatics, or (Management) Information Systems research.

⁴ In this dissertation, I use the term “information system” to refer to a socio-technical construct that comprises structures, people, tasks, and technology, as defined in socio-technical systems theory (Emery and Trist 1960; Bostrom and Heinen 1977). This definition should not be confused with the widespread, but narrower, use of the term to refer only to “application systems”, “computer systems”, or “IT systems”, a usage common in everyday language and occasionally even found in the literature (see also Krcmar 2015, p. 22; Laudon et al. 2016, pp. 18–25).

Call for work support. Consequently, in this dissertation I engage more closely with the consumer household and the work performed within it in order to understand how this work may be alleviated through work support. To this end, I apply the (socio-) technological lens to inform the design of consumers' information systems by exploring, understanding, and improving their configuration.

This leads to following research question: *How can a socio-technical lens advance our understanding of consumers' work in order to inform the design of work-supporting information technology [RQ1]?*

1.2 Motivation from emerging information technologies addressing consumers' work

At the same time, the German consumer market shows a growing emergence of information-technology-driven business models that explicitly address consumers' work-related challenges and vulnerabilities. In light of my research interest in consumers' work, this development raises the question of how these emerging services relate to consumers' information-related work and what role they can play in supporting it.

E-Commerce, comparison platforms, and agentic AI. For many years already, the purchase of consumer goods has increasingly shifted to online marketplaces. Platforms such as Amazon.com or Alibaba.com allow consumers to access a wide range of products through targeted search functions and to filter them according to price, brand, or other preferred characteristics.

Furthermore, comparison platforms have emerged for travel, utilities (gas, water, electricity), insurance, and financial products. Prominent German examples include Check24, Verivox, and Clark.⁵ Research suggests that such platforms may reduce search costs, mitigate information and choice overload, and rationalize purchasing decisions as well as facilitate contract switching (Clement et al. 2019, pp. 153-162; Oehler 2021c, pp. 263-268; Boden et al. 2024, pp. 92-103). By aggregating information and incorporating user reviews, they aim to reduce uncertainty and lower cognitive effort. Such information technologies already intervene in consumers' transactional work.

They are embedded in the broader digital platform economy. Household technologies increasingly integrate into these online purchasing processes. For instance, voice assistants can

⁵ <https://www.check24.de>; <https://www.verivox.de>; <https://www.clark.de> (last accessed August 2025).

initiate transactions through simple commands such as “Alexa, buy me new razor blades”. Moreover, weak signals indicate the advancing role of chatbots and agents based on Generative Artificial Intelligence (Generative AI) in supporting consumers in searching, comparing, deciding, and managing consumption-related matters. A recent report by researchers at OpenAI shows that ChatGPT is already used not only for productivity gains at work but also for private purposes. Alongside writing tasks (28,1%), the most frequent conversation topics include practical guidance (28,3%) and information seeking (21,3%). Technological support for consumers’ work is therefore not hypothetical but already part of everyday practice and likely to expand further (Chatterji et al. 2025).

Special consumer software. Beyond that, a wide range of more specialized digital services has emerged that directly mediate specific domains of consumers’ work (see also Dethier 2023):

- **Tax software.** In Germany, tax software has a long tradition. Established providers include WISO Steuer from Buhl Data as well as more recent entrants such as Taxfix. For decades, such software has assisted consumers with the highly bureaucratic and competence demanding accounting work required for tax refunds.⁶
- **FinTech.** Financial management and budgeting has long been supported by spreadsheets or applications that function as digitalized household ledgers (cf. Vyas et al. 2016). More recently, open banking, enabled by the revised EU Directive on Payment Services (PSD2),⁷ has allowed third party providers to access bank data with user consent. Applications such as Finanzguru, Finanzblick, or Outbank aggregate accounts across banks, analyze cash flows, classify consumption categories, and identify ongoing subscriptions.⁸

Some of these services go beyond monitoring. Finanzguru, for instance, enables users to retrieve contract details, set reminders, contact providers, or initiate terminations directly within the application. In such cases, the provider supports coordination tasks in dealing with providers, effectively mediating transactional work.

Further services focus even more strongly on contract management, such as Aboalarm or Volders specialize in contract termination and switching. Both

⁶ <https://www.buhl.de/steuer>; <https://taxfix.de> (last accessed August 2025).

⁷ Directive (EU) 2015/2366 of the European Parliament and of the Council of 25 November 2015 on payment services in the internal market (PSD2), OJ L 337, 23.12.2015, pp. 35–127

⁸ <https://Finanzguru.de>; <https://buhl.de/finanzblick>; <https://outbankapp.com> (last accessed August 2025).

providers promise legally effective cancellation, suggesting that the effort associated with termination is substantial enough for consumers to delegate it.⁹

- **LegalTech.** Legal technology providers similarly specialize in specific consumer problems. Services such as Flightright and Fairplane assist consumers in enforcing EU passenger compensation claims, thereby taking over labor intensive legal coordination and enforcement.¹⁰
- **Document manager.** Document management applications such as Fileee.com enable users to scan and archive documents, create searchable records, and receive automated notifications about contract deadlines. These tools address the ongoing paperwork associated with invoices, policies, contracts, and other consumption related documents.¹¹

Taken together, these developments indicate that consumer markets increasingly produce business models that explicitly target consumers' work. They promise to reduce effort, structure information, coordinate transactions, and even assume certain managerial tasks. As such, they are highly relevant to the inquiry pursued in this dissertation.

Call for theory. Yet from a technical perspective, however, it remains unclear how these heterogeneous digital offerings relate to existing (socio-technical) information systems of consumers. In this dissertation, I therefore seek to connect these practical, solution-oriented technologies with conceptual understandings of the work they aim to support. It remains to be examined to what extent such technologies integrate into and advance consumers' information systems across different work task domains, such as shopping, taxes, finance, legal, or document management.

Accordingly, socio-technical IS research should pursue a second research question: *What role do existing information technologies play in consumers' work across different task domains, and how does this enhance our understanding of consumers' support needs [RQ2]?*

1.3 Research aims and objectives

Following the real-world problematization (cf. Sandberg and Alvesson 2011) of consumer's work (see section 1.1), as well as the observation of emerging, potentially work-supporting

⁹ <https://www.aboalarm.de>; <https://www.volders.de> (last accessed August 2025).

¹⁰ <https://www.flightright.de>; <https://www.fairplane.de> last accessed August 2025).

¹¹ See <https://www.fileee.com/features-private> (last accessed August 2025).

technologies in consumer markets (see section 1.2), the two preceding strands motivate the research interest of this dissertation. Together, they constitute two complementary pillars, standing in dialectical opposition as a potential problem description on the one side and a potential solution domain to be examined on the other.

Abductive inference. The two pillars can be connected through an abductive inference in line with Peirce's epistemological logic (1935, CP 5.189; see also Reichertz 1988). In this sense, the observation of increasingly prevalent work-supporting information technologies in consumer markets (RQ2) can be regarded as a "surprising fact" that becomes a matter of course under the assumption that consumers' work constitutes a burdensome problem requiring support (RQ1).

This inferred connection serves as the dissertation's working hypothesis. It informs the research process, which is guided by the open questions (RQ1 and RQ2) that arise within each pillar.

Research objectives. These high-level research questions can be transformed into the following corresponding research objectives (RO1–4):

- RO1) First, I aim to identify, uncover, and theorize socio-technical aspects of the work tasks that consumers perform in managing their households (cf. RQ1).
- RO2) Second, I aim to systematically collect, explore, and assess different domains of household-related consumption work (cf. RQ1 and RQ2).
- RO3) Third, I will explore the current environment and appropriation of work-supporting technologies within consumers' households (cf. RQ2).
- RO4) Fourth, I will evaluate work arrangements, service models and work practices of existing service providers supporting market coordination and cooperation across different sectors (cf. RQ2).

To pursue these aims, I conducted four empirical studies together with research colleagues, with each study corresponding to one research objective. The objectives were operationalized within these studies, which were conducted sequentially under a shared methodological framework and partly build on each other's insights.

In this research process, I employed a mix of qualitative and quantitative empirical methods (see Chapter 3). Empirical material was collected from participating consumers and firms in Germany.¹²

In doing so, this dissertation brings together interdisciplinary perspectives from multiple research communities that—as I will show in the following—describe the same or closely related phenomena through their own conceptual lenses. At the same time, I argue that these perspectives still lack a systematic empirical examination of how consumers’ work can be effectively supported in practice, a gap this dissertation seeks to address. To this end, the socio-technical lens of Information Systems research provides a fruitful analytical and conceptual foundation for examining how consumers’ work can be reduced, supported, and improved.

¹² Germany is an industrialized economy and ranks among the world’s largest in terms of economic performance measured by Gross Domestic Product (GDP) 2024; World Economic Outlook Database, accessed via <https://www.imf.org/external/datamapper/NGDPD@WEO/WEOWORLD> (last accessed August 2025).

“Today I believe we stand on the edge of a new age of synthesis. In all intellectual fields, from the hard sciences to sociology, psychology, and economics—especially economics—we are likely to see a return to large-scale thinking, to general theory, to the putting of the pieces back together again” (Toffler 1980, p. 146).

2 Theories and State of the Art

With regard to the challenges inherent in consumers’ work outlined in the introduction, a substantial body of research and theoretical concepts already exists across several scientific communities. Since these perspectives originate from different research traditions and are shaped by distinct theoretical lenses, the specific problems they emphasize also differ. However, in the following, I integrate their consumption-related dimensions under the concept of consumers’ work, thereby bringing these perspectives together to inform the present object of inquiry and its theoretical foundation.

Accordingly, this chapter proceeds in two steps. First, it develops an overview of various perspectives from the social sciences, highlighting their commonalities and interconnections at a high level, and synthesizing them for the context of consumers’ work within IS research. Second, it engages with prior work and established concepts in IS research, particularly within the CSCW and HCI communities, presenting relevant investigations into the design of work support on whose shoulders this dissertation builds.

2.1 Perspectives on consumers' work in the social sciences

In this first step, I examine consumers' work through several interconnected perspectives within the social sciences, moving from sociology to (New) Home Economics and finally to microeconomic and New Institutional Economics approaches.

2.1.1 Household labor through a sociological lens

The sociological perspective focuses on how humans live in social communities such as families, partnerships, or shared households, where they share physical spaces and organize their everyday lives in relation to one another. In this context, the household can be understood as a physical space in which people sleep, eat, store and share personal belongings, and engage in leisure activities. It is also a place where basic needs are met and where self-realization is pursued by shaping the environment according to individual preferences and values.

However, the household is also a site of labor. Its members must perform various housework chores to meet their basic needs. These include well-visible, predominantly physical tasks such as preparing meals, washing clothes, cleaning, and maintaining the home. Both in academic literature and in people's minds, such housework is recognized as necessary labor carried out mostly by household members themselves (e.g., DeVault 1987; Bianchi et al. 2012; Trübner and Nisic 2024).

Task accomplishment versus household management. In addition to the accomplishment of such housework, numerous authors have emphasized that the execution of housework also requires coordination. The term "household management", "[...] described as the behind-the-scenes orchestration of meeting loved ones' needs" (Mederer 1993), refers to the cognitive dimension of household labor that ensures chores such as cooking, cleaning, or doing laundry to be done (see also Daniels 1987; DeVault 1987; Hochschild 1989; DeVault 1991; Daminger 2019).

This cognitive household labor in general terms includes anticipating needs, identifying of possible measures, making decisions, and monitoring whether needs are sufficiently satisfied by the measure (Damingier 2019). This form of labor can cover a broad range of domains not only managing of housework but also taking care of general household needs, including meal planning, scheduling appointments, cleaning and laundry, financial organization, the maintenance of social relationships (such as buying gifts for birthdays), shopping of food and other household goods, home and car maintenance, as well as the coordination of travel and leisure activities (ibid.).

While discussions on household management often address a wide range of activities, Mederer distinguished between the domains of caring for the physical home itself (like with cleaning, maintenance), care for household members (such as cooking, washing laundry, child care), and “transactional matters” (like paying bills, scheduling appointments, or coordinating repairs) (see Mederer 1993; drawing on Ferree 1988; Thompson 1991; Hochschild 1989).

By broadening the latter one, Emens (Emens 2015; Emens 2020) reframes it as administrative labor, a ubiquitous aspect of daily life, introducing the term “life admin” to describe tasks that extend beyond the household sphere for running a life and a household. She defines life admin as “[...] office-type work—both managerial and secretarial—that it takes to run a life or a household. Examples include completing paperwork, making grocery lists, coordinating schedules, mailing packages, and handling medical and benefits matters” (Emens 2015).

Fair distribution of household labor. A substantial body of sociological research has examined especially the unequal distribution of household labor between the sexes, as well as the differing ways in which this labor is perceived and valued (Hochschild 1989; Bittman and Wajcman 2000; Emens 2015; Baxter and Tai 2016; Schneider and Hastings 2017; Ciciolla and Luthar 2019; Daminger 2019; Aviv et al. 2025). Household labor is widely understood as gendered work, historically and culturally associated with activities done by women. This applies not only to the accomplishment of chores, but also to managing the household with “mothers as captains” of the household (Ciciolla and Luthar 2019). Despite a trend toward a more equal distribution of household labor, studies still find that women perform significantly more domestic work than their male partners (Coltrane 2000).

While household labor is already difficult to distribute fairly, its cognitive dimension is even more challenging to share equitably, as it tends to be more invisible and unrecognized, and thus harder to articulate or delegate to other household members (Daniels 1987; Daminger 2019).

In dual-earner families, where both partners are engaged in paid employment, this can result in an additional burden and in challenges related to mental health and well-being, especially for women (Wayne et al. 2023). Hochschild (1989) describes this phenomenon as the “second shift”, the unpaid domestic labor that begins after returning home from paid work. Mederer (1993) emphasizes that the unequal distribution of household labor can create social inequities and serve as a source of conflict and dissatisfaction within partnerships and marriages, which could be mitigated through a more equitable division of labor and social support for those performing it (Mederer 1993; Ciciolla and Luthar 2019).

Value of household labor. The research findings culminate in societal demands to recognize household efforts and to ensure their fair distribution among household members. Household labor is considered to be overlooked and unseen not only within the household and among its members, but also within the economy. As it is usually unpaid, household labor does not contribute to key indicators of a country's economic performance, such as the gross domestic product (GDP) (Ostwald and Sesselmeier 2011). In comparison to paid employment, household labor is socially regarded as devalued (DeVault 1987). The framing of the “non-working woman merely caring for the household” has been criticized in literature, as household labor is indeed part of economic productivity, given that the household at least reproduces the labor power of its members (see the following section and its economic lens; Hesse and Judt 1996).

Yet, the management of these transactional matters, such as arranging contracts, appointments, and payments with service providers, remains difficult to capture and account for (Daminger 2019), although it clearly involves time and effort. At this intersection of the economic value of household labor, Gary S. Becker's theory of the allocation of time (1965) plays a central role (see in the section 2.1.2 below), as it conceptualizes everyday human life through the lens of an individual's time budget.

Measuring the workload. Building on Becker's theory of the allocation of time, several studies have already sought to capture the workload associated with household labor by measuring the time spent on these activities. Most of these rely on methods such as questionnaires or time diaries (Winkler and Ireland 2009).

Large-scale national and multinational studies regularly collect time-budgets on how people spend their daily time, including the Australian Time Use Survey, the Multinational Time Use Study (MTUS), the Harmonized European Time Use Survey (HETUS), the German time use survey (ZVE), and one of the most well-known, the American Time Use Survey (ATUS) (Krantz-Kent 2009; Winkler and Ireland 2009; Möser 2010; Anxo et al. 2011; Moreno-Colom 2017; Craig and Powell 2018).

In the ATUS conducted by the U.S. Bureau of Labor Statistics, U.S. citizens are annually asked how much time they spend in their daily lives on various primary and secondary activities such as sleeping, eating and drinking, household activities, purchasing goods and services, and caring for and helping household members, etc. In 2023, the 8,500 surveyed participants reported spending an average of almost two hours per day on household activities, with men averaging about 1.5 hours and women about 2.3 hours. Within this category, the subcategory household management is recorded at an average of eight minutes per day, corresponding to approximately one hour per week or four hours per month (U.S. Department of Labor 2024).

According to the German Time Use Survey of 2022, fathers and mothers aged 18 and older spend on average about four hours per week on the category “shopping and household organization” (3.42 hours for fathers; 4.77 hours for mothers).¹³

However, a major limitation of such time-use surveys is that they typically record only primary activities, even though household tasks are often carried out in parallel with other activities (for example, checking private emails or scheduling appointments at the workplace). Moreover, some activities are not classified as household-related but are part of household responsibilities, such as making phone calls, writing emails and letters, or shopping (Winkler and Ireland 2009; see also Boden et al. 2024, pp. 95-99). In the ATUS, for instance, activities such as telephone calls, mail and email (about 10 minutes per day), homework and research (about 10 minutes per day), or purchasing goods and services (about 40 minutes per day) are treated as separate categories (U.S. Department of Labor 2024).

Furthermore, the subjective perception of time expenditure, the meaning of activities, the perceived quality of work, and the physiological and cognitive burdens of household labor are not captured (Habib et al. 2010; Moreno-Colom 2017).

Hence, the burden of household management for those performing it may be greater in terms of time than previously assumed, of considerable economic value within the overall economy, and of even greater mental and emotional significance. Surveys should therefore be complemented by workload measures (Dean et al. 2022), acknowledging that optimizing time is not the only objective, but that mental workload, satisfaction, and well-being are also crucial (Pandve 2017).

Structural coupling with external bureaucracy. Acknowledging the administrative burdens imposed by government agencies, the U.S. government (2015) set a goal of reducing bureaucratic workload, which was estimated at 9.43 billion hours in 2014.

In this context, it becomes evident that bureaucratic demands from external actors, such as government agencies or interacting firms, require rule-bound and rational forms of administration that are enacted within the household as part of everyday practices. In its absence of “fun”, this bureaucracy demands objectivity and record-keeping, which Weber may would describe as disenchantment, the process that forces modern life into rational and rule-based

¹³ Federal Statistical Office of Germany (Statistisches Bundesamt). (2025, revised June 6). Time Use Survey 2022 (Zeitverwendungserhebung 2022), <https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Einkommen-Konsum-Lebensbedingungen/Zeitverwendung/Tabellen/arbeit-muetter-vaeter-zve.html> (last accessed August 2025).

forms (Weber 1989; Weber 1922, pp. 551 ff.). In households, this shows up as binders, files, and the matter-of-fact processing and answering of mail. What emerges at the intersection of the informal living sphere and externally imposed bureaucratic requirements could be framed as a compound of lived routines and a “juridification” of the lifeworld (cf. Habermas 1988).

In this context, Dujarier (2016) identifies three sociological types of “consumer work”, one of which, named as “organizational work”, has consumers performing tasks as if they were inside organizations. She also highlights a contradiction in firms’ marketing: while rhetoric proclaims the “customer is king”, marketing departments simultaneously seek to steer customers through advertising, confusing tariffs, or exit barriers—what she calls the status of the “king in chains”. A comparable critique appears in Illich’s notion of “shadow work”, which culminates his notion of slave labor embedded in forced interactions with organizations, both public authorities and private firms (Illich 1980; Illich 1981).

From a sociological perspective, private households can thus be viewed as structurally coupled to their environment and thus to interacting organizations (cf. Luhmann 1988; Luhmann 1997). Triggered by their needs, household practices are then shaped by the contractual relations they enter, whether as citizens subject to public obligations or as customers bound by private contracts, which they must enact by paying bills, contacting customer service, and therefore using organizational interfaces. Thus, people must perform tasks within their households that arise from their own demands, but they are also activated by externally coupled systems.

Rationalization and professionalization of household work. In addition to reducing the burden of such external bureaucratic demands, another approach is to consider how they can be handled more efficiently. Emens (2020) wrote a widely read book on coping with what she frames as “life admin”, subtitled “How to Do Less, Do Better, and Live More”. In recent years, this term, often referring to Emens’s publication, has gained considerable attention in the Anglo–American world, particularly on social media, leading to numerous guides and self-help resources promoting the efficient optimization of everyday administration. For instance, YouTube videos suggest planning a “life admin day” once a week or once a month to complete the annoying and overdue administrative tasks of one’s own life within an efficient and limited timeframe.¹⁴

¹⁴ See Life admin day | how to get it all done in one productive day, YouTube, <https://youtu.be/O8uELtgKn7A?si=py19xKKdWbukoWey>; A Reset Vlog: Life Admin Day, Brain Dumping, Refreshing, YouTube, <https://youtu.be/OIbpxRpsouo?si=2X0TtQHthDI0wgP3>; How to plan a life admin day |

Efforts of Rationalization—how Weber (Weber 1922; Weber 1989) might have described them—have a long history with the household as the “workplace of women” (Meyer 1928; Hagemann 1996). For centuries, in an industrialized world marked by a gendered division of labor, numerous manuals have sought to professionalize the activities of the “skilled housewife” (Germershausen 1783; Scheibler 1823; Beecher 1846; Frederick 1921; Löffler 1977; Piorkowsky 2000; Beeton 2020). Originating in the United States, the idea of household rationalization also gained popularity in Germany in the 1920s, when umbrella organizations of housewives advocated for the “professionalization of housework” through an optimization of “household management” (Hagemann 1996, pp. 305-307; see also Rutherford 2003). This movement emphasized not only order and cleanliness but also the rational management of household wealth and finances. One prominent example is the home economist Erna Meyer, who wrote several influential books on household rationalization (Hagemann 1996, pp. 305-307).

In its professionalization as a scientific discipline, the field has increasingly attracted the attention of design and economic sciences. One of the most prominent examples of a design project aimed at creating a rational and efficient working environment, the “worksite of the housewife”, is the “Frankfurt Kitchen”. In this project, a kitchen was designed in 1926 by the architect Margarete Schütte-Lihotzky according to ergonomic and work-scientific principles, the insights of which continue to influence kitchen design to this day (Kuhn 1998).

Key considerations through the sociological lens. Following the sociological discourse, managerial, administrative, and transactional aspects of household labor are problematized as burdensome, often invisible, socially devalued, and unequally distributed among household members. The central objectives of this research community are:

- Achieving a fair distribution within marriage and partnerships,
- gaining societal recognition and quantifying this work,
- advocating the reduction of external bureaucratic demands on households, and
- improving efficiency through professionalization and the design of workplaces.

2.1.2 Production of consumption goods through a (New) Home Economics lens

In continuing the questions about rational and economic household management, as pursued by home economists such as Erna Meyer as a prominent representative, the sociological perspective meets the theoretical lens of economics. Both perspectives within the social sciences are, however, difficult to separate where social matters overlap with those of an economic nature. Thus, the boundaries are fluid, and the respective distinctions between sociology and economics blur within the shared observations of the same practices, individuals, and artifacts under different conceptualizations.

The neglectful focus of Consumer Theory. Traditionally, however, (neo) classical economic theory treats consumption within the household largely as a black box, in which consumers satisfy their needs or derive utility directly from market goods (Pollak 1985, pp. 581-582). The so-called Consumer Theory (in German “household theory”) represents a partial-analytical perspective of the consumer as a market participant, which seeks to maximize the satisfaction of their needs—their utility—by demanding market goods. In this theory, goods are produced by and purchased from firms.

The budget that consumers generate for this purpose is derived from their income, which in theory is scarce and must be allocated efficiently (see also Boden et al. 2024, pp. 86-92; Jaquemoth and Hufnagel 2018, pp. 15-20). Within the neoclassical framework, the circular flow between the firm and the consumer is characterized by private households supplying labor on the labor market and demanding consumer goods on the consumer market, while firms supply consumer goods and demand labor (Piorkowsky 2011, p. 75; Piekenbrock and Hennig 2013, pp. 85-91; Jaquemoth and Hufnagel 2018, pp. 63-74).

Origins of (Home) Economics. Yet, within this “black box” of the household, the concept of proper household management also shaped the term “economics” itself. Derived from the ancient writings of Xenophon’s “Oikonomikos”, the term is composed of the words “oikos” (antient Greek for “house” or “household”) and “nomos” (“law” or “practice”), referring to a proper household management (Piekenbrock and Hennig 2013, p. 51; Wächter 2020, p. 59). The Oikonomikos, often referred to in English as “The Oeconomicus” or “The Economist” (Ruskin 1876), was described as the “skilled household manager” (Strauss 1970, p. 3). As one of the earliest writings in economics, it discusses economic principles and questions such as how a landowner manages a household or estate in an efficient and virtuous manner. The work also addresses aspects of division of labor and quality assurance within household production (Piekenbrock and Hennig 2013; Wächter 2020, p. 49; see also Boden et al. 2024, pp. 86-87).

With the origins of the term economics in mind, the name of the economic subdiscipline concerned with economic activities within the household, “Home Economics”, is a pleonasm.

The agrarian household economy and the proper administration of “the entire house” ¹⁵ — that is, the premodern household as a comprehensive social and economic unit encompassing family members, servants, and dependents—represented the natural paradigm of economics at the time. “The entire economy” was thus understood through the analysis of household management (Piorkowsky 2011, p. 76; referring to Brunner 1952).

During what Toffler (1980, pp. 282-305) describes as the agricultural phase, households, manors, or farms produced these goods themselves for the consumption of their members. However, where once almost every household engaged in livestock breeding and agriculture to feed the family, in what Toffler describes as the second wave or industrial phase, consumers earn their income in specialized professions, which they then exchange for food produced and sold by agricultural or livestock enterprises. According to Toffler, family-based production gave way to industrialization, as the efficient production of mass goods during this phase created a division between producing and consuming actors within the economy:

“The two halves of human life that the Second Wave split apart were production and consumption. [...] Until the industrial revolution, the vast bulk of all the food, goods, and services produced by the human race was consumed by the producers themselves, their families, or a tiny elite who managed to scrape off the surplus for their own use” (Toffler 1980, p. 53).

Today’s industrialized view of production and consumption as distinct spheres became established in traditional economic theory and continues to shape the discipline. Piorkowsky (2011, p. 88) notes that Hicks (1952), in his understanding regarding market theory, clearly separates producer and consumer, thereby excluding the “fundamental economic significance” of unpaid household and family work from the definition of production. Blaug (2006, p. 54) refers to this distinction, with reference to Smith’s classification of “productive and unproductive labor”, as “probably the most maligned concept in the history of economic doctrines” (found in Piorkowsky 2011, p. 88 also referring to Blaug’s 1971 edition).

¹⁵ The term “entire house” is translated from the German “das ganze Haus”. It is sometimes rendered as “whole house”, but there is no unambiguous translation without a loss of meaning. The term does not denote a building but a premodern social and economic unit comprising family members, servants, and dependents, a community of authority and life.

Household production and New Home Economics. In line with this, economists already began more than sixty years ago to criticize the prevailing understanding of consumption in (neo) classical economics, particularly its strict separation between the production of directly consumable goods and the passive act of consumption.

Lancaster (1966), in his “new approach to consumer theory”, argues that consumers do not derive utility directly from purchased market goods but rather from the characteristics that compose them. These characteristics are combined into compositions that are ultimately consumed. This concept goes hand in hand with the influential “theory of the allocation of time” by Gary Becker, published one year earlier (1965). In this context, Becker similarly argues that people do not derive utility directly from market goods but instead maximize utility from basic “commodities” (also referred to as Z-goods) that households produce themselves by purchasing market goods as “semi-manufactures” and combining them with their own time.

For example, to satisfy the need for food, the household produces a meal (Z-good; Z_i) from groceries (market goods; x_i) by using its own time to study the recipe, prepare a shopping list, cook, set the table, and wash the dishes (t_i).

This concept illustrates that the consumption of goods inherently requires effort and activity. Here, Becker also refers to the “full price” of a good, which, beyond its market price, includes a “shadow price”, namely the consumers’ time input that is not reflected in market transactions (Michael and Becker 1973; see also Piorkowsky 2011, pp. 108-126).

Accordingly, Becker described the household as a genuinely productive unit:

“The integration of production and consumption is at odds with the tendency for economists to separate them sharply, production occurring in firms and consumption in households. It should be pointed out, however, that in recent years economists increasingly recognise that a household is truly a “small factory”: it combines capital goods, raw materials and labour to clean, feed, procreate and otherwise produce useful commodities” (Becker 1965).

In line with this, consumption in a narrower sense can be understood as the acquisition of production factors by the household conceived as a “small factory”. Furthermore, consumption

in a broader sense can also encompass all activities and the time expended for the production for consumption.¹⁶

The concept of household production explains the demand for convenience food, delivery services, appliances, or eating out, as these options can save time. For Becker the time spent on household work are opportunity costs relative to foregone earnings from market work or loss of leisure time. In any given period, each individual has only a limited amount of time that can be allocated to market work, household work, or leisure.

In the tradition of rationalizing household work (cf. sociological perspective above), according to Becker's model, the price of a Z-good can be reduced not only through the price of the market good but also by minimizing the time required for its production through increased productivity. As one example relevant to this dissertation, productivity can be improved through the use of technology, such as household appliances like dishwashers or microwaves, or through enhanced expertise and more efficient household practices.

Pollak and Wachter (1975), however, criticize Becker's model of household production and the allocation of time, arguing that it only yields a consistent economic theory under very restrictive assumptions. For example, each activity is assumed to produce only one good, excluding the possibility of joint production that generates multiple outputs at once, such as cooking, which may produce not only a meal but also enjoyment, a hobby, or family time. Consequently, the hypothetical "full prices" of individual commodities are difficult to quantify. Additionally, time may also represent not only an input but an output when the activity itself provides satisfaction. Therefore, the authors suggest an activity-centered rather than a time-based analysis.

Nevertheless, economists such as Lancaster and Becker paved the way for a New Home Economics that extends neoclassical Consumer Theory by introducing a production theory of consumption (Piorkowsky 2011, p. 85), thereby conceiving of the household as a productive and consumptive system (see also Deaton and Muellbauer 2009, pp. 243-272).

Changing society and Prosumption. Beyond the insights of New Home Economics in the 1960s and 1970s regarding household production for consumption, futurist Toffler argued in the 1980s for the arising of a new era of post-industrial society and the information age, which he termed the "Third Wave":

¹⁶ See also Streissler and Streissler (1966, p. 13), who distinguish between consumption in a narrower and a broader sense.

„Above all, as we shall see. Third Wave civilization begins to heal the historic breach between producer and consumer, giving rise to the “prosumer” economics of tomorrow“ (Toffler 1980, p. 27).

In this third phase, the economy transforms from machine-driven mass production to a knowledge- and information-based economy in which the service and information sectors increasingly dominate. As observed and predicted by Toffler in the 1980s, households increasingly return to producing goods and services for their own use (as in the agricultural phase) rather than purchasing them on the market (“production for self-use”). Examples of this development include self-care, self-help groups, self-service at gas stations and supermarkets, do-it-yourself repairs, and the active participation of consumers in the design and manufacture of products. This leads to an inseparable interweaving of production and consumption within households, which Toffler describes with the neologism “Prosumption” (ibid.).

Thirty to forty years later, further works interpret Prosumption as the realization of Toffler’s “prophecy” through the rise of the internet and digitalization. Blättel-Mink and Hellmann (2010), drawing on Voß and Rieder (2005), speak of the “working customer”, who, through the pervasive rise of self-service, takes on work activities that were previously performed by companies—an observation that Dujarier (2016) conceptualizes as consumer work with the customer as “king in chains”, and that Illich (1980; 1981) described as “shadow work” (see within sociological perspective above).

Furthermore, households no longer produce only for their own consumption but also use the effects of the platform and sharing economy as well as gig work to generate additional income from private assets. For example, on social media, consumers simultaneously become producers by creating posts, photos, and videos whose consumption generates profit for platform operators from other users. Similarly, in the sharing economy, private cars are rented out via car-sharing platforms (cf. Blättel-Mink and Hellmann 2010; Ritzer and Jurgenson 2010; Ritzer 2015b; Ritzer 2015a; Boden et al. 2024, pp. 95-96).

However, according to Boden et al. (2024, pp. 20-27), forms of prosumption already existed before digitalization, for instance through flea markets or private car rentals organized via bulletin boards. However, digitalization has significantly reduced the costs of coordinating such exchanges, enabling the emergence of online intermediation platforms such as eBay, Airbnb, and Uber (more on this in section 2.2.2 below).

Key considerations through the lens of (New) Home Economics. Combining the perspectives of New Home Economics with Toffler’s predictions of a changing society,

households can be understood not only as consumers of goods but also as sites of production, especially within a changing post-industrial and information society.

Accordingly, the central concerns of this research community include:

- Maximizing the “real” utility and optimizing the time involved,
- conceptualizing consumers not only as buyers but also as producers,
- understanding trade-offs between self-production and market provision, and
- considering Prosumption within economic concepts in a changing society.

2.1.3 Costs of market coordination through a (micro) economical lens

If consumption is understood solely as the acquisition of goods from the market, consumers are conceptualized in economic literature as interacting with various actors at the boundary of their household.

In industrially-shaped neoclassical microeconomic theory, a distinction is made between two autonomous basic units of the economic system: households/ consumers and firms—leading to Consumer Theory and Producer Theory (Piorkowsky 2011, p. 76; see also Toffler 1980). In this framework, consumers appear as the counterpart to firms, and both are conceptualized as individual, interacting “agents”. Together, they form the core actors with Market Theory (Piekenbrock and Hennig 2013, pp. 85-86).

Price mechanism as incomplete coordination mechanism. Within this concept, microeconomics focuses under model-theoretical assumptions on identifying optimization approaches that determine mathematical equilibria between the supply and demand plans of both individual economic subjects (Piekenbrock and Hennig 2013, pp. 85-117; see also Varian 1992, pp. 313-338). Here, a central concept is the price mechanism, with the notion that, under flexible prices, the price regulates automatically the optimal balance between supply and demand on markets: When supply exceeds demand, prices fall; when demand exceeds supply, prices rise until a market equilibrium is reached. The price thus functions as a coordination instrument that allocates scarce resources efficiently. Thus, in simplified terms, the idea of microeconomics is to calculate supply and demand with optimal prices and quantities, which should, in a (partial) market equilibrium, lead to economic efficiency. The state of optimal efficiency describes perfectly functioning markets that could not work better for any actor without making another worse off—this condition is also referred to as the “pareto efficiency” or “pareto optimum” (Varian 1992, pp. 214-232, 313-337; Jaquemoth and Hufnagel 2018, pp. 65, 74).

The underlying assumptions for determining such efficient outcomes are those of perfect competition, in which all agents act fully rationally, possess complete information within entirely transparent market environments, and face no barriers to market entry or exit (Varian 1992).

Transaction Cost Theory. Although neoclassical microeconomics can depict fundamental economic relationships, its theoretical assumptions represent an oversimplification that does not reflect reality. In 1937, the economist Coase published a work regarding the question of why firms exist at all if, in theory, any—however small—production carried out by individuals could be coordinated through markets via the price mechanism rather than through the coordination of an entrepreneur. He concluded that the main reason for coordinating production through an entrepreneur and internal structures instead of the price mechanism is that there are costs associated with using this mechanism, such as those incurred for searching and discovering offers as well as for negotiating and concluding contracts for a transaction. To avoid these transaction costs on the market, firms arise (Coase 1937).

This theory of transaction costs was taken up by Williamson (1975; 1981) and decisively shaped into what became known as “Transaction Cost Economics” (Williamson 1989, pp. 136-178). Here, the analytical focus is switched from goods to transactions as the smallest unit of economic activity. It expands the conception of efficient markets by understanding the exchange of goods and services not as a frictionless market process but as a contractual and coordination problem accompanied by costs. Arrow (1969) refers to these transaction costs as the “costs of running the economic system” (1969, p. 48; see also Piekenbrock and Hennig 2013).

Consequently, markets themselves generate costs that arise for consumers (as well as for firms) when procuring semi-manufactured goods. These costs are incurred when consumers inform themselves, compare offers, negotiate and conclude contracts, pay invoices, switch providers, terminate agreements, or enforce contractual or statutory claims (cf. Boden et al. 2024, pp. 92-95). This theory shows that the exchange of goods through market transactions entails additional effort and time (in economic terminology “costs”) beyond the price of the good itself. Consumers incur this effort and time when coordinating consumption within the household (see also “transactional matters” in the sociological perspective or “shadow price” in the New Home Economics perspective discussed above).

Structures within households. Furthermore, Pollak (1985) argues that when we open the “black box” of consumption by observing households, we also find internal organization and

structure, comparable in kind to what the transaction cost approach has long emphasized for firms:

“The new home economics ignores the internal organization and structure of families and households. Although this may surprise noneconomists who tend to believe that the internal organization and structure of an institution are likely to affect its behavior, economists find it natural. For the economist the most economical way to exploit the fundamental insight that production takes place within the household is to apply to households techniques developed for studying firms. Since neoclassical economics identifies firms with their technologies and assumes that firms operate efficiently and frictionlessly, it precludes any serious interest in the economizing properties of the internal structure and organization of firms. The new home economics, by carrying over this narrow neoclassical view from firms to households, thus fails to exploit fully the insight of the household production approach ... [By contrast,] the transaction cost approach which recognizes the significance of internal structure provides a broader and more useful view of the economic activity and behavior of the family” (Pollak 1985, pp. 581-582; found in Williamson 1989, p. 165).

In this respect, integrating the analytical lens of Transaction Cost Economics extends New Home Economics by accounting not only for budget restrictions, frictionless procurement of semi-manufactures, and time for production, but also for the costs of coordination and management. Moreover, economists such as Pollak acknowledge the role of organization and structures (see “coordination mechanisms” or “organizing systems” in Section 1.1) within the household in shaping consumption-related behavior, a perspective that is also reflected in the socio-technical lens.

Consumer behavior in market coordination. While coordinating consumption within household structures through market transactions entails costs in the form of work for consumers, the act of carrying out this work also gives rise to effects that shape consumer behavior. In this context, a substantial body of research, especially in experimental Behavioral Economics, has challenged the neoclassical assumption of a consistently rational consumer,¹⁷ showing that consumers face cognitive limitations and effort-related constraints that shape transaction costs in economic decisions:

¹⁷ Cf. “economic man” (Ingram 1888) or “homo oeconomicus” (Pareto 1906)

- **Bounded rationality:** Following the works of Simon (Simon 1955; 1957; 1971; 1978; 1982; 1997), consumers, when acting on the market, behave only in a boundedly rational manner. Accordingly, consumers do not possess complete information about the market, as such information not only comes at a cost, but the human mind also has only limited capacity for absorbing and processing information as well as limited time to solve its problems. The cognitive work required for decision making can therefore overload consumers. In this context, Behavioral Economics commonly refers to “information overload” and “choice overload”, describing situations in which increasing amounts of information or options do not necessarily lead to better decisions or improved need satisfaction (see also Miller 1956; Kahneman and Tversky 1979; Gigerenzer and Selten 2002; Baron 2009).

Because of these limitations, consumers cannot fully think through all possible courses of action and instead rely on heuristics. According to Simon (Simon 1955), consumers do not choose the optimal option but rather one that is sufficiently good, limiting the effort and costs invested in searching and comparing alternatives up to a “good-enough” decision.

- **Heuristics and biases.** Drawing on studies by scholars such as Kahneman and Tversky, Behavioral Economics has identified and systematized additional effects that shape consumer behavior in ways that lead to “particular” behavioral patterns. Within the broader framework of the Heuristics-And-Biases School, these include loss aversion (Kahneman and Tversky 1979), mental accounting, framing, the reduction of cognitive dissonance, and overconfidence (see Jaquemoth and Hufnagel 2018, pp. 53–56).
- **Interests versus behavior.** In line with this, consumer sciences, prominently feature models that describe a discrepancy between what people want, think, or say and how they actually behave, such as the “attitude behavior gap” or “value action gap”. According to that attitudes do not directly determine behavior or people’s actions do not always correspond to their values (cf. Blake 1999; Park and Lin 2020). This discrepancy may also be explained by the (opportunity) costs or effort required to implement attitudes and values in actual behavior.

As outlined above, the behavioral mechanisms that often weaken consumers create opportunities for firms to pursue their own interests in ways that may conflict with those of consumers.

Uncertainty in market transactions increasing transaction costs. Moreover, further well-known theories of New Institutional Economics show that in certain situations markets may even fail when any agent behaves fully rational:

- **Principal–Agent Theory.** One of the most important theories within this stream is Principal–Agent Theory, which describes situations in which a principal delegates a task to an agent. The central problem is not a gap between intention and behavior but diverging interests between principal and agent. Within this theory, the agent may possess more information or pursue different objectives, thereby creating incentive problems and potential opportunism.

Before contracting, the principal may face “adverse selection” due to incomplete or incorrect information about the agent. After contracting, “moral hazard” may arise, facilitated by the fact that certain actions or knowledge of the agent are not fully transparent to the principal, a situation referred to as “hidden action” and “hidden information”. These problems are rooted in asymmetric information, which constitutes a central source of market failure (Jensen and Meckling 1976; see also Clement et al. 2019, p. 170 f.).

- **Markets with asymmetric information.** Adjacent to that within the broader stream of Information Economics, economists such as Akerlof (1978), Spence (1978), and Stiglitz (1978) described markets characterized by asymmetric information.

A prominent example is Akerlof’s (1978) analysis of the used car market, where sellers possess more information than buyers. Because buyers cannot distinguish high-quality cars (“peaches”) from low-quality ones (“lemons”), they are only willing to pay an average price reflecting this risk. As a result, high-quality cars exit the market, low-quality cars dominate, average quality declines, and average prices fall further, ultimately leading to market failure. As a result, markets with asymmetric information require mechanisms that reduce uncertainty for market participants, such as warranties, quality seals, or reputational signals.

- **Structural dependence and power asymmetries.** Beyond informational asymmetries, consumers also face structural power imbalances in their interactions with firms. In mass markets, products and contracts are largely designed and controlled by providers, leaving consumers with limited bargaining power and structural dependence. They often have only the choice to accept or reject standardized terms, which they must first understand (cf. Jaquemoth and Hufnagel

2018; Oehler 2021b). As individual and comparatively weak actors, consumers lack the organizational capacity to build countervailing power (cf. Dethier et al. 2022; see also Jaquemoth and Hufnagel 2018, p. 87; p. 90 referencing M. Tamm 2011, pp. 15 ff., and BVerfGE 1993/94, vol. 89, pp. 214 ff.).

These insights from the past half century about boundedly rational consumer behavior, together with the concept of costs in market transactions, represent central findings that have given rise to the era of the New Institutional Economics. Within this tradition, theories are collected that demonstrate why free markets not only fail to function efficiently but may even fail altogether, a phenomenon referred to as market failure. At worse for the consumer as the “weaker” party compared to firms (Jaquemoth and Hufnagel 2018, pp. 84-92).

Market-oriented Transaction Cost Economics, taking into account the findings of Behavioral Economics and New Institutional Economics, motivates the consideration of coordination and management costs for consumption and its associated (internal household) structures.

Key considerations through the (micro) economical lens. Altogether, from a market-oriented economic perspective, the exchange of goods is not frictionless but involves (transaction) costs in the form of work that must be performed. This work is accompanied by behavioral patterns of consumers as well as household and market structures that may lead to inefficiencies, weaknesses, irrational outcomes, or even market failure.

Accordingly, central concerns within this research tradition include:

- Conceptualizing transaction costs and internal structure for transactions,
- identifying ways to reduce transaction costs and thereby improve market efficiency,
- understanding consumer behavior to support rational decision making, and
- mitigating market failure through institutionalized measures (laws, rules, norms).

2.1.4 Interim conclusion and synthesis of different concepts of “work” as problematic

As introduced in this chapter, these different perspectives and their theoretical constructions refer to the same or closely related phenomena, which I synthesize under the concept of consumer’s work. This synthesis integrates perspectives that have thus far been treated separately across several academic communities and renders their associated problematizations analytically usable for examining the information systems underlying consumers’ work.

In Table 1, I present a comparison of the research communities that examine what is described synonymously as (household) labor, price (of a product), (transaction) costs, or work

in the context of running a household (sociology), household production (home economics), market coordination (microeconomics), or consumer's work (concept in this investigation).

Although criticism is justified, particularly the concern that this perspective may be overly reductionistic given the many diverse problems it addresses, all of these theories nonetheless delineate a shared thematic area because the boundaries between social interaction and economic questions are inherently blurred. This shared thematic area concerns work activities involved in the management or coordination of consumption.

Table 1: Overview and comparison of different conceptualizations for consumers' work

Research community	Framing	Synonym for work	Constructs	Problems
Sociology	Running a Household	Labor	Household management, life admin, cognitive household labor, mental load, shadow work	• Fair distribution within marriage and partnerships • Societal recognition and quantification • Reduction of external bureaucratic demands • Increased efficiency through professionalization and workplace design
(New) Home Economics	Household production	Price, time	Allocation of time, Commodities/ Z-goods, full price, shadow price, small factory	• Maximization of "real" utility and optimization of the full price of commodity goods • Buyer-producer duality of consumers • Analysis of trade-offs between self-production and market provision • Prosumption in a changing society
Microeconomics/ New institutional economics	Market coordination	Costs	Transaction costs, consumer behavior, choice and decisions, market failure	• Costs and internal structures shaping in transactions • Improvement of efficiency in market coordination • Understanding of consumer behavior • Mitigation of market failures
Information systems research	Consumers' information systems	Work	Digital consumption practices, money work, VRM, intermediation	• Analysis of prevailing information systems • Design and use of work supporting technology • Analysis of intermediation

Shared problems. Furthermore, the combination of these manifold perspectives, each foregrounding distinct problems, provides a rich sediment that can be placed under the analytical lens of socio-technical information systems. All the associated theories discussed above bring problematizations of consumers' work to the fore that could be addressed through the design of supporting technologies. These include overburdening, undervalued and unfairly distributed household labor and work time, as well as transaction costs accompanied by adverse behavioral patterns and decisions, and even market failures. This evidence, drawn from a rich body of studies produced over decades and motivated by diverse concerns, informs the

multifaceted discourse on the challenges associated with consumers' work as well as associated information systems.

Analytical discourse. The various academic perspectives provide important groundwork for characterizing this work while also offering analytical approaches for examining it. For example, they discuss methods for (qualitatively and quantitatively) measuring and observing household work practices, including time- or activity-based analyses as well as structural and behavior-oriented patterns. They also point out that technology shapes society and that society is currently undergoing a transformation warranting examination in socio-technical terms.

2.2 Studies on socio-technical information systems in IS, CSCW and HCI research

Through the lens of understanding, analyzing, and designing information systems within the household and at the market boundary, the socio-technical perspective opens new opportunities to support consumers and offload work through technological design.

Although managerial practices within the household and those directed toward market actors are intertwined in everyday consumer life, they can be analytically distinguished. Consumers may therefore be understood as acting either (a) within the household by coordinating internal tasks or (b) at its boundary by coordinating with external market actors. The following sections distinguish between these two analytical levels.

2.2.1 Supporting coordination practices in the home

According to the analytical frameworks of CSCW and HCI, and consistent with findings from Behavioral Economics, consumers do not always organize their household systems, mechanisms, and tools in a fully rational manner. Instead, their actions are embedded in routinized sequences of activity—so-called practices—which require support through careful design (see Reckwitz 2002; Reckwitz 2003).

Additionally, consumer practices are shaped by the infrastructures with which they interact, leading to “situated action”. Consumer action is therefore not fully predictable or plannable but instead emerges in response to situational conditions within their environment (Suchman 1987), an environment strongly shaped by firms in consumer markets.

Consequently, practices and tools mutually influence one another: practices utilize tools and create mechanisms, while technologies can shape and change them. From a socio-technical perspective, work and its context are therefore inseparable from the artifacts that support it. The approach within the communities of CSCW and HCI is to analyze these coordination

mechanisms, tools or infrastructures as well as to understand their meaning for consumers' work practices (see Schmidt and Simonee 1996; Schmidt 2000).¹⁸ In this context, a range of studies has emerged examining domestic information systems closely related to consumption matters.

Intra-household coordination systems. Within CSCW and HCI, a number of empirical, predominantly ethnographic studies have observed and analyzed existing “organizing systems” within households (Tolmie et al. 2002; Taylor and Swan 2005; Vyas et al. 2016; see also “ordering systems” in Schmidt and Wagner 2004). These systems structure routines and schedules, shopping activities, paperwork such as letters or invoices, finances, and collaboration among household members. In these studies, special attention has been given to tools used for “keeping track”, including wall calendars, sticky notes, organizers, noticeboards, or slips of paper placed on refrigerator doors, all of which facilitate information exchange within the household (McKenzie and Davies 2012; Snow and Vyas 2015; Vyas et al. 2016). I interpret what the CSCW and HCI community refers to as “organizing systems” as a synonym for information systems.

Moreover, Kaye et al. (2014) show that among the tools consumers use to organize their finances are paper-based systems, handwritten account notebooks, datebooks (i.e., calendars), folders, and spreadsheets. However, in their qualitative study of 14 participants, they did not identify a single person who used digital aggregation applications provided by commercial vendors (they refer here to Mint.com, Quicken, and FinanceWorks, which are comparable to Finanzguru in Germany).

Furthermore, Vyas et al. (2016) show that various artifacts can accumulate in specific, central locations within the household, which they describe as the “financial hub” observed in several families. Such coordination structures include both physical and digital “places” (see also Crabtree et al. 2003) and are often ubiquitous in the household, yet remain overlooked and thus invisible (see also Bødker 2016).

The aim of such studies is usually to understand this work context by uncovering its embodied action involving various artifacts. They make work visible so that designers can gain an intimate understanding of it (Suchman 1995). Vyas et al. (2016) emphasize that one must be sensitive to these places and to the existing collaborative practices of family members in order to support them technologically. If digitalization efforts overlook or disregard these practices,

¹⁸ In this context, by “infrastructure” I refer to an abstract concept that includes any technical or social artifact used for coordination, either for oneself or in interaction with others (see also Pipek and Wulf 2009).

they may, at best, fail to add value for consumers and, at worst, even hinder them. This implies that the simple integration of new technologies or straightforward digitalization can disrupt existing consumption practices and may generate emotional stress or anxiety among the users (Vines et al. 2011; Pritchard et al. 2015). Thus, the mechanisms employed by those managing a household have a considerable influence on how well the household functions.

Money work. Here, the organization of finances represents a central aspect of coordinative work within the household, and its diverse practices and mechanisms have been documented over decades in HCI and CSCW studies (Muske and Winter 2001; Snow and Vyas 2015; Perry and Ferreira 2018; Lewis and Perry 2019). For example, financial budgets are organized and tracked using tools such as coin jars, multiple envelopes, or digital spreadsheets. Spreadsheets have been observed not only for accounting but also for comparing products and making purchasing decisions (Vyas et al. 2016).

Financial practices connect intra-household organization with market-related activities, since money provides the budget for planning, organizing, and obtaining consumption. Perry and Ferreira (Perry and Ferreira 2018) frame these practices in use and social interaction around transactions as “money work”. They show that multiple technical as well as social aspects are involved in transactions and that a variety of technologies “constitute and underpin transactional activities” (ibid.).

2.2.2 Mediating market cooperation with technology

Continuing this line of thought, Mitchell et al. (2008) describe the coordination of market-related relationships as involving a “set of tools” that helps consumers organize providers and their offerings, thereby facilitating transactions.

VRM. They outline a rationalizing approach in which technical systems support the coordination of need-appropriate exchanges of goods through Vendor Relationship Management (VRM). In this sense, consumers are equipped with an organizational counterpart to the CRM systems used by firms. While CRM systems digitize the management of customers from the firm’s perspective, VRM systems potentially enable the efficient digital organization of providers for consumer procurement (Searls 2012).

In this context, VRM systems are conceptualized as empowering consumers to share accurate and up-to-date personal data with suppliers, thereby transforming inefficient marketing practices into a potential win–win situation. In doing so, it promises to improve operational efficiency by reducing unnecessary costs within firms’ marketing, consistent with a (micro)

economic logic. According to Searls (2012, pp. 163-166), VRM tools therefore hold the potential to strengthen consumers as more sovereign and independent actors in the marketplace.

Intermediation. Closely related to this, research on comparison platforms examines how such services support consumers' search and information work by reducing transaction costs and improving decision-making (Clement et al. 2019, pp. 154-156; Mundt and Scheidgen 2021, p. 525; Oehler 2021c). Oehler (2021c) argues that information and comparison portals can contribute to more adequate consumer information and education and thus foster improved decisions. In particular, price comparison platforms, search engines, and reputation systems may help reduce information asymmetries between market participants (Clement et al. 2019, p. 172; referring to Klein et al. 2013).

Clement et al. (2019, pp. 154-198) conceptualize such services as forms of intermediation, linking supply and demand either directly or indirectly. In this context, they describe that intermediation can address transaction costs across four distinct phases:

- 1) **Information phase**, involving search effort, comparison activities, quality assessment of offers, and verification of the identity and trustworthiness of market participants;
- 2) **Agreement phase**, including negotiation effort, contract design, and the establishment of contractual safeguards;
- 3) **Execution phase**, involving monitoring of contract fulfillment; and
- 4) **After-sales phase**, concerning renegotiation of conditions, coordination in cases of contractual or performance discrepancies, and the enforcement of rights when problems arise.

They also distinguish between traditional and digital intermediaries. Traditional intermediaries include, for example, wholesalers or brokers who support consumers across all phases of a transaction through personal advisory services rather than digital interfaces. Their consultations assist consumers in information and search activities, their guidance supports applications and contract completion during the agreement and execution phases, and as representatives of a sector or of multiple providers in the case of independent brokers, they remain available as contact persons in the after sales phase (ibid.).

Digital intermediaries. Digital intermediaries include, as described above, search engines, price comparison platforms, and reputation systems that support information and search work (Phase 1), and in some cases aspects of contract agreement (Phase 2), although negotiation is often hardly possible for consumers in mass markets.

With regard to monitoring (Phase 3), as well as switching and cancellation processes, contract managers and cancellation service providers—such as Aboalarm.de or Volders.de—have for several years offered consumers the possibility to receive notifications about contract durations and automatic renewals and to initiate cancellations quickly and digitally (Mau et al. 2023, pp. 85-88). Moreover, for identifying subscriptions that consumers maintain or may wish to cancel, financial monitoring of transactions is also supported by apps such as Finanzguru.de.

Reduction of coordinative contacts. Beyond that, consumers themselves still face a large number of providers whose cooperation they must coordinate (Dethier 2023; Clement et al. 2019, pp. 155-159). Through the central bundling of providers via intermediation, the Baligh–Richartz effect (Baligh and Richartz 1964; see also Toporowski 1999) theoretically describes a reduction in contacts and thus in the coordination effort required on both sides, the consumers and the firms.

For example, assuming an equal distribution of agents on the supply and demand sides, three agents on each side (3×3) would require nine direct contacts. With a single intermediary that centralizes all interactions, only six contacts ($3+3$) would be necessary in the market (Clement et al. 2019, p. 156). As the number of actors increases, this advantage becomes even more significant. For example, with 100 actors (50×50 versus $50+50$), there would be 2,500 connections compared to only 100. This theoretical reduction through the Baligh–Richartz effect, illustrated through the market-theoretic perspective of a star topology enabled by intermediation, demonstrates the economic relevance of achieving more efficient markets through intermediary agents. In this sense, intermediaries offer the potential to increase market efficiency by reducing transaction costs.

Furthermore, the literature also discusses their ability to mitigate market failure, as they potentially reduce uncertainties for market actors through rating and evaluation mechanisms, thereby creating trust and reputation (Clement et al. 2019, pp. 155 ff.).

Risk of market failure with intermediaries. However, profit-oriented intermediaries may also foster negative market effects that can lead to market failure, such as asymmetric information or principal–agent conflicts (Clement et al. 2019, pp. 169-171). As stated by Mundt und Scheidgen:

“At the same time, however, comparison websites are repeatedly criticized for not being sufficiently neutral or transparent with regard to key factors such as the independence of the comparison, the breadth of market coverage, the ranking of offers, information on availability, or the handling of reviews. Problematic behavior by comparison websites in

this context can lead consumers to make purchasing decisions that they would not have made if they had been fully aware of the market facts” (Mundt and Scheidgen 2021, p. 525).

Oehler (2021c, pp. 265-267) notes that these platforms do not always disclose all information that consumers need for their decisions. What he calls “net tariffs” (cf. Becker’s “full price”) may conceal commission payments to providers behind certain offers or additional costs such as advertising. Although these costs are included in the consumer’s price, they are often not transparent enough for consumers to identify the best offer. Non-participating providers not shown in the comparison or not listed on the platform also represent missing information (Clement et al. 2019, pp. 168 ff.).

To counter these problems, Oehler (2021c, p. 266) calls for minimum requirements for intermediaries: the disclosure of who conducts the comparison (identification), which criteria and comparison methods are used (verification for traceability), and specification of the focus and weighting factors (relevance and usefulness).

2.2.3 Key considerations through the socio-technical lens and research gap

Finally, in the preceding sections, I have shown that several studies with a socio-technical lens have already examined (a) intra-household organization and coordination work, often with a particular focus on household finances, and (b) digital tools and intermediation that support market coordination and cooperation. In the context of this dissertation, consumers’ work has been partially examined empirically or described theoretically in IS research and related communities:

- (a) Empirical studies in CSCW and HCI have focused on family coordination and financial practices (“money work”). These studies provide important methodological groundwork for understanding socio-technical mechanisms in domestic contexts in order to design related technologies (relating to RQ1).

A focus on consumption, rather than on finance as only one of its aspects, remains underexplored.

- (b) At the same time, (rather technically and economically oriented) IS research has conceptually examined vendor management and market intermediation through various forms of digital technologies. These studies describe such technologies as means of supporting different market-related tasks (relating to RQ2).

These theories remain insufficiently supported by empirical evidence.

For my research questions (RQ1 and RQ2), existing research still provides only limited understanding of how intermediation technologies and the work they aim to support mutually shape and fit one another. Specifically, within a work-activity-oriented perspective (cf. suggestion by Pollak and Wachter 1975) and with regard to transactions as an analytical focus (cf. Williamson 1989), empirical knowledge remains limited. Greater understanding is needed of consumers' transaction-related work practices within households (RQ1) and how tools and intermediary services are appropriated and integrated into both household practices and market transactions (RQ2).

Accordingly, this dissertation conducts a systematic inquiry into consumers' information systems in order to generate empirical evidence on the socio-technical configuration of consumers' work and the technologies associated with it.

*“It is a familiar and significant saying that
a problem well put is half-solved”*

(Dewey 1938, p. 108).

3 Research Design

Through the preceding problematization of consumers’ work and the abductively connected observation of emerging information technologies offering potential work support, these two pillars informed the beginning of this dissertation’s research process. The two pillars can be understood as a problem domain and a solution domain.

The various theoretical lenses from different research communities, including sociological, economic, and socio-technical perspectives, constitute a rich sediment of both longstanding and more recent concepts on which an understanding of consumers’ work can build (relating to RQ1). Based on this understanding, potentially work-supporting technologies can be examined (relating to RQ2). Building on the initial causal structure of the abductive inference at the outset of this research process, the research design of this dissertation follows a retroductive inquiry.

In this chapter, I first derive, from common problem-based approaches within socio-technical design, both guiding principles and gaps relevant to this kind of investigation, leading to the chosen methodology of retroductive inquiry. Within this framework, I describe its units and levels of analysis, followed by the inductive studies and methods employed.

3.1 Common problem-based approaches in socio-technical design

In both industrial practice and academic research, a wide range of problem-based design approaches exists. These approaches aim to develop adequate solutions by introducing interventions that address identified deficiencies in reality. Prominent examples include, among many other frameworks:

- Double Diamond,¹⁹

¹⁹ Design Council, <https://www.designcouncil.org.uk/our-resources/the-double-diamond/> (last accessed August 2025); see also Banathy 1996.

- Design Thinking (Plattner et al. 2013; Plattner et al. 2016),
- Design Sprint (Knapp et al. 2016),
- Design Science Research (Hevner 2007; Hevner and Chatterjee 2010), and
- Design Case Studies (Wulf et al. 2011).

These practical or scientific approaches, share at a high level the common assumption that, in order to solve a problem, one must first address its context, by exploring, structuring, and understanding it. Once the problem is sufficiently understood, (alternative) solutions can be developed and prototypically tested, thereby empirically intervening in reality.

All of the approaches mentioned above incorporate a division of problem solving into exploring and understanding the field empirically and designing and evaluating a solution answering a problem. The well-known concept of the “Double Diamond” introduced by the British Design Council in 2005 exemplifies this (sometimes twofold) division (see Figure 1, DD).

Each of the two spaces of the double diamond is shaped as a diamond that first expands from a narrow point, symbolizing the open exploration of the problem space, and then narrows again as this exploration leads to the precise formulation of a now understood (sub-) problem. Likewise, the second diamond of the solution space begins broadly exploring a range of possible solutions and then converges toward a specific one. The process starts with a problem and ends with a solution through an iterative cycle that involves repeatedly moving through the two diamonds. With increasing understanding, one gradually approaches the problem context and identifies an appropriate intervention.

Industry-oriented frameworks, such as Design Thinking (see in Figure 1, DT) or Design Sprints (see Figure 1, DS), focus on addressing problems situated within a specific context and/or for a particular target group first before starting with problem solving. The Design Sprint framework focuses on creating and evaluating a prototype within a single five-day work week, which allows for rapid and small-scale iterations.

Comparable approaches from science that move from a problem toward a solution can be found in the methodologies of Design Science Research (see Figure 1, DSR) and Design Case Studies (see Figure 1, DCS), which are commonly applied in different communities related to IS research.

In Design Science Research, the contextual understanding of a problem-laden reality is referred to as the application domain, upon which a solution is designed based on this understanding. Within the framework of a Design Case Study following the Siegen School of

Socio-Informatics (Wulf et al. 2011; Wulf et al. 2018), the process also proceeds through an intervention with a solution in a specific context. In the first of its three stages, a Design Case Study explores the actual context by means of a pre-study to identify relevant practices in a work context, which are then prototypically intervened through an artifact developed within a design study.

While Design Science Research aims to generate scientific findings through iterative testing cycles, a design case study includes a third stage of long-term appropriation, in which the designed solution is evaluated through its integration of the work practices understood from the pre-study. Although these research methodologies, like the industry-oriented frameworks discussed above, follow an iterative logic at the level of individual cycles, their overall movement from problem to solution is linear.

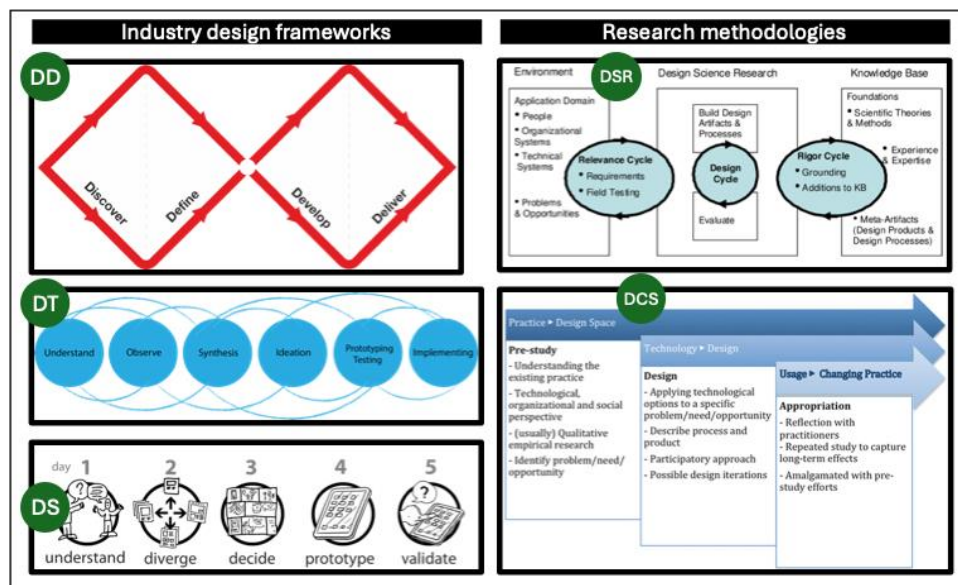


Figure 1: Process flows of selected problem-based design frameworks ²⁰

As scientific methodologies, both seek to abstract their theoretical insights from the design process itself. In Design Science Research, this is captured in the third pillar, the knowledge base, whereas in a Design Case Study it is represented through a collection of “portfolios” from multiple design case studies (Stevens et al. 2018).

However, in general these different practical or scientific frameworks share

²⁰ Source of figures: DT: <https://medium.com/design-bootcamp/the-problem-with-the-double-diamond-57ab03719ce0>; DS: <https://medium.com/i-want-to-be-a-product-manager-when-i-grow-up/the-design-sprint-92f61b18fb72>; DSR: https://www.researchgate.net/figure/Design-Science-Research-Cycles_fig1_254804390; DCS: https://link.springer.com/chapter/10.1007/978-1-4471-6720-4_7 (last accessed August 2025).

- a problem-driven, context-sensitive, and iterative orientation,
- intervene empirically in a given context through solution artifacts,
- evaluate these interventions,
- and generate knowledge through this process.

These models can be seen as empirically inductive, since their problem-centered orientation relies on case-specific, single observations to develop problem solutions. In addition, the scientific design approaches also aim to draw conclusions to derive generalizable insights applicable to others.

3.2 Retroductive design inquiry

The research project of this dissertation likewise positions a problem domain vis-à-vis a solution domain. Furthermore, it establishes a dialectical relationship between these two pillars rather than an overall linear movement from problem to solution that characterizes the problem-based design approaches discussed above. Insights about existing problems inform the solution space, while insights drawn from existing solutions in turn shed new light on the problem space. This interaction also resonates with Orlikowski's (1992) concept of the duality of technology, in which technology supports the structures within which people act in the problem space, while at the same time reshaping those very structures, and thereby producing new phenomena.

Accordingly, the starting point of this inquiry was not only a problem statement but mainly the observation of “surprisingly” emerging information technologies that already exist on the market. These “surprising solutions” (cf. “surprising fact” Peirce 1935, CP 5.189) have so far rarely been connected to existing real-world problems or to questions of work support within this context.

According to Peirce (1935, CP 5.189; see also Reichertz 1988), at the beginning of this research process, I undertook an abductive inference to derive a possible causality between these “surprising solutions” and real-world problems discussed in the literature. This abductive inference, linking observation and conceptualization, is followed by deductively formulated hypotheses that are iteratively investigated and verified through inductive observations (Peirce 1976, p. 393 f., 579 ff. as referenced in Reichertz 1988).

“We adopt an abductive logic when we reflect on surprising findings and then return to the field to examine our assumptions. Abduction is therefore subject to an iterative

process of moving back and forth between the data and conceptualization [...]" (Mey and Mruck 2011, p. 192).

Peirce's process of abduction, deduction, and induction was later expanded by Dewey (1938) in his theory of inquiry, a comprehensive cognitive and practical process of problem solving. Dewey conceived inquiry as a procedural method of research, problem solving, and learning that aims to transform an uncertain, problematic situation into a stable, action-guiding one (Dewey 1938, pp. 102 ff.).

Inspired by this understanding, this dissertation proceeds as follows:

- (1) It begins with the observation and description of "surprising solutions" and the corresponding problems these solutions may address (Sections 1.0–1.2). Based on this, a possible causal relationship is established through abduction and the deductive formulation of research questions and objectives (Section 1.3).
- (2) The core of the research consists of empirical, inductive studies that address both the problem-oriented research questions (RQ1) and the solution-oriented research questions (RQ2) through interwoven contributions to each other (Sections 4–7).
- (3) Finally, the results are critically discussed with regard to the problem–solution relationship and the theories derived (Section 8).

By starting with observed ("surprising") solutions, I infer an underlying problem that may previously have remained beneath the surface. Once this problem is empirically and inductively understood, its solutions can be evaluated and further improvements advanced. This process follows, yet also reverses, the logic of problem-based design approaches by moving back and forth between problem and solution.

Peirce later referred to his abductive process as "retroduction" to emphasize its backward-oriented yet productive nature (Reichert 1988, p. 352). It differs from the previously discussed, purely forward-oriented problem-based design frameworks. The aggregation processes of inductive scientific design methodologies, such as the knowledge base in Design Science Research, take place within the ongoing dialectic of abduction, deduction, and induction and are ultimately reflected in the research outcome. Adele Clarke describes Peirce's abduction as an epistemic virtue of anticipation, achieved through looking backward in order to develop the future:

“Here, abduction becomes a tool that stitches together what lies behind us with what lies ahead of us, generating futures, loops between futures, pasts, and presents, and providing blueprints for the production of the future” (Clarke in Mey and Mruck 2011, p. 155).

Within this “retroductive design inquiry”, I conceptually look back at the underlying problematic work. By understanding the challenges of consumers’ work, I can examine information systems and the technologies embedded within them in order to design work support. In this way, the retrospective analysis enables a productive intervention of a “new future”. In doing so, this kind of inquiry systematically establishes a foundation for this academic field while supporting future research and problem-solving applications.

In this sense, design in the narrow sense recedes into the background, while the structuring of the problem becomes all the more important for establishing the context in which a solution must be evaluated: “a problem well put is half-solved” (cf. Dewey 1938, p. 108).

3.3 Units and levels of analysis

With regard to the problem context, the primary unit of analysis consists of consumers’ work practices as performed within their everyday household contexts (RO1–2). These practices are embedded in spatio-temporal structures and involve individual consumers, artifacts, and also technological components used in the current environment of the household (RO3). In this sense, the problem space is investigated bottom up from a micro-level perspective within individual households. Here, the unit of observation is the consumer in relation to their household context.

Because household work is structurally coupled with external demands, obligations, and issues, households respond at the micro level through corresponding practices. Analytically, this perspective draws on sociological practice theory (e.g., Garfinkel 1986; Reckwitz 2002; Reckwitz 2003), which understands everyday action as constituted through socially shared routines that gain meaning in interaction with artifacts, other actors, and situational contexts. It also resonates with perspectives on situated action, according to which behavior is shaped by technologies and infrastructures in use (Suchman 1987). Within this analytical framework, artifacts can be followed across different contexts of household work (RO1), while corresponding tasks can be identified and categorized across domains (RO2) and environmental characteristics (RO3).

With regard to the solution context, the unit of analysis is the intermediation work performed by emerging information technology providers that support consumers' market-directed work in relation to firms (RO4), thereby partially taking over consumers' tasks and mediating interactions between consumers and firms. Here, intermediary organizations constitute the unit of observation.

These intermediary organizations operate at an inter-organizational meso level, where both their own practices on a micro level and their effects on the meso level can be examined. In this way, the meso level is analytically connected to the micro level as an influential context shaping consumers' interactions. The design of intermediary services, their socio-technical infrastructures, and their cooperative arrangements provide insight into how support is delivered and how consumers' work is facilitated in practice.

3.4 Inductive studies and their methods

Following the retroductive research design, the inductive empirical part of this dissertation (Step 2 in Section 3.3) comprises four individual studies I conducted in collaboration with colleagues, each addressing a specific research objective ($RO_n \rightarrow \text{Study}_n$). The methodological approach in each study was selected to ensure an appropriate investigation of the respective unit of analysis.

The studies were conducted in collaboration with several colleagues. Accordingly, the following sections switch from "I" to "we" when referring to joint work and its results.

Study 1: Handling invoices. The first study examines the activities involved in handling invoices within the household, treating invoices as coordinative artifacts both within the household and in relation to market transactions. It represents an initial qualitative exploration of a cross-cutting aspect of consumers' work. Together with colleagues, I adopted a follow-the-artifact approach, specifically a follow-the-invoice strategy. We entered both physical and virtual household contexts and conducted ethnographically informed interviews combined with artifact analysis. By following the invoice, we were able to observe the processing of what we consider a characteristic work artifact, representing a sub-activity within virtually every transaction (see section 4).

In this context, qualitative methods were employed as they are particularly suited to exploring emerging or under-researched domains (cf. Pakusch 2020; referring to Gill et al. 2008). Their flexibility allows researchers to adjust focus and pursue emerging insights during the research process. Qualitative approaches enable in-depth understanding by allowing follow-

up questions, the gathering of narratives, and close examination of situated practices. Ethnographically-informed interviews, complemented by artifact collection, broaden the empirical basis. Participant observation can further reduce reliance on verbal accounts by directly engaging with practices in situ. However, such approaches are typically limited by small sample sizes and can only capture a few specific contexts.

Study 2: Categorizing and characterizing different activities. Building on the exploration of invoice handling and insights from the literature, particularly sociological work on household labor, we observed that consumption encompasses multiple distinct domains of work. These activities differ in terms of preference, avoidance, and distribution among household members.

To gain a broader overview of these domains, we conducted a quantitative study. The aim was to measure the subjective workload associated with each domain and to identify perceived “pain points.” We designed an online questionnaire and administered it via a panel of 617 German participants. The data were analyzed using statistical methods, including comparisons across socio-demographic groups such as age, gender, income, and education (see section 5).

In doing so, the limitations of qualitative approaches can be addressed, in part, through quantitative research. Quantitative methods enable more standardized and scalable measurement, for example through online surveys with large samples and statistical comparisons across socio-demographic groups. However, the valid measurement of constructs remains a challenge that requires careful consideration. Moreover, while numerical responses can be analyzed statistically, they lack qualitative depth, as they do not capture how respondents interpret questions or why they choose particular responses.

Study 3: Exploring the current environment. The questionnaire developed for Study 2 also included items on the work environment and the technologies used by consumers. These data were analyzed in a third study to provide an overview of the prevalence and role of work-supporting technologies. This analysis yielded further insights into the technological context of consumers’ work (see section 6).

Together, Studies 1–3 contribute to a comprehensive understanding of the problem space of how consumers manage transactions within their households.

Study 4: Intermediation work. Finally, the fourth study focuses on potential work support provided by intermediaries. It examines how third-party actors integrate into market interactions between consumers and firms.

We again employed qualitative methods, including interviews and field observations with five intermediary organizations. The aim was to investigate their work practices as potential solutions. These intermediaries operate in several of the domains identified in Study 2 and

provide support for consumers' work in those areas. As these organizations already have established business models and customer bases, the focus was not on user adoption but on the feasibility and efficiency of their interactions with firms when taking over consumers' tasks (see section 7).

In this dissertation, I adopt a mixed methods design, combining qualitative and quantitative approaches. The strengths of each method are leveraged while their respective limitations are mitigated through the triangulation of multiple studies employing different methods. As the studies build on one another, they collectively provide a robust empirical foundation across the defined units of analysis.

The four studies are presented in the following.

4 Making Order in Household Accounting—Digital Invoices as Domestic Work Artifacts

4.1 Abstract

The digitization of financial activities in consumers' lives is increasing, and the digitalization of invoicing processes is expected to play a significant role, although this area is not well understood regarding the private sector. Human-Computer Interaction (HCI) and Computer Supported Cooperative Work (CSCW) research have a long history of analyzing the socio-material and temporal aspects of work practices that are relevant for the domestic domain. The socio-material structuring of invoicing work and the working styles of consumers must be considered when designing effective consumer support systems. In this ethnomethodologically-informed, design-oriented interview study, we followed 17 consumers in their daily practices of dealing with invoices to make the invisible administrative work involved in this process visible. We identified and described the meaningful artifacts that were used in a spatial-temporal process within various storage locations such as input, reminding, intermediate (for postponing cases) buffers, and archive systems. Furthermore, we identified three different working styles that consumers exhibited: direct completion, at the next opportunity, and postpone as far as possible. This study contributes to our understanding of household economics and domestic workplace studies in the tradition of CSCW and has implications for the design of electronic invoicing systems.

4.2 Introduction

'My wife doesn't work.'

Tired of such male sayings, one overarching theme of the early feminist movement was to overcome the notion that domestic life was a private, relaxing, entertaining, and apolitical affair (Hayden 1982a). Instead, right from the beginning, material feminism has drawn attention to the fact that a multitude of obligations, unpaid work, and unequal distribution of labor characterize the domestic context (Hayden 1982a; Hochschild 1989; Mederer 1993).

In the history of feminism, two non-mutual calls to action emerged. The first emphasizes the need to redefine gender roles, advocating for greater male participation in household chores

(Friedan 1963). The second one emphasizes the need to redefine the working conditions, focusing on improving the work environment and processes (Frederick 1921; Gilbreth 1927). Both demands, while separate, share a common goal: to rectify long-standing injustices in domestic labor dynamics.

Moreover, both movements recognized the importance of making household labor visible (Hochschild 1989; Daminger 2019; Dean et al. 2022). In contrast to professional work, domestic work at home lacks any legally binding contract, a clear job description, formal training, prescribed rules for work execution, and well-specified process models. Instead, domestic work is self-organized organically by its very nature; people design their practices, learn by enculturation, use guidebooks and online tutorials, or adapt knowledge from professional contexts.

These long-standing demands of feminism are still valid today, even if the forms of domestic work have changed over time. When household appliances such as washing machines, kitchen appliances, or vacuum cleaners were not yet widespread, the primary focus was physical labor, such as cooking or cleaning (Frederick 1921). In the 1950s, the view broadened, stressing that caring is not the naturally given passion of a woman but unpaid and unequally distributed household work (DeVault 1991). Today's feminists, such as Daminger (2019) or Emens (2021), further insist that domestic administration activities such as paperwork and managing contracts are serious as this kind of work is time-consuming. It is mentally, emotionally, and psychologically stressful but often goes unnoticed, unpaid, undervalued, and unequally distributed. People are overwhelmed by such administrative work and cannot comply with it (Emens 2021), which leads to financial losses and increases the risk of over-indebtedness (Mendoza and Pracejus 1997; Gerrans et al. 2022).

Feminists like Emens (2015) take up the long-standing demand to reduce undesirable administrative household work through efficiency improvements and technology support is an important task. The digitization of administrative processes and special tools such as fileee²¹, anybill²², or GetMyInvoices²³ for private record-keeping (Zahedi 2020) offers new opportunities to make domestic work easier but also poses the risk of disrupting established practices. Yet, system design must avoid such 'ideology of the industrialized home' (Rutherford 2010) as too simplistic, ignoring the specifics of the domestic context.

²¹ <https://www.fileee.com>

²² <https://anybill.de>

²³ <https://www.getmyinvoices.com/en/>

From this perspective, the paper addresses the following research goals:

- Uncovering and making accountable the informal work practices of domestic invoice management to sensitize researchers and designers to the contingencies of domestic work practices and a wide diversity of domestic ordering systems
- Analyzing the effects of the co-existence of digital and electronic documents and how these impact domestic work practices
- Developing some ‘implications for design’ that support domestic work practices beyond a naive rationalization and automatization paradigm

To ‘get a grip’ people’s daily administration work, we adopted a kind of *follow-the-actor* approach (Lawo et al. 2020) and focused on the ‘secret’ life of invoices within the domestic context. Overall, we visited 17 individuals to observe their domestic workplaces and conducted semi-structured interviews to understand their invoicing practices. Reconstructing what people do with invoices in minute detail, we contributed to the outlined research goal by making mundane household accounting visible, observable, and reportable.

This paper’s findings show that invoices are more than just pieces of information. Managing invoices involves checking, processing, archiving, and searching for them for various purposes, such as paying bills, completing tax returns, or receiving customer support. Invoices are essential artifacts that structure, coordinate, and articulate these domestic work processes. Furthermore, we observed that people have adopted and created various physical and digital systems for organizing and managing their invoices. These ordering systems (Schmidt and Wagner 2004) are part of the many working styles and practices used to distribute and coordinate invoicing work among household members.

Our findings contribute to understanding household economics (Cécora 1991; Molina 2011) and research on the domestic workplace (Kooreman and Wunderink 1996; Doling and Arundel 2022). In particular, our findings demonstrate that thirty-year-old literature on paperwork (Sellen and Harper 2003) in CSCW is still relevant and must be taken into account by electronic invoice standardization initiatives (Swathi et al. 2020) as well as the design of domestic document systems.

4.3 Related work

4.3.1 Making domestic work visible

Domestic work refers to the tasks and responsibilities performed within a household to ensure its functioning. It encompasses a wide range of activities, including procurement and sourcing, repairing and maintenance of the living environment, cooking and cleaning, parenting and caring (DeVault 1987; Hochschild 1989; Mederer 1993), but also administrative and financial activities such as household accounting and financial management (Piorkowsky 2000; Antonides 2015), the paperwork at home (Taylor and Swan 2005; Vyas et al. 2016), consumer's vendor relationship and contract management (Searls 2012; Alvarez 2017), or the cognitive and mental work of household management (Walzer 1996; Offer 2014; Daminger 2019).

Feminist scholars were among the first to point out that the home presents a hidden economy, where housework has no price but value (Illich 1980; Daniels 1987; Primeau 1992; Duque Garcia 2021). They also were the first to document how this work is not just unpaid but also unequally distributed among family members (DeVault 1991; Bittman and Wajcman 2000; Baxter and Tai 2016; Schneider and Hastings 2017; Ciciolla and Luthar 2019). The unequal distribution of labor has long been recognized regarding physical-oriented housework (such as cooking and cleaning) and emotional-social housework (such as caring and parenting). Recent studies, however, indicate that this inequity holds for mental-administrative household work as well (Hochschild 1989; Mederer 1993; Emens 2015; Daminger 2019) although the difference seems smaller in this case (U.S. Department of Labor 2023).

The literature often uses time-use and time-budget surveys to highlight the inequality of housework. These surveys ask participants how much time they spent on a specific activity in the past, or the 'time diary' approach asks what activity they performed over a given time (Birch et al. 2009; Hurst 2015; BLS 2022). Often researchers use public national or cross-national time-budget surveys, such as the Australian Time Use Survey, the Multinational Time Use Study (MTUS), the Harmonized European Time Use Survey (HETUS), or the most popular American Time Use Survey (ATUS) (Krantz-Kent 2009; Winkler and Ireland 2009; Möser 2010; Anxo et al. 2011; Moreno-Colom 2017; Craig and Powell 2018). Grouping various ATUS categories, Winkler and Ireland (2009) estimate that US citizens spent about 1.64 hours per week on household management. In contrast, the US Government (2015), estimated that the paperwork burden generated by legal issues to be 9.43 billion hours in 2014, which is higher than expected by the ATUS data.

Various authors criticize time budget surveys because they underestimate cognitive domestic work as they are typically performed in parallel with other activities (Winkler and Ireland 2009; Emens 2015). The numbers also do not capture the subjective dimension of time use, the meaning of activities, the perceived work quality, and the physiological and cognitive cost of household work (Habib et al. 2010; Moreno-Colom 2017). Concerning two objectives, fair work distribution and improved working conditions, time-budget studies are helpful only for the former, as they quantify temporal inequalities. However, the latter requires methods to make the natural orderliness and structuring of the situated work accountable (Crabtree et al. 2000).

This requirement entails a deeper engagement with the nature of accounting. For this reason, we give an overview of accounting research in general and household accounting in particular. We also delve into business accounting because household and business accounting are structurally connected (Luhmann 2005). For example, private households must react to the payment procedures of companies. Moreover, invoices, although key artifacts in household accounting, are generated and defined by the business accounting processes and systems. Since the research on administrative housework benefits much from the workplace studies on office work in CSCW (Rouncefield et al. 1994; Tolmie et al. 2002), we summarize the findings of this branch of research, which are relevant to our work.

4.3.2 Accounting research

Accounting has a long history as a research field. It is a practice used by individuals, organizations, and governments to measure and make economic issues visible (Glautier and Underdown 2001). Garfinkel pointed out accounting involves practical actions of making order (Heritage 2013). Accounting does not simply describe reality but actively constructs it (Morgan 1988). The categories used in accounting are not neutral but rather the result of political negotiation (Suchman 1993).

4.3.2.1 Business accounting

Business accounting aims to improve the efficiency of organizational financial activities and make them reportable (Libby et al. 2017). Modern business accounting is based on accounting systems, which are typically constantly evolving legacy systems (Gupta and Bhatia 2005). These systems represent the organizational memory of the company, which should keep financial records for a minimum of five (preferably seven) years (Clarke and Wilson 2018). The retention period is defined by internal business policies but also by legal obligations. A

business should file accounting records logically and systematically to facilitate information retrieval (Clarke and Wilson 2018).

Document management and business accounting systems have mainly studied process automatization (Gupta and Bhatia 2005). Yet, ethnographic studies on record keeping point to the materiality of record keeping and the contribution of records and archives for the aggregation and production of knowledge (Shankar 2004). Record keeping presents a practice across various domains (Al-Omar and Cox 2013; McKemmish and Gilliland 2013; Balogh et al. 2022), where it is vital to investigate multiple record types, immaterialities, competencies, and practices (Shankar 2004).

A key record of business accounting is the invoice. Following Webster's Dictionary (1913), an invoice is "*a written account of the particulars of merchandise shipped or sent to a purchaser, consignee, factor, etc., with the value or prices and charges annexed*". One can trace the history of such accounts back to the use of clay 'tokens' in early societies, such as Mesopotamia, which used tokens for counting and for keeping records of accounting transactions (Yeo 2021). In modern business accounting, invoices act as 'a record of the work that has been done to it [... where] learning how to work with an invoice means learning the labor associated with paperwork' (Anderson and Sharrock 1992). Related to this, various types of invoices are relevant, such as commercial or tax invoices, and one must handle these invoices differently depending on whether the transaction is based on a credit purchase or a credit sale (Clarke and Wilson 2018). For ordering purposes, the invoice number is crucial as it serves as a reference code to map electronic funds transfers to a particular transaction and track the state of the transaction (e.g., if the goods are delivered, are paid, etc.). The purpose is to keep all records of a particular transaction together and systematically archive them (Clarke and Wilson 2018).

In the business-to-consumer (B2C) sector, there are significant efforts to automate the paper-based invoicing process (Španić et al. 2011; Gupta 2020), such as the standardization of the message exchange between companies using EDIFACT (Electronic Data Interchange for Administration, Commerce, and Transport) or Electronic Data Interface (EDI) (Deshmukh 2006). In Germany, there is an increasing interest in the electronic invoices format "ZUGFeRD". This format includes the invoice data as an embedded structured XML in a PDF/A-3 format, supporting both machine-readability and human-readability. A Franco-German standard for electronic invoices, Factur-X 1.0. UN/CEFACT CII (United Nations Center for Trade Facilitation and Electronic Business Cross-Industry Invoice), presents international standards for electronic invoice exchange.

Due to their complexity and cost, it is common for organizations to send invoices via email as PDFs or by scanning and emailing them with printed copies to their customers. (Gupta 2020). Such a lightweight concept of the electronic invoice has also gained popularity in the B2C segment, where companies such as Amazon, eBay, Netflix, Spotify, and others do not send paper-based invoices but only electronic ones via email or through apps and web portals. The following section discusses how a change in organizational practices also affects the domestic side. Still, according to Palmer (2022), about 90% of all invoices worldwide are still sent manually. As a result, electronic and paper-based records exist in parallel, where workplace studies in the business context (Rouncefield et al. 1994) show that these semi-digitalized and semi-automated processes influence daily work practices and should be considered by system design.

In summary, business accounting is trending towards digitalization. This trend is driven primarily by the B2B sector but is also increasingly affecting the B2C sector. However, as we know from previous CSCW studies, ill-considered digitization can have unintended consequences for existing work practices (Berndtsson and Normark 1999; Vines et al. 2011). Therefore, we must examine the impact of digitizing invoicing processes in the B2C area on administrative housework more closely to avoid harmful effects.

4.3.2.2 Household Accounting

Household accounting encompasses various activities, such as expense budgeting, money saving, bookkeeping, contract management, calculation, and monitoring of personal and familial net worth (Walker 2008).

Household accounting has mainly been studied in home economics. Authors like Langhojer (2009), Pankow et al. (1991), and Piorkowsky (2000) studied accounting work concerning expense tracking books for household accounting together with usage recommendations. These solutions typically adopt professional business accounting concepts but aim to provide less complex tools that give consumers a basic budget overview (Hoque 2006). Similarly, Hawkins and Bischoff (2003) have suggested five simple techniques for financial management at home: the receipt method, where all invoices are sorted into categories and collected in a box or drawer; the envelope system, where envelopes are labeled with different categories and filled with the planned amount of money to be spent; the calendar or notebook method, where incomes and expenses are listed under the corresponding categories; the checkbook method, where expenses are tracked in a checkbook, including the date, check number, amount, and a note of the spending category; and use of a computer system.

There is also a market for textbooks and practical guidelines that teach skills valuable for domestic tasks (Haskins 1903; Piorkowsky 2000; Hoque 2006; Langhojer 2009), as well as software tools such as Quicken or Mint.com that support people in bookkeeping, cash flow analysis, and budget planning. Yet, most of the guidelines and software solutions seem to fail in practice. For instance, a survey in Germany shows that only 27% of households kept regular accounting records (Piorkowsky 2000). This finding is consistent with empirical studies conducted in the domestic context (Harper and Shatwell 2002; Kaye et al. 2014; 2016), showing that many people use self-developed bookkeeping systems based on pen and pencil, Google Drive, or self-created Excel sheets.

Walker (2008) points to a vital factor contributing to the practical irrelevance of home economics approaches is their orientation on the *homo economicus* and ‘virtuous practices to take the emotion out of domestic money matters’ (Walker 2008). Similarly, Kaye et al. (2014) argue that such rational principles misguide design efforts. Instead, they stressed that dealing with money is not a purely factual, rational administrative act but is accompanied by many emotions, like annoyance, anger, safety, shame, pride, etc.

Feminist research on administrative housework (Emens 2015; Daminger 2019) and the research on household accounting (Piorkowsky 2000; Walker 2008) have emphasized its work-like nature. However, there are few studies in this area that investigate how administrative work is performed in everyday life. In fact, it is from CSCW research that we can learn in this regard.

4.3.2.3 Accounting as a mundane practice

While many studies on home economics have focused on accounting tools in isolation, research in CSCW stresses that we must understand technology as socially embedded (Wulf et al. 2018), where the flow of information does not follow abstract process models, but must be considered as part of a socio-material practice (2017).

Regarding this, invoices are not just pieces of information, but represent the cooperative work between a company and its clients as independent and interdependent actors ‘who interact through changing the state of a common field of work’ (Schmidt and Simonee 1996). In this sense, invoices serve as recognizable artifacts and boundary objects facilitating cooperation (Star and Griesemer 1989). Moreover, invoices are work artifacts within the household, where processing invoices is not just a series of isolated actions, but rather a lifecycle of accounting-related activities.

In the domestic context, people also create accounting systems that involve artifacts, routines, and shared responsibilities among household members (Muske and Winter 2001;

Taylor and Swan 2005; Vyas et al. 2016). These domestic accounting systems also address activities with different goals, such as short-term tasks, like paying an invoice, and long-term endeavors, like saving money for a holiday, house, or retirement (Muske and Winter 2001; Vyas et al. 2016). It is also important to note that these activities are not independent, as short-term actions often influence long-term objectives. Compared to the highly standardized and structured business processes, domestic accounting practices are also much less structured (Muske and Winter 2001). Despite their contingency, however, they are not arbitrary. Instead, 'doing order' and making domestic routines serve as 'the glue of domestic life' (Tolmie et al. 2002).

The ecology of domestic artifacts used for accounting is also related to the concept of ordering systems (2016). As noted by Schmidt and Wagner (2004), ordering systems are constructed and maintained through cooperation. The cooperative nature of human work requires articulation work, which is 'constituted by the need to restrain the distributed nature of complexly interdependent activities' (Schmidt and Simonee 1996). Because of the materiality of practice, artifacts reduce the complexity of coordinating activities and supporting articulation work. Specific artifacts articulate distributed activities in a routinized manner. They have a recognizable material structure and common meaning, through which the state of a common field of work is made accountable to the actors involved (Schmidt and Simonee 1996). This view can also be applied to domestic life. For example, Taylor and Swan (2005) studied the use of everyday objects such as calendars, to-do lists, and paper notes as 'organizing systems' to support families' daily routines. Swan et al. (2008) found that these organizing systems are not fixed entities but result from an ongoing effort to maintain an organized home.

Making finance-related activities accountable involves various domestic physical and spatial resources (Harper and Shatwell 2002; Vyas et al. 2016). These resources are used to store and display physical and digital financial documents. For example, people place invoices on specific surfaces such as kitchen tables or study room desks (Vyas et al. 2016), or use them as 'obstacles' in front of a door (Harper and Shatwell 2002) to remind themselves to deal with them later. Snow and Vyas (2015) further note that consumers have developed paper-based techniques that require little technology to organize the domestic division of labor in the collaborative process of money management. Also, Vyas et al. (2016) found that paper is still a vital artifact in the home, supporting people's organization of their financial work. For example, paper mail is used to share and broadcast letters within the household and among family members. Paper can 'oil the wheels' of an organization, enabling collaboration and communication (Harper and Shatwell 2002).

These domestic accounting practices refer to what Rouncefield et al. (1994) defined as paperwork as a ‘spatial and temporal marker of the progression of work [and generates and encourages] the work process’. Paper-based practices have some unique features, such as the fact that information written on paper is easier to read and discuss cooperatively with others than digital information (Sellen and Harper 2003). In addition, paper offers interactional flexibility, which is why it is still used for certain tasks even after a computer system has digitized the process (Luff et al. 1992). Thus, ‘without paper, organizations would be very different places than they are now’ (Harper and Sellen 1995) because ‘paper and work practices have co-evolved over the years, and changing these long-standing work patterns within existing social, technological, and cultural infrastructures is difficult’ (Sellen and Harper 2003). Regarding the domestic context, Kaye et al. (2014) uncovered that tracking family financial affairs included various paper systems, like index cards, notebooks, datebooks, or labeled folders.

However, paper also has its disadvantages, and its consumption is decreasing (Briscoe 2022). Paper has higher delivery, storage, and retrieval costs than digital-based systems. Additionally, its physical nature limits its use in cases where amendment, revision, or remote access is necessary. However, the goal is not to criticize work practices for the limitations of the medium (Turner 2003), but to understand the related work practices in which paper serves as an information and coordination artifact (Sellen and Harper 2003).

The digitalization of business and household accounting does not present a straightforward evolution, where the new digital version simply replaces ‘analog’ practices. Concerning the domestic context, Muralidhar et al. (2019), for instance, point out that money practices evolve organically through adopting new technologies. However, technology design must respect people’s existing practices and zone of proximal development to enable such co-evolution. Regarding the trend toward online banking, Vines et al. (2014) stress that digitalization can open new opportunities for these individuals, but there is also the danger of making existing practices impossible. Similarly, Collins et al. (2009) argue that IT could support the money practices of low-income individuals in the US but that we must prevent deepening the digital divide in that context. In this regard, Muralidhar et al. (2018) highlight that people use a mix of paper and digital artifacts to organize their financial affairs. Despite advantages, such as time savings, cost savings, and improved information supply due to digitization, Muralidhar et al. (2018) show that paper-based artifacts are still in use.

In summary, our research questions and approach arise from the interplay of all three research areas: The need to seriously consider housework as a marginalized practice represents

a long-standing, feminist demand. While we know from feminist research that this work is unequally distributed, we know less about how people perform this work. The research on business accounting shows that also the B2C sector is becoming increasingly digitized, but without investigating the effects on people's daily life. In this respect, it is the methodological toolkit of CSCW research that can make the mundane work visible and accountable to envision administrative support systems. Next, we outline, how we implement this work program in our empirical study.

4.4 Methodology

4.4.1 Sampling and participants

We conduct an ethnomethodologically informed, design-oriented interview study (Crabtree et al. 2000; Rohde et al. 2017) to understand how people use invoices for all practical purposes. We used convenience sampling (Bryant and Charmaz 2010) combined with the snowball method (Helfferich 2011) to identify interview participants among friends, family members, and university colleagues. We recruited 17 participants from various cities in North Rhine-Westphalia and Rhineland-Palatinate, Germany. Three researchers conducted the interviews between October 2021 and January 2022. Due to COVID-19 restrictions, thirteen interviews were conducted online via videoconferencing, two interviews were conducted in the participants' homes, and two interviews took place in the researchers' office. The interviews lasted between 13 and 47 minutes (average: 36 minutes). In total, we recorded 10.3 hours of audio material. During the interviews, we also took photographs or asked the participants after the interviews to send us photos and screenshots of the records and the places where they buffer or archive them.

The average age of the participants was 38 (range: 21-81), six male and 11 female (see Table 2). Their professional backgrounds were quite diverse: 12 were employed, two were self-employed, two were students, and one was a pensioner. The household type was also diverse (single: three; couple: nine; family: four; community: one). Nearly all participants regularly file tax returns. Two participants have private health insurance, which reflects the national average. In our context, these are relevant pieces of information because tax and insurance have special requirements for transactions to be substantiated by invoices. In Germany, people with private health insurance have more paperwork to do with their insurance company than people with statutory health insurance.

Table 2: Overview of the interviewees and their household situation
(Interview form: F2F = on-site interview; VC = video conference)

Name ²⁴	IF	Age	Gender	Household Type	Profession	Average monthly income [€]	Health insurance
Sophia	VC	21	W	Couple household (two-person)	Student with part time job	450	public
Isabella	VC	21	W	Single; household with 6 persons (Family)	Student without part time job	No income	public
Kim	VC	24	W	Single; single-person household	Student and Medical assistance	450	public
Emma	F2F	24	W	Single; household with 3-4 persons (community)	Research associate	4.400	public
Mia	VC	24	W	Couple household (two-person)	Student without part time job	No income	-
Oliver	VC	26	M	Couple household (two-person)	IT-Product Manager and Financial Advisor	7.500	public
Amelia	VC	27	W	Couple household (two-person)	Research assistant	4.000	public
Noah	VC	28	M	Single; single-person household	Sales Manager	3.000 – 4.000	public
Evelyn	VC	31	W	Couple household (two-person)	Research assistant	1100	public
Olivia	F2F	34	W	Married, a two-person household	Research associate	4.800	public
William	F2F	36	M	Single; single-person household	Research associate	4700	public
Kathy	F2F	38	W	Married; four-person household; two children	Social worker	–	public
Ava	VC	55	W	Married; four-person household; two children	Employer	450	public
James	VC	57	M	Married; three-person household; one child	Insurance company worker	>10.000	private
Charlotte	VC	57	W	Couple household (two-person)	Personal Assistance	3.500 - 4.000	public
Benjamin	VC	61	M	Couple household (two-person)	Financial and investment advisor	7.000 - 9.000	private
Henry	F2F	81	M	Couple household (two-person)	Pensioner	-	public

4.4.2 Methods and setting

We conducted semi-structured interviews asking participants to describe their typical private invoice processing in retrospect and to describe the artifacts they use. We refined our interview guidelines in an iterative manner based on the insights gained from the interviews until we reached theoretical saturation.

During the semi-structured interviews, we initially collected demographic data such as age, number of persons in the household, and profession. After this, we asked participants how they handled invoices. We then asked more specific questions regarding (a) the channels through

²⁴ The names of our participants are pseudonymized.

which they received invoices (e.g., mail, email, shop), (b) their most recent invoices and how they processed them, (c) the relationship they had to that work, (d) and the division of tasks and role models they followed. If possible, we asked participants to demonstrate their practices using their current filing systems or email inboxes. We also inquired about (I) the number of invoices they receive per channel and (II) the average time it took them to process an invoice.

4.4.3 Data analysis

All interviews were transcribed by the authors using the transcription software Amberscript. In the first step, we used this software to produce transcripts of the interviews. The authors then reviewed and revised the transcripts for accuracy and content to ensure a high level of quality.

In the tradition of ethnomethodologically informed workplace studies (Crabtree et al. 2000), our analytic stance was ‘to describe and explicate in lived detail the practices [...so] that any competent member engages to get the activity done and done again’ (Crabtree et al. 2000).

About this goal, we used thematic analysis (Braun and Clarke 2012) as a tool to identify and represent themes that are relevant to understanding the domestic context. Sensitized by previous research on domestic work and ordering systems, we investigated work artifacts, work procedures, and collaborative efforts as topics of particular interest. We further made use of the ‘following-the-artifact’ as an analytic lens (Lawo et al. 2020), adopting techniques from business process modeling (Salimifard and Wright 2001) to analyze and represent the sequential order of domestic work. We also used the analytic lens from material culture theory (Lueger and Froschauer 2022) to view artifacts as materializations of practice, in which knowledge, skills, and meaning crystallize and are analyzed as such.

The transcripts were analyzed independently by two researchers. Photos of domestic materials and places enriched our analysis visually, helping us to understand the materiality of the practices described in the interviews. Afterward, the researchers discussed their respective analyses to resolve any differences. Several joint interpretation workshops (Heinze et al. 2020) discussed interpretations, theme naming, and documentary accounts (such as artifacts) of the work practices. In these sessions, the authors presented their understanding of the context and the work practice to harmonize the analysis and to ensure a common understanding of ‘the lived work of witnessed activities’ (Crabtree et al. 2000) doing administrative work at home.

4.5 Findings

4.5.1 Invoices as a work artifact

An invoice is not just a piece of paper for our participants but an artifact to work with for various purposes. The invoices are necessary for making payments, organizing financial affairs, or associating contracts with a company. For instance, Amelia (27 y.o.) stated that invoices include anything she receives from another company when she purchases a service or product. Similarly, Ava associated invoices with the services she received: ‘Water and electricity, gas, newspaper, telephone. Those are the invoices’ (Ava, 55 y.o.).²⁵ For Noah, an invoice is ‘resulting from, for example, contracts you’ve entered into, so monthly accruing fixed costs, respectively, monthly debits generally from things you’ve bought’ (Noah, 28 y.o.).

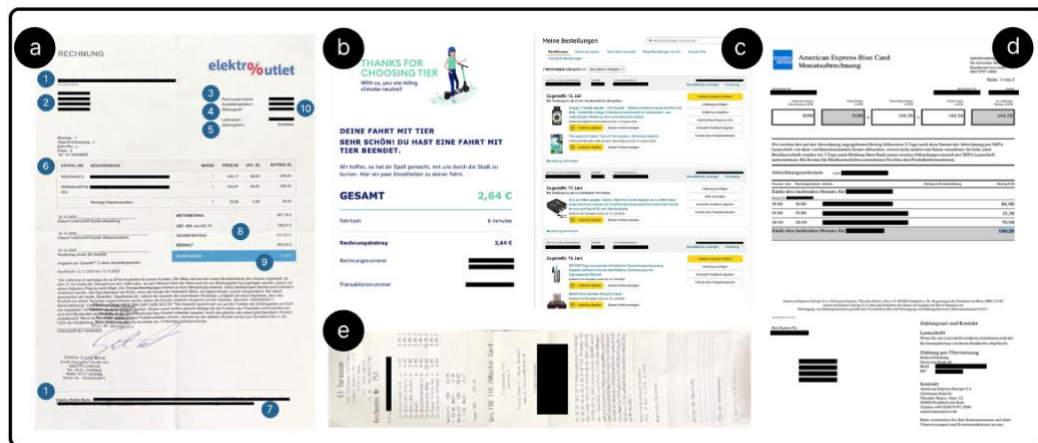


Figure 2: Examples of German invoices: (a) Paper-based, (b) Email, (c) Web portal, (d) Bank statement served as an Invoice, (e) Receipt

Our participants also developed mundane and procedural knowledge to make use of invoices. In the following, we want to analyze this knowledge in more detail, outlining the material and meaningful structure of invoices from the domestic perspective of our participants.

Structure and Materiality. Invoices can look very different but follow specific conventions that make them recognizable to our participants. These conventions result from legal requirements but also express the common knowledge of what an invoice looks like. As shown in Figure 2.a, an invoice in Germany usually contains (1) the name and address of the company,

²⁵ The interviews were conducted in German language, and the quotes have been translated by the authors for this paper.

(2) the name and address of the invoice recipient, (3) an invoice number, (4) the date of invoice, (5) the date of delivery or service, (6) information on the type and number of goods delivered or type and duration of service. It is also common for invoices to include (7) tax numbers, VAT rates on item level (8), as well as a total (9). The tax-relevant information indicates that legal transactions are not only conducted between two parties (company and client) but are also structured by the tax system (state), where invoices present a boundary object within the cooperative work between the tax office and citizens or companies. In some cases, invoices also contain explicit status information (open invoice, the invoice has been paid) as well as explicit instructions for action, such as (10) ‘Payable after receipt of the invoice’.

Traditionally, invoices in Germany were paper-based (such as in Figure 2.a). However, digital invoices are also common today and are becoming increasingly prevalent. All participants stated that they receive invoices in both paper and digital form. Although most invoices are received digitally via email (such as in Figure 2.b), our respondents saw paper-based invoicing by mail as the most common variant. Benjamin referred to paper-based invoices as the ‘classic’ ones and only considered such objects as invoices ‘that come to me by mail’ (Benjamin, 61 y.o.). Another type of digital invoice is one from service providers (e.g., health insurance, mobile operators) or e-commerce retailers (e.g., Amazon) and made available through a web portal (such as Figure 2.c) or app. In the case of ongoing contracts with direct debit, some participants also consider account statements (such as Figure 2.d) as a type of invoice. From a legal perspective, such account statements do not represent an invoice, but they are perceived as invoices by some participants as they have a similar function.

The particular structure of the artifact affords certain forms of work. For example, our participants mentioned they do various things with paper-based invoices, such as stapling, putting them somewhere, tucking them away, or writing something on them. Kim, for instance, mentioned: ‘My mother always writes the date and “done” on what she has paid for by hand’ (Kim, 24 y.o.). The small size and weight of cash receipts from supermarkets and shops allowed them to be carried in the pocket, stapled together, cut up, torn, etc.

Digital invoices have different affordances, depending on their format and the tools used to work with them. Email-based invoices, for example, can be easily forwarded, replied to, sorted into mailboxes, and searched, and one can easily cut and paste information from them (like the IBAN) elsewhere. For other processing purposes, however, they must be saved or printed out first. Invoices sent by email also reach consumers in various formats, such as plain-text, rich-text, HTML, and/or as an attached file, commonly in the exchange format ‘PDF’ (Portable Document Format). Thus, the email itself or the contained file is archived. Invoices provided

by web portals or apps offer a good overview but are limited to one company or marketplace (-operator). In addition, if they are edited and used or processed elsewhere, they must be transferred to other formats, saved, exchanged between devices, or printed out first.

Goals and Meanings. Fundamentally, invoices contain essential information about a business transaction. This information is summarized in a very compact and schematic manner using various abbreviations and technical expressions (such as VAT, VAT ID, IBAN, customer, or invoice number). This schematic structure indicates that the meaning of the information will be understood by established knowledge practices and common knowledge stocks. The specific structure of invoices and their meaning are not taught in school. Instead, our participants learned to read and manage invoices informally through experience with accounting work.

By their very nature, invoices are intended to be paid. For companies, this is one of the main reasons for invoicing. From a consumer perspective, paying the invoice is also a common goal when they receive them. However, invoices also serve as working artifacts for a variety of other activities, such as filing a tax return, canceling a contract, reselling a product, substantiating a warranty claim, complaining about or resolving an issue with customer support, or splitting costs. All these activities shape the meaning that invoices have for the participants.

Over the years, our participants have gained some level of ‘invoice literacy’. The general knowledge the participants acquired includes taking it for granted that invoices must be paid (and what needs to be done if they are forgotten), knowing which invoices must be kept, which invoices need to be submitted to the tax office, which invoices are essential in the case of a warranty claim, and how to use invoices to keep household accounts. ‘It depends on how important it seems to me. So, I prioritize and then see if I keep the invoice at all’ (Kim, 24 y.o.). Whether and how they might need invoices later influences the participant’s decision of whether an invoice is significant or not. As said by Henry (81 y.o.): ‘I understand Invoices as a request for payment that a company gives me’.

The meaning of an invoice for a person has implications for the definition of what is considered as an invoice. For instance, a cash receipt is considered as an invoice from a legal perspective, but among our respondents, it is controversial whether cash receipts are a type of invoice. Many respondents did not initially consider cash receipts part of their relevant set of invoices but ultimately included them after further reflection in the interviews. As noted by Noah: ‘Basically, you could now also include cash register receipts [...] Whereby I don’t keep them [...] but in the form, yes, actually also an invoice’ (Noah, 28 y.o.).

Beyond the common knowledge of handling them, invoices also have a personal and emotional meaning for the participants. For some, working with invoices represents a rather

annoying necessity in their private life. Noah, for instance, stated: ‘[...] invoices [are] actually never really something nice. So, they’re always stressful – or what do you mean by stressful – It’s just annoying. Let’s put it that way. Annoying and just something that must be done’. Others associate invoices with intense feelings of shame, bad conscience, and fear. Henry (81, y.o.), for instance, fears having forgotten something: ‘If the suspicion is raised or I would be asked that I have not paid the invoice, that it is ascertainable by me if I then pick that up’.

4.5.2 Invoicing as a stateful process

The term ‘invoicing’ indicates that an invoice is not just a dead artifact, but a living document. Traditionally, invoicing has been studied from the company perspective, which defines invoicing as creating and sending out invoices, requesting payments for work completed, a service provided, or a product delivered (Cambridge Dictionary)²⁶. We use the term invoicing regarding the consumer side, referring to the messy activities where our participants pick up and use invoices (such as paying, making a tax declaration, etc.).

The specific performance of such activities was almost unique to every situation. Yet, in a very simplified manner, we can identify recurring states for multiple invoicing activities. In the simplest case of a payment process, an invoice could have the states: ‘*TODO*’ or ‘*DONE*’.

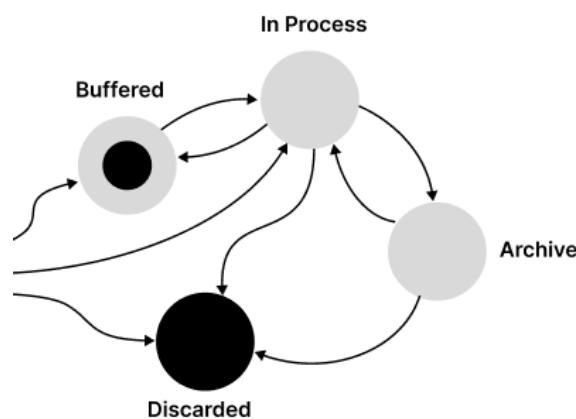


Figure 3: Simplified state transition diagram characterizing the invoicing process

Figure 3 presents a simplified state transition diagram of the observed invoice management. Despite all the differences in detail, the model results from a recurring pattern in the organization of work that we have seen in the data.

²⁶ <https://dictionary.cambridge.org/dictionary/english/invoicing>

Buffered. Buffered denotes the state where a received invoice is preliminarily stored for taking care of it later. Buffering depends on the type of invoice and the context of receiving it. For instance, cash receipts from shopping consumables are often thrown away directly without buffering.²⁷ However, some consumers use their pockets or wallets as a buffer, where they routinely put paper slips in to sort and deal with them later. Invoices sent by email or mail are often buffered at designated places such as the email inbox, a basket, or just put on a stack of unopened (or opened yet still unprocessed) mail. Instead of dealing with them immediately, these invoices are waiting to be picked up later.

One of the reasons for buffering is that our participants only have limited control over when and how they receive invoices. From the consumer's point of view, getting an invoice represents an external event that might come when they do not have the time or inclination to deal with the issue right away. We typically observe various buffering practices for dealing with the temporal contingencies of receiving invoices. Our participants also mentioned several reasons for this kind of buffering. Sometimes, people receive invoices for already paid product services, which require no further action but simply provide documentation. In addition, companies often allow several days and weeks to pay an invoice, so an immediate reaction is unnecessary.

In Process. 'In process' denotes the state where our participants engage with the invoice actively. There are various reasons and occasions for our participants to process an invoice. First, they must decide whether the invoice needs to be paid, whether it should be archived, or whether it can be thrown away. For instance, our participants receive 'to-be-paid' or 'already paid' invoices. These to-be-paid invoices are taken in hand for payment. By doing so, they change their status to a paid invoice, which could be discarded or archived (depending on several circumstances described in the following section). In our observations, already paid invoices mainly resulted from upfront payment methods in case of shopping or continuing obligations (such as mobile phone contracts). Payment methods vary between direct payment (like point-of-sale cash payments or electronic payments) or purchase on account.

In addition to paying invoices, there were various occasions when our participants searched through their archives to pick up invoices. For example, they may do this when doing their tax return, canceling a service, keeping track of expenses, checking purchases or deliveries, and claiming a guarantee.

²⁷ Note that in Germany, where our study takes place, there is no general law requiring cash receipts to be kept (unless for specific tax or warranty purposes), unlike in some other European countries.

Archived. Our participants did not always discard invoices after processing them; they frequently archived them instead. They archived them for explicit reasons, such as the need to have these documents for tax returns or to prove the purchase to the seller or authorities. However, it seems that sometimes invoices are archived because it has become a routine or habit, as noted by Benjamin (61 y.o.): ‘[T]here is simply a principle: I keep all invoices’. This habit appears to be driven by a desire to maintain a general paper trail in case an invoice is needed later, even when it seems unlikely, or by the fear that it might be crucial in the future. By archiving everything, consumers may reduce the burden of making keep-or-discard decisions regularly.

Invoices are often archived directly after processing. Sometimes, it is done immediately after checking them, such as in the case of paid invoices, as mentioned by Charlotte (57, y.o.), ‘The invoice from the insurance company is just for information because the insurance company has a direct debit policy’. Concerning post-processing, we also saw that some participants placed them in a particular place (cf. post-processing buffer) rather than directly archiving them, indicating that they would archive the invoices later.

Discarded. Most invoices are not kept forever but are thrown away or destroyed at some point. Generally, our participants threw invoices away when they realized that keeping them was no longer relevant and that deleting them would be beneficial. It can happen at any time and sometimes occurs immediately after a participant receives a cash receipt or after paying an invoice. Discarding invoices often occurs when participants clean up their archives to create space and organized their records. Discarding was not always a conscious process, however. Sometimes invoices are simply lost over time. This is usually noticed when someone needs an invoice for some reason but can no longer find it. The most common benefit of deleting documents from the archive was to save space in the analog context. Digital invoices were typically kept because of the increased storage capacity (and the low memory impact of a few kilobytes per invoice), so active deletion was often not necessary.

We used the simplified model shown in Figure 3 as an analytical lens to study the flow of invoicing work. Depending on the type of invoice, the invoicing process can be more complex than in this simplified model. For example, some participants had a strategy of not paying an invoice immediately, but only after receiving the first (free) reminder. In this case, invoicing can have additional states such as: ‘Invoice received’, ‘First reminder received’, ‘Invoice paid’, and ‘Invoice archived’. In Germany, dealing with medical invoices for privately insured individuals is even more complex, as consumers may pay the medical invoice directly but then receive reimbursed from the health insurance company and employer. In this case, the flow of

the invoicing work can include states such as: ‘Invoice received’, ‘Invoice paid’, ‘Invoice submitted to the health insurance company’, ‘Invoice submitted to the employer’, ‘Invoice reimbursed by the health insurance company’, ‘Invoice reimbursed by the employer’, etc.

The participants sometimes mark the current state of an invoice-related task on the invoice itself. For example, they might write ‘Paid’ on a paid invoice or mark it with a symbol and the date after they have processed it. As we describe below, our participants often use self-created ordering systems to track the process and make the state observable, such as by placing invoices in a specific location that signifies that they must still be checked or archived. For example, Noah notes, ‘I have the [invoice] lying on the table in the kitchen and have put a post-it in the hallway with the heading “Pay invoice medical supply store”’ (Noah, 28 y.o.).

Archiving and sorting into folders indicate that the invoice has been checked and paid. Sometimes, the actual status is unclear and cannot be discerned from the invoice itself or the ordering systems. This applies especially to chaotic ordering systems. Such a situation would lead to uncertainties and more significant effort to determine, for example, whether an invoice still needs to be paid.

4.5.3 Filing systems used for invoicing

An essential part of invoicing is to get an overview of which invoices need to be processed and to find the necessary information and documents for other tasks, such as filing a tax return or obtaining reimbursements from insurance companies. We observed that people developed their ordering systems for these purposes. These systems consist of specific locations, tools, practices, and conventions for organizing invoices according to various principles. In the following, we will discuss these ordering systems in more detail.

4.5.3.1 Buffer

Buffers are intermediate storage areas that keep invoices temporarily while waiting for the next processing step. Our respondents used them to pause their work process and continue it later.

Buffers are used before or after specific activities in the editing process. They remind humans of tasks that they need to do later. We could distinguish various types of buffers based on their purpose.

Input buffer. When an invoice is received, the participant’s billing work officially begins. In addition to getting cash receipts (e.g., parking receipts, restaurant receipts, retail receipts), our participants receive most invoices either physically in their mailboxes (see Figure 4.a),

digitally in their email inboxes (see Figure 4.b), or through the web portal or app of the service provider (see Figure 4.c). These input buffers mark the transition between the public and private spheres and are used by consumers or household members.

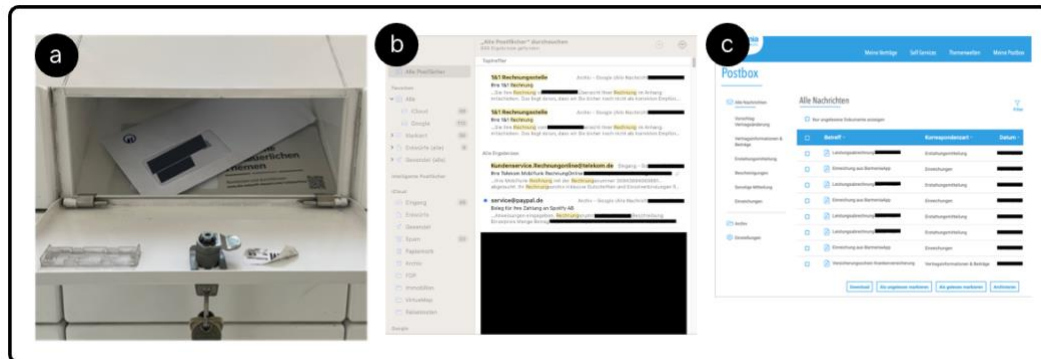


Figure 4: Input buffer: (a) letterbox with newly arrived letters, (b) inbox with unread emails, (c) unread messages in the web portal

Regarding this, invoices stored in the web portals/apps of the providers present a particular case. The design of these portals/apps restricts the user's ability to configure ordering systems for personal purposes. Even if the functions of the different ordering systems are not always clearly distinct, they can be simplified into buffering and archiving systems.

For instance, some web portals/apps support input-buffering practices, such as highlighting which invoices are new or unread. Additionally, bank statements can be used as a tool for invoicing work. In the case of automatic direct debiting of monthly service fees (e.g., for Netflix, Spotify, electricity, and communication), reviewing bank statements helps to get an overview of which services have been paid in each time frame (and to check if a specific service has been paid or not, for example when a participant receives a reminder that an invoice is overdue). Some participants noted that they sometimes search through corresponding invoices in apps, web portals, emails, or letters just in case something unusual happens.

Regarding paper-based invoices, there was also a common practice of placing letters in a visible location at home (see Figure 5) but leaving the letter closed, signaling that it has not yet been checked. Pragmatically, older invoices should be placed on top (following the First-In-First-Out principle) because they typically need to be paid sooner (e.g., within the next 14 days). However, these letter stacks are typically unsorted, with the newest letter on top for practical reasons and older ones at the bottom. This structure constitutes a last-in-first-out affordance. In principle, this upside-down order is dysfunctional because the lowermost mail is often the most urgent. However, in most cases, this does not cause any practical problems because the input buffer was usually not very large and was processed in bulk (some consumers had regular

invoicing habits, while others acted when the stack looked big enough and things were beginning to feel too disorganized).

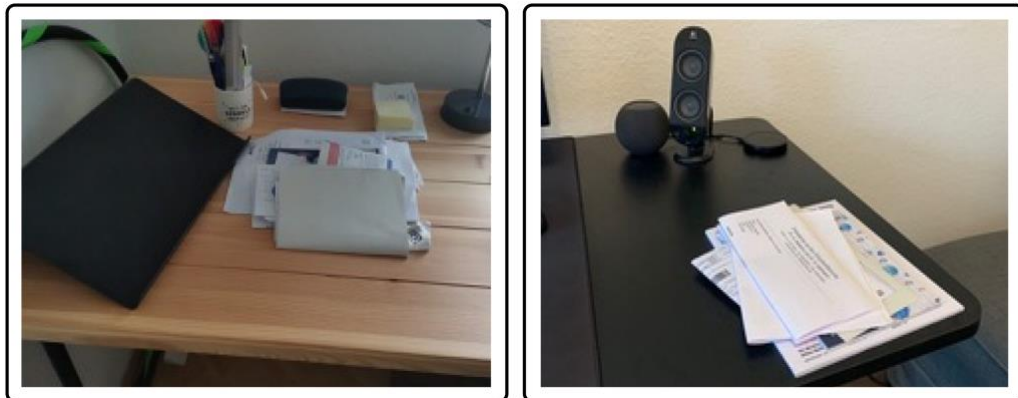


Figure 5: Stacks of pre-sorted invoices

Pre-processing buffer. Input buffers have the disadvantage of mixing invoices with other letters and emails. Therefore, each email/letter must be checked to determine whether it is an invoice and if and when it needs to be paid. In our study, we observed the typical habit that after this initial checking, invoices were stored in a pre-processing buffer until they were handled.

The checked-but-not-handled paper-based invoices were typically stored in a specific location in the living area, such as the kitchen table, a chest of drawers/cupboards, or on the desk (see Figure 5). Like the input buffer, the invoices were typically stacked, constituting a Last-In-First-Out (LIFO) affordance. In some cases, this buffer consisted of more than one stack, for example, pre-sorting them by type, but most often to express priority. Depending on the importance and due date of the invoice, the participants made marks on the invoice itself and created notes or reminders elsewhere.

These stacks also served as a reminder for participants due to their location in the living area. According to Noah (28 y.o.), the participant is more likely to remember the processing deadline if the storage location was more unsettling: ‘So either in the hallway, on the dresser, or the kitchen table, so it’s as present and annoying as possible, and you always have to think about it’. We also observed that participants located the pre-processing buffers near the place (desk, kitchen table, etc.) where they worked on the invoice.

Regarding digital invoices received by email, we observed a similar practice mentioned by Whittaker and Sidner (1996) for organizing emails in general. For example, after reading the email, participants marked it as a new unread message to highlight that the invoice still needed to be processed or moved to a unique, self-created folder in the email inbox with a name, such

as ‘house’, ‘car’, ‘bank’, ‘tax office’, ‘insurances’, or ‘invoices’. Most participants said they forgot about digital invoices if they were not marked as unread or printed out directly.

Almost all participants mentioned that they printed out invoices at least occasionally. They put these printouts in the paper-based pre-processing buffer and handled them in the same way as the other paper-based invoices. This printout habit indicates that paper-based ordering systems align more closely with people’s everyday lives and practical needs in organizing their invoicing work. In some cases, they scanned or digitized paper-based invoices with a smartphone for digital archives (see below).

The average time spent in the pre-processing buffer depended on the individual working style of participants. For example, some participants tended to complete tasks immediately, while others delayed them to proceed with the invoices in bulk (see below).

Post-processing buffer. As mentioned, our participants retrieved invoices for various reasons, such as reviewing a contract, substantiating a purchase, or filing a tax return. They retrieve the invoices from the pre-processing buffer or the personal archive. After completing the work, they sometimes threw away or archived the invoices. However, we observed that people typically did not sort them into the archive or throw them away directly but instead put them into a post-processing buffer. Olivia described this habit as follows: ‘I don’t actually throw them in the trash immediately, but maybe I move them from this present place to this other place, which is a bit further back at the desk, where a few things are already piled up’ (Olivia, 34 y.o.).

This storage can be a stack next to the pre-processing buffer in the same location following the same ordering principle (LIFO-Stack) for paper-based invoices. However, we found no indications of any methods of sorting or marking importance or urgency used in this context. The post-processing buffer tended to be more inconspicuous, as it had little reminder function and served only as a backup in case of a mistake that needed later investigation.

Many of our participants marked invoices as processed or paid. Invoices that had not yet been transformed into paper form were generally still processed in the email inbox and, as such, were either deleted, left unmarked, and unsorted in the email inbox, or archived immediately.

Due to the lack of externally imposed deadlines or dates that must be reached in the following processing, the respondent typically processed invoices within weeks or years without purposeful sorting.

4.5.3.2 Archives

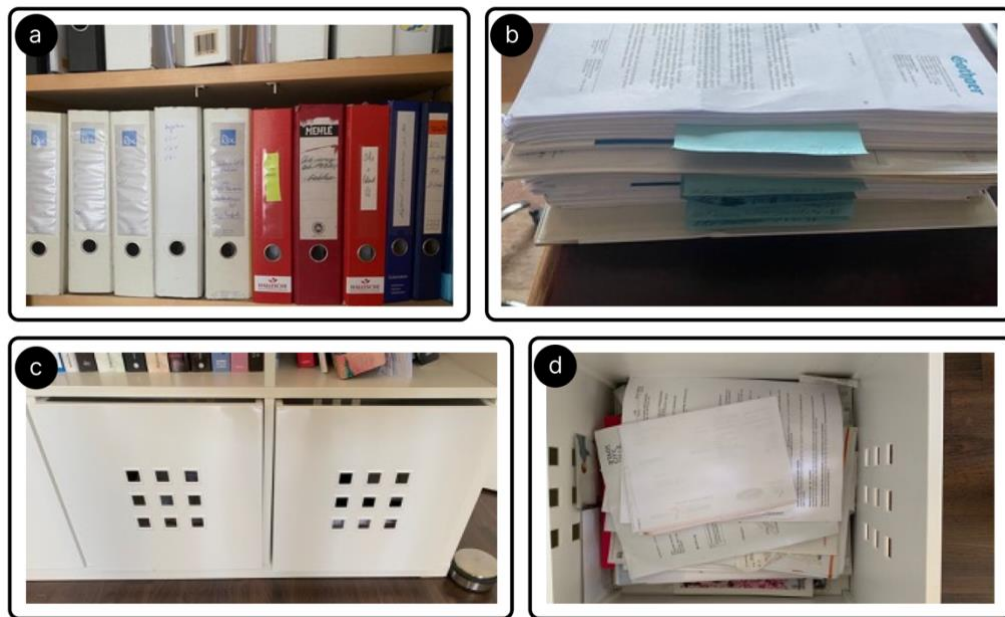


Figure 6: Locations of archives (a) open shelf with files, (b) thematic grouping, (c) closed shelf with boxes and organization of archives (d) chaotic order

Many respondents had a personal archive system containing essential documents and records, such as birth certificates, training certificates, tax assessments, pension notices, ongoing contracts, and invoices (see Figure 6). The form factor and organization of these archives varied greatly, and the amount of time the respondent stores the invoices depended on the type of invoice and the person's working style. The organization of the documents ranged from very chaotic systems (e.g., Figure 6 c-d) to very structured systems (e.g., Figure 6 a-b).

In the archive, invoices were stored for decades until they were discarded or used for one of the invoicing goals mentioned above (such as making a tax return). To facilitate re-use and related re-finding, our respondents organized and sorted invoices in various physical locations, with other media, and with varying levels of effort from respondent to respondent.

Paper-based archives. For paper invoices, the location of the archive was typically within a cabinet, shelf, or something similar. The cabinet then contained one or more thematically separated units. These units consisted of boxes, drawers, or file folders. We noticed that some participants divided a topic into one or more units to manage their archives. The most common solution chosen by interview partners was to use file folders to divide them thematically with dividers.

Regarding this, the German verb 'abheften' (filing something away) was often used to describe the characteristics of the ordering system and the activity of putting things in order.

Most of our participants create a manageable set of subdivisions. ‘And then I file them in the appropriate folder’ (Charlotte, 57 y.o.). This kind of organization facilitates the retrieval of invoices and keeps all documents for specific transactions together. Within the smallest subdivision, the participants often filed the documents chronologically. The number of subdivisions and their organization depended on the volume of managed documents, as Emma explained: ‘[T]he more you have, the more you might want to have it sorted so that you can somehow find something again’ (Emma, 24 y.o.).

The organization of personal archive systems was also influenced by how much time participants wanted to spend maintaining the system and retrieving documents. In this regard, individual practices were quite diverse. One extreme was represented by James (57 y.o.), who filed the archived documents ‘very meticulously’ in appropriate folders so that he could find them again when needed. The other extreme was presented by Oliver, who noted, ‘Okay, so in the end, it’s just a box, a box, where the stuff goes in’. Oliver’s practice implements a fast-filing procedure but a slow retrieval strategy, which requires much effort when a specific document is needed later: ‘Then I would try to look through all the channels where I have now ordered something together via my mailbox. That would involve a lot of effort’ (Oliver, 26 y.o.).

Another aspect that affects filing practices is individual ‘invoice literacy’. To decide whether and where to archive a document, our participants often needed to know which documents would be needed later and for what purpose. For example, Amelia (27 y.o.) noted, ‘I have an extra tax folder’ to make later tax return work easier. After the documents had been used for a particular purpose (e.g., making the annual tax return), some participants filed them in their standard archives like other invoices. Amelia’s tax folder practice demonstrated that the organization of the archives expressed the current state of an invoice task, such as whether the tax return had been completed or not.

Digital archives. Many digital invoices are printed out to store them in paper-based archives. All our participants, however, mentioned that they store various invoices digitally in parallel. As they received digital invoices via email, they used the email system as a digital archiving system. Due to large storage capacities, many participants, such as Noah, did not delete digital invoices, leaving them in the inbox or moving them to dedicated folders: ‘I actually just leave it in the email inbox’ (Noah, 28 y.o.).

We also observed that some participants stored digital invoices on their local file systems in addition to other methods. For example, Amelia (27 y.o.) preferred a file system archive because she did not trust her email system as a long-term reliable repository:

'I have a folder on my desktop, and I drag the invoices in there. [...] It's organized in the same way as a physical folder. [...] But I don't use cloud storage, everything is on the hard drive. I just use web.de [a German email provider] and it's not very secure. If I think the server is down, I log off and still have all my invoices on my desktop.'

We observed that participants organized their digital archives following the principles of their paper-based counterparts. For example, some participants, such as James, created folders in their email and file systems to organize the documents by theme or invoice type: 'I have a directory tree in the inbox with folders for invoices, home, invoices-other, and vacations. You can file them in the appropriate folder. It's not as detailed as the [paper-based folder], but it's still easy to find' (James, 57 y.o.).

However, the digital archives provided new search affordances that some participants used. For instance, our participants said they use the built-in search function to find invoices in digital archives, making sorting increasingly obsolete. In the interview, Noah showed us how he uses the search function on his smartphone to find an invoice when needed: 'I would just type "Telekom" in the search bar and then I would have my Telekom landline invoice for September quickly' (Noah, 28 y.o.).

Online retailers and providers increasingly provide invoices only in web portals and apps. This practice restricts consumers' options for organizing these documents, but they can still manually store them digitally or print them out if they want to file them in their archive system. We were surprised that none of our participants mentioned this as a restriction. In contrast, some participants said they trusted the providers to keep invoices available long-term and handle them confidentially. They only found it annoying and inconvenient that they had to manage credentials and log in to web portals to access the documents.

4.5.4 Temporal patterns of invoicing work

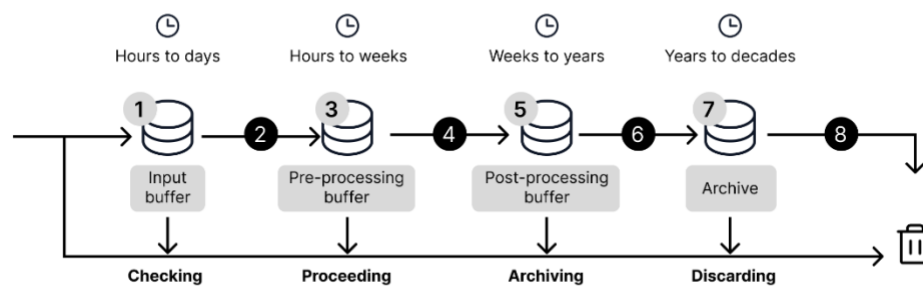


Figure 7: Typical temporal order of invoicing, including steps and storage

The previous section outlined the lifecycle of invoices moving from input buffers to the archive. The specific conditions, the invoice subject, the materiality of the invoice, the individual working style, etc., affect how long each processing step takes and whether an action is delayed. However, we found some recurring temporal patterns in the life of an invoice concerning state model mentioned above.

In the following, we provide an outline of the lifecycle of invoices and its temporal structure:

- (1) The lifecycle typically starts when participants receive an invoice via letter or email. However, it can take hours or days for people to notice the delivery (push principle). In addition, some invoices are stored in a web portal/app, where our participants access them only upon request (pull principle). Some providers use both methods, sending invoices via email and storing them in the web portal/app (push/pull principle). We also observed that participants check their bank account charges to determine if new invoices might exist that can be found in a web portal/app.
- (2) Upon receiving an invoice, all participants typically opened and checked it immediately. In many cases, the participants quickly determined if an urgent response was required or if it could wait to be processed later.
- (3) In many cases, after a quick check, our participants left invoices unprocessed but put them in pre-processing buffers. Delaying is a way of collecting tasks to work through them more efficiently. It also represents a form of procrastination. Very few of the respondents found invoicing to be a pleasurable activity. On the contrary, some participants tended to suppress or postpone invoicing work as much as possible. Our interviewees related that the duration between pre-checking and execution typically ranged from hours to weeks.

- (4) Because of the pre-processing buffering practice, we often observed that invoices in the buffer would be processed in bulk. Such bulk processing had some benefits for the participants, such as dealing with the (tedious) invoicing work less frequently (e.g., doing this job only on the weekends). In addition, bulk processing was typically also more efficient as most effort mainly consisted of work preparation (e.g., setting up the desk, searching documents, opening websites or apps to transfer money) and follow-up activities (e.g., cleaning up the desk, filing documents). Compared to this form of articulation work, the actual processing time was usually relatively short.
- (5) Most participants did not archive directly after processing but put invoices in a post-processing buffer. This step had the benefit of decoupling the processing work from the archiving work. In many cases, an invoice that remained in these post-processing buffers stayed there for several weeks or even several years, as there was no external obligation to handle these post-processed invoices immediately.
- (6) When cleaning up the post-processing buffer, participants archived some of their invoices in a structured manner.
- (7) This structured filing involved searching for the right place in the personal archive system that followed its own logic. Some participants had a pure paper-based archive system, so they printed out electronic invoices to archive them. We have not observed the reverse case of a fully digitized archiving practice.
- (8) Participants rarely cleaned up their archives. Invoices remained in the archive for years. Furthermore, it seemed that they only deliberately threw away paper-based invoices. In principle, invoices contain confidential information, so the owner should shred or tear them up before disposal for security reasons. However, our participants rarely mentioned this issue. After a period of a few years (1-5 years) for most goods and up to several decades for long-term contracts, the invoice was removed from the archive. However, the period could be even longer, as James notes, ‘because such contracts run for 20-30 years’ (James, 57 y.o.).

4.5.5 When it is time for invoicing work

External events and the work styles of participants also influenced the temporal patterns. In this regard, we observed three basic types when doing invoicing work: (a) direct completion, (b) handling at the next opportunity, and (c) postponing as far as possible.

Direct completion. Some participants tried to process an invoice immediately after receiving it and either threw it away, archived it, or at least placed it in the post-processing

buffer for archiving within the next hours or days. Noah, for example, said that ‘it’s a principle [...] for me to get invoices off the table as quickly as possible, no matter what form they come in’ (Noah, 28 y.o.). Noah also files the invoice directly into his filing systems, with buffers rarely persisting for hours or days.

The entire invoicing process takes the shortest time for participants with these working styles, ranging from minutes to days. We also noticed that these participants did not limit their direct completion habits to invoices. They felt forced to perform their daily mandatory processes without delay.

This style also affects the organization of the pre-processing buffer. For example, Noah put unpaid invoices in a prominent and disturbing place so that he did not forget to file them promptly: ‘[...] so that it’s as present and annoying as possible’ (Noah, 28 y.o.).

At the next opportunity. Most participants collected invoices to work through them when time was available. Benjamin described this working style as follows: ‘As soon as there is time available in the office, I process the invoices’ (Benjamin, 61 y.o.). Kathy also described this next-opportunity style: ‘I do it the next time I have time and feel like working on it’ (Kathy, 38 y.o.).

This method somewhat decouples the processing of the invoice from its receipt, where the personal workload determines how much time should be spent on invoice-related tasks. Kathy’s quote also suggested that it depends on one’s mood. As Charlotte noted, the speed at which bills accumulate affects when the task is complete: ‘I just collect a bit, and then [...] I only do it every 2-3 months if more comes [...] then I often file it away’ (Charlotte, 57 y.o.).

As in the previous case, the next-opportunity style also affected the organization of the input buffers. Typically, participants chose a place for the input buffer so it was regularly visible as a reminder of the open task. This place was also often located close to the home workplace, enabling consumers to process the invoice bulk occasionally, such as during breaks from other activities. For example, Benjamin (61 y.o.) placed invoices that arrived on a small table next to the desk that holds his printer. If Benjamin took a break while working at his desk or had an opportunity to process an invoice, the stack reminded him, and he processed the invoice.

Postpone as far as possible. Some participants postponed invoicing work as much as possible. On an emotional level, this working style seemed to be related to the human mechanism of repression and denial. Unlike in the previous case, piling up unfinished invoices does not trigger action but rather avoidance. As stressed by William, the perception of a large number of invoices leads to procrastination: ‘So I noticed that I procrastinated, that so much has come at once sometimes I didn’t feel like taking care of it at all’ (William, 36 y.o.).

However, postponing cannot be endless. For this reason, Charlotte (57, y.o.) used a trick to outsmart herself by writing reminders on envelopes or sending them to herself electronically via email. However, if she did not actively look at the envelope occasionally, she tended to forget or miss a payment deadline.

4.5.6 Invoice management as a collaborative effort

Most participants lived in multi-occupant households where invoice management was typically a collaborative effort. In these households, we found that both individual contracts and joint contracts, such as electricity costs or the broadcasting fee, were shared by all household members.

In doing so, we often observed an informal division of labor in managing these individual and joint contracts where one person became responsible for invoicing and handling related concerns. While a general division of labor was common, the specific strategy to divide the work among each other was quite different.

Division by topic. One strategy of participants was for one person to manage all contracts that belong together thematically. In Charlotte's case, for example, her husband took care of all invoices relating to the house and had his own filing system and archive for them: 'It's more my husband who gets them because everything concerns the house: gas, electricity, water, telephone. He gets all that and he gets that in his email box. And he has a filing system on his computer for that' (Charlotte, 57 y.o.).

Division by competencies. Another strategy was for the person in the household perceived as most competent at invoicing to take on the responsibility. For example, Amelia (27 y.o.) took over the tasks of her partner due to his lack of country-specific and German language skills.

Division by specialization. As shown above, invoicing work comprises various steps, such as reviewing, processing, and filing. In the case of Henry (81 y.o.), we observed a kind of specialization where he became responsible for one specific task, namely archiving. Henry and his partner had separate incomes and usually paid their invoices in partnership: 'In this respect, the invoices are paid for each one individually. But I do all the administrative work that goes into the invoices' (Henry, 81 y.o.). He became responsible for this dedicated task because of his 'accounting' habit of keeping order: 'I'm used to being systematic from my work, filing everything nicely, picking everything up is second nature to me' (Henry, 81 y.o.).

Division by dispatching. Another way of organizing the division of labor was to check who was responsible for receiving an invoice and then dispatch it to that person. This practice was encouraged by commonly shared input buffers, such as mailboxes or storage areas. As in

Oliver's case, these input buffers were managed collectively to distribute work across the household based on an initial check: 'Actually, when I get home, there's either a letter there or there's not. But I honestly don't actively look in the mailbox because someone empties the mailbox and then distributes the letters' (Oliver, 26 y.o.). As in the case of Kathy, they also used the shared buffers to signal that there was work that they had not yet been assigned to someone: 'In case of doubt, the [letters] always end up all in the front at the phone table in the entryway' (Kathy, 38 y.o.).

Who-pays-what Principle. We observed that the division of labor was closely connected with the question of who paid for what in a household. In most multi-occupant households, the members jointly paid for everyday goods and services, with costs divided among them. In this context, they negotiated which share they accounted to the community and which share they accounted to the individual. A particular case of this was the relationship between children and parents, which was also manifested in payment practices, as shown in the case of Sophia: 'Is this about my private pleasure [...] then I pay for it myself. If it's something health-related or something like that, then, of course, my mother or my parents will pay for it' (Sophia, 21 y.o.).

Evelyn described a common practice for organizing such joint payments: 'One person takes over [the payment] at the checkout, and then you have the receipt, and then it's just settled among each other that you transfer it or give it back in cash' (Evelyn, 31 y.o.). This joint financial management also affects invoice management, as was evident with Henry: 'I first collect the invoices over a while and then make a clean settlement with my life partner. We each pay half of the invoice. When the sharing is complete, the invoices disappear into the trash' (Henry, 81 y.o.).

This division of labor usually occurred routinely without any need for articulation work. Articulation work occurs only when responsibilities are unclear, as in the case of Evelyn dealing with joint contracts: 'So if everyone pays the invoice themselves, then we don't talk about it. So only with joint invoices do we have to coordinate with each other' (Evelyn, 31 y.o.).

A greater need for negotiation and articulation of the division of work occurred when partners started a new household together and had to harmonize different invoicing practices. We observed this situation in the case of Olivia, who recently moved in with her new partner. She described the challenge of bringing different practices together: 'So, I feel like they differ because, of course, I think my system is better than his. But it's always difficult to change an already existing system entirely' (Olivia, 34 y.o.).

Additional articulation work also results by eliminating paper-based invoices, which served as a coordination mechanism in the distributed work. We became aware of this role in cases

where only one person received the invoices digitally via email. This process disrupted well-established routines of shared responsibility and dispatched the work to the person in charge. To deal with the digitalization of invoices, some participants printed them out, so they could be used as established coordination artifacts, such as putting the printed-out invoice in the physically shared input buffer. In addition, we also saw the formation of new digital practices, such as using shared email inboxes or forwarding invoice-related emails to the person in charge. For instance, Isabella (21 y.o.) reported that her family used her father's email inbox for all contractual matters. The digitization process significantly influenced the division of labor and the associated procedures.

4.6 Discussion

Household management presents a work practice mostly neglected by mainstream research. Self-critically, this also applies to large parts of CSCW research. Feminist research has drawn the most attention to it to expose the unequal distribution of work and campaign for better working conditions.

Numerous feminist studies in sociology show the unequal distribution of work in the household (Hochschild 1989; Mederer 1993; Winkler and Ireland 2009). The great merit of these studies is their ability to draw attention to a relevant social problem. In the context of feminist CSCW research, however, these studies gloss over the situated nature of the work practices but only measure the temporal and mental workload. Consequently, the feminist demand to reduce undesirable household work (Frederick 1921; Gilbreth 1927; Emens 2015; Emens 2019) remains more programmatic than empirically grounded. With its tradition in workplace studies (Schmidt 2000), we believe CSCW research can contribute to this gap in feminist research.

With our study, we make a first step in this direction by studying administrative household work as a socio-material practice. In this respect, we see our study contributing on three levels:

- **At the methodological level:** Our study demonstrates how to overcome the limitations of time-series studies to empirically research situated household work.
- **At the level of the subject matter:** Our study reveals how people accomplish mundane administrative household chores by making order and structuring the work.
- **At the design level:** Our study provides insights and requirements for the design of support systems beyond process automation.

The following sections discuss these three contributions of our study in more detail.

4.6.1 ‘Get a grip’ on domestic work

It is a methodological challenge to ‘get a grip’ on domestic work because of its highly unstructured, implicit, and invisible nature, where tasks are often taken for granted and performed concurrently with other activities (Daniels 1987; Winkler and Ireland 2009; Emens 2015; Daminger 2019).

While the socio-materiality of the kitchen as a domestic workplace has been studied in the early days of household research (Frederick 1921; Kuhn 1998; Meyer 2021), ‘getting a grip’ on the administrative work at home is still an open challenge. A prevalent method in the literature is time budget surveys (Krantz-Kent 2009; Winkler and Ireland 2009; Möser 2010; Anxo et al. 2011; Moreno-Colom 2017; Craig and Powell 2018). The merit of these surveys is to shed light on the immense quantitative time burden associated with domestic paperwork and its unequal distribution between genders. Yet, these studies have several limitations. Firstly, they provide only a vague estimation of the time spent due to the messy, fragmented nature of these activities (Winkler and Ireland 2009), and the numbers do not capture the subjective dimension of time use, the meaning given to activities, the perceived work quality, and the physiological and cognitive cost of household work (Habib et al. 2010; Moreno-Colom 2017). Most importantly, they fail to capture the practical execution of this kind of work, making its spatial-temporal ordering and accomplishment visible.

Another commonly used method in home economics is relying on abstract models on how household accounting should be done and how business accounting concepts could be simplified for private users (Piorkowsky 2000; Hoque 2006; Langhojer 2009; Gomes et al. 2021). However, there is a danger of glossing over the messiness of domestic work and neglecting the situated context, and practical demands. The failure stories and limited market success of household accounting tools show that it is not just an academic issue, and that ‘getting a grip’ on situated domestic work is of practical relevance.

We have shown how the methodological toolbox provided by CSCW can be adopted for this purpose. While previous studies on CSCW have mainly focused on money work (Kaye et al. 2014; Pritchard et al. 2015; Dolata and Schwabe 2017; Perry and Ferreira 2018), our main goal was to get a grip on the household accounting as messy, fragmented domestic work.

Table 3: Topics to which the ‘following-the-artifact’ methodology contributes

Topic	Contribution
Working times	Time budget surveys implicitly assume that tasks have a clear beginning and end (Hamermesh et al. 2005). Through <i>Following-the-invoice</i> , however, it becomes evident that the beginning and end are not natural given. It is a result from artful competency to create temporal order with the help of buffers, reminders, and sorting orders to manage the distinction between working time and processing time.
Work placement	Previous domestic studies (Harper and Shatwell 2002; Taylor and Swan 2005; Vyas et al. 2016) emphasize that work placement is a vital resource for coordinating domestic activities. With <i>Following-the-invoice</i> , we gain additional insights about the spatial-temporal nexus of this placement, which aligns with the workflow. For instance, the pre-processing mainly aims to make the work visible, while pre-processing placement aims to make the work invisible so that it does not disturb the home’s aesthetics as a place of leisure and relaxation.
Work Distribution	Feminist studies show that domestic paperwork is unequally distributed (Damingier 2019; Emens 2021). <i>Following-the-invoice</i> gives us additional insights about the domestic division of labor in practice regarding responsibilities, organizational issues, and reasons given.
Interface Work	Business accounting (Deshmukh 2006) and domestic work (Vyas et al. 2016), are commonly perceived as distinct research fields. <i>Following-the-invoice</i> , however, shows that digitalizing the invoicing process affects existing household accounting work in unintended ways. Individuals are required to perform interface work to make the external invoicing processes compatible with the internal ordering systems.

Moreover, Table 3 shows, where our *following-the-invoice* methodology contributed to previous research. This methodology allowed us to gain detailed and novel insights into the domestic ordering systems established and utilized by household members for this purpose.

4.6.2 Ordering systems used for household accounting

Our study confirms previous studies (Harper and Sellen 1995; Taylor and Swan 2005; Vines et al. 2014) that people use multiple ordering systems at home. Our study contributes to this research and explores these related practices in fine-grained detail. For instance, we found no related work that distinguishes between pre-processing and post-processing buffers.

Table 4 provides an overview of the various artifacts that bring order to domestic invoice management. As our findings show, these artifacts serve as buffers to structure, organize, and articulate the invoice work process and archives that build up the financial memory of the household.

Goals. Our study has shown that invoicing work, as a financial activity at home, has various goals. Adopting the taxonomy of Vyas et al. (2016), we can distinguish invoicing work that serves short-term goals, such as paying an invoice, from that which serves long-term goals, such as archiving an invoice for later use. These different goals reflect the corresponding ordering systems. For instance, we have uncovered that the size and physical locations of

buffers typically address short-term goals, while the organization of archives typically addresses long-term goals.

Table 4: Overview of ordering systems used in households to organize invoices and the invoicing work

	Buffer		Archive	
	Physical	Digital	Physical	Digital
Goals	Short term goals		Long term goals	
Retention time	Input Buffer: hours to days Pre-processing Buffer: hours to weeks Post-processing Buffer: weeks to years		Years to Decades	
Location	Kitchen Table, on the Cabinet, Dresser, Desk, etc.	Email Inbox, Service Provider/Retailer Apps	In the Cabinet, Shelf, etc.	Email Inbox, App, Hard Drive
Ordering principle	Organically, often chronological	Chronologically	Chronologically, Thematic, Numbered/Alphabetical	Chronologically, Thematic, Numbered/Alphabetical
Search support	No	Full-text search	No	Full-text search
Articulation & Awareness	High	Email: Medium Apps: Low	Medium-Low	Low

Retention time. Our study showed that buffers and archives have some typical retention times. The buffers were primarily used for short-term goals, and their retention times differ according to their functions. The input and pre-processing buffers have the shortest retention times, while invoices typically remain longer in post-processing buffers, which are the preliminary stage to final archiving. In archives, invoices will typically be stored for years to decades.

Location. For locations, we were able to ascertain that the physical locations differ significantly between buffers and archives. Buffers often have a prominent location, such as the kitchen table or dresser, so they are constantly visible to household members. In contrast, filed papers in the archive were hidden on a shelf or in a cabinet. Digital invoices, however, tend to remain in the same place throughout the entire invoice lifecycle, either in email inboxes or an app provided by a vendor/retailer. Some people also used cloud or hard drive folders as long-term storage, where they archived digital invoices in rare cases.

Ordering principle and search support. Our study uncovered various ordering principles, especially in the case of archives, such as sorting them thematically, numerically, or alphabetically. The ordering principle also articulated who will be responsible (e.g., one person taking care of the insurance folder) and when invoices are needed (e.g., filing them in a tax

return folder). Most commonly, buffers, but also archives, were organized in chronological order. The practice of putting new invoices on the top of a buffer created a kind of LIFO stack ('Last In First Out'), which risks overlooking older but urgent invoices.

The maintenance of ordering principles may create extra work initially, but it reduces the effort required for retrieval later. Concerning search support, digital buffers and archives supported retrieval through full-text search or the option to list documents, emails, etc., by different criteria such as time, sender, or subject. Creating order in the filing system became obsolete within full-text search.

Articulation/ Awareness support. We observed that the location and ordering of physical buffers supported awareness of which invoice work needed to be done. In addition, shared spaces, such as the kitchen table, helped people coordinate and articulate the work among household members. While the perception of physical buffers was very strong, the perception of digital buffers was low. This was especially true for invoices provided in apps or web portals when one did not receive an additional email or notification about them.

Due to the lack of open tasks, the perception of the physical and digital archives was quite low. Invoice emails could get lost among the many other emails stored in a client's inbox, and physical folders, boxes, shelves, or cabinets used as archives were often hidden to avoid disrupting the domestic aesthetic.

4.6.3 Implications for design

There is a current trend towards eliminating of paper-based invoices (Gupta 2020). Our study shows that electronic invoices provided by apps and web portals can help to organize invoices and make tasks, such as paying bills, more efficient. Yet, our study confirms that the 20-years-old insight of CSCW, that a naive digitization of processes is harmful, when the importance of paperwork is neglected (Sellen and Harper 2003). Furthermore, the limited adoption of dedicated household accounting and invoice management tools could be due to a misguided design approach relying on abstract, rationalistic work models (2000; Walker 2008), while overlooking the inherent contingency, messiness, situatedness, and spatial-temporal orderliness of domestic administrative work.

Table 5: Overview of design issues

Topic	Gained insights	Design issues
Workflow support		
Tasks	Dealing with invoices does not serve one purpose only, but is part of various activities (such as paying, doing taxes, and handling claims)	Design should not focus on a single task but should consider several purposes. Design should focus on making common tasks efficient but also facilitate non-anticipated purposes.
Processes	Invoices have a life cycle. They are used together with other records in multi-stage workflows.	Design should allow users to implement at least their simplified workflow, as shown in Figure 3.
Channels & Formats	Digitization has led to a multiplication of the channels through which household members receive or retrieve invoices and other documents. The same applies to the data formats.	Design should recognize the co-existence of multiple channels (mail, email, and increasingly proprietary apps and web portals). Companies should provide standardized API making their e-invoices accessible. Design should recognize the co-existence of multiple human-readable data formats (paper-based, HTML/txt, and pdf). The industry should standardize machine-readable invoice formats, which can be included in human-readable formats (such as QR codes or as meta-tags in HTML/pdf).
Buffering	Various forms of pre- and post-processing buffers organize administrative work in practice, deal with the fragmentation of the work process, and signal the current work status.	Design should support buffering, including means for pre- and post-processing buffering. Design should provide features of both functions of buffers: Temporal, enabling different work rhythms and signaling work status. Spatial, raising awareness and embodying the work in the social space of the household.
Living documents	Invoices are not immutable pieces of information but living documents edited by household members over time.	Design should provide means for labeling, marking, annotating, and putting records together. Typical ways of labeling and marking should be efficient, but non-anticipated cases should also be possible.
Task Awareness	Some tasks are tied to deadlines that are often overlooked due to a lack of awareness.	Design should support task and deadline awareness (such as paying a bill, canceling a contract, or making the tax on time) and warn the user actively if needed.
Archiving support		
Archiving	Archiving invoices is a common practice for maintaining the household's organizational memory.	Design should support the archiving, including means for filling, sorting, retrieving, and cleaning up.
Ordering	Invoices and other records are stored by various ordering principles in practice.	Design should support a set of common ordering principles (such as chaotically, chronologically, thematically, alphabetically), but enable users also to store them based on their own ordering principles.
Retrieving	There is a tension to avoid investing time in sorting but aim to retrieve records efficiently.	Design should be aware that people do not want to spend time in filling and sorting but still want to retrieve records in a reasonable time.
	Retrieving records is typically caused by a special task (like tax submission).	Design should support task-related retrieving of single documents but also document collections that are needed for the task at hand.
Cleaning up	Invoices do not have a fixed expiration date, but there is tension to keep records permanently and secure while having a clean and proper archive.	Design should provide means to ensure the long-term availability of the household's archives. Design should provide means to clean up archives, but people fear of throwing away crucial documents accidentally.

Additional demands		
Cooperation	Dealing with an invoice is a matter of cooperation and division of work.	Design should provide means for cooperation, shared document spaces, and informal division of work (such as division by topic, by specialization, by dispatching)
Hybrid-icity	Dealing with invoices refers to hybrid practices, where analog and digital channels, records, tools, and archives co-exist in parallel.	Design should acknowledge the fragmented nature of invoices, which can exist in both analog and digital formats, and may also have redundant copies (such as when invoices are printed out or scanned). Design should facilitate the transition, referencing, and linking between digital and analog artifacts throughout the entire lifecycle of invoices, encompassing their acquisition, buffering, processing, and archiving stages.

Ethnographically informed workplace studies should not be reduced to simplistic ‘implications for design’ (Dourish 2006), but they can sensitize designers to contextual needs and providing accounts for the way people accomplish order (Schmidt 2000). With this in mind, we have listed in Table 5 the insights gained from our study and the design guidelines derived from them.

Table 5 shows why general-purpose groupware, such as shared file systems, messengers, and email systems, are preferred in practice over specialized solutions. Specialized solutions are mainly designed as single-user applications, whereas general-purpose groupware better addresses the cooperative nature of domestic work. In addition, specialized solutions tend to be designed for the ‘rational user’ enforcing rigid process models, whereas groupware is more flexible regarding work styles, usage goals, and self-designed ordering systems (Whittaker and Sidner 1996; Bellotti et al. 2002; Balogh et al. 2022). Furthermore, as invoices increasingly arrive via email, email-based invoice management reduces the burden of import activities, pre-processing and post-processing them.

Table 5, however, also points to existing shortcomings of specialized systems and general-purpose groupware. None of these solutions address the hybrid character of invoice management very well. This lack includes the transition from paper-based to electronic documents and vice versa. Moreover, appropriate solutions are needed to support people to deal with the co-existence and messiness of hybrid ordering systems, where the spatiality of placement tasks and documents is critical.

Last, but not least, instead of enforcing one single task model, the design must be open and should provide means for manifold tasks, such as paying a bill or retrieving documents for tax purposes. Instead of using a prescribed process model as a design guideline, we should adopt the support lens of CSCW, providing resources that help users organize their personal records and accomplish the task at hand.

4.7 Limitations

Our primary aim was to make marginalized practices visible, yet future research should investigate in more detail, how these practices will be accomplished by marginalized people. In this respect, our study has several limitations. The study is based on the principles of qualitative research and has a limited sample size, which does not allow for quantitatively supported generalizations. While we reached theoretical saturation about the main categories identified through the seventeen interviews, it should be noted that we only interviewed people from Central-Western Germany. As sociological and cultural factors can influence invoice management practices, the practices we observed may differ in other cultures, countries, and regions. Additionally, it is possible that the results were influenced by the homogeneity of the sample, which was selected using the snowball method and may have been composed of people with good education, parental guidance, and income. It is possible that other groups, such as those with lower levels of education, do not use any invoice management practices or utilize different practices.

4.8 Conclusion

There is a growing trend towards electronic invoices. This digitization promises to be eco-friendly and improve process efficiency. However, we must not reduce invoices to their informational content; they are also socially embedded artifacts that are integrated into established household routines, where people organize, coordinate, and articulate their invoice work. In addition, for many people, archived invoices serve as a financial memory for their household.

However, uncovering the artful work of dealing with invoices in research and design also supported our aim to bring to the fore this mundane work that is usually taken for granted. It became clear that household accounting has no price, but a value. Furthermore, although managing invoices is not a formally recognized profession, it is by no means unskilled work. It involves responsibilities, competencies, specialization, and delegation, and requires collaboration.

Following the actors along their paper trails, we reconstructed in minute detail the domestic life of invoices and the ordering system to manage them. Although the practices of our respondents were unique, our study showed that there were recurrent patterns in terms of temporal processing, applied ordering principles, and physical locations. These places were

carefully designed to bring attention to the work of managing invoices, but also to hide it when necessary. This interplay of making visible and masking focuses on the unique nature of the domestic context as a place of work and leisure at the same time.

This study demonstrates how to apply a CSCW lens to the domestic context to inform and sensitize designers of consumer software to the importance of supporting established routines. The next step would be to conduct design case studies (Shankar et al. 2020; Wulf et al. 2011) implementing support systems for household accounting and examining their appropriation by consumers.

5 The Burden of Administrative Household Labor—Measuring Temporal Workload, Mental Workload, and Satisfaction

5.1 Abstract

This research paper investigates the temporal and mental workload as well as work satisfaction regarding bureaucratic, administrative household labor, with a focus on socio-demographic differences. The study utilizes a paid online survey with 617 socio-demographically distributed participants. The results show significant differences in the temporal workload of different chore categories and in the quality of work, whereby satisfaction and mental workload are examined. In addition, the influences of gender, age, and education are analyzed, revealing differences in temporal and mental workload as well as work satisfaction. Our findings confirm prevailing literature showing that women have lower work satisfaction and a higher workload. In addition, we also discovered that younger people and groups of people with higher incomes have a higher level of satisfaction and a higher workload. In our study, a perceived high mental workload does not necessarily go hand in hand with a low level of satisfaction. This study contributes to the understanding of the bureaucratic burden on adults in their households and the variety of activities to manage private life.

5.2 Introduction

Domestic life is often portrayed as a private, relaxing, and entertaining sphere that is not worthy of serious investigation (Hayden 1982b). However, feminism has challenged this notion, highlighting that the domestic context is characterized by a multitude of obligations, unpaid labor, and an unequal distribution of tasks (Hayden 1982b; Hochschild 1989; Mederer 1993).

Most research in this area has focused on daily chores, which arise internally within the domestic environment, such as cleaning, cooking, and caregiving, to keep the household running. In addition to these internal chores, this paper focuses on the various tasks that are influenced by external factors, stemming from the structural coupling of the household with its broader environment. One prominent example is the administrative work necessitated by bureaucratization (U.S. OMB 2022; U.S. OMB 2023). These tasks include managing invoices, handling official documents, coordinating with service providers, and navigating various regulatory requirements. The impact of these external chores is significant, as they represent an additional layer of complexity and workload to the household. Unlike the predictable routine

of internal chores, administrative tasks often require interactions with external entities and adherence to external schedules and regulations.

The fulfillment of such administrative work constitutes a bureaucratic burden, which is part of daily household labor (Emens 2015; Dethier et al. 2024a). Compared to household chores, such as cooking, cleaning, or caring, administrative household labor is mainly cognitive and invisible work that is difficult to quantify (Hochschild 1989; Mederer 1993; Daminger 2019). Nevertheless, it shares with these other tasks the characteristic that it is unequally distributed within the household generally, for example, between women and men (DeVault 1991; Twiggs et al. 1999; Coltrane 2000; Offer 2014; Moreno-Colom 2017; Ciciolla and Luthar 2019).

Administrative household labor represents the work after work, which has social value but not a monetary price (Hochschild 1989). Its costs are discernible in terms of expended time as well as the impact on personal well-being (Pandve 2017). While the negative effects of excessive bureaucracy are well-known in organizational science (Koppes 2014), they are commonly neglected concerning private life. This also resulted from the fact that domestic work in general is invisible, informal, boundaryless, enduring, and difficult to articulate (Illich 1981; Daniels 1987; DeVault 1987; DeVault 1991; Mederer 1993; Winkler and Ireland 2009; Daminger 2019; Dean et al. 2022).

Overall, the prevalence of bureaucratization is undeniable, but its impact on household labor is under-explored, in terms of both temporal and mental workload. For this reason, we conducted a paid online survey to answer the following research questions:

- RQ1) In terms of quantitative workload, what amount of time do individuals spend on different everyday administrative tasks?
- RQ2) In terms of qualitative workload, how do individuals perceive administrative work and its mental demands?
- RQ3) In terms of socio-demographics, are there any differences in both the quantity and quality of work?

Investigating these research questions contributes to gaining a deeper understanding of the effects of bureaucratization on private life as well as identifying potential differences between different population groups.

5.3 Literature review of administrative household chores

Household administration has become increasingly recognized as a distinct area of study over the past few decades (DeVault 1987; Hochschild 1989; Mederer 1993). This kind of labor encompasses activities such as filing tax returns, managing insurance claims, renewing licenses, canceling contracts, etc. (Mederer 1993; Twiggs et al. 1999; Emens 2015; Daminger 2019; Emens 2019).

Understanding this kind of labor requires moving beyond the traditional view of the household as an isolated unit. Instead, households function as social systems that are structurally coupled with their external environment (Luhmann 1988; Luhmann 2020). This coupling is manifested by administrative chores, which are deeply intertwined with the bureaucratic processes and requirements imposed through public authorities (U.S. OMB 2022; U.S. OMB 2023) and private companies (Emens 2015; Dethier et al. 2024a). They demand cooperation with external entities, adherence to regulatory requirements, and compliance with varying timelines and procedural norms. This external dimension of household labor adds complexity and stress to the everyday management of the household.

Currently, there is no unified taxonomy of the manifold administrative household chores. In this paper, however, we take into account the activities and categories that are often mentioned in the literature (see Table 6).

Goods and services. In modern consumer societies (Sassatelli 2007), consumers satisfy their wishes and needs through the procurement of goods and services. In addition to the price of the goods, conducting transactions on the market causes additional, often hidden costs (Williamson 1979). A specific transaction cost represents the consumers' administrative work involved in planning purchases, managing contracts, paying invoices, or dealing with problems in the provision of services. With the rise of double-income households, hiring household help has become a common practice to reduce housework time (Craig et al. 2016). Still, this domestic outsourcing also comes with an administrative overhead as appointments must be planned, employment contracts managed, etc. (Winkler and Ireland 2009; Emens 2015; Daminger 2019).

Table 6: Overview of administrative household activities

Category		Description
Goods & services	Transactional	Administration of the purchase and stocking of consumer goods (food, clothing, household goods, etc.) by creating shopping lists, researching information, comparing offers, etc. Not the purchase itself.
	Commodity products	Administration of the procurement, management, and termination of term contracts (electricity, water, gas, telephone, internet, streaming/newspaper subscriptions, etc.) by researching information, making comparisons, signing contracts, ensuring payment, enforcing termination, etc.
	Recurring	Administration of work/repairs in the house or on appliances/cars carried out by tradesmen, fitters, workshops, etc., by researching information, making comparisons, contracting, arranging appointments, etc.
	Transactional	Administration of work/repairs in the house or on appliances/cars carried out by tradesmen, fitters, workshops, etc., by researching information, making comparisons, contracting, arranging appointments, etc.
	Household services	Administration of recurring (household) services or employment of helpers (babysitters, cleaners, domestic help, tax consultants, private secretaries, etc.) by researching, contracting, arranging appointments, concluding an employment contract, if necessary, etc.
	Recurring	Administration of recurring (household) services or employment of helpers (babysitters, cleaners, domestic help, tax consultants, private secretaries, etc.) by researching, contracting, arranging appointments, concluding an employment contract, if necessary, etc.
Public authorities	Governmental affairs	Administration and handling of authority procedures or official matters (registration/registration, identity card, passport, residence permit, driver's license, etc.) by filling out forms, making and keeping appointments, ensuring that forms are up to date or expired, etc.
	Tax affairs	Administration and handling of tax matters and interaction with the tax office (for income tax, real estate transfer tax, flat rate withholding tax, etc.) through information research, preparation of declarations, submission of documents, etc.
Health and insurance	Insurance management	Administration of the settlement of insurance claims for property insurance (liability, household contents, motor vehicle, cell phone, etc.), including all activities of filing or asserting claims.
	Health management	Administration in the handling of a claim concerning health care, illness, and nursing care (this may include arranging appointments, applying for benefits, submitting receipts, checking payments, etc.), not the visit to the doctor itself.
Supportive activities	Household accounting	Planning/controlling/analyzing everyday expenses and account movements, keeping household books, carrying out banking transactions, etc.
	Private asset management	Administration of long-term investment decisions, private pension savings, and asset management (real estate, shares, funds, etc.) through information research, comparisons, support, maintenance, etc.
	Document management	Management of documents of all kinds, such as official documents (ID cards, passports, tax assessments, etc.), private business documents (contracts, invoices, receipts, etc.), as well as other documents (certificates, wills, etc.) by filing/archiving, retrieving, etc.
	Problem management	Dealing with problems (with invoicing, services/quality, etc.) with companies, authorities, business partners, etc., including all activities for complaints, clarification, or correction of deficiencies

Note: Task categories are collected from various qualitative studies (Mederer 1993; Emens 2015; Daminger 2019).

Authorities. Another source of administrative housework is excessive government bureaucracy. By law and regulations, private individuals must interact with public authorities to obtain identification cards, report address changes, apply for driver's licenses, collect records, and file annual tax returns, etc. (Emens 2015). The United States Government (2015),

for instance, estimated that the paperwork burden in the US that has been caused by administrative issues amounted to 9.43 billion hours in 2014.

Health and insurance. In modern societies, a freely functioning insurance market has been established, enabling individuals to procure insurance coverage against a variety of life risks (Pearson 1997). Yet, insurance contracting leads to administrative burdens in two respects: firstly, consumers have to assess future risks, find trustworthy providers, and conclude contracts that are often complex and opaque (Tennyson 2011). Secondly, in the exceptional case of an incident or loss, consumers have to document damages and apply for reimbursements, often resulting in disputes among the parties that have to be settled (Tennyson 2011; Emens 2021). Health insurance is a special case in this regard (Brown and Finkelstein 2008). Concerning administrative work, health incidents trigger a series of administrative procedures, including organizing doctor's appointments and notifying employers, etc. (Mederer 1993). Especially for chronically ill persons, this can result in significant time expenditures (Emens 2021).

Supportive activities. Administrative work also includes a series of supportive household management activities to plan, organize, and monitor the household administration as a whole (Arienzo 2022). An example of such secondary activity is financial management at home, where we can distinguish between household accounting (Mederer 1993; Northcott and Doolin 2000; Walker and Llewellyn 2000; Hawkins and Bischoff 2003; Molina 2011; Emens 2015; Daminger 2019) and private asset management as part of financial provision (Campbell 2006). Corresponding administrative work includes planning financial investments, searching for reliable information, and seeking advice from financial experts, etc. (Campbell 2006). In addition, domestic practices of doing paperwork and document management (Walker 2008; Emens 2015) address the scriptural and documentation obligations of bureaucratic processes.

This brief overview illustrates the range of bureaucratic processes of companies and public authorities that households are confronted with. This applies to households in general, but it depends on their specific structure, skills, and needs as to how they cope with the bureaucratization of daily life and its associated temporal and mental burdens.

5.4 Methodological considerations

5.4.1 Measuring the temporal workload of domestic labor

In the literature, it is most common to quantify workload by measuring the time that people need to fulfill the task on average. Still, quantifying the extent and impact of administrative housework is methodologically challenging and various methods exist in the literature. They can be distinguished at the following levels: the timing of the survey (retrospective questionnaires or in situ time-budget studies), the used timescale (duration oriented and/or frequency oriented), and the used activity classification scheme (tailor-made categories or adapting categories of used secondary data).

Regarding timing, two main approaches can be distinguished. Firstly, the retrospective approach, which involves inquiring about the estimated amount of time spent on specific activities in the past. This approach is most common in the literature; however, it has the drawback that participants may not accurately remember the exact time spent when the activity is too far in the past. Secondly, the in situ approach aims to collect the data in near real-time during the task execution. Examples of this approach are ‘time diary’ and ‘point-in-time studies’, where participants were asked to report the activities undertaken during a specific day or time interval (Birch et al. 2009; Hurst 2015; BLS 2022). Point-in-time studies, however, are labor-intensive to implement and are therefore only used in large-scale national or cross-national time-budget surveys conducted by public authorities. Examples of such surveys are the Australian Time Use Survey, the Multinational Time Use Study (MTUS), the Harmonized European Time Use Survey (HETUS), or the most popular American Time Use Survey (ATUS) (Krantz-Kent 2009; Winkler and Ireland 2009; Möser 2010; Anxo et al. 2011; Moreno-Colom 2017; Craig and Powell 2018).

Regarding the timescale used in the survey, we can distinguish between the duration and frequency of activities. The duration-oriented scale asks participants how long an activity lasted. In retrospective surveys, however, the duration of activities is often recalled only vaguely. This is especially true for routine activities, which are systematically forgotten due to recall problems (Te Braak et al. 2023). Another challenge is the fact that household tasks are often performed in parallel with other activities (Winkler and Ireland 2009; Emens 2015). In addition, there are more general challenges in measuring time budgets, as some tasks might be carried out over several days, which makes them difficult to estimate for consumers filling out a one-time survey (Hamermesh et al. 2005).

All of this can lead to biases when the survey records only primary activities with a specific amount of time (Hamermesh et al. 2005). Therefore, to obtain a more robust measure, household activities should not only be measured by their duration but also by their frequency (Hurst 2015). Thus, frequency-oriented scales try to measure the activities by asking how many times an activity has been performed in, for example, a past period (Sonnenberg et al. 2012; Hurst 2015). In this way, an exemplary described activity can be reflected in terms of how often it was performed, for instance, in the last month.

Regarding the activity classification scheme, we can distinguish between the approaches of tailor-made and secondary data categories. This distinction arises because there is no standardized classification of household activities. Instead, the classification schemes used in surveys depend on the specific research question (Keith Bryant et al. 2004; Winkler and Ireland 2009).

The approach of using existing (secondary) data also relies on existing data categories, such as from the American Time Use Survey (ATUS) or the Multinational Time Use Study (MTUS). However, in order to align the data with the specific research objectives and make it interpretable, researchers usually reclassify the dataset in the case of secondary use by summarizing categories (Winkler and Ireland 2009). By doing so, researchers can leverage extensive datasets that have already been collected. However, the categories in secondary data cannot always be adapted, and important details may be lost when categories are combined. In such a case, conducting a survey with tailor-made categories becomes necessary. Since conducting time-budget studies is time-consuming (Sonnenberg et al. 2012) and involves substantially higher costs (Keith Bryant et al. 2004), the approach of tailor-made categories is mainly used in retrospective surveys, which are easier to implement.

Because of various methods measuring the temporal workload in the literature, absolute numbers must also be contextualized to interpret them correctly. Moreover, relative differences in the performance of household work will be more robust than absolute numbers. For instance, while the absolute temporal workload differs, numerous studies consistently reveal a relative disparity between genders (Hochschild 1989; DeVault 1991; DeVault 1991; Mederer 1993; Twiggs et al. 1999).

5.4.2 Measuring satisfaction and mental workload

“With rare exceptions, time-budget studies have not included measures of the satisfaction people derive from their activities. Similarly, questions about time-use and about the

subjective experience of specific situations are rarely included in surveys” (Kahneman et al. 2004).

Another limitation of time-budget surveys is that numbers do not capture the qualitative dimension of work, such as giving meaning to activities, work satisfaction, and the physiological and cognitive cost of household labor (Habib et al. 2010; Moreno-Colom 2017). Hence, time-budget surveys should be complemented by workload measures (Dean et al. 2022), acknowledging that optimizing work performance is not the only objective, and also also considering mental workload, satisfaction, and well-being (Pandve 2017).

The mental workload also depends on the nature of the work. In general, all kinds of housework involve physical, affective, and mental elements—but to varying degrees (Hochschild 1989; Dean et al. 2022). For instance, cleaning is more physically demanding, while care work is more emotionally demanding and affective (Lee and Waite 2005; Revenson et al. 2016). In contrast, in the case of cognitive labor, such as administrative work, organization, thinking, and planning are at the forefront (Mederer 1993; Voss and Rieder 2005; Daminger 2019). This nature of labor further includes decision-making authority, scheduling skills, and prioritization of tasks and activities (Offer 2014). Regarding this, Marut and Hedge (1999) found that some domestic tasks, such as scrubbing, are perceived as being more tiring than other domestic tasks, such as preparing meals. Dean et al. (2022) also note that cognitive labor comes along with a high mental workload, which is perceived as complex and mentally stressful (Damingier 2019).

Moreover, unlike the completion of physical tasks, the intangible nature of cognitive work often results in a lesser sense of satisfaction (Damingier 2019). However, there are also influences from the life situation of people: Kaye et al. (2014) show that, for low-income earners, dealing with invoices and personal finances can also be emotionally stressful. The workload perception further seems to be gender specific. For instance, Daminger (2019) notes that women are more likely to report stress, anxiety, and feelings of time constraints in doing household labor. When it comes to parenting, the different workloads beyond actual time is also related to a tendency of fathers to be more engaged in “fun” activities (Craig 2006).

As stressed by work economics, labor does not only cause stress and alienation but can also be a source of self-expression, satisfaction, and well-being (Sayers 2011; Ulich 2020). This is also the case for some household activities, as the myriad of “food-porn” (Koh 2017) and do-it-yourself posts on social media demonstrate (Collier and Wayment 2018). Regarding bureaucratization, Emens (2015), however, notes that administration chores are typically

associated with negative connotations as undesirable, annoying, and tiresome tasks. However, we are not aware of any study that has attempted to empirically measure this assumption. In a similar vein, Dean et al. (2022) note that there are a lack of appropriate instruments to measure the mental workload of cognitive housework.

In organizational psychology and human factor research (Koppes 2014), workload assessment has a long tradition with the goal of gaining a profound understanding of the workload and stress experienced by employees. In the Anglo-American context, the NASA Task Load Index (NASA-TLX) (Hart 2006) is a well-established tool used to measure the perceived workload of individuals engaged in various tasks. Similarly, the Job Satisfaction Questionnaire (JSQ) (Smith 1969) is widely employed to assess employees' satisfaction with their jobs. In addition, there are more holistic measurement methods such as KFZA (Prümper et al. 1995) or KAFA (Haarhaus 2016) to evaluate humane working conditions in terms of goal setting, self-monitoring, feedback mechanisms, and the adaptation of strategies to achieve desired outcomes. While these instruments were originally developed concerning organizational context, various researchers have adopted these instruments to the domestic context, to study the workplace ergonomics of household chores (Stübler 1986), the mental workload of physical household activities (Dunckel 1999; Resch 1999), and the stress and physical strain associated with these activities (Albert and Härtig 2014). To the best of our knowledge, there is currently no application of such methods for measuring the mental workload and work satisfaction in administrative household activities.

5.5 Methodology

To answer our research questions, we conducted an online panel survey in Germany in which we asked the participants about the various administrative housework activities, how much time they spend on such activities, and how they perceive the work.

5.5.1 Measures and procedure

We operationalize our research questions through a systematic process. Firstly, we adopt the classification scheme outlined in Table 6. For each category, we have created an introductory text that explains the category and provides examples (cf. Appendix A) for the category description used.

Secondly, we operationalize the temporal workload by taking recommendations from the literature (Keith Bryant et al. 2004; Winkler and Ireland 2009) into account, asking questions

about duration as well as frequency to make the results more robust (cf. Appendix B). To reduce the recall bias in surveys (Te Braak et al. 2023), we did not ask about the task duration in general but only asked about the duration of the last task that was performed. Thirdly, we operationalize the issues of work quality by adopting four items from the KFZA short-scale questionnaire (Prümper et al. 1995) (cf. Appendix B) as well as seven items from the KAFA short-scale questionnaire (Haarhaus 2016) (cf. Appendix B). Both questionnaires are established measures in human factor research to measure workload and work satisfaction. As they never apply to administrative household labor, we analyzed their validity by conducting an explorative factor analysis (EFA) (Malhotra et al. 2017). To confirm the hypothesis that administrative tasks are primarily cognitive, we added one question in our survey on the nature of the work (cf. Appendix B).

To avoid statistical bias, each participant was asked to answer the questionnaire for two, randomly selected household chore categories. This random assignment ensured that the task type did not correlate with socio-demographic factors, preventing any confounding effects that might arise if differences in socio-demographic factors were influenced by the task type. By controlling for task type in this manner, we aim to isolate the true impact of socio-demographic variables on the observed outcomes, ensuring that our analysis accurately reflects the relationships between these factors and the various household administrative tasks.

If a participant indicated that they had never performed a particular chore in the past, the corresponding set of questions was omitted. By omitting these questions, the responses became more reliable and accurate, as participants were not forced to provide information about household chores they had never performed.

The survey was conducted as follows: First, there was a general introduction to the background of the study and administrative housework. Then there were two rounds, in each of which one category was selected at random. The category was introduced at the beginning of each round with a picture and descriptive text. Then, participants were asked to answer questions about the temporal workload. Next, participants were asked to rate the work quality of the respective category. Finally, participants were asked demographic questions (gender, age, household income, and level of education).

The survey was pretested twice. The first version was tested with 10 persons. We asked them to think aloud while filling out the survey to determine if the questions and descriptions were understood correctly, or if they were too complex. The revised version was completed online by 60 people as a second pretest. The results show that some questions were too complex so we either rephrased or dropped them.

5.5.2 Sample and data cleaning

The final survey was conducted between October and November 2023, utilizing a paid online panel. The online panel was provided by the market research institute Question Pro GmbH (Berlin, Germany), which was also tasked with recruiting a sample that should correspond to the German population in terms of gender and age. For this, Question Pro GmbH was compensated with a total EUR 2700 for the 617 participants (EUR 4.5 per participant; 17 participants were free of charge for us). The participants granted their informed consent at the beginning of the study and thereby approved the use of the anonymized data for the scientific study.

Table 7 shows the demographics of the sample. The age of the participants ranged from 18 to 85, with a mean age of 46 (SD = 17.0). Regarding gender distribution, 49.8% identified as female, 49.8% as male, and 0.5% as non-binary. The median of the education level reported was completion of vocational education, and the median of the household income reported was between EUR 1200 and 2500 net (cf. Table 7).

Table 7: Demographics of the sample

Characteristic	Value	$N_{(p)articipants}$	Percentage	Mean (SD)	Min	Max
Gender	Female	307	49.8%	45 (17)	18	85
	Male	307	49.8%			
	Non-binary	3	0.5%			
Age	Not known	17	2.7%			
Income	<EUR 1.2 k	87	14.1%			
	EUR 1.2 k–2.5 k	189	30.7%			
	EUR 2.5 k–5 k	250	40.6%			
	>EUR 5 k	74	12.0%			
Education	School or lower	101	16.4%			
	Vocational education	361	58.5%			
	University or higher vocational education (master)	155	25.1%			

After the data cleaning process, which entailed the removal of incomplete questionnaires, we had a total of $N_{p(articipants)} = 617$ entirely completed surveys. Every participant was given questions on two randomly selected task categories, amounting for $2 \times 617 = 1234$ question blocks in total. In 102 (8.3%) of the cases, participants reported they had never engaged in this type of housework activity in the past. In these cases, we did not require the participant to

complete the question block but instead treated these blocks as missing data and excluded them as a standard data-cleaning technique. Due to a technical problem, one block of answers was also damaged, so we excluded it from the analysis. This resulted in a total of $N_{c(ases)} = 1131$ valid responses to the different household chores.

5.5.3 Limitations

We used an online panel for our study, as this is a recognized and widely used method in the literature. However, like all online panel studies, our study is subject to several limitations.

Research shows that participants in such panels tend to be younger and more educated, which can influence the generalizability of the findings (Buhrmester et al. 2011). As Table 7 shows, this is not the case with our sample.

Another concern can be that the exact recruitment process and compensation of participants are proprietary secrets of the online panel providers. This lack of transparency can raise concerns about self-selection effects and potential biases in participant recruitment and engagement (Goodman et al. 2013). Still, previous research shows that online panel studies often yield results similar to those from more traditional samples, especially concerning psychological and social measures (Buhrmester et al. 2011).

The lack of control about when and where the questionnaire will be filled out, and due to incentives, there is also the risk that participants provide hurried or inattentive answers. Besides the checks implemented by the panel provider to mitigate this risk, we additionally checked the meaningfulness of responses to open-ended questions.

Another limitation relates to our retrospective approach, where there is the risk that activity duration might not be accurately recalled (see Section 3). To reduce this risk, we asked to estimate the average task duration (which is mental), but of the last occurrence only (which is easier to recall). We also asked about the frequency of activities, which is generally more reliable. Additionally, our large sample size helps to balance out individual inconsistencies.

5.5.4 Data analysis

Before the data analysis, the survey data underwent a screening process to identify outliers and improper and incomplete data. Subsequently, to assess the data and gain an overview, descriptive statistical methods were employed, including the computation of frequencies, means, and standard deviation (SD). For non-metric scales, we computed the median and interquartile range (IQR) as more robust metrics (Malhotra et al. 2017). In addition to the

descriptive statistics, inferential statistics were used to draw conclusions about the entire sample (Eid et al. 2015). Analyzing the differences among various socio-demographic groups, we applied analysis of variance (ANOVA) for metric scales, and a Kruskal–Wallis (H) test for ordinal scales (Malhotra et al. 2017). For the adapted items from KFZA and KAFA, the EFA was part of the sociometric scale validation (Moosbrugger and Kelava 2011) using R (version 4.3.0, 21 April 2023) and the psych package (version 2.3.9).

5.6 Findings

5.6.1 Temporal workload

We quantify the temporal workload of various administrative work activities using two measures: the frequency of task execution and the duration of the most recent task performed (cf. Table 8). Using both metrics enhances the robustness of the results; as in surveys, retrospective reports of task duration tend to be imprecise (Keith Bryant et al. 2004; Winkler and Ireland 2009). For time-related data, we also limit the use of the median as a robust statistical measure of central tendency.

As mentioned, in 102 (8.3%) of all cases, participants answered that they had never performed the activity in the past. This was most prominent in the category of recurring household services (such as domestic help, babysitters, etc.) with $N_c = 19$ (20.9%), in private asset management with $N_c = 14$ (14.4%), and in health management with $N_c = 16$ (15.0%).

Across different categories, administrative household labor displays significant variations. For instance, participants engage in procurement planning (Commodity products transactional) every week, while they only address tax returns once a year on average. In contrast, the median duration for the first category was approximately 30 min, whereas for the second category the duration was notably longer, averaging approximately 3 h.

To ascertain the monthly overall effort involved in administrative household labor, we calculated the average monthly total effort for each category by multiplying frequency and duration and then aggregating the totals (mean of the intervals). This calculation indicates that participants spend an average of approximately 7.2 h per month on administrative household labor. Even if this is only a rough estimate due to survey imprecision, it is in the same order of magnitude as other time-budget surveys, such as ATUS (U.S. Department of Labor 2023).

In addition to the absolute numbers, the relative differences between the categories are quite informative. As can be seen in Figure 1, three to four areas can be identified: The focal point is

the middle range, where household labor occurs monthly and typically requires about one hour of effort. Representing this category are tasks related to the management of household services and utilities such as electricity, water, and gas. This area also includes administrative tasks and asset management, even if they occur less frequently. Further, problem management, health management, and document management fall into this area, whereby the completion of the corresponding tasks is shorter. Two other areas also stand out. Firstly, the frequent but brief tasks, such as planning purchases and monitoring income and expenditure. Secondly, the infrequent but time-consuming tasks represented by making tax returns annually. A fourth area is given by insurance management as it is distinguished by the fact that it has a similar frequency as tax returns but is less time-consuming on average.

Table 8: Temporal workload of the administrative household activities

Category		N _{c(ases)}	Frequency of the Chores			Duration of Last Case		Freq. × Dur.
		All	Never	Median	Q1–Q3	Median	Q1–Q3	Mean
Commodity products (trans.)		116	1	weekly	m.t. a week—weekly	30 min	15 min–1 h	~90 min p.M.
Household accounting		114	6	weekly	m.t. a week—m.t. a month	30 min	15 min–1 h	~90 min p.M.
Health management		107	16	m.t. a month	weekly—m.t. a year	30 min	15 min–1 h	~45 min p.M.
Commodity services (recur.)		95	4	monthly	m.t. a week—annually	1 h	15 min–1 h	~45 min p.M.
Household services (trans.)		104	11	monthly	weekly—m.t. a year	1 h	15 min–3 h	~45 min p.M.
Private asset management.		97	14	monthly	m.t. a month—m.t. a year	1 h	15 min–1 h	~45 min p.M.
Document management		109	5	monthly	weekly—m.t. a year	30 min	15 min–1 h	~25 min p.M.
Problem management		95	3	monthly	weekly—m.t. a year	30 min	15 min–1 h	~25 min p.M.
Household services (recur.)		91	19	m.t. a month	m.t. a week—m.t. a year	1 h	30 min–3 h	~10 min p.M.
Governmental affairs		106	6	m.t. a year	m.t. a month—annually	1 h	15 min–1 h	~10 min p.M.
Tax affairs		103	8	annually	m.t. a month—annually	3 h	1 h–3 h	~10 min p.M.
Insurance management		96	9	annually	m.t. a month—l.t. annually	1 h	15 min–3 h	~5 min p.M.
Total		1233	102					~7.2 h p.M.

Note: Never = an activity was never carried out in the past; Q1 = first quantile; Q3 = third quantile; m.t. = multiple times; l.t. = less than; p.M. = per month; sorted in descending order of frequency.

Table 8 further shows another important finding: The interquartile range (Q1–Q3) shows a remarkable variance between the respondents. The wide spread of the range indicates that there are considerable differences, not only among the categories but also within the categories in

terms of the temporal workload of individuals. In other words, even though they live in an equally bureaucratized environment, they have developed individual strategies for structuring the work involved in terms of time.

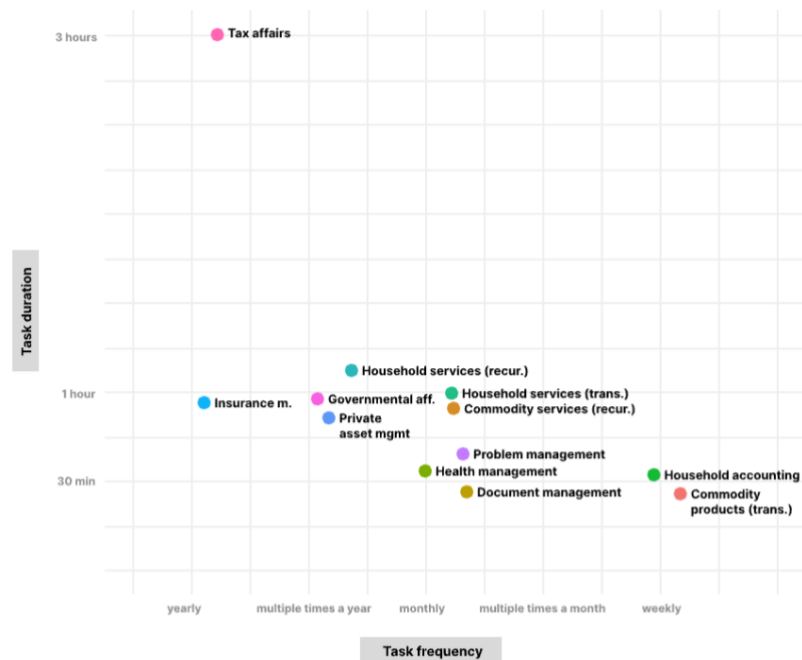


Figure 8: Frequency and duration comparison.
Note: The dots represent the median.

5.6.2 Nature of work

Each task requires varying degrees of physical, emotional, and cognitive work (Hochschild 1989; Dean et al. 2022). Administrative work is often described as being primarily cognitive (Emens 2015). This view is confirmed by our survey. On average across all categories, 64.0% of participants state that administrative tasks are primarily cognitive, 24.1% of participants describe it as primarily emotional work, and only 11.8% describe it as primarily physical (cf. Table 9). This shows that administrative chores are perceived primarily as cognitive, but also have an emotional as well as a physical component.

However, there are large fluctuations between the individual categories. The top three cognitive activities are managing recurring commodity services (74.7%), tax affairs (74.7%), and insurance management (69.0%). This could be attributed to the fact that these activities deal with complex contractual clauses and administrative regulations. In comparison, the planning and organization of procuring commodity products (transactional) is far less complex, which explains why only 57.4% stated that this is primarily a cognitive task, but also as emotional (33.0%).

Table 9: Percentage of respondents classifying the identified work categories as having more of a cognitive, emotional, or physical nature

	N _c	Cognitive	Emotional	Physical
Total	1131	64.0%	24.1%	11.8%
Commodity Services (recurring)	91	74.7%	16.5%	8.8%
Tax Affairs	95	74.7%	16.8%	8.4%
Insurance Management	87	69.0%	20.7%	10.3%
Document Management	104	65.4%	23.1%	11.5%
Governmental Affairs	101	63.4%	20.8%	15.8%
Health Management	91	62.6%	24.2%	13.2%
Household Accounting	108	61.1%	23.1%	15.7%
Household Services (recurring)	72	61.1%	23.6%	15.3%
Problem Management	92	60.9%	32.6%	6.5%
Household Services (transactional)	93	59.1%	23.7%	17.2%
Private Asset Management	83	59.0%	31.3%	9.6%
Commodity Products (transactional)	114	57.4%	33.0%	9.6%

Note: N_c: number of cases.

At first glance, the low rating of private asset management was surprising. Only 59.0% describe this type of work as primarily cognitive, while at 31.3%, a fairly large proportion of participants, described the situation as primarily emotional. Still, this is in line with Kaye et al.'s (2014) observation that dealing with one's own financial situation is an emotional issue. However, health management has the highest share, with 24.2% classifying it as primarily emotional work. This finding is consistent with the fact that health and care work in general has a high need for empathy and emotional involvement (Craig 2006; Revenson et al. 2016; Emens 2021).

As mentioned, most participants do not regard administrative activities as physical work. The highest physical component is household services management, with 17.2% of respondents. This relatively high proportion aligns with the existing literature, which discusses physical aspects such as overseeing craftsmen, handing over keys, etc.

Overall, our survey confirms the cognitive nature of administrative work. Furthermore, our findings underscore Dean et al.'s (2022) argument that the emotional component of mental work should not be overlooked. The detailed category system we used in the survey offers additional insights, shedding light on the proportion of the different nature of work among the categories and emphasizing the significant differences.

5.6.3 Quality of work

We adopted seven items from the KAFA and four items from the KFZA. Both are established work economic measures, but so far they have only been psychometrically validated within the organizational context only. For this reason, we analyzed the validity of the scale. In the first step, the Kaiser–Meyer–Olkin test ($MSA = 0.85$) showed the adequacy of the dataset for factor analysis. The analysis of the eigenvalues of principal factors showed that two factors are above one, while the others are below. For that reason, we conducted an EFA with two factors, using varimax as the rotation method, minimum residual as the factor model estimation method, and performing a maximum of 1000 iterations (cf. Table 10).

Table 10: Factor loadings of the explorative factor analysis (EFA)

Item	M1 (Workload)	M2 (Satisfaction)	Com.	Uni.	Compl.
I find such activities stressful.	0.774	−0.249	0.662	0.338	1.21
I am often under time pressure.	0.725	0.043	0.528	0.472	1.01
I have too much to do.	0.710	0.071	0.509	0.491	1.02
There are things that are too complicated for me.	0.663	−0.037	0.441	0.559	1.01
The activities are not to be wished on anyone.	0.612	−0.318	0.476	0.524	1.50
The activities are exciting.	0.137	0.812	0.677	0.323	1.06
I like the activities.	−0.070	0.790	0.629	0.371	1.02
I find the activities pleasant.	0.004	0.732	0.536	0.464	1.00
The activities challenge me.	0.466	0.240	0.274	0.726	1.50
The activities bore me.	0.454	−0.412	0.375	0.625	1.98
The activities are uninteresting.	0.407	−0.458	0.375	0.625	1.97
SS loadings	3.055	2.428			
Proportion Var	0.278	0.221			
Cumulative Var	0.278	0.498			

Note: The used factor method: Minimizes residuals. Rotation varimax. High loadings are in bold.

The results show that these two factors collectively account for 49.8% of the total variance. Examining the factor loadings provides further insights into the nature and interpretation of the two main factors. The first factor (named “mental workload”) primarily comprises the mental workload measured by items such as working stress, time pressure, too much work, too complex, and not wished on anyone. The second factor (named “satisfaction”) refers to the work satisfaction measured by items such as being excited, liking it, and finding it pleasant.

Other items such as interesting, boring, and challenging have neither a high loading to the first nor to the second factor.

In the subsequent analysis, we utilized newly created non-standardized factor scores instead of the raw item values. These non-standardized scores were derived to represent the underlying constructs more accurately and were calculated by averaging the non-standardized item responses associated with each factor. The non-standardization improves the interpretability, where factor scores with a value of 3.0 can be interpreted as neutral, while a value of 1.0 means low mental workload/satisfaction and a value of 5.0 means high mental workload/satisfaction.

The findings show that, across all categories, participants on average maintain a neutral stance towards administrative household tasks (cf. Table 11). This applies to both the perceived mental workload (mean = 3.00, SD = 1.56) as well as work satisfaction (mean = 2.97, SD = 1.39). The neutrality in their attitude towards mental workload suggests that they likely perceive it as neither excessively burdensome nor exceptionally light. Similarly, the neutral stance on job satisfaction suggests that participants neither find significant fulfillment nor dissatisfaction in their engagement with administrative household tasks. Carrying out bureaucratic tasks is a job that needs to be done, yet it is not one of the domestic work “fun” activities (Sullivan 1996; R. Fluegge-Woolf 2014).

Table 11: Perceived mental workload and satisfaction in the various work categories

Category	N _c	Mental Workload		Satisfaction	
		Mean	SD	Mean	SD
Total	1131	3.00	1.56	2.97	1.39
Tax affairs	95	3.62	1.61	2.66	1.50
Private asset management	83	3.27	1.30	3.34	1.36
Household services (recur.)	72	3.24	1.35	3.15	1.50
Problem management	92	3.15	1.42	2.66	1.34
Insurance management	87	3.13	1.58	3.00	1.40
Commodity services (recur.)	91	3.01	1.46	2.80	1.57
Household services (trans.)	93	3.00	1.36	3.17	1.23
Governmental affairs	101	2.95	1.70	2.65	1.48
Health management	91	2.85	1.45	2.81	1.33
Household accounting	108	2.73	1.83	3.29	1.24
Document management	104	2.72	1.63	2.65	1.37
Commodity products (trans.)	115	2.59	1.57	3.42	1.04

Note: 1 = low, 3 = neutral, 5 = high. High resp. low values are marked in bold. Sorted in descending order by satisfaction. N_p: number of participants. N_c: number of cases.

As for temporal workload, there are significant differences in work satisfaction and the perceived mental workload across the categories. This becomes evident when plotting the ratings on a 2×2 matrix (cf. Figure 2). The resulting four quadrants could be described as follows.

Quadrant I (Easy work getting fun): Tasks in the quadrant are likely to align with participants' preferences and contribute positively to their overall experience. A good example is the purchasing planning of commercial goods (cf. Figure 2). Shopping is not just a necessity, but also a means of self-gratification and identity formation (Belk 1988).

Quadrant II (Hard work but enjoyable): Tasks in this quadrant are challenging or demanding, but individuals find them enjoyable, perhaps due to a sense of accomplishment or personal fulfillment. An illustrative instance is private assessments, which are complex, demanding, and could be financially stressful. Still, people should be intrinsically motivated to care about their financial future, and people seem to derive gratification and personal growth by engaging with financial products.

Quadrant III (Simple but disliked work): Tasks in this quadrant are simple, but do not translate into a positive experience for participants. A notable case is document management (cf. Figure 2). This work is needed to maintain organization; it is also not inherently complex and can usually be done without time pressure. However, organizing documents does not provide a source of fulfillment, possibly due to lack of excitement and creativity.

Quadrant IV (Hard, unsatisfying work): Tasks in this quadrant are perceived as stressful, difficult, alienating, and demanding. They do not contribute to satisfaction at all. This is exemplified by activities such as filing tax returns (cf. Figure 2). The complexity and difficulty of this task, coupled with time pressure, the sense of vulnerability, and the perception of unfair treatment, lead to a sense of dissatisfaction.

Overall, our findings reveal that none of the quadrants in Figure 2 is unoccupied. This indicates that mental workload and satisfaction cannot be equated. Instead, a high mental workload may coexist with a sense of satisfaction, and vice versa. This demonstrates that making administrative household labor measurable requires both measures for the mental workload as well as for work satisfaction.

Figure 9 further shows that the rating of various administrative housework tasks tends to be neutral, both in terms of its burden and its satisfaction. This means that this kind of work does not stand out as particularly positive or negative in the memory but tends to remain inconspicuous.



Figure 9: Perceived mental workload and satisfaction.
Note: The dots represent the median

5.6.4 Socio-demographical differences

5.6.4.1 Gender

A well-explored topic in the literature is the unequal distribution of household labor overall. The works of Daminger (2019); Emens (2015), Hochschild (1989), etc. suggest that cognitive labor is also distributed unevenly. In the administrative tasks we examined, we were also able to identify a tendency towards a higher mental workload for women.¹ While the frequency is the same for both genders (median = monthly, Q1–Q3 range = weekly to multiple times annually), for women, the temporal workload is higher in terms of the task duration (female: median = 1 h, Q1–Q3 = 15 min–3 h; male: median = 30 min, Q1–Q3 = 15 min–1 h). As the scales used to measure frequency and duration are not metrically distributed, we opted for the non-parametric Kruskal–Wallis (H) test. In both frequency ($H(df) = 0.768(1)$, $p = 0.381$) and duration ($H(df) = 3.105(1)$, $p = 0.078$), gender differences were not statistically significant.

However, the gender differences are particularly pronounced in the rating of the quality of work. Men have a higher level of work satisfaction (mean = 3.08, SD = 1.33) than women (mean = 2.84, SD = 1.42). Conversely, men rate the mental workload lower (mean = 2.90, SD = 1.61) than women (mean = 3.09, SD = 1.50). Conducting an ANOVA shows that these gender-specific differences are significant for both mental workload ($F = 4.696$, $p = 0.030$, η^2

= 0.004) and work satisfaction ($F = 8.039$, $p = 0.0005$, $\eta^2 = 0.007$). Even though the effect size (η^2) is rather small in both cases, they are still significant (cf. Table 12).

Table 12: Differences between the sexes over all questions

	N _p	N _c	Never	Frequency Median	Q1–Q3	Duration Median	Q1–Q3	Satisfaction Mean (SD)	Men. Workload Mean (SD)
Female	307	571	43	monthly	weekly—m.t. a year	1 h	15 min–3 h	2.84 (1.42)	3.09 (1.50)
Male	307	554	59	monthly	weekly—m.t. a year	30 min	15 min–1 h	3.08 (1.33)	2.90 (1.61)
Non-binary	3	6	0	weekly	m.t. a week—annually	1 h	30 min–3 h	4.60 (1.30)	4.66 (1.66)
H-Test (df) ¹				0.768 (1)		3.105 (1)	F ¹	8.039	4.696
Asymp. Sig. ¹				0.381		0.078	P ¹	0.005	0.030
							η^2 ¹	0.007	0.004

Note: High resp. low values are marked in bold. N_p: number of participants. N_c: number of cases. Due to the low number of non-binary participants, we excluded them from the statistical analysis.¹ Q1: first quantile; Q3: third quantile; m.t.: multiple times; l.t.: less than.

Regarding the existing body of research on gender inequalities in the household, we did not observe gender differences regarding the temporal workload in our study. However, the difference was significant for other aspects, such as the perception of mental workload and satisfaction with the tasks performed. This result indicates the importance of considering the subjective experience of work when assessing the unequal burden of administrative labor across genders.

5.6.4.2 Age

In the literature on domestic labor, age differences have been scarcely explored so far. As bureaucratic demands vary across different life stages, it is reasonable that administrative housework differs among age groups. This is confirmed by our findings, both in terms of work quantity as well as work quality (cf. Table 13).

Table 13: Differences between the ages over all questions

	N _p	N _c	Never	Frequency Median	Q1–Q3	Duration Median	Q1–Q3	Satisfaction Mean (SD)	Men. Workload Mean (SD)
Young adults (18–29)	145	277	12	weekly	m.t. a week—monthly	1 h	30 min–3 h	3.41 (1.25)	3.44 (1.33)
Adults (30–62)	346	625	67	monthly	weekly—m.t. a year	1 h	15 min–1 h	2.82 (1.37)	3.11 (1.50)
Elderly (>63)	126	229	23	m.t. a year	weekly—annually	30 min	15 min–1 h	2.84 (1.46)	2.19 (1.69)
H-Test (df)				33.322 (1)		5.252 (1)	F	19.543	46.654
Asymp. Sig.				<0.001		0.022	p	<0.001	<0.001
							η^2	0.033	0.076

Note: High resp. low values are marked in bold. N_p : number of participants. N_c : number of cases. Q1: first quantile; Q3: third quantile; m.t.: multiple times; l.t.: less than.

Younger adults' complete tasks here more frequently (median = weekly; Q1–Q3 = multiple times a week to monthly) than adults (median = monthly; Q1–Q3 = weekly to multiple times a year), as well as elderlies (median = multiple times annually; Q1–Q3 = weekly to annually). Regarding task duration, the differences are smaller. The average task duration for young adults (median = 1 h, Q1–Q3 = 30 min–3 h) and adults (median = 1 h, Q1–Q3 = 15 min–1 h) is the same. In contrast, the task duration of elderlies is lower (median = 30 min, Q1–Q3 = 15 min–1 h). The Kruskal–Wallis (H) test shows that for both frequency ($H(df) = 33.322 (1), p = < 0.001$) and duration ($H(df) = 5.252 (1), p = 0.002$), age differences were highly significant.

The analysis of work quality reveals a surprising outcome. Among these groups, young individuals perceive the highest workload (mean = 3.41, SD = 1.25), while the elderly perceive the lowest workload (mean = 2.19, SD = 1.69). The surprising issue was that, despite the high mental workload, young individuals exhibited the highest work satisfaction (mean = 3.41, SD = 1.25), whereas it is considerably lower for adults (mean = 2.82, SD = 1.37) and the elderly (mean = 2.84, SD = 1.46). The ANOVA indicates that age differences are highly significant in both satisfaction ($F = 19.543, p < 0.001; \eta^2 = 0.033$) and mental workload ($F = 46.654, p < 0.001; \eta^2 = 0.076$). In the case of satisfaction, however, η^2 is rather small, which means that the age factor has a small but still significant impact. As η^2 shows, the effect of age on mental workload is quite high.

An explanation for the surprising observation might be that younger individuals may be more resilient and adaptable, allowing them to cope better with high workloads. It could also indicate a shift in preferences and attitudes toward cognitive work. It is important to note that this interpretation cannot be directly derived from the available numbers. Further research, especially in the field of age-related household labor studies, would be necessary to gain deeper insights into the underlying mechanisms and factors that contribute to the observed differences in the perception of workload and satisfaction.

5.6.4.3 Income

Income is another factor to be considered as it generally relates to access to resources, stress resilience, or time management (Marmot et al. 2013; Thilagavathy and Geetha 2021). Regarding this, monthly household income is a common indicator used to assess financial well-being, even though the financial situation is also affected by various household circumstances,

such as the number of family members, the employment status of household members, and their ages. In our study, we also adopt monthly household income as an indicator of financial well-being to evaluate its effect on administrative housework.

Our findings (cf. Table 14) show some small differences among income groups. Individuals with a household income of EUR 1200–2500 per month are, on average, least frequently engaged in administrative household labor (median = monthly, Q1–Q3 = weekly—annually). In contrast, the shortest task duration on average is for individuals with lower incomes (median = 30 min, Q1–Q3 = 15 min–1 h). The Kruskal–Wallis (H) test, however, indicates that the differences are small and only significant for task frequency ($H(df) = 8.709(3)$, $p = 0.033$).

Table 14: Differences between income groups over all questions

			Frequency			Duration		Satisfaction	Men. Workload
	N_p *	N_c *	Never	Median	Q1–Q3	Median	Q1–Q3	Mean (SD)	Mean (SD)
low (<EUR 1.2 k)	87	146	28	m.t. a month	m.t. a week—m.t. a year	30 min	15 min–1 h	3.01 (1.49)	3.17 (1.62)
medium (EUR 1.2 k–2.5 k)	189	345	33	monthly	weekly—annually	1 h	15 min–3 h	2.99 (1.37)	3.11 (1.46)
Medium-high (EUR 2.5 k–5 k)	250	470	30	m.t. a month	weekly—m.t. a year	1 h	15 min–3 h	2.92 (1.37)	2.80 (1.62)
high (>EUR 5 k)	74	141	7	m.t. a month	weekly—m.t. a year	1 h	30 min–3 h	3.14 (1.43)	3.26 (1.51)
H-Test (df)				8.709 (3)		7.237 (3)	F	0.926	5.181
Asymp. Sig.				0.033		0.065	p	0.427	0.001
							η^2	0.003	0.014

Note: High resp. low values are marked in bold. N_p : number of participants. N_c : number of cases. Q1: first quantile; Q3: third quantile; m.t.: multiple times; l.t.: less than. * 33 answers are not given, because 17 participants did not know their household income.

We further observe differences in work quality among income groups. Here again, we observe the surprising fact that a high mental workload does not necessarily correspond to low work satisfaction. Quite the contrary, for households with an income of more than EUR 5000 per month, the mental workload is the highest (mean = 3.26, SD = 1.51), yet they also have the highest work satisfaction (mean = 3.14, SD = 1.43). The ANOVA test, however, reveals that the effect is only significant in the case of mental workload ($F = 5.181$; $p = 0.001$; $\eta^2 = 0.014$).

5.6.4.4 Education

Administrative housework encompasses duties that demand cognitive skills such as arithmetic, reading, writing, and comprehension of complex texts and forms. Therefore, it is reasonable to

assume that education impacts both work quantity and quality. Our results, however, show a mixed result.

Regarding frequency, participants with higher education engage in administrative work more frequently (median = m.t. a month; Q1–Q3: weekly to m.t. a year) compared to others. The Kruskal–Wallis (H) test ($H(df) = 12.516$, $p = 0.002$) indicates that this difference is significant. Regarding task duration, our findings did not show a significant difference between the groups.

Concerning work quality, we expected that a higher education would accompany a lower mental load. Still, we could not observe a significant effect. Surprisingly, such an effect is noticeable in work satisfaction. Participants with a higher level of education generally report higher satisfaction. The ANOVA test ($F = 5.984$; $p = 0.003$; $\eta^2 = 0.010$) reveals that, while this effect is small, it is still significant (cf. Table 15).

Table 15: Differences in education over all questions

				Frequency		Duration		Satisfaction	Men. Workload
	N_p	N_c	Never	Median	Q1–Q3	Median	Q1–Q3	Mean (SD)	Mean (SD)
School or lower	101	179	23	monthly	weekly—m.t. a year	1 h	30 min–3 h	2.81 (1.48)	3.15 (1.45)
Vocational education	361	657	64	monthly	weekly—annually	1 h	15 min–1 h	2.91 (1.36)	2.92 (1.52)
University or higher vocational education	155	295	15	m.t. a month	weekly—m.t. a year	1 h	30 min–3 h	3.20 (1.37)	3.10 (1.70)
H-Test (df)				12.516 (2)		3.215 (2)		F	5.984
Asymp. Sig.				0.002		0.200		p	0.003
								η^2	0.010

Note: Q1: High resp. low values are marked in bold. N_p : number of participants. N_c : number of cases. Q1: first quantile; Q3: third quantile; m.t.: multiple times; l.t.: less than.

One possible explanation is that, due to their level of education, they have a more positive attitude towards cognitive tasks and enjoy more mentally demanding work. Still, further studies are needed to understand the observed effect in more detail.

5.7 Discussion

Administrative work and bureaucracy not only affect organizations but also everyday private life (Emens 2019). It is increasingly recognized that the extensive hours spent by citizens on bureaucratic processes lead to economic damage (U.S. OMB 2022; U.S. OMB 2023). However, the hidden costs on a personal level, such as mental workload, which involves feelings of stress,

anxiety, and alienation, are often neglected. Moreover, authors such as Daminger (2019), Emens (2015), and Hochschild (1989) have drawn attention to the fact that housework is not only materially shaped but also consists of a broad spectrum of administrative and cognitive work, which is often unequally distributed between the sexes. The underlying reason for the unequal distribution, according to Dean et al. (2022), is that this work is largely invisible and difficult to measure. The authors therefore call for research to focus more on measuring cognitive household labor and the resulting qualitative workload, even if the operationalization of valid measurement results requires innovative approaches (Damingier 2019). Furthermore, Daminger (2019) calls on future research to review the previous qualitative research on a representative basis for an entire population (of adults), as well as to investigate demographic differences between population groups.

In this regard, our study makes a significant contribution by offering a nuanced perspective by, firstly, examining the wide range of activities involved (Emens 2015) and, secondly, considering not only the temporal but also the mental workload associated with these tasks (Damingier 2019; Dean et al. 2022). Firstly, the classification scheme enabled us to gain a deeper understanding of administrative work within the household and how it is influenced by the external environment. Concerning the second, we have shown how methods for measuring temporal workload can be combined with methods for measuring mental workload to gain a comprehensive understanding of the nature of bureaucratic household labor.

Applying the measures in an online survey, we are gaining novel insights into the nature and quality of administrative work. Even if our study only focuses on the German population and the results cannot be easily generalized to other countries or cultures, our study further indicates that there are socio-demographic factors that can influence differences in the quantity and quality of perceived administrative work.

Doing the fun stuff. Regarding work quantity and quality, our survey shows that there are major differences among the various administrative household labor tasks in terms of satisfaction and mental workload. These differences may manifest themselves in the nature of the job, with complex, highly formalized, and alienating activities, such as tax affairs, or more self-fulfilling activities, such as shopping planning. Moreover, our results show that a high mental workload must not go hand in hand with low work satisfaction. Instead, the work quality depends on the nature of the work.

Previous studies show that a distinction can be made between physical, emotional, and cognitive housework (Hochschild 1989; Daminger 2019; Dean et al. 2022). In this respect, our study confirms that administrative work is primarily cognitive but also involves emotional and

physical components. However, our study also points to a second, relevant feature classifying household labor that has been underexposed in previous studies, namely the categorization of the work along the dimension of autonomy versus heteronomy. Heteronomous chores are highly constrained by external parties and bureaucratic demands. This includes chores such as problem management or tax returns, where people deal with legal issues. Moreover, they must rely on the cooperation of external authorities as being right does not mean getting justice. The system of the private household reacts (passively) to external influences and has little room for creativity or negotiation in this social process (Luhmann 1988; DeShon and Gillespie 2005). For most people, these chores therefore belong to the large area of “non-fun stuff” of household labor (cf. Figure 2, Quadrants III & IV, including “insurance management”) characterized by a low level of work satisfaction.

In contrast, there is household labor that is characterized by a high degree of autonomy, self-direction, and self-fulfillment, so that individuals are intrinsically motivated to engage in the tasks. In our study, this type of work is represented by the planning of purchases and asset management. Both planning purchases and managing assets require individuals to make independent decisions. Additionally, asset management offers the opportunity to gain competence experience (Burmester et al. 2010), while planning purchases offers the chance to cultivate the social identity through symbolic consumption (Belk 1988). This type of housework is therefore not only perceived as a burden but also as a source of well-being and satisfaction.

Regarding quality of work, however, we discovered a tendency towards neutrality in most cases. We explain this by the fact that most administrative chores are extrinsically motivated, but the necessity is accepted and not perceived as too much burden (DeShon and Gillespie 2005; Miebach 2006). The fact that this kind of cognitive labor remains neither positive nor negative in the memory could also explain why it often goes unnoticed, overseen, and neglected in research (Daniels 1987; Daminger 2019; Dean et al. 2022).

One size does not fit all. Our survey reveals significant variability, both in terms of types of activities and individual differences concerning temporal and mental workload. This demonstrates that there is no determinism in how people will be affected by the bureaucratization of societies (U.S. OMB 2022; U.S. OMB 2023). Instead, households function as autopoietic systems (Luhmann 2008), which are structurally connected to their environment, but also demonstrate their internal autonomy through the different reactions to external bureaucratic demands.

Despite the observed heterogeneity, we were able to discover important socio-demographic effects. First of all, similar to previous studies on domestic work, we found gender-specific

differences. Women tend to have a slightly higher perceived workload and significantly lower work satisfaction. However, the socio-demographic effects were far greater in terms of age. These results point to a hitherto largely unexplored relevance of age differences, which should be given greater consideration in future research on domestic work.

A closer look at income and education differences yielded another unexpected result. Due to higher cognitive skills, we would have expected that the mental workload would decrease in the group with a high income or a high level of education. However, we were unable to observe this. Instead, we make the surprising observation that work satisfaction increased in these groups.

This result underlines the demand that satisfaction, enjoyment, and fun are neglected but centrally important topics in domestic work research (Offer 2014; Dean et al. 2022). Only if we take the quantitative as well as the qualitative side seriously can we gain a comprehensive understanding of this kind of domestic work. This insight also has practical consequences. For instance, tutorials and courses on home economics mainly focus on the transfer of knowledge and best practices (Piorkowsky 2000; Walker 2008). In contrast, our results pinpoint the necessity of addressing the work attitude, showing how cognitive work can be enjoyable.

5.8 Conclusions

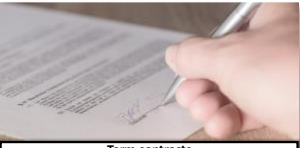
This study shows the quantitative (temporal) and qualitative (mental) workload that the bureaucratization of our world has led to for households (RQ1, RQ2). It motivates us to take a closer look at the nature of the work in addition to the time spent on it. Furthermore, our work also sets priorities for reducing the burden on households. It is not only the degree of heteronomy and the regulatory formalism of a workplace that can make a difference, but also demographic differences besides gender, such as in age groups or wealth (RQ3).

5.9 Appendix A: Categories and descriptions

Introduction of the overarching topic: “You [the respondent] will be asked questions below about your regular work with authorities or companies that you have to do to run your household. This type of work can be called “office work” (or office-like work), which is necessary to run your own life or a household. It includes both management and secretarial-like activities. [...]. As this type of housework is rarely talked about or thought about in public, we realize that it may be difficult for you to make associations or even get a complete picture of it.

We will therefore ask you about individual activities or scenarios and ask you to assess them. Your opinion is very important to us”.

Table 16: Categories and descriptions

Category	Explanation Including Examples (Translated from German to English)	
Goods & services	Trans.	 Commodity Products Procurement/storage of consumer goods (food, clothing, household goods, etc.) In the field of consumer goods (creating shopping lists, researching information, comparing offers, ... of food, furniture, clothing, household goods, etc.—NOT the purchase itself!) ... [Question]
	Commodity products	
	Recur.	 Term contracts Acquisition, management and cancellation of term contracts (electricity, water, gas, telephone, internet, streaming/newspaper subscriptions, etc.) In the field of fixed-term contracts (information research, comparison, conclusion, administration, cancellation, ... for electricity, water, gas, telephone, internet, subscriptions, insurance, etc.) ... [Question]
	Trans.	 Commissioned household works Work/repairs in the house or on appliances/car carried out by tradesmen, plumbers, workshops, etc. In the field of commissioned household work (information research, comparison, commissioning, making appointments, ... for repairs in the house, on appliances/car, etc.) ... [Question]
Household services	Recur.	 Household services Utilisation of recurring services or hiring of auxiliary staff (babysitters, cleaners, domestic help, tax consultants, private secretaries, etc.) In the field of household services (research, commissioning, making appointments, employment contract if necessary, ... of auxiliary staff such as babysitters, cleaners, domestic help, tax consultants, etc.) ... [Question]
	Governmental affairs	
	Governmental affairs	 Governmental Affairs Dealing with authorities or official matters (registration/registration, identity card, passport, residence permit, driving licence, etc.) In the field of public authorities (dealing with authorities, filling out forms, making and keeping appointments, ... for registration/registration, personal/passport, residence permit, driving license, etc.) ... [Question]
	Tax affairs	 Tax Affairs Contact with the tax office and tax matters (income tax, real estate transfer tax, flat-rate withholding tax, etc.) In the field of tax affairs (information research, preparation, filing, ... of income tax, real estate transfer tax, flat-rate withholding tax, etc.) ... [Question]

Health & insurance

- Insurance management



In the field of claims handling for insurance compensation (submission, damage reports, ... for household contents, liability, motor vehicles, mobile phones, etc.) ... [Question]

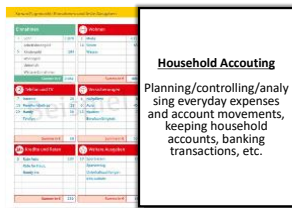
Health management



In the field of health/care services (making appointments, applications/reimbursements, ... for prevention, illness, or care— NOT the visit to the doctor itself! [Question])

Supportive activities

Household
accounting



In the field of housekeeping (planning, control and analysis of everyday expenses and account movements, keeping budget books, carrying out banking transactions, etc.) ... [Question]

Private Asset
Management

In the field of private pension provision and asset accumulation (management of pension provision, assets, ... such as real estate, shares, funds, etc.) ... [Question]

Document management



In the field of documents (retrieving, filing, archiving, managing, ...
of ID cards, certificates, invoices, contracts, etc.) ... [Question]

Problem management



In the field of problem handling (clarification, complaint or rectification of problems, ... for billing, benefits, refunds, cancellation, etc.) ... [Question]

5.10 Appendix B: Questionnaire for each work category

Table 17: Questionnaire for each work category

Type	Question	Response Selection	Scale
Temporal workload	How often do you deal with activities in this area in your everyday life?	Daily, multiple times weekly, weekly, multiple times monthly, monthly, multiple times annually, annually, less than annually, never	ordinal
	Duration of a single task: How much time did you need for the last process described above?	Less than 5 min, less than 15 in, less than 30 min, less than 1 h, less than 3 h, less than 6 h, less than 12 h, one day, multiple days	ordinal
Nature of work	Is this work more of a cognitive, emotional, or physical nature?	Single choice out of three	nominal
Mental workload items adopted from KFZA ²	I find such activities stressful.	5-point Likert-scale	quasimetric
	I am often under time pressure.		
	I have too much to do.		
	There are things that are too complicated for me.		
Work satisfaction items adopted from KAFA ³	The activities are not to be wished on anyone.	5-point Likert-scale	quasimetric
	The activities are exciting.		
	I like the activities.		
	I find the activities pleasant.		
	The activities challenge me.		
	The activities bore me.		
Demographics	Gender	Female, male, divers	nominal
	Age	N (type in)	metric
	Household income	Not known; <EUR 1.2 k net per month; EUR 1.2 k to 2.5 k net per month; 2.5 k to EUR 5 k net per month; >EUR 5 k net per month	ordinal
	Educational level	School or lower; vocational education; university or higher vocational education (master)	ordinal

Notes

1. In our study, only $N_p = 3$ individuals considered themselves as non-binary. Due to this small sample size, we did not include this group in our statistical analysis.
2. Short questionnaire for work analysis (German: Kurzfragebogen zur Arbeitsanalyse) (Prümper et al. 1995).
3. Short questionnaire to assess general and facet-specific job satisfaction (German: Kurzfragebogen zur Erfassung von Allgemeiner und Facettenspezifischer Arbeitszufriedenheit) (Haarhaus 2016).

6 Digitalization of Administrative Work at Home: Findings of an Online Survey

6.1 Abstract

People must perform bureaucratic, administrative work in daily life, such as applying for official documents, concluding contracts, organizing purchases, managing pension plans, etc. This work is time-consuming and unequally distributed in the household. At its best, it is perceived as boring; at its worst, it is mentally and emotionally stressful, leaving people overwhelmed and unable to fulfill their obligations. People can benefit from the digitalization of domestic bureaucracy automating repetitive tasks, reducing mental effort, and saving time for leisure activities. In recent years, there has been a need for more empirical knowledge about the use of technology or the working environment for this purpose. This paper presents insights from an online survey with 617 socio-demographically distributed participants highlighting the devices, tools, special software, and common places people favor for accomplishing these office-like household chores. Our results provide a solid empirical basis that not only quantifies previous qualitative results now using the German adult population but also offers orientation for further in-depth research as well as design.

6.2 Introduction

In interacting with companies and public authorities, people must carry out manifold administrative chores such as managing contracts, comparing offers, paying bills, renewing identity cards, registering cars, submitting tax returns, etc. (Winkler and Ireland 2009; Emens 2015; Verne and Bratteteig 2016; U.S. Department of Labor 2023). This office-like, secretarial work is also referred to in the literature as cognitive household labor (Damingier 2019), household management (Hochschild 1989; Mederer 1993), domestic bureaucracy, or life admin (Emens 2015; Emens 2017). Research in sociology and psychology shows that these activities are time-consuming, mentally, emotionally, and psychologically stressful, but crucial for financial well-being (Emens 2015; Damingier 2019; Dethier et al. 2024c).

This work often overwhelms people; they cannot meet their obligations (e.g., payment deadlines) or need help claiming their rights (compensations, reimbursements, etc.). Issues like these can arise or worsen due to a lack of skills, illness, and mental and physical disabilities

(Emens 2021), increasing the risks of financial losses and over-indebtedness (Mendoza and Pracejus 1997; Gerrans et al. 2022). As unpaid and undervalued work, it contributes to inequality for women as it is often unfairly distributed in the home (Offer 2014; Schneider and Hastings 2017). Besides a fair distribution of tasks in the household, supporting individuals with ergonomic tools and working environments is also crucial (Dethier et al. 2024a). A feminist call in literature demands to examine domestic work with the same care as the business context (Dethier et al. 2024a). The goal is to reduce physical and mental strain and increase individuals' well-being and productivity. Here, digitalization and thus professionalization of the household with properly designed technology can play a pivotal role in achieving these goals (Emens 2015). Yet, despite the importance of people's financial well-being, the topic of domestic bureaucracy is under-researched in human-computer interaction (HCI).

Problem-oriented design approaches in information systems research and HCI, such as design thinking (Plattner et al. 2013; Plattner et al. 2016), design science research (Dresch et al. 2015), design case studies (Wulf et al. 2011), design sprints (Banfield et al. 2015), lean innovation (Maurya 2012), etc., involve, as a first step, an understanding of the current problem context through (pre-) studies before prototyping and testing solutions. By understanding the domestic working environment in both a narrower (e.g. regarding tools) and broader sense (e.g. regarding spaces), design implications can be derived (Akkreditierungsstelle 2010). Therefore, this study aims to guide researchers and practitioners with an overview of the domestic working sphere for designing ergonomic and efficiency-enhancing tools. In this way, one can become aware of current trends as well as socio-demographic differences by considering the needs of specific groups, such as those defined by gender, age, and other factors.

For this reason, we utilize a paid online survey with 617 socio-demographically distributed participants to address the following research questions:

RQ1) Digitalization support: Which tools (e.g., pen, paper, computer, smartphone, special apps) are used for administrative work at home?

RQ2) Work context: At which places do people complete their administrative work at home?

RQ3) Inclusive design: What socio-demographic differences exist regarding administrative work at home?

Our findings extend the primarily qualitative explored body of literature by quantifying it and providing a comprehensive overview of a large population. Additionally, the findings

reveal differences in terms of gender, age, education, and income. This also leads us to discuss design implications from our study together with the existing literature.

6.3 Related work

6.3.1 Domestic admin work studies

Professional bureaucracies and administrations are significant topics in sociology, described by Weber (Weber 1922; Hill 2013) as forming legal-rational authority and by Luhmann (Luhmann 1988; Luhmann et al. 2018) as communication between different systems. In recent decades, however, current research has increasingly discussed the effects of bureaucracy on private households and the administrative work it generates (DeVault 1987; Hochschild 1989; Mederer 1993; Emens 2015; Daminger 2019).

In the past, this kind of work has been often described as “household management” (Hochschild 1989; Mederer 1993). In recent years, the term “life admin” has also become popular in Anglo-American countries, focusing on efficiently completing necessary bureaucratic tasks to maximize leisure time (Emens 2017). This work includes various activities that recur among different authors, such as shopping planning, appointment management, financial management, work with authorities, insurance and pension provision, etc. (Mederer 1993; Emens 2015; Daminger 2019; Dethier et al. 2024c).

Besides doing physical chores such as cleaning, cooking, and washing, life admin activities are rather cognitive (Emens 2015; Daminger 2019). In the past, this dimension of domestic work has been neglected in the literature as the work is invisible in two respects (Daniels 1987; Ciciolla and Luthar 2019; Emens 2021): First, managing and organizing a household is predominantly cognitive, mental work. Unlike physical chores, which have visible and tangible outcomes, cognitive work happens mainly in the mind and does not produce immediate, observable results. Due to its intangible nature, this kind of work is typically underestimated or ignored (Daniels 1987). Moreover, the time spent on this household work is challenging to quantify, as it is ubiquitous, fragmented, and often carried out in parallel with other activities (Winkler and Ireland 2009; Dethier et al. 2024c). Yet, time-budget studies in the United States of America indicate that this work involves at least one hour per week (U.S. Department of Labor 2023). Other studies suggest that the amount is higher (Winkler and Ireland 2009; Dethier et al. 2024c).

Second, like other household work, it represents unpaid labor, so it does not appear in any national gross domestic product statistics (Craig 2012). However, this does not mean that the work has no value. The value, therefore, refers to the hidden cost of a market economy (Williamson 1989), which stems from the costs of performing market transactions to satisfy household needs. These include ex-ante costs, such as the effort required to search, compare, and evaluate offers, and ex-post costs to monitor contracts, submit claims to insurance companies, pay invoices, etc. (Williamson 1989). The resulting bounded rationality in making optimal transaction decisions (Simon 1997) not only causes economic harm but also jeopardizes the financial well-being of individuals, as it weakens consumer sovereignty and creates the risk of information and power asymmetries (Oehler 2021b; Dethier 2023).

Domestic studies, especially in the feminist tradition (DeVault 1991; Bittman and Wajcman 2000; Offer 2014; Ciciolla and Luthar 2019), emphasize the societal impact of domestic bureaucracy by highlighting how women and marginalized groups are disproportionately affected. On the one hand, the work is unequally distributed in the household (DeVault 1991; Offer 2014). On the other hand, people with disabilities are often unable to master this kind of activity, affecting their financial and psychological well-being (Emens 2021). For this reason, feminist researchers, such as Emens (Emens 2015), argue for a fair workload between the genders, lean government, more efficient consumer protection, and better computer support for this kind of work.

6.3.2 Computer-supported work at home

To our best knowledge, the digitalization of domestic bureaucracy has not yet been systematically studied. Still, in HCI/Computer supported-cooperative work (CSCW), various qualitative-oriented research in the tradition of CSCW workplace studies has explored dedicated aspects of this topic, such as domestic money practices, private investment strategies, or using a domestic ordering system to coordinate household chores (Northcott and Doolin 2000; Walker and Llewellyn 2000; Schmidt and Wagner 2004; Vines et al. 2011; Molina 2011; Vines et al. 2014; Ferreira et al. 2015; Snow and Vyas 2015; Vyas et al. 2016; Perry and Ferreira 2017; Dethier et al. 2024a).

For instance, Dethier et al. (Dethier et al. 2024a) have analyzed people's practices in dealing with their invoices as an artifact to organize domestic bureaucracy. They uncovered various processing and archiving systems. In doing so, bureaucratic work in the household is characterized as taking place in well-defined but highly individualized ways in different places

in the household (study, kitchen/dining room, living room, etc.). These practices require and represent a well-developed bureaucracy literacy (Tennyson 2011; Dethier et al. 2024a).

Several CSCW studies also investigated work with money at home. Studying money practices, Kaye et al. (Kaye et al. 2014) have identified various tools and techniques used in different home places to manage finances, such as multiple paper systems like index cards, notebooks, diaries, or labeled file folders. Similarly, Vyas et al. (Vyas et al. 2016) demonstrate how various tools and locations are used in financial management, such as notes on the fridge in the kitchen, calendars, and pinboards in the home office, and physical objects such as preserving jars in which money is budgeted.

The work of agencies that provide financial advice and support to people, as investigated by Verne and Bratteteig (Verne and Bratteteig 2016) or Dolata and Schwabe (Dolata and Schwabe 2017), shows that interaction continues to be dominated by working with paper, traditional work tools, and involves a variety of different communication media. Here, an understanding of a person's prevalence of current tools in market processes is crucial for designing innovative systems (Dolata and Schwabe 2017). In this regard, HCI research constantly stresses the co-existence of digital and paper-based systems and techniques, which prevail despite many digitalization concepts, such as the paperless (home) office (Kaye et al. 2014; Briscoe 2022; Dethier et al. 2024a).

IS Researchers, such as Mitchell et al. (Mitchell et al. 2008), empathize with market innovation for consumer household technology, that consumers will use more and more a “set of tools” that empower them to accomplish market-driven household work. Innovative and intelligent media is seen here as an opportunity to overcome inefficiencies and reduce transaction costs for the people (Mitchell et al. 2008; Searls 2012).

6.3.3 Working from home interferences

There is already a large body of knowledge in CSCW that has studied well-being and productivity aspects in traditional offices, as well as in working from home (WFH) for several decades, with increasing attention in recent years, especially due to the COVID-19 pandemic (Cho et al. 2022).

Whereby research under different terms like “telework” or “remote work” over a long period has consistently viewed WFH as positive, enhancing productivity and improving work-life balance (Bailey and Kurland 2002; Hill 2013; Felstead and Henseke 2017). However, the strong increase in recent years has also led to findings on negative aspects, such as a lack of physical and mental separation between work and private life. As these are mixed in terms of space and

time, WFH can lead to serious compromises and conflicts in the work-life negotiation on the other hand (Ciolfi et al. 2020; Aczel et al. 2021; Schieman et al. 2021; Cho et al. 2022). Where workers have enjoyed time savings by being able to do household chores, such as cleaning or laundering, at the same time as working, now the re-bundling of personal and business life creates an “always-on” feeling for people at home. This means that they are constantly on call and constantly mentally at work (Cho et al. 2022; Wethal et al. 2022), which is the case for both paid and unpaid work at home (Daniels 1987; Emens 2015; Daminger 2019). An extreme example is provided by Leshed et al. (Leshed et al. 2014), where the private household and the family business of farmers are all in one place.

Studies show that people try to reproduce their (business) workplace at home, whereby the home setting differs from household to household (Holmes et al. 2022; Wethal et al. 2022). In order to work in a pleasant place, people also design their working environment as a place where they feel comfortable, so that they, for instance, decorate it with flowers (Cho et al. 2022).

Some households already have separate spaces respectively rooms that they can use for WFH, others have still to create them (Wethal et al. 2022). Here, social inequalities arise insofar as not everyone in a shared household has their own desk or the facilities for a separate room. This led not least to the prominent examples that we saw in video calls during the COVID-19 pandemic when the children of work colleagues came into the camera’s lens or interrupted meetings. Thus, people at home are often disturbed and interrupted in their office work by family members, which can lead to dissatisfaction and unproductivity (Wethal et al. 2022). Cho et al. (Cho et al. 2022) recommend creating a better work environment in which the workplace is a dedicated space that should be physically (if possible) or at least mentally (e.g. virtually) separated.

The considerable development of WFH has also led to the extensive introduction of various groupware to enable remote collaboration (Cho et al. 2022). These developments in remote work have also resulted in positive aspects for people’s household work in interacting with external organizations, so that authorities, service companies, etc. can now also make remote appointments and on-site appointments are no longer necessary (Verne and Bratteteig 2016; Dolata and Schwabe 2017).

6.3.4 Gendered technology and age groups

Feminist research emphasizes that technology has a profound influence on women's work - including the private sphere (Rakow 1988; Faulkner 2001). Technology both positively and negatively shapes gender relations and is influenced by them. Traditionally, technologies have been developed for the Western, masculine world, which can contribute to existing gender inequalities (Rakow 1988). Gender stereotypes and roles may also be reflected and reinforced by technology, or gender-specific requirements can be neglected (Faulkner 2001).

Concerning work design and work support, not only a feminist demand but also other socio-demographic factors make it necessary to examine and design technology for specific differences. For example regarding money work studies with a focus on specific groups, Vines et al. (Vines et al. 2011) found that older people more often use checks to track their spending and organize their finances. To just simply digitalizing money practices of older people can disturb the way they work and hinder financial collaboration (Pritchard et al. 2015). Moreover, in a later study, Vines et al. (Vines et al. 2014) emphasized the importance of technology when managing a low income.

6.3.5 Research gap

Research calls from a socio-economic perspective for reducing administrative work in private households, which, besides sociological studies, has also been studied as collaborative work within HCI and CSCW, focusing on tools and techniques used. Office work at home respectively for private work is a challenge for the design of productive, appropriate, and comfortable workplaces, which should fit the respective user characteristics.

However, empirical studies have primarily used qualitative methods, which means that future research should quantify these qualitative findings in a quantitative study of the prevalence of technology use and the work environment in the home.

6.4 Methodology

To pursue the motivated research gap, we have chosen a quantitative method for this study to create a solid empirical basis for further research and design work. We answered our research questions R1-R3 with the help of an online survey, where we queried 617 adult people in Germany about administrative housework and its digitalization.

6.4.1 Measures and procedure

The questionnaire comprises four sections: (1) For typical administrative tasks (Emens 2015) (such as governmental affairs, contract management, health and insurance issues, etc.), we asked about the tools commonly used (e.g., pen and paper, smartphone, computer, officeware, etc.); (2) Additionally, respondents were provided with a blank text field to list any additional software they use. (3) We further asked about the typical places (Kaye et al. 2014; Vyas et al. 2016; Dethier et al. 2024a) where these tasks are performed (such as the home office, kitchen/dining room, living room, bedroom, etc.). (4) Finally, demographic data such as gender, age, level of education, and income were collected.

We pretested our questionnaire twice to increase validity. First, we asked 10 people to answer the questionnaire while thinking aloud. Based on their feedback, we revised the questionnaire. The second version was completed by 60 people online. We analyzed the results for plausibility and made minor corrections. We used this final version to commission QuestionPro GmbH as a professional market research institute to conduct the study.

The online survey was carried out between October and November 2023. The respondents' participation was voluntary, and informed consent was given for anonymized data collection and analysis.

6.4.2 Sample and data cleaning

After a data cleaning, 617 (=N) participants completed the questionnaire. The participants' ages ranged from 18 to 85, with an average age of 46 (SD=17.0). Regarding gender, 49.8 % were classified as female, 49.8 % as male, and 0.5 % (N=3) as non-binary. The median level of education is a completed vocational training, and the median level of the stated household income is between € 1,200 and € 2,500 (see Tabel 18).

Table 18: Demographics of the sample

Characteristic	Value	N	Percentage	Mean (SD)	Min	Max
Gender	Female	307	49.8%	45 (17)	18	85
	Male	307	49.8%			
	Non-binary	3	0.5%			
Age						
Income	Not known	17	2.7%			
	<EUR 1.2 k	87	14.1%			
	EUR 1.2 k–2.5 k	189	30.7%			
	EUR 2.5 k–5 k	250	40.6%			
	>EUR 5 k	74	12.0%			
Education	School or lower	101	16.4%			

Vocational education	361	58.5%
University or higher vocation education	155	25.1%

6.4.3 Data analysis

Before the data analysis, the survey data was screened to identify outliers, inadmissible, and incomplete data. Second, we used common descriptive and inferential statistical methods to evaluate the data.

Our descriptive statistics use percentages of frequencies for ordinal scales as well as means (M) and standard deviations (SD) as key measures of central tendency and variability of Likert scales. As the data approximates an interval-level distribution, we run an analysis of variance (ANOVA) (Malhotra et al. 2017) to test whether the differences between socio-demographic groups (gender, age, education, income) are statistically significant. For ordinal scales (places of work), we conducted the more robust Kruskal-Wallis (H-) test (Malhotra et al. 2017). All tests were conducted using SPSS Version 29.0.1.0.

Regarding the open question of what special software is used, two researchers independently formed categories inductively following the qualitative content analysis methodology (Mayring and Fenzl 2019). Then, we use standard descriptive statistics to analyze and summarize these categories.

6.4.4 Limitations

We conducted our study using an online panel, as a well-established and commonly employed method in the literature. However, as with all online panel studies, there are some general limitations to our study.

Studies indicate that participants in such panels are often younger and more educated, which may affect the generalizability of the results (Buhrmester et al. 2011). As shown in Table 18, however, our sample does not have these characteristics.

Another potential issue is the proprietary nature of the participant recruitment process and compensation details of the online panel providers, which can lead to concerns about self-selection effects and potential biases (Goodman et al. 2013). Despite these concerns, prior research shows that online panel studies often produce results comparable to those obtained from more traditional samples, particularly in psychological and social domains (Buhrmester et al. 2011).

A further limitation is the lack of control over the conditions under which participants complete the questionnaire, including timing, setting, and self-reporting. Additionally, the

presence of incentives might prompt some participants to respond fleetingly or inattentively. To address this, besides the panel provider's quality checks, we also assessed the meaningfulness of responses to open-ended questions. Here, qualitative studies are able to overcome such biases. They have the advantage of an in-depth understanding of the context in which tools and locations are used, as well as understanding different scenarios and reasons, which a quantitative study cannot achieve. Previous qualitative studies, which have examined different working environments in specific cases, lack an overview of the population and its socio-demographic differences.

6.5 Findings

6.5.1 Tools used for admin work

With the category “work tools”, we refer to the various digital and physical resources that individuals use to manage, organize, and complete administrative household tasks. We used a five-point Likert scale (1=never, 2=rarely, 3=sometimes, 4=often, and 5=very often) to evaluate which tools are used how frequently for diverse administrative tasks (see Figure 10).

We categorized the various work tools into four main groups: Devices, Officeware, Communication, and InfoAssistants.

Devices cover basic digital tools like computers and smartphones as well as analog tools like paper-based file folders and pen and paper. Officeware encompasses general office software for organizing and managing tasks, such as calendars, word processing programs, and spreadsheets. Communication refers to tools used for information exchange, including email, telephone calls, chat, and video calls. Lastly, InfoAssistants are tools used for information access and AI assistance, highlighting the role of search engines and the emerging use of chatbots in managing administrative household tasks.

In the following, we discuss these four main categories in more detail:

Devices. Administrative work is often called ‘paperwork’, underscoring the historical reliance on pen and paper as the primary tools (Kaye et al. 2014; Vyas et al. 2016; Dethier et al. 2024a).

Our survey, however, shows that this is currently changing. Although pen and paper ($M=3.25$; $SD=1.17$) and file folders ($M=3.28$; $SD=1.23$) remain important, our findings indicate a slight tendency towards the use of digital devices such as computers ($M=3.36$; $SD=1.27$) or

smartphones ($M=3.31$; $SD=1.3$). This means there is no clear preference but rather a coexisting of digital and analog tools in households.

Officeware. Officeware like Microsoft Word, Google Docs, and LibreOffice are pivotal in professional administrations. Our study shows that this also applies to the private sector to a certain extent.

A closer look reveals that the usage frequency of the various programs within an office suite is quite different. The respondents most often used the calendar for coordination and organizational work ($M=2.79$; $SD=1.3$). Tools for word processing ($M=2.64$; $SD=1.31$) or spreadsheets ($M=2.45$; $SD=1.3$) are only used rarely to sometimes. The answers in the free-text field provide a valuable impression of which office suites are commonly utilized in the home context. Most often, people mention using Microsoft Word ($N=21$), Excel ($N=15$), Google Docs ($N=7$), and Outlook ($N=5$). Other tools mentioned include Microsoft Office as a whole suite ($N=2$), Open Office ($N=2$), Libre Office ($N=2$), and Apple's iWork suite ($N=2$).

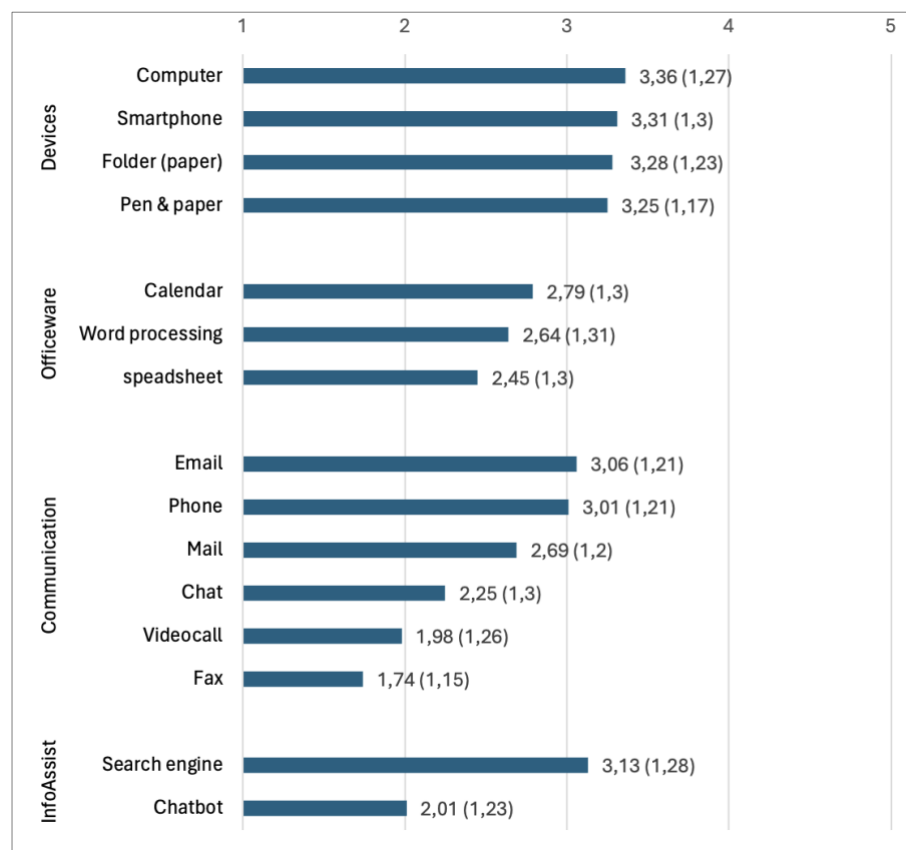


Figure 10: Frequencies of tool usage
(1 = never, 2 = rarely, 3 = sometimes, 4 = often, and 5 = very often. Numbers on the bars present mean and standard deviation)

Communication. Administrative work is not just cognitive but involves a lot of communicative work. Customer service must be contacted in case of problems or questions,

appointments are arranged by phone or email, friends and family members are asked for advice or to coordinate activities, etc.

Our survey also demonstrates the importance of communicative work. The results show that communication tools are as important as officeware for domestic administrative work. Email ($M=3.06$; $SD=1.21$) and telephone calls ($M=3.01$; $SD=1.21$) were the most frequently used tools. Chat ($M=2.25$; $SD=1.3$) and video calls ($M=1.98$; $SD=1.26$) were used less frequently. Our results further show that some people still use the quite outdated technology of fax machines, although they are rarely used ($M=1.74$; $SD=1.15$). Communication tools mentioned in the free-text field were Outlook ($N=5$), Microsoft Teams ($N=3$), and Slack ($N=1$).

InfoAssistants. Rational market decisions require consumers to search for the available options, obtain product information, and evaluate the information's quality and trustworthiness (Akerlof 1978). Besides communicative work, information work is thus an essential component of domestic administrative work. With the internet and information assistance tools, this work has dramatically changed with digitalization (Laudon et al. 2010).

The importance of these tools is also evident in our survey. The search engine was the most frequently used tool (running on a computer or smartphone) ($M=3.13$; $SD=1.28$), indicating a certain need for search/ research by people performing bureaucratic work in the household. In contrast to the hype around ChatGPT and the chatbot tsunami in academia (Grudin and Jacques 2019), chatbots are only rarely used for administrative household work so far ($M=2.01$; $SD=1.23$). This is also reflected in the InfoAssistants tools named in the free-text field, where Google ($N=71$), Bing, or Yahoo ($N=2$) are more often mentioned than chatbots like ChatGPT ($N=3$), Steuerbot ($N=3$), or Alexa ($N=1$).

6.5.2 Special software

In addition to these main categories, the free-text responses indicate a long tail of special software people use for their administrative work at home. Overall, the use of special tools is mentioned 263 times in the free text field. Among others, the most mentioned were Elster ($N=31$), Check24 ($N=16$), WISO Steuer ($N=14$), Whatsapp ($N=12$), Taxfix ($N=6$), Instagram, ($N=6$), Facebook ($N=6$), Doctolib ($N=5$), Clark ($N=2$), or Trade Republic ($N=2$). While each tool presents a niche, collectively, they make up a significant portion of the tools used for domestic administrative work.

By using qualitative content analysis, we have split them into ten categories (cf. Figure 11). Thereby, tax software ($N=70$) is the most frequently mentioned category, in which products such as Elster ($N=31$), WISO Steuer ($N=14$), and Taxfix ($N=6$) are named. After that,

portals/apps (N=68) from companies, service providers, and governments are utilized for personal administrative work. These include Online Banking (N=10), Health Insurance Apps (N=10), Company websites (N=8), and Government websites (N=3).

Comparison portals (N=38) present another important category. These platforms play a crucial role in helping users make informed decisions by providing comprehensive comparisons of products and services across various sectors. Examples mentioned by the participants were Check24 (N=16) and Idealo (N=2). In addition, our survey indicates that online marketplaces (N=20) are not just used to buy products; people use them similarly to comparison portals to find and compare products.

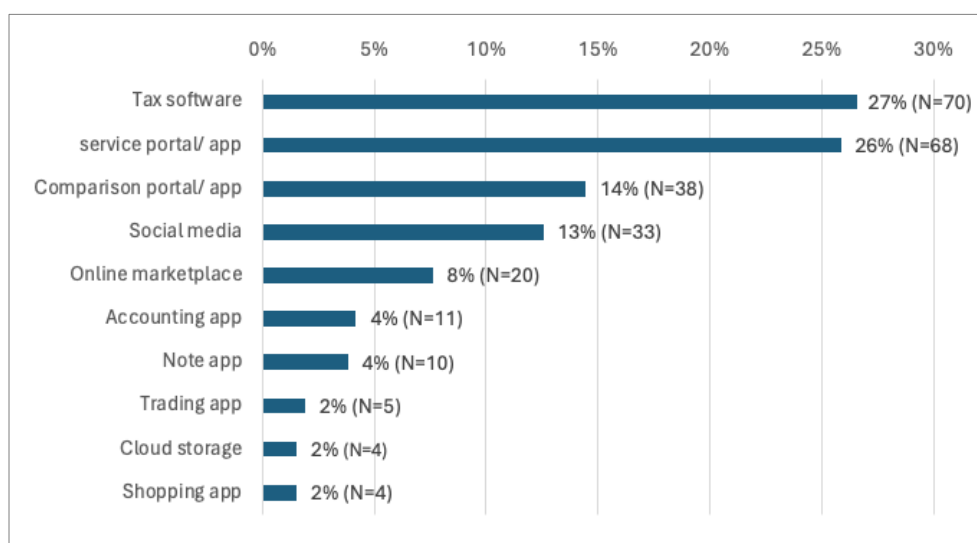


Figure 11: Frequency of special software usage
(The numbers on the bars indicate the relative (%) and absolute frequency (N))

We were somewhat surprised by the frequency with which participants identified social media as a tool for private administrative work (N=33). Despite not being designed initially for administrative tasks, consumers may leverage these platforms to gather information, search for consumer goods, and discuss administrative matters. In addition, social media commerce has become popular in recent years (Zhao et al. 2023), where these platforms are used to buy/sell goods and services. In our survey, Instagram (N=6), Facebook (N=6), TikTok (N=3), and YouTube (N=3) were the most mentioned social media platforms used in the context of administrative work.

Further software and apps mentioned are used for Accounting (N=11), Note-Taking (N=10), Trading (N=5), Cloud Storage (N=4), and Shopping (N=4).

6.5.3 Places used for admin work

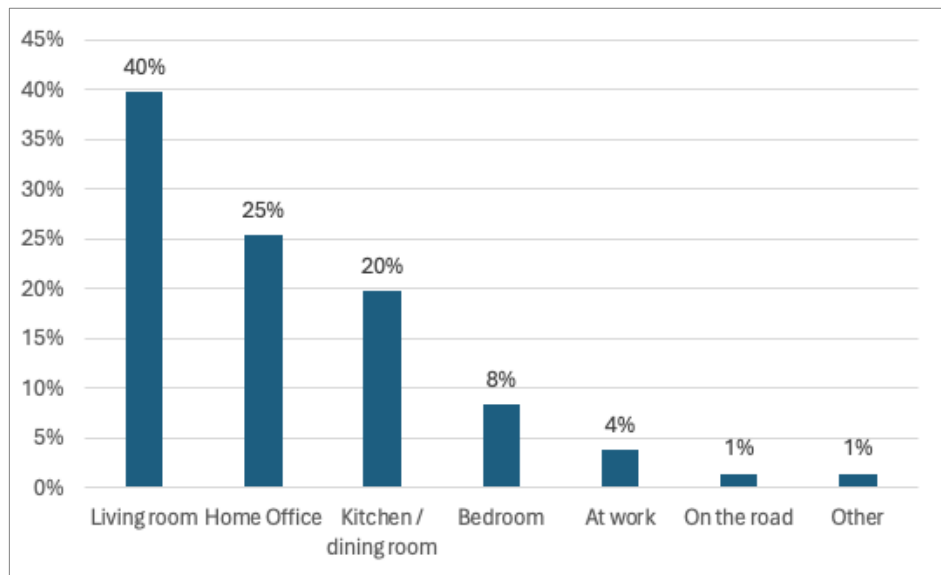


Figure 12: Places where people do admin work

As usability engineering has demonstrated, not only the tools but also the work environment play a crucial role in ergonomics (Akkreditierungsstelle 2010). In the corporate context, for instance, regulations like the German ordinance “BildscharbV”²⁸ mandate that employers ensure that office work environments adhere to ergonomic standards. This does not hold for the home setting. Therefore, it’s crucial to understand where domestic administrative chores are usually performed.

From an ergonomic standpoint, a well-equipped home office would be the preferred workplace. Yet, our survey (see Figure 12) shows that the primary place for domestic office work is the living room (40%) alongside the Kitchen/ Dining room (20%) and Bedroom (8%). For only 25% of the participants, the home office is commonplace for domestic office-like work. Other places, such as the employer’s workplace (4%) or on the road (1%), are rarely mentioned.

6.5.4 Socio-demographical differences

²⁸ Ordinance on Safety and Health Protection at Work with Visual Display Units (Bildschirmarbeitsverordnung - BildscharbV) of December 4, 1996, last amended on January 29, 2001 (German Federal Law Gazette I p. 1841, 2785, 2865)

Previous research shows that socio-demographic factors impact the temporal workload (Offer 2014; Emens 2021; U.S. Department of Labor 2023; Dethier et al. 2024c). We also identified some socio-demographic differences in the prevalence of places and tools (see Table 19).

In the following, three interesting categories are compared: (1) Devices, as they show the degree of digitization and the basis technology on which work takes place and officeware or communication services run. (2) InfoAssistants, as they provide insight into the current use of search and innovative (AI) assistants. (3) Workplaces, as they provide an insight into the domestic working environment of different groups and guide the ergonomic design of work equipment.

Gender. Regarding work devices, our study shows significant gender differences in the use of computers and smartphones (see Table 19)²⁹. While men use computers more frequently, women use smartphones as their primary device for admin work (see Table 20).

Also, significant differences exist regarding the workplace. While both prefer the living room, making use of the home office or bedroom is slightly higher in the case of men. Instead, women rather use the living room or do it at work (see Table 21). The other locations were chosen with equal frequency for both genders.

Age. In the case of age differences, we measured by far the highest effect sizes, which are found in the use of smartphones, search engines, and chatbots (F-values; see 19). Here, our findings unsurprisingly show that younger individuals exhibit a higher degree of digitalization. This is particularly true when using Smartphones, search engines, or chatbots for domestic admin work (see Table 19, Table 20). The use of pen and paper is also significantly lower among younger people than older people.

Age also has a significant impact on the used workplace, with younger people more likely to work in the bedroom and older people most likely to work in the home office (see Table 21).

Education. Our results show that people with a higher degree of education use computers more frequently than people with a lower degree of education, who are more likely to use smartphones. The use of search engines and chatbots is highest among people with low levels of education and second highest among people with the highest levels of education. Chatbots are most used by people with higher levels of education and second most used by people with the lowest. These differences can also be explained by age differences, with younger people

²⁹ Only three participants in the sample stated that they were non-binary. As this small number can lead to distortions, we have excluded this group from the analysis of gender differences for statistical reasons.

having lower levels of education as they are still in their training. However, it is conclusive that a high need for knowledge of household bureaucracy leads to a higher use of search engines among younger people and people with low levels of education. Younger and well-educated people are most likely to be supported by AI in their cognitive housework.

Table 19: Socio-demographic differences across devices, workplaces, InfoAssistants (ANOVA was used for devices, Kruskal-Wallis (H) test was used for workplace)

Use of	Gender			Age			Education			Income		
	F	p	η^2	F	p	η^2	F	p	η^2	F	p	η^2
Pen & Paper	.104	.747	.000	3.863	.021*	.007	1.761	.172	.003	0.054	.984	.000
Folder	4.206	.041	.004	.882	.414	.002	1.225	.294	.002	3.053	.028*	.008
Computer	20.00	<.001*	.017	1.427	.240	.003	11.64	<.001*	.020	4.336	.005*	.012
Smartphone	3	*					2	*			*	
Search-engine	4.555	.033*	.004	64.664	<.001*	.103	7.954	<.001*	.014	2.216	.085	.006
Chatbot	1.090	.297	.001	53.384	<.001*	.086	8.087	<.001*	.014	4.682	.003*	.013
					*			*			*	
	.159	.690	.000	102.92	<.001*	.154	21.38	<.001*	.036	4.795	.003*	.013
				4	*		5	*			*	
Prevalence of	Gender			Age			Education			Income		
	H-Test	df	Asymp.Sig.	H-Test	df	Asymp.Sig.	H-Test	df	Asymp.Sig.	H-Test	df	Asymp.Sig.
Workplace	6.305	1	.012*	12.206	2	.002**	10.208	2	.006**	14.322	3	.002**

We also see significant workplace differences (see Table 21). People with a low level of education were more likely to use the kitchen/dining room or bedroom for a workplace, people with vocational training used the living room, and people with a higher level of education were most likely to use the home office. The simplest explanation for these differences can be found in the available budget and housing situation, for example, whether one has a home office or not.

Table 20: Mean values & SD in differences for devices and InfoAssistants (Non-statistically significant figures were left out for overview reasons; Age groups: Young adults: 18-29; Adults: 30-62; Elderly: >62)

Demographics	Pen & paper	Folder	Computer	Smartphone	Search engine	Chatbot
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Gender						
Female			3.19 (1.27)	3.39 (1.25)		
Male			3.52 (1.23)	3.23 (1.35)		
Age						
Young adults	3.08 (1.1)			3.83 (1.01)	3.65 (1.24)	2.75 (1.31)
Adults	3.29 (1.18)			3.35 (1.26)	3.13 (1.26)	1.93 (1.16)
Elderly	3.33 (1.2)			2.58 (1.4)	2.52 (1.26)	1.33 (.74)
Education						
School or lower			3.21 (1.23)	3.64 (1.09)	3.46 (1.24)	2.25 (1.33)
Vocational edu.			3.26 (1.27)	3.21 (1.33)	3.03 (1.28)	1.83 (1.1)
University/ higher education			3.66 (1.22)	3.35 (1.31)	3.18 (1.3)	2.33 (1.37)

Income				
<1,2 k€	3.24 (1.15)	3.32 (1.21)	3.19 (1.18)	2.25 (1.27)
1,2 k - 2,5 k€	3.13 (1.26)	3.23 (1.29)	2.99 (1.34)	1.91 (1.2)
2,5 k - 5 k€	3.39 (1.2)	3.41 (1.26)	3.15 (1.28)	1.99 (1.21)
> 5 k€	3.31 (1.34)	3.66 (1.18)	3.46 (1.22)	2.28 (1.4)

Income. Indeed, income also has a significant influence on the preference for the workplace, but also a slight influence on the choice of devices and InfoAssistants (see Table 20). People with higher incomes use computers and file folders more frequently than people with lower incomes. In the use of InfoAssistants, we see that people with higher incomes most frequently utilize search engines and AI chatbots to accomplish administrative household work. For chatbots, we also observe a high level of usage among people with lower incomes, as this – again – can be explained by factors such as age, with younger people more likely to use AI chatbot tools.

The effect of income on the workplace is as already mentioned: a lower income leads to work in the (1) living room, (2) kitchen/dining room, or (3) bedroom, a higher income may allow to utilize a home office.

Table 21: Percentages in differences for workplace
(Values in % of each line)

Demographics	Workplace						
	Living room	Home office	Kitchen/dining r.	Bedroom	At work	Road	Other
Gender							
Female	42.3	21.2	19.9	.09	4.8	1.6	1.3
Male	37.3	29.6	19.6	7.7	2.9	1.3	1.6
Age							
Young adults	33.8	22.8	17.2	17.9	5.5	2.8	0
Adults	43.1	24.0	19.9	5.8	4.3	1.2	1.7
Elderly	36.5	33.3	22.2	4.8	.8	0	2.4
Education							
School or lower	34.0	17.5	23.3	16.5	5.8	1	1.9
Vocational education	44.4	21.8	21.5	6.6	2.5	1.7	1.7
University or higher vocation education	33.1	38.9	13.4	7.0	5.7	1.3	.6
Income							
<1,2 k€	33.3	16.7	27.8	5.6	11.1	5.6	0
1,2 k - 2,5 k€	44.3	13.6	20.5	12.5	4.5	0	4.5
2,5 k - 5 k€	49.5	17.4	22.1	6.8	1.6	1.6	1.1
> 5 k€	34.1	32.1	18.7	8.7	4.4	1.6	0.4

6.6 Discussion

We have responded to the socio-economic literature's request to investigate the use of technology (RQ1) and the domestic environment (RQ2) as well as socio-demographic differences (RQ3) in administrative household work. We operationalized implications from qualitative literature, conducted a large quantitative survey using a paid sample, and analyzed valid data (e.g., verified by two pre-tests). Therefore, our study contributes as a first step to

support design by understanding the context of administrative household work and identifying important socio-demographic differences among the people.

The following discussion reflects the results of our study together with the findings from the existing (mainly qualitative) literature. It concludes with an overview of selected design implications for researchers and practitioners (see Table 22).

6.6.1 Working environment matters

As the literature already indicates, work and leisure areas are mixed physically or mentally in the household (Winkler and Ireland 2009; Kaye et al. 2014; Emens 2015; Vyas et al. 2016; Aczel et al. 2021; Schieman et al. 2021; Cho et al. 2022). We quantify to which extent administrative household work takes place in the leisure sphere and, therefore, spatial areas that have not been professionalized or ergonomically designed for office-like activities, such as the living room, kitchen/ dining room, or bedroom. Our results provide a reliable picture of the distribution of work and work artifacts in people's homes, confirming that leisure areas overlap or mix spatially as well as inevitably mentally.

As we measured, many people do not have a separated home office space for household work and instead work at their desks in the kitchen/dining room or on the couch in the living room, like due to income differences. Furthermore, the pleasant and comfortable atmosphere of the living area could also play a role in the choice of workplace (Cho et al. 2022).

The choice of the location combined with work tools indicates that women are more likely to work on a smartphone and in the living room, whereas men are more likely to use a computer and work in a home office. Thus, our study makes an important and clear contribution to research on gendered technology, which calls for gender-equitable and appropriate work support (Rakow 1988; Faulkner 2001).

HCI design should consider heterogeneous spatial conditions - especially those of the living room - to the extent that bulky desktop PC applications should be avoided and convenient, flexible working on different devices in different locations should be strongly considered in the design.

However, the differences measured between the genders may be caused by another common factor, such as the different division of responsibilities and task-typical differences in the prevalence of technology and location, such as creating shopping lists versus managing contracts.

6.6.2 Admin tools are more than officeware

From the literature, it is already known that digital and paper-based systems must coexist (Kaye et al. 2014; Vyas et al. 2016; Briscoe 2022; Dethier et al. 2024a), but we have quantified that the use of paper is not only relevant but is nearly equal to or only slightly behind the use of digital tools. This means once again that the paperless home office remains a myth (Briscoe 2022).

The most frequently used tools are communication tools (such as email, telephone calls, etc.) and research tools (such as search engines). We interpret this to mean that communication makes up a significant part of the work and that there is a strong need for “bureaucratic literacy”, which search engines, and possibly increasingly AI chatbots, can support. Although chatbots are rarely used due to their younger existence, they are well-represented compared to other media, especially among younger generations or higher income and education levels.

As the increasing use of groupware for WFH (Cho et al. 2022) and collaborative work of agencies shows (Verne and Bratteteig 2016; Dolata and Schwabe 2017), we are also observing in the case of specialized software that most of the special software is used for interaction, communication, and research. They are used, for example for the cooperation with tax authorities (Elster, WISO Steuer, Taxfix) and private companies (check24, online banking, health insurance, company website/ portal, Doctolib). Here, people are adopting an extensive and heterogeneous “set of tools” by carrying out various organization-oriented bureaucratic tasks (Mitchell et al. 2008; Dethier et al. 2024c). For example, social media (Instagram, Facebook, YouTube, TikTok) also play a role in this work. Nevertheless, mentioning special software should not be considered a real-valid distribution, as we did not explicitly ask about this. However, they are interesting insights that may correlate with the real distribution. Following studies can verify this.

6.6.3 Designing for heterogeneity

Differences in age regarding innovative technologies are mostly unsurprising, although other differences have exciting implications.

According to our results, higher educated and higher income earners are more likely to use computers, whereas less educated and lower income earners use smartphones. This may be related to the separate workspace at higher income households and working in the living room for lower-income households or, as discussed with gender differences, to another common factor of different task specifics. Nevertheless, we can conclude that when designing solutions

for weaker consumer groups, e.g. for education, information, comparison, etc., we should focus on smartphone technology and the living room as a workspace. With the higher usage of search engines among younger and less educated people, we conclude that properly designed technology can help low-income groups with financial management and empower their financial well-being (Vines et al. 2014). In this context, search engines and chatbots can play an important role in providing access to “bureaucracy literacy” (Tennyson 2011; Dethier et al. 2024a). Regarding innovative AI chat assistants, we provide in the context of administrative household work groups of early adopters to design for at first. These early adopters are young, highly educated, or currently in education, with either high or low incomes, representing a milieu of expedites and performers (Barth et al. 2023).

Table 22: Overview of selected design implications

Topic	Design implications
Leisure sphere	Design should prioritize mobile support for household services in informal environments like sofas or kitchens.
	Design should consider possibilities of mentally separating cognitive housework from leisure time and space, for example by disabling notifications for reminders, emails, etc., at certain times or places (Cho et al. 2022; Wethal et al. 2022).
	Design should provide concepts to create (virtual) dedicated work environments within different leisure areas in daily life (Cho et al. 2022).
Various standard tools & dedicated software	Solution design should not only include general officeware but also enable the development of specialized software for specific use cases (Mitchell et al. 2008; Dethier et al. 2024a).
	Design should take into account the simultaneous presence and use of different communication channels and media (e-mail, phone, mail, chat, etc. as well as web portals (Verne and Bratteteig 2016; Dolata and Schwabe 2017; Dethier et al. 2024a).
Age	Design should not neglect older people or those who prefer paper-based work by digitalizing important customer or citizen interactions without any alternative (Vines et al. 2011; Pritchard et al. 2015; Dethier et al. 2024a).
Gendered technology	Design should address gender differences regarding preferred work environment (such as the living room), preferred devices (rather smartphone than PC), etc. (Rakow 1988; Faulkner 2001).
Literacy tools	Design should increasingly promote and optimize tools that aid in knowledge access, comparison, and search (Tennyson 2011; Dethier 2023; Dethier et al. 2024a).
Weaker consumer groups	In this context, appropriate technology offers the opportunity to empower vulnerable consumer groups through innovative, conversational or search-based tools (Vines et al. 2014; Dethier 2023).
Early Adopters	Designing new, innovative tools should target young, well-educated people first.
	The design should be careful about disrupting the practices of older people (as mentioned above), but also the middle class (middle income; middle education level)

These considerations allow us to derive the following user groups, which are not disjoint entities and may overlap:

Stationary users. The typical image of an office at home for office-like tasks is the desk at home with a computer, telephone, printer, etc. However, this was rarely observed among all participants, it is more the case for male persons, persons with a high degree of education, or persons with a higher income. This group of users are more likely to use stationary and rather professionally equipped computer workstations, whereby higher incomes also more include paper-based proper filing systems.

Mobile users. This user group tends to work in different working environments in the household, which are distributed through the private sphere and are also characterized by a non-specialized setup. This was “the normal case”, especially for women, younger people, or people with a lower level of education. Thus, mobile working environments should be facilitated here. Innovative users. Some users like to use intelligent (search) assistants, which can make work easier and increase efficiency. Young, well-educated people or people with high or low incomes may represent a set of early adopters.

6.7 Conclusion

In this article, we have explored what the domestic spatial-technical workspace in the German population currently looks like for administrative household work. We presented and discussed an overview of the digitalization of domestic bureaucracies (RQ1), the common workplace for this kind of work (RQ1), and their socio-demographic differences (RQ3).

HCI design should consider the heterogeneous workplace structure, especially that of the living room, and find out which devices and assistants are best suited for each user group or task. It is also important to still consider the coexistence of digital and paper-based tools. Communication and research technology are particularly important for accomplishing this work and, when properly designed, may help to empower weaker consumer groups.

7 Bridging Work of Intermediaries: A Qualitative Study on How Five Intermediary Firms Implement Interoperability in Cross-Boundary Infrastructures of Consumer Markets

7.1 Abstract

Managing private life and household affairs requires considerable work for consumer households, sometimes in cooperation with private companies or public administrations. In their role as consumers/citizens, people must perform work such as monitoring and managing supplies and contracts, comparing and purchasing offers, submitting insurance claims, or renewing passports. While some CSCW studies have examined intra-household coordination work, this study investigates the emerging role of intermediary firms that perform inter-organizational work on be-half of, and driven by, consumers in areas such as finance, insurance, utilities, healthcare, and general administration. Employing qualitative methods, we combined interviews and artifact analysis with five intermediary firms across different sectors and conducted a week-long field study with one of them. In doing so, our study sheds light on intermediaries' largely hidden role in bridging inter-organizational cooperation in consumer markets. We show to what extent this work involves predominantly human, manual bridging efforts. All five intermediaries face (common) social-level conflicts in their newly formed work arrangements, as well as technical-level conflicts within the infrastructures of the market. We analyzed these conflicts alongside breakdowns they mitigate through coping strategies. Our findings suggest that while some conflicts—whether socially or technically caused—can be resolved by intermediaries, others must be bridged using concepts of ‘adversarial interoperability’ or ‘backward interoperability’. Hence, when designing CSCW systems of organizations interacting with consumers, we should also consider the role of intermediaries, their work practices, and the conflicts identified in this study.

7.2 Introduction

‘Our clients are [...] exclusively private individuals [...] who need [help with] administration in the private domain because they are overwhelmed [...], ill [or] tired of it [...]’ (Participant/ Intermediary 5).

‘[There are] two options: do it yourself or have it done’ (Participant/ Intermediary 1).

Running a private household is permeated by daily administrative, secretarial, and managerial tasks that require considerable work. Consumers must constantly anticipate needs, monitor supplies, compare offers, decide between (purchase) options, and conclude, terminate, or change term contracts (Daminger 2019). This need for household coordination has been underestimated for a long time, until feminist and sociological discourses advocated for its equitable distribution and recognition, highlighting especially the invisible nature of cognitive household work of women. Recently, the topic has received growing attention in research (Coltrane 2000; Bianchi et al. 2012; Emens 2015; Daminger 2019; Emens 2021; Dethier et al. 2024d).

At the same time, the nature of this domestic work is changing due to the ongoing digitalization of economic goods and services, which requires consumers to manage a growing number of contractual agreements and adapt continuously to rapidly changing digital apps and services (Dethier et al. 2024d). Research shows the vulnerability of humans acting in traditional and digital markets, as they are generally influenced by principal-agent conflicts (Jensen and Meckling 1976) and negative market effects such as power asymmetries between providers and consumers (Oehler 2006; Oehler 2011; Oehler 2021a; Kenning et al. 2021; Mau et al. 2023), information asymmetries (Akerlof 1978) as well as dark patterns in digital user experience design (Krauß et al. 2024) or fake reviews (Walther et al. 2023; Walther et al. 2024), etc. To take it to the extreme: Trends such as the platform economy and ‘everything-as-a-service’ (XAAS, (Duan et al. 2015; Riasanow and Krcmar 2020)) further intensify the need for continuous monitoring, comparison, and decision-making on product offerings and term contracts on a daily basis (Dethier et al. 2024d). For consumers, especially those in the midst of life or maybe living in larger dual-income households with children, this consumer work (Dujarier 2016) can become a stressful ‘second shift’ (Hochschild 1989).

In response to the effects outlined above, new and increasingly relevant service models have emerged that offer to assist consumers in their contractual relationships as well as civic obligations. This support varies by industry and spans across services such as flight compensation management, document management, contract monitoring, termination and switching, as well as product consultation (Dethier 2020; Boden et al. 2024). Such service providers, which we characterize as ‘intermediaries’³⁰ (cf. Bailey and Bakos 1997), can be

³⁰ Unlike in German, the English term intermediary is often strongly characterized by the role of a broker. In German, as well as from the Latin origin of the word, an intermediary is more of a middleman, a mediator,

either personal agents working in offices or digital offerings serving consumer-driven needs, such as,

- ensuring that one always has the best energy tariff for electricity, gas, or water (Intermediary 1),
- taking care of financial wealth and future (Intermediary 2),
- managing personal health and, for instance, getting appointments with medical specialists (Intermediary 3),
- doing paperwork with invoices, contract documents, etc. (Intermediary 4),
- submitting applications to authorities or simply paying your bills if one can no longer do it himself (Intermediary 5).³¹

Apart from having to pay for the service, consumers must also relinquish some autonomy over their household obligations to the intermediaries, who then perform professional work on their behalf. From a CSCW perspective, this leads to an interesting cooperative work arrangement, where intermediaries build a bridge between the private household members, their interests and obligations on one side, and multiple (private or public) organizations on the other side. By intermediaries' 'bridging work', we refer to a set of practices aimed at connecting these actors and their infrastructures with each other. This involves coordinative efforts to achieve interoperability across heterogeneous components within the infrastructures of the market, referring to the ability of people, groups, and organizations to collaborate effectively, both organizationally and technically.

So far, we know little about this type of work in private contexts, as well as its mediation in the context of technical infrastructures (Pipek and Wulf 2009). Neither companies, public organizations nor consumers have much experience in cooperating with such intermediaries, who perform more than just brokering of products. This bridging work requires new work arrangements and infrastructuring that is currently not considering customer/citizen interaction involving third parties. Furthermore, businesses might even try to resist the involvement of intermediaries (Jensen and Meckling 1976; cf. Chircu and Kauffman 1999), which promise to act in the consumer's interest, thus cutting into the profit of the service providers.

someone in the middle. We would like to follow this rather German/ Latin definition of the term, as we have not found a better - popular - term in English.

³¹ Intermediary 1 to intermediary 5 took part in our study.

Our study seeks to shed light on this so far understudied field of cooperative consumer work, considering inter-organizational ‘boundary-spanning work’ (Levina and Vaast 2005) and its technical mediation towards consumer-facing organizations. We aim to investigate intermediary models and interoperability concerns, which pose unique characteristics for this field. We will show how five selected intermediaries face challenges we identified within our long-term partnership with them in bridging cooperation not only between two market parties but also different cooperation and communication infrastructures used, which can be characterized as ‘infrastructuring work’ (Pipek and Wulf 2009; Lee and Schmidt 2017).

Therefore, the aims of this study are to

- uncover the often-invisible, administrative work performed by intermediaries on behalf of consumers in their interactions with organizations, as well as the resulting professional practices,
- analyze the cooperative work arrangements and its interaction with technical infrastructures,
- and discuss best practices and improvements within these infrastructures.

Using qualitative research methods, including interviews and artifact analysis with five founders of intermediary businesses (intermediary 1 to intermediary 5) and a week-long field study with participant observation with one of these firms (intermediary 5), our sample comprises research on common challenges in Germany.

7.3 Related work

While research in computer-supported cooperative work (CSCW) has traditionally focused on workplaces (Schmidt 2000; Blomberg and Karasti 2013), the digitization of everyday life has also led to an increased interest in consumer work and resulting cooperation in consumer markets (Dujarier 2016; Verne and Bratteteig 2016). Human–computer interaction (HCI) and CSCW-related works already emphasized its complex, messy, competency-demanding, ubiquitous, and often invisible nature, particularly in the context of financial practices (Vines et al. 2011; Vines et al. 2014; Ferreira et al. 2015; Pritchard et al. 2015; Snow and Vyas 2015), domestic ordering systems (Vyas et al. 2016; Sannon et al. 2020; Dethier et al. 2024a), and bureaucratic tools (Dethier et al. 2024b), as well as the volatile interplay between ongoing digitalization and household practices (Perry and Ferreira 2017).

However, examining intermediaries that support the consumer work of private households introduces a novel perspective for CSCW, whereas previous CSCW and HCI research has largely focused on boundary-spanning activities. Therefore, in this section, we present related work that situates our study within the context of consumer work in private households (Section 2.1), which can be supported by various intermediary services (Section 2.2). Finally, we outline well-documented conflicts and breakdowns in boundary-spanning activities that occur on different levels—both social and technical (see Section 2.3).

7.3.1 Consumer work in CSCW, HCI, and IS research

Originating in the social sciences, interdisciplinary research communities have, for decades, examined physical household labor and its equitable distribution between male and female household members (DeVault 1987; Benin and Agostinelli 1988; Hochschild 1989; Mederer 1993; Twigg et al. 1999; Coltrane 2000; Bianchi et al. 2012).

Within this discourse, a currently trending field of household labor investigation focuses on its cognitive dimension (Daminger 2019), emphasizing its often invisible yet pervasive nature. This form of work weighs heavily on those who act as the ‘captain of the household’ (Ciciolla and Luthar 2019), carrying the mental load of coordinating daily life. This cognitive work, also referred to as ‘household management’ (Hochschild 1989; Mederer 1993; Beeton 2020) or ‘life admin’ (Emens 2015; Emens 2020) is described as a time-consuming, unpaid, sometimes stressful activity. It involves continuously anticipating needs and inventories, monitoring contracts, identifying and evaluating options, and deciding between them (Daminger 2019). Authors such as Emens (2015; 2020) describe this work as office-like, secretarial, and managerial activities performed by individuals at their domestic workplace. From a CSCW perspective, these coordinative practices are particularly interesting to study, as they encompass the administrative, often highly bureaucratic, and organization-directed duties of running a household (Verne and Bratteteig 2016).

Household studies in CSCW and HCI reveal that consumers develop artful coordination mechanisms to manage their households, as shown in research conducted by Ferreira, Kaye, Perry, Snow, Vines, Vyas, and many others in domestic contexts (Vines et al. 2011; Kaye et al. 2014; Vines et al. 2014; Ferreira et al. 2015; Pritchard et al. 2015; Snow and Vyas 2015; Perry and Ferreira 2017; Sannon et al. 2020; Sannon et al. 2020; Dethier et al. 2024a). These studies find that intra-household coordination involves a wide spectrum of arranged artifacts, spaces, responsibilities, competencies, and technologies in collaboration with household members (Vyas et al. 2016). It also involves extensive, ongoing articulation work with household

members, as Timmermans and Freidin (2007) demonstrate in their study of mothers implementing medical treatments while monitoring and anticipating the needs of children with asthma.

When observing these intra-household systems from the outside, some activities appear as forms of self-fulfillment during leisure time, while others are influenced or triggered by the external market system and the organizations operating within it (cf. Luhmann 1988). In this context, Dujarier (2016) identifies ‘organizational work’ as one of three categories of consumer work, referring to activities that consumers undertake to manage their consumption-related issues with interacting organizations. In economics, efforts to engage with one’s consumption are typically summarized under the term ‘transaction costs’ (Williamson 1989), which, however, overlooks the labor-intensive coordination tasks and complex work arrangements in which consumer households are involved (Pollak 1985; Dethier et al. 2024a). These tasks include managing contracts for goods and household services, handling taxes and other official matters, dealing with insurance and personal health, managing accounting and financial assets, and processing or archiving related documents (Emens 2015; Daminger 2019). In particular, the administration of taxes, other governmental matters, and the management of term contracts are perceived as mentally burdensome and challenging by the German population. Young adults and individuals with lower educational levels report the highest mental workload when accomplishing such consumer work (Dethier et al. 2024d).

While CSCW literature primarily has focused on intra-household coordination, it has rarely examined household-to-organization cooperation in the context of technology and infrastructure. Information Systems (IS) researchers, such as Mitchell and Searls (Mitchell et al. 2008), have long advocated for the establishment of ‘vendor relationship management systems’ as counterparts to customer relationship management (CRM) systems. They argue that such systems could support cooperative consumer work through a ‘set of tools’ and thus improve market mechanisms from a technical perspective. In doing so, it may be possible to mitigate negative market effects, reduce the burden on private households, and more effectively meet consumer needs.

However, consumers already use various tools to support their consumer work tasks, such as search engines and generative AI tools for accessing knowledge, communication media such as email and telephone, and computers and smartphones alongside traditional paper-based tools. In addition, consumers often employ specialized tax software to cooperate with tax authorities or use customer service and comparison portals as infrastructures for interacting with providers and manage contractual arrangements (Dethier et al. 2024b).

7.3.2 The emerging field of intermediary work

In Germany, which serves as the focus of our study, several brokerage portals such as Check24, Clark, and Verivox ³² have been established in recent years. They enable consumers to compare and purchase services offered by different vendors online, thereby reducing search costs, facilitating comparisons, and allowing products to be digitally ordered. These intermediaries are perceived as potentially lowering transaction costs for consumers (Clement et al. 2019, pp. 158-159).

Industry-driven intermediation. These online brokerage portals have digitally transformed a longstanding industry-driven tradition of intermediation as part of the ‘market-making’ strategies of service providers (Spulber 1996; Bailey and Bakos 1997; Chircu and Kauffman 1999). They are well-established intermediaries in consumer markets primarily mediating products within a specific industry, such as in real estate, insurance, or stock brokerage, and earning income through brokerage fees. In this paper, we refer to these brokering activities as ‘industry-driven intermediation’. As shown in Figure 13, these actors are highly visible and well-recognized by organizations as middlemen between the organizations and consumers. However, industry-driven information and comparison portals, whose business models primarily rely on the brokerage of products, may also lead to adverse effects when principal-agent conflicts arise between the interests of consumers and those of the platform operators (Oehler 2021c).

Consumer-driven intermediation. Building on this development, a variety of business models have emerged that promise to assist consumers by always securing the best deals, claiming refunds or compensation, optimizing financial assets, and more. Driven by consumers’ interests, needs, and obligations, this kind of intermediation takes over parts of consumers’ transaction costs / household labor by representing their interests and obligations on the one hand, and by interacting with (private or public) organizations on the other (Mau et al. 2023, pp.79–94).

Examples for that latter type of intermediation are financial technology (FinTech) providers such as ‘Finanzguru’ promise consumers simplified management of term contracts by automatically identifying them through bank transactions and recommending optimizations. In the field of legal technology (LegalTech), providers like ‘Rightnow’ promise to assist consumers claiming their passenger rights in cases of flight delays or cancellations. With the

³² <https://www.check24.de>; <https://www.clark.de>; <https://www.verivox.de>, last access 10.03.2025.

health data manager Vivy, consumers have been able to centrally collect and manage their medical data from doctors and healthcare facilities for several years, prior to the introduction of the official ‘digital patient record’ by Germany’s Ministry of Health ³³ (Mau et al. 2023, pp.79–94; Boden et al. 2024, pp.85–133). Their services are framed as being primarily driven by a mandate from consumers, with the promise of supporting consumers’ tasks. Business models in this field are highly diverse, ranging from indirect compensation through brokerage commissions (as in industry-driven intermediation) to direct payments from consumers (e.g., per working hour) (cf. Figure 13).

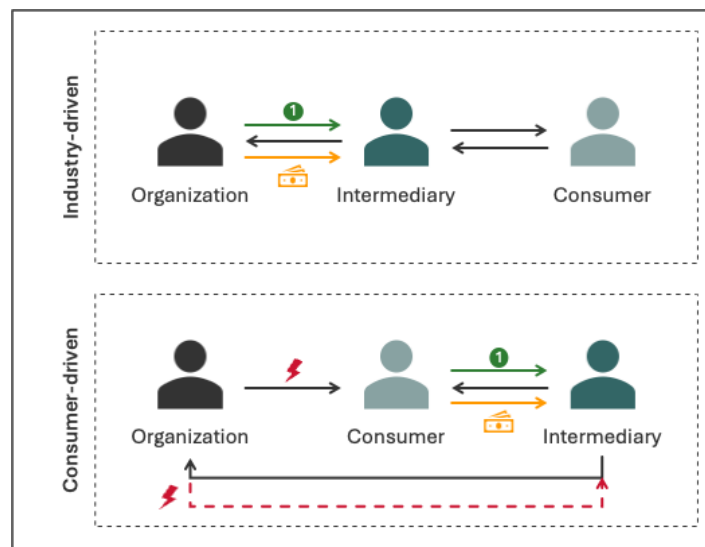


Figure 13: Industry-driven versus consumer-driven intermediation

In our investigation, we will focus on such newer forms of ‘consumer-driven intermediation’, showing that such intermediation work is often invisible to other companies, occurring ‘behind’ or in the background of consumers (see Figure 13). This invisibility to organizations may lead to unintended conflicts within these work arrangements. Furthermore, by placing consumers’ needs and interests at the center of their actions, consumer-driven intermediation—acting in place of the consumers—may also encounter conflicts of interest with organizations during cooperation. Foundational insights from economics on consumer markets highlight negative market effects that hinder the ideal—or, as economists would term it, ‘efficient’—satisfaction of all market actors’ interests, potentially leading to market failures

³³ <https://finanzguru.de>; <https://www.rightnow.de>; <https://vivy.com>, last access 10.03.2025. We have only given examples from the literature of those who did not take part in our study in order to guarantee our participants (intermediary 1 to intermediary 5) anonymity. Their descriptions can be found in section 3.2. Additionally, these examples show how such intermediaries can assist with monitoring, claiming, and documentation tasks, while at times possibly relying on business models adverse to consumers’ interests (e.g. data driven or brokerage business models).

(as discussed above concerning principal–agent conflicts, power and information asymmetries, transaction costs, etc.). Some actors with whom intermediaries must cooperate may, due to their business models, attempt to influence consumers' purchasing decisions in ways that conflict with consumer interests (cf. Jensen and Meckling 1976). These resulting conflicts of interest may further impede cooperative arrangements involving intermediaries.

An open question remains as to how these intermediaries can (efficiently) perform their services when they themselves must cooperate with consumer-facing organizations—even in the presence of conflict (cf. Easterbrook 1996).

7.3.3 Conflicts and interoperability in cross-boundary work arrangements

Cross-boundary cooperation (Tushman and Scanlan 1981; Gasson 2006), along with its associated conflicts and resulting breakdowns, has been extensively studied in CSCW for several decades (Symon et al. 1996; Avram et al. 2009; Easterbrook 2012; Abraham and Reddy 2013; Olson and Olson 2014; Lee and Schmidt 2017).

Easterbrook (2012) frames it as a '[...] phenomenon in interactions both between individuals, and between groups of individuals' describing it as '[...] the opposite to “cooperation”'. In this context, Bardram (1998) argues that breakdowns should not be seen '[...] as a problem but as an important resource in design', as they allow researchers to observe 're-coordination'/ coping strategies that actors develop to mitigate them (Easterbrook 1996; Abraham and Reddy 2013).

In their studies on remote collaboration, Olson and Olson (2014) propose a socio-technical perspective to structure the wide variety of conflicts in distributed work, categorizing them as occurring on either a social or a technical level. The latter, the technical level, refers to the design of appropriate cooperation infrastructures and the media used within them. Moreover, Olson and Olson note that many barriers to collaboration are social rather than technical and, while not unmanageable, are often overlooked because people are less aware of these issues and therefore less likely to address social-level conflicts.

Conflicts on a social level. On the social level, the previously derived conflicts stem from the differing interests of the actors involved and the systemically induced invisibility of consumer-driven intermediaries. CSCW studies describe such socially induced conflicts (Dahrendorf 1958) as arising from potentially incompatible or opposing goals, objectives, values, and aims (Putnam 1987; Easterbrook 1996; Easterbrook 2012), often triggered by competition for scarce resources, or, in other words, benefits and incentives (Pondy 1967; Grudin 1988; Easterbrook 1994; Olson and Olson 2014). In pursuing their respective goals,

objectives, or values within inter-organizational activities, each cooperating actor exercises a certain degree of independence within the shared work arrangement (Schmidt and Simone 2000). To address such conflicts, coordinative efforts are required to achieve interoperability among people, groups, and organizations.

Furthermore, studies indicate that socio-structural conflicts can emerge in functional relationships when the procedural alignment with interacting (social or technical) systems is neglected. These systemic issues may, for example, disrupt the ‘flow of information’ (Pondy 1967); (see also Avram et al. 2009). As a result, conflicts may arise from ‘[...] an error of communication or of perception by either party, or a difference in understanding of the situation’ (Easterbrook 1996).

Conflicts on a technical level. Conflicts and breakdowns in cross-boundary work arrangements also manifest in the technical infrastructures that intermediaries rely on to cooperate vis-à-vis different parties. Duckert et al. (2025) describe that infrastructure and work itself influence each other. While work occurs within a local context (such as households or intermediary firms), in practice it is often co-determined by the infrastructure and influenced by (invisible) independent entities embedded within it, such as people, artifacts, systems, and more (ibid.).

Intermediaries seek to integrate into, or position themselves as, cooperation infrastructures, building a bridge between consumer households and organizations (and their systems), thereby creating interoperability between actors and their information systems. Consequently, intermediaries develop what Suchman (1996) describes, ‘artful integrations’ into the infrastructure of the market—elements that CSCW research seeks ‘[...] to bring [...] forward into the light’. In doing so, intermediaries’ employees utilize a subset of tools within a heterogeneous infrastructure landscape (cf. Hüllmann 2022).

Regarding the use of various tools, HCI research has developed influential theories on media appropriateness, such as ‘media richness theory’ (Daft and Lengel 1986) or ‘social information processing theory’ (Fulk et al. 1987) along with subsequent developments focusing on symbolism (Trevino et al. 1987), synchronicity (Dennis and Valacich 1999; Dennis et al. 2008), social presence (Rice 1993; King and Xia 2007), and other factors influencing media use (Sitkin et al. 1992; Robert and Dennis 2005; Ishii et al. 2019). All of these theories aim to predict which characteristics media used in cooperative infrastructures should possess to identify the most suitable medium—a task that is challenging to generalize across countless diverse situational contexts (cf. Suchman 1987). Nevertheless, these media-related theories remain highly relevant for designing effective CSCW systems (Kies et al. 1998).

Finally, over time, an intensive scholarly discourse has led to an understanding that many different cross-boundary work arrangements are shaped by the complex interplay of technical and social factors (cf. Olson and Olson 2014). Work arrangements and infrastructures must therefore be conceptualized as an interwoven picture of actors and systems that have evolved over time, rather than being reduced solely to market mechanisms or media use. This multi-perspective view provides a compelling empirical lens for investigating the work of consumer-driven intermediation.

7.4 Methodology

To investigate the bridging work performed by intermediaries, we employed a qualitative multi-method approach. This allowed us to consider both social and technical perspectives as we uncovered the work practices of the five intermediaries we studied. In doing so, we examined them on two analytical levels (cf. Olson and Olson 2014):

- commonalities in work arrangements and associated social perspectives, and
- interactions with infrastructures from a technical perspective.

From a socio-technical standpoint, these two levels are inseparably interconnected, mutually influencing one another and together shaping the resulting work practices of the intermediaries. Within our multi-method approach, we aim to capture the shared understanding of this ‘community under observation’ at both levels, along with their patterns of interaction, cooperation, artifact sharing, and the use of ‘specific technologies’ (Kies et al. 1998). To achieve this, we followed an iterative two-step research process:

(1) In the first step, we conducted five qualitative interviews with founders of intermediary companies (cf. Crabtree et al. 2000; Rohde et al. 2017), who all also have first-hand experience with the type being required, as they built these companies themselves from the ground up. In these interviews, we asked participants to elaborate on their businesses and relationships, to narratively describe and explain concrete work practices, and to present related artifacts. This approach enabled us to gain insights into both analytical levels.

The interviews followed a semi-structured guideline covering topics such as (I) business models, (II) perceived customer pain, (III) cooperation work with consumers and (IV) with organizations, (V) digitalization and automation, routines, and (VI) challenges. Whenever possible, alongside the interviews, we collected and analyzed various work artifacts, including advertising materials, client-related documents (both physical and digital), binders, and apps.

(2) Following up on the interviews, we sought in a second step to deepen our understanding and interpretations from the interview study through direct field observations. To capture work practices more directly and in situ, one of the authors conducted a one-week participant observation in one of the five firms, acting as an intern to gain deeper insights into the cooperative work practices of the intermediaries in real-world settings (Kies et al. 1998). For this fieldwork, we selected a firm operating across multiple industries to observe work practices that are comparable to those of the other intermediaries (see section 7.5.2).

During the observation, detailed field notes were taken in five- to fifteen-minute intervals, supplemented by photographs of the observed activities and artifacts. The notes included verbatim quotes whenever possible, which were finalized and revised at the end of each day. During the observation, the researcher participated in meetings, self-performed internal and external-directed tasks, and engaged in informal discussions with employees (Boden et al. 2009). Here, the researcher sought to minimize interventions in order to avoid disrupting ongoing work practices.

The results on the two different levels on analysis are first described separately in this paper, leading to joint discussions and conclusions. We only present findings that we could comprehend by both the interviews and the fieldwork. However, in the presentation of infrastructuring practices, data from the field observations predominate as they provide a greater level of detail as quotes from the interviews.

7.4.1 Sampling and participants for the interviews

As part of the recruitment phase of our research process, we contacted ten German firms from different industries to request whether we could investigate their work practices as part of our study. Five of them responded and agreed to participate in the interviews, with one also granting us access for field observations. Through prior research projects in adjacent contexts with these participating five intermediaries, we had already established trusted relationships—either through personal contacts or through our research institution—which facilitated access and enabled a trustful research cooperation. The five participating intermediaries vary in their business model, industry and size of the customer base, providing a diverse sample for our interviews (see Table 23).

All interview participants are the founders of small startups or branches. Their ages ranged from 34 to 67, with a median age of 36. Four were male, and one was female.

We selected founders, as they possess a certain level of abstraction over the entire firm, as well as detailed knowledge of all basic practices, processes, and products from the beginning

of their founding. Because of the relatively small size of the firms, our participants not only hold a managerial perspective but also engage in day-to-day operations as senior employees with the most client experience. At Intermediaries 1 and 2, we learned from the interviews that the founders still manage their own clients, while at the other firms, the founders were the first employees and had previously performed the same tasks now handled by their staff. All the founders are frequently hands-on involved or consulted by other employees on how to handle specific client issues or for background information on particular clients, as they accumulate knowledge across the entire firm. Furthermore, over the years, they have gained experience through trial and error, learning what works and what is feasible or accepted by consumers, partners, and both private and public organizations.

As we interviewed only one person per organization, we acknowledge the potential risk that this could make otherwise heterogeneous organizations appear homogeneous. However, our analysis focuses on fundamental commonalities and differences between intermediaries interacting with organizations, rather than on internal workplace conflicts within a single intermediary.

Due to the partly large number of customers that each of these companies represents (ranging from hundreds to hundreds of thousands) and the many years of experience (three to 21 years), this sample accumulates a very large number of consumers and their resulting consumer work. It thus also forms a broad spectrum of consumer-driven needs, interests, and experiences with many cooperating organizations. This helps to capture and understand a variety of dynamics within the inter-organizational marketplace. Furthermore, while the five intermediaries in our study have different business models, ranging from traditional brokerage commissions over monthly subscription fees and freemium app models to a payment per working hour, they all share a common customer promise of serving primarily or exclusively the interests of their clients following a consumer-driven approach.

Through our well-established rapport with the companies, the interviews were conducted in a trustful and candid environment, facilitating open dialogue about sensitive issues such as undisclosed business models and collaboration hurdles with other organizations. For example, we were able to have honest discussions about principal-agent conflicts (Jensen and Meckling 1976; Akerlof 1978), even among intermediaries. To ensure confidentiality, identities were pseudonymized (see Table 23), and certain passages in the interview transcripts were redacted. This precaution was essential in the competitive but also trust-based market landscape, which could lead to potential risks if identifiable details were disclosed.

7.4.2 Field description

In the following, we provide an overview of the different intermediaries involved in our study, in order to help the reader to understand the context of the following findings.

Table 23: Overview of the intermediaries interviewed
(Interview form: F2F = on-site interview; VC = video conference)

Intermediary ID	IF	Industry	Time in the market	Number of employees	Number of customers	Business model
I1	VC	Energy supply	- ³⁴	- ⁶	- ⁶	Brokerage commission
I2	F2F	Insurance & financial advisory (Branch)	13 years	15	≈ 2.000	Brokerage commission
I3	VC	Health management	3.5 years	11	120 users from 60 companies	Paid by an employer for its employees
I4	VC	Document management	>10 years	15	>100.000	Freemium
I5	F2F	General administration with focus on older consumers	21 years	13	≈ 100 (active)	€/ h

Intermediary 1 in the energy sector. Intermediary 1 (I1) assists consumers in always having the best energy tariff. A client of I1 first specifies the characteristics that a tariff must match, such as lowest price, sustainability, regionality, etc. Then, within the spectrum of these characteristics, the firm continuously searches for the best deal and either (a) regularly makes recommendations to the consumer via email with an offer to change the tariff, or (b) adjusts the tariff automatically using a pre-signed power of attorney. The standard business transactions for I1 include comparison, commissioning, tariff changes, contract termination, and providing information about contract updates (e.g., price increases). I1 receives a brokerage fee from the energy supplier when facilitating a tariff change or commissioning a new contract. However, I1 assures consumers that this payment is accepted solely as a standard industry practice, enabling the company to offer its consumer-driven service free of charge.

Intermediary 2 in insurance and financial advisory. Intermediary 2 (I2) is a branch headed by our participant, who works as a freelance financial advisor and independent insurance broker. He employs 14 staff members who assist him in advising consumers on their financial affairs. I2 earns revenue through commissions from brokering financial products. As a representative of the insurance industry, I2 places orders for financial products on behalf of

³⁴ To protect the anonymity of the participating company, the respective values are not presented and have been redacted in the transcripts.

consumers, while also promising to support them—both before and after the conclusion of contracts—with inquiries, insurance claims, and the modification or termination of contracts.

Intermediary 3 in health management. Intermediary 3 (I3) is a startup that partners with employers to support the health management of their employees and their family members through so-called ‘employee assistance programs’ (Walsh 1982). The employer pays for the service on a monthly subscription basis, allowing employees, as users of the services, to receive support from I3 for health challenges or preventive care. If an employee in the role of a consumer experiences a physical or mental illness, the intermediary provides advice and guidance on how to address the issue. One of I3’s most common business activities, alongside the initial assessment of diffuse symptoms, is assisting consumers in securing specialist doctor appointments or therapy placements, as well as supporting them with health insurance claims and billing. In practice, I3 arranges appropriate appointments for consumers and communicates relevant medical or health-related information, as obtaining specialist care or therapy in Germany is often very difficult—particularly for individuals with mental health conditions.

Intermediary 4 in document management. Intermediary 4 (I4) is a digital startup that offers an app for managing personal paperwork and related documents. The founder’s vision is to improve cooperation between providers and consumers through the use of boundary objects, beginning with the digitization of paper-based artifacts. I4 seeks to achieve a fully digital simplification of service processes, enabling organizations and consumers to cooperate on equal terms. The company follows a freemium business model, providing a free app with basic features that users can upgrade via a subscription plan to access additional premium functionalities.

Intermediary 5 in general administration focusing on older consumers. Intermediary 5 (I5) is the oldest of the firms we observed and has no specific industry focus, but primarily supports older consumers with general administrative tasks, similar to a ‘family office’ for wealthy families (Dunn 1980). I5’s 13 employees manually manage paperwork across various sectors, including energy, (health) insurance, finance, and document management. Its services primarily involve handling all correspondence, organizing and archiving documents, processing insurance claims, preparing financial overviews, carrying out financial transactions, assisting with tax preparation, and managing living wills, powers of attorney, and estate administration. The firm’s most frequent activity is claiming reimbursements for health services for privately (additionally) insured consumers.

We selected I5 for the one-week in-depth participant observation due to our longstanding collaboration, trustful relationship, and, most importantly, its broad range of working contexts

across various industries as a general administration service provider for its clients. Additionally, I5 is the longest-standing firm among all participating intermediaries, offering the broadest variety of services. Hence, the practices we observed there cover a very broad range and, at the same time, can be expected to be rather stable and established. Unlike sector-specific intermediaries, I5 primarily serves older consumers—many of whom are physically or mentally impaired—across all areas of private administration. This creates thematic overlaps with all other participating intermediaries (I1–I4). Because many of I5's customers have particularly limited autonomy, it was possible to observe the extent to which intermediaries can support consumer work, even up to a nearly autonomous execution.

7.4.3 Data analysis

After completing the data collection, all interviews were transcribed and reviewed by the authors. Field notes were taken during the observation and completed at the end of each day. The two types of data were analyzed side by side through a comparative coding process.

Throughout the study, approximately five hours of interviews—each lasting about one hour on average—were conducted, alongside roughly 35 hours of fieldwork distributed over typical seven-hour observation days. The fieldwork resulted in 39 pages of detailed field notes. Additionally, 20 photographs were taken during the interviews and fieldwork.

To consistently analyze the interview transcripts and field notes, identify common patterns, and develop themes, we used thematic analysis for both types of data (Braun and Clarke 2012). Drawing on prior studies on consumer work, we focused on work artifacts, procedures, and collaborative efforts as key analytical topics (cf. Dethier et al. 2024a). We also applied an analytic lens from material culture theory (Lueger and Froschauer 2022), treating artifacts as embodiments of practice, through which knowledge, skills, and meanings are materialized and made observable.

Within our iterative, two-step research process, one researcher first analyzed the interviews, developing a coding system from the insights gained. The emerging themes and patterns were then applied to the field notes, and the coding system was refined accordingly. This iterative process alternated between interviews and field notes to ensure robust theory development across the two data sources. Photographs and other materials visually enriched the analysis, supporting a deeper understanding of the material aspects of the practices examined.

Several joint interpretation workshops (Heinze et al. 2020) were conducted to discuss interpretations, theme naming, and develop documentary accounts of the examined work practices. These sessions enabled all authors to align their understanding of the context and

work practices, ensuring a unified interpretation (Crabtree et al. 2000) of the intermediaries' cooperative work.

7.5 Findings

7.5.1 Understanding the cooperative work arrangements

In the following, we first present the insights regarding the cooperative work arrangements, which are primarily derived from the interviews conducted across the different intermediaries, but are enhanced by our deeper understanding from the fieldwork as outlined in our two-step research approach above. As we will show, when an intermediary integrates into the consumer-to-organization cooperation, a newly formed working arrangement must first be (1) articulated and established. Within this arrangement, we identified (2) common conflicts and breakdowns, as well as (3) the coping strategies used to mitigate them.

7.5.1.1 Establishing and articulating work arrangements

According to our study participants, the consumer work that is handled generally arises from a series of contractual relationships or civic obligations with multiple private or public organizations. Consequently, heterogeneous relationships result from the diversity of consumer needs and the resulting complex relationship landscape: large vendors versus small enterprises, commodity products versus solution-oriented services, differing industries and their regulations, public versus private institutions, etc. As I4 stated: 'So, there is not just one private individual, there is not just one company [...]. They all have different challenges and approaches'. For both intermediaries and consumers, this heterogeneity presents a challenge to maintain an overview and achieve harmonization, as I1 describes:

'We have a rather large number of providers here, all of whom have slightly different processes and it is not enough just to squeeze this into five processes and then the issue is over; instead, if we add up all the contract processes alone, we end up with a very high number of different contract processes'.

I5 also highlighted the complexity of determining whom to contact, even for a single topic:

'You can't call an insurance company today and clarify everything with one person. You have your own contact person for every single piece of the puzzle. There is the care

insurance company, there is the health insurance company, [etc.]. You can only ever handle everything in facets, and that makes life difficult for people' (I5).

Entering the new work arrangement. When intermediaries enter such a complex relationship landscape as a third party from the outside, they must establish themselves within a new working alliance (see Figure 14). To do so, intermediaries like I2, I3, and I5 first carry out an inventory to gain an overview of the existing contractual relationships within the respective industry sector, helping to bring structure to each client's complex situation. I5, for instance, collects postal mail, as many of its customers accumulate large amounts of unanswered correspondence at home: '[It] also happens that people have piles of paper, have collected them for years, [and] have no overview at all [such as] [...] piles of payment warnings' (I5). From there, I5 identifies which tasks must be addressed immediately, such as settlements with health insurance companies or responses to incoming requests. From I5's perspective, they primarily collect and organize, for example:

'Invoices, letters from the tax office, for electricity, water, house, utility costs, documents that we [...] gladly file are health care powers of attorney, living wills, [...] passports copies, copies of ID cards, [...] bank statements, but it depends on the customer to what extent they are willing [...] to give us access'.

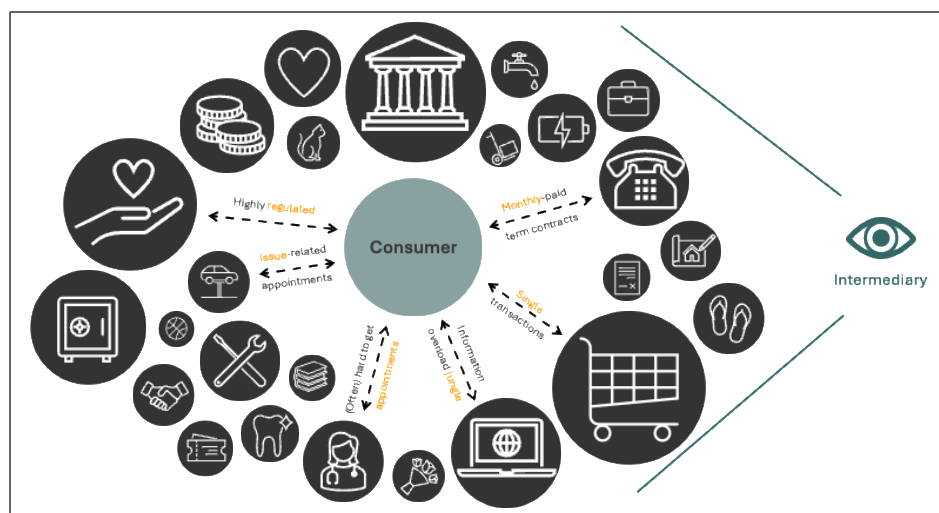


Figure 14: Allegorical illustration of the messy, heterogeneous relationship landscape with an intermediary as an outside third-party

I2, as a financial advisor, creates an overview of the current financial obligations and financial products that could be optimized, changed, terminated, or might be missing—such as essential health, life, pension, or property insurance. 'If we are honest, probably only 20 percent

of customer folders are neatly sorted before they come to us. 80 percent are really messy’³⁵ (I2). I2 continues that

‘[...] sometimes there are also evidence documents that are needed in the event of an insurance claim [but] [...] you have a folder full of [...] 500 sheets of paper, [...] which of those 500 pages are really relevant? In most cases, maybe 20-30-40 pages’.

If desired, I2 and I5 create a so-called ‘emergency folder’ by collecting and organizing documents that contain the most important records such as birth certificates, marriage and divorce certificates, church documents, copies of ID cards and passports, important contacts, CVs, term contracts, passwords (at I5, see Figure 15a-b), pension plans, health, long-term care, accident, life and property insurance, as well as other financial plans and assets (at I2, see Figure 15c-d). Both intermediaries call it an ‘emergency folder’ because, in the event of a crisis—such as a house fire, an unexpected hospital stay, or the death of the respective person—all essential documents can be accessed at once. What is considered an important document varies slightly between I2 and I5. The term ‘emergency folder’, however, serves as a catchy label by appealing to consumers’ general desire to be prepared for emergencies.

Here, I2 (and also I4 in general) provides their clients with a free app for handling such documents by themselves, getting them automatically sorted by the software, and sharing them digitally with third parties. With their document app, I4 states that they provide a ‘[...] peace-of-mind feeling. So that you know you have a structure [with your documents]’.

The heterogeneity and the high volume of paper-based artifacts result in highly manual, labor-intensive tasks that are challenging to automate, digitize, and systemically integrate, as I3 notes: ‘Until the end of last year, I would have said that we were 80 percent manufactory. [...] Now we are perhaps at 65, 70 percent, as can be seen from the personnel cost ratio [...]’. This is also due to the often extensive human-to-human interaction, which entails a significant amount of articulation work.

³⁵ [originally, he said ‘bird wild’ instead of ‘really messy’ but this translation would make no sense]

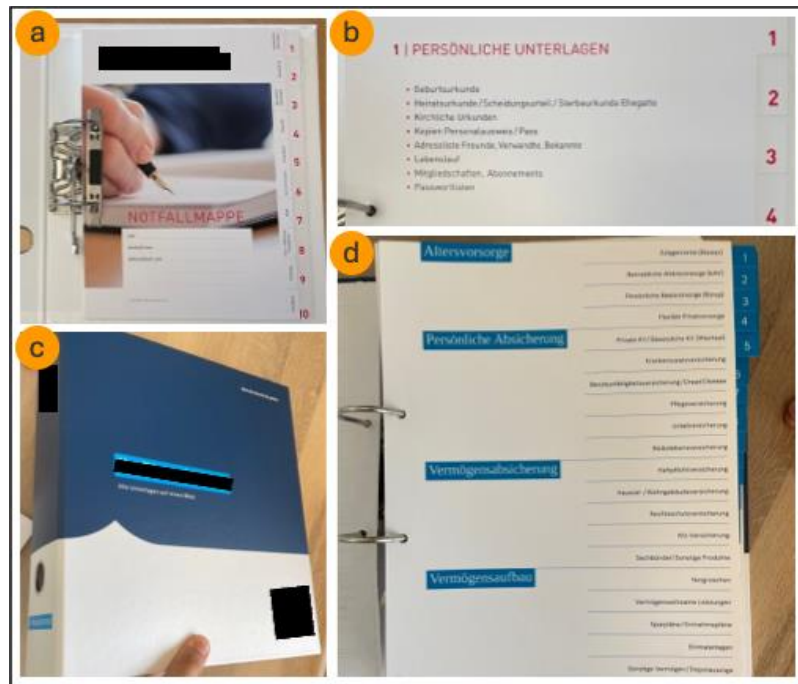


Figure 15: ‘Emergency folder’ at I5 (a, b) and I2 (c, d)

Articulating the work arrangement. As we have explained above, we found that acting on behalf of a client requires a particular articulation of the current work arrangement. I5 essentially sums it up: ‘We usually communicate with powers of attorney. [...] We usually attend the appointments with powers of attorney’.

To articulate their ‘rightful’ role as intermediaries, I2 asks the customer to sign all actions before sending them out. In contrast, I1, I3, and I5 have their work arrangement authorized by a power of attorney statement in advance. At I1, this is done by signing specialized general terms and conditions online: ‘[You just] make a tick. ‘I accept the terms and conditions’ [...] We write [...]: ‘I [as a consumer] hereby authorize [...]’. This is easier to negotiate as a paper-based, and notarized (general) power of attorney that I5 requires for their work. Here, I5 either uses a template from the German Federal Ministry of Justice (see Figure 16) or asks their clients to create individual documents at a notary, exclusively issued in paper format. In practice, I5’s articulation work is carried out ‘[...] either by telephone or, if that is not possible, by email, by sending the power of attorney and then receiving information in this way’.

Such notarized general powers of attorney, as utilized at I5, have no legal limitations within the work arrangement. Instead, I3 perceives some restrictions in its work constellation, as some actions must ultimately still be carried out by the consumers themselves. As I3 describes: ‘We cannot take the step. We can’t issue the transfer ourselves, but we can make the process as easy

as possible. In other words, we inform [the consumer] beforehand. [...] What do you have to say there to get it?’.

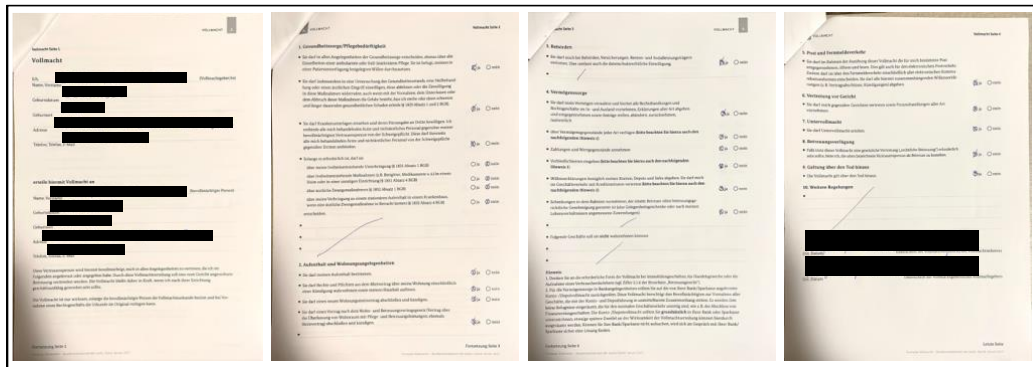


Figure 16: Record of a power of attorney at IS based on the template of the Federal Ministry of Justice of the Federal Republic of Germany³⁶

7.5.1.2 Challenges of (not) being ‘man in the middle’

Equipped with a negotiated and articulated working arrangement, the idea is that the intermediary—as the name suggests—positions itself between a consumer and an organization (either within a specific industry or in general) and acts as an interface for both, as visualized schematically in Figure 17a.

However, the complex and heterogeneous relationship landscape of providers, combined with the variety of communication infrastructures, makes this positioning challenging. By intervening in the one-to-many (1:N) relationship, intermediaries encounter obstacles arising from communication channels and systems designed to interact directly with consumers, without accounting for their role. Hence, ‘simply’ positioning themselves as middlemen is a major challenge, as the following two examples illustrate (see Figure 17b-c). Even though well-established through their brokerage activities, I1 and I2, operating as recognized intermediaries within their industries, are often excluded from organizational communication directed toward consumers: ‘[...] if there is correspondence that is only available by postal mail [that goes directly to the customer], there is no possibility of obtaining the information’ (I1).

³⁶ Reference:

https://www.bmj.de/SharedDocs/Downloads/DE/Formular/Vorsorgevollmacht.pdf?__blob=publicationFile&v=6
; Version from January 2023; last access 10.03.2025.

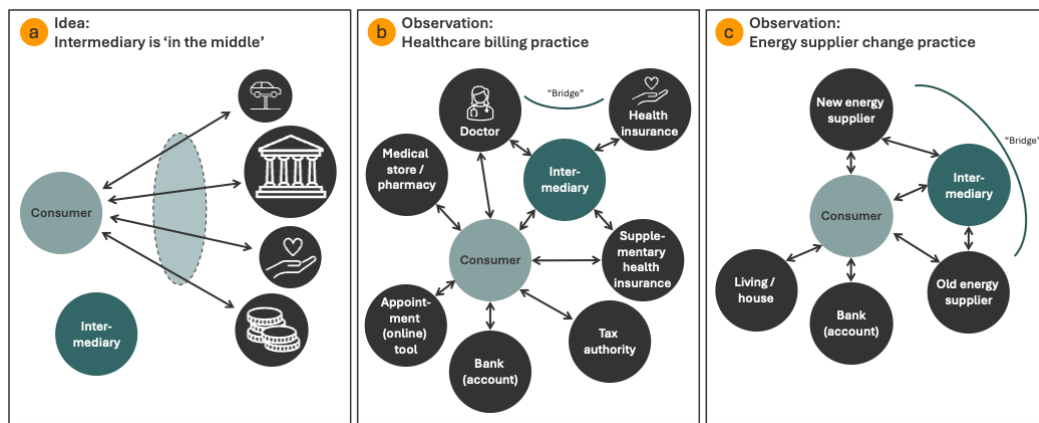


Figure 17: Idea (a) versus empirical findings (b, c) of being 'in the middle'

Example 1: health care billing. I5 regularly mediates in the medical billing process on behalf of the consumer, coordinating between the billing doctor, the paying insurance company, and any supplementary insurers. This often also involves further organizations, such as medical supply stores, pharmacies, appointment platforms, the consumer's bank, or even the tax authority. The process includes several work steps, such as

- (1) checking the invoice (e.g. plausibility, already paid or not, due date, etc.),
- (2) submitting it to one or more insurers (by postal mail, email, or via an online portal) including medical prescriptions (see Chapter 4.2.2 below),
- (3) tracking and following up on the reimbursement,
- (4) checking the reimbursement (sometimes repeatedly until it arrives),
- (5) clarifying any issues with the reimbursement (this happens often) with insurers and the billing doctor, and
- (6) transferring the invoice amount to the biller via the client's bank account.

In this context, I5 stated that this is

'[...] exactly what is left undone. [The clients] receive payment reminders from the doctor. We also have clients where [they have] stacks of reminders from all kinds of medical institutions because [they] simply don't manage to get the money [reimbursed]'. In this way, as shown in Figure 17b, the intermediary bridges cooperation between the biller (doctor) and the bill payer (insurance company) and thus performs the consumers' work.

However, within the flow of cooperation / communication, I5 is neither recognized as an intermediary nor acknowledged as actor on its own, since all responses from the organizations are addressed directly to the consumer (e.g. via postal mail or email). Instead, as Figure 17b implies, the consumer remains at the center of all communication, requiring the intermediary

to step in and coordinate case-specific exchanges between the consumer and multiple interacting organizations. This includes managing the initial invoice from the doctor as well as handling issues, answers, and reimbursement statements from the insurance company in reply to requests submitted by the intermediary (either under its own sender identity or via the customer's account on online portals).

As I5, despite its long-standing history, is still a relatively unknown player in this industry, they explained that they must invest considerable effort to establish themselves and articulate their role towards the organizations. They usually exchange confidential patient data during healthcare billing practices and therefore the formal power of attorney is often essential for their work and must frequently be presented multiple times to the same organization.

Example 2: energy supplier change. I1 aims to ensure that consumers always have the best energy tariff and therefore completely takes over transaction costs in the transition process from an old to a new energy supplier (see Figure 17c). In doing so, they continuously monitor the market rates for their clients. When it comes to a contract change,

- (1) the new supplier must be commissioned,
- (2) the old supplier must be terminated,
- (3) the current (water, electricity, or gas) meter reading and the meter ID must be transmitted to both the old and the new supplier,
- (4) the amount of the monthly advance payment aligned with the consumer's consumption and other recipient-specific details, must be negotiated, and
- (5) the order status must be continuously monitored until the process is complete.
- (6) If an issue arises, I1's employees must fix it.

As a standard business model in this sector, I1 is less frequently required to articulate its role in the work arrangement than I5. Nevertheless, I1 still faces the major challenge that some suppliers ignore or block their inquiries or termination requests, and customer communications such as price increase notifications do not reach them.

To resolve such conflicts and establish themselves as intermediaries toward an organization, our participants employ specific practices and special artifacts, as discussed above. The goal is to create a lasting work arrangement in which all communication is directed entirely to the intermediary, who is authorized to act on behalf of the person, as observed in our fieldwork: '[One employee] create[s] a letter for a client's pharmacy so that the invoices are sent to [I1] and not to the client' (Fieldnotes Wednesday).

However, this requires the intermediary to be accepted by the organizations, which must acknowledge this arrangement in their customer relationship management (systems). We found that this was often not successful. As we have discussed with the participants, the interviewed intermediaries frequently perceive that they are (either intentionally or unintentionally) ignored by the organizations, despite their articulation of the newly formed work arrangement. The intermediaries reported that organizations often resist cooperating with them, leading to conflict situations. For instance, our interviews revealed a notable perception among the intermediaries, with three explicitly stating, that some organizations deliberately sabotage collaboration:

‘[...] Not every [energy] provider appreciates that we exist [...] and therefore don’t make life easy for us. [...] Classically, you have very much a game of cat and mouse [in the cooperation]. They bet on inertia, and we are canceling out inertia. [...] And depending on how the partner understands us, [they] make it easier or less easy for us [...]. So, a partner or a provider who doesn’t like us won’t provide us with an [application programming interface (API)], and then it’s up to us to communicate this in other ways. And nobody can prevent us from carrying out an action in the interests of the [consumer] but can only make it a little more difficult [...]’ (I1).

This often leads to silent breakdowns, as it sometimes occurs at I5 that an insurer does not receive a reimbursement claim or requests additional information that has already been provided, with the issue only becoming apparent when the intermediary follows up. Similarly, at I1 or I2, for example, a termination during a contract change was not accepted and therefore not processed, with I2 stating that ‘[t]here is a certain regularity to it, and maybe even a systematic approach with one insurer or another’. Furthermore, digital interfaces (APIs) or access to cooperative systems are often not provided, which complicates and slows down cooperation.

In the following, we will analyze the coping strategies of the intermediaries that have to deal with such (perceived or real) breakdowns in the cooperation arrangement.

7.5.1.3 Coping strategies I: Redirection and onsite work

As a first coping-strategy category, we found that the intermediaries seek to redirect the communication coming from the organizations that is meant to go directly to the consumer:

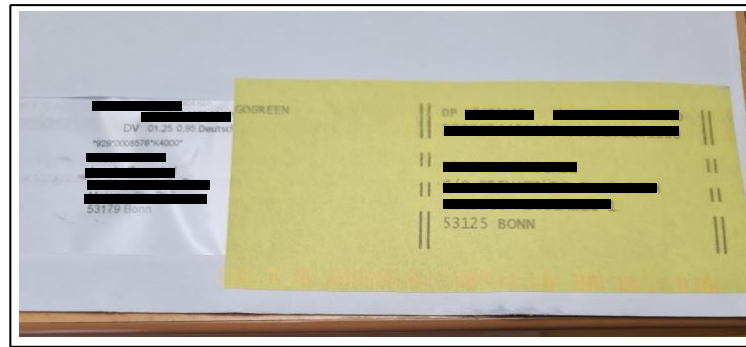


**Figure 18: Mail at I5 that was re-directed by mail forwarding order
(the yellow sticker is added by the post authority for redirection)**

Redirection by authority. At I5, it is common practice to establish a forwarding order with the postal authority, a supervisory governmental entity that can control message traffic (exclusively) in the postal system. Postal mail that would normally be sent directly to the consumer's address is redirected to the intermediary's office. 'We work a lot with postal mail forwarding requests so that the mail no longer gets lost and doesn't end up in a corner somewhere [...] but actually arrives here and can be processed promptly.' (I5). These forwarding orders are originally intended for situations where consumers move and not all organizations have their new address.³⁷ However, this service is only available for the postal system and does not extend to emails, phone calls, or other communication media (see Figure 18).

Redirection by consumer. Furthermore, when possible, the consumer is requested to forward incoming mail or other needed information from their home to the intermediary. I1 advises clients to forward everything they receive to them via email: '[...] simply take a photo of everything that comes from the provider in case of doubt and then pass it on'. In some cases, the intermediary may need to receive not only messages but also information that can only be accessed on-site at the customer's home, such as a photo of the water meter within the apartment. To professionalize this forwarding strategy, I2 has integrated an upload function into its client app or provides a link to cloud storage so that their clients can share documents with them: 'They are simply photographed via an app and immediately deposited with us—we call it the advisory folder—our digital customer folder, so to speak. [...]' (I2).

Redirection via platform. At I3, for example, the team shares doctor's appointments through brokerage platforms: 'So, we basically appear like a doctor's office, [...] with our own

³⁷ <https://www.deutschepost.de/de/n/nachsendeservice/haeufige-fragen.html>, last access: 10.03.25.

clients, patients, calendar and can send appointments from the calendar'. To this end, I3 is trying to establish new partnership models with platform organizations.

On-premise work. Some parts of consumer work still require tasks to be completed on site at the consumer's home. That means consumers, their relatives, or the intermediary must be physically present to carry out certain actions. As I1 explains: 'There are actions that we cannot do [...] that have to do with your own four walls' (I1). In this case, all interviewed intermediaries except I5 ask their customers to do work onsite. But at I5, their customers are often no longer able to do this due to their (usually age-related) limitations, so I5 employees visit their customers regularly: 'Yes, there must be someone on site who visits the lady regularly'.

7.5.1.4 Coping strategies II: Utilizing awareness

The second coping-strategy category we identified is the development of a certain awareness regarding organization- and industry-specific processes, which intermediaries build through their long-standing experience:

'[...] Provider-related communication[:] In some cases, we also do not know exactly when what is being communicated. Keyword: price increase. We know rough patterns. We still actively ask [our clients] when the probability is very high [...]' (I1).

Here, we noted several aspects:

- **Awareness of patterns.** Anticipating correspondence that will reach consumers allows intermediaries to proactively address potential issues, as illustrated by I1's comment about expected price increases above. This also ensures that consumers are prepared and informed about possible outcomes: 'Should I take action? What happens if I do nothing?' (I1).
- **Articulation awareness.** Understanding the processes of an industry is crucial for some intermediaries, who often possess a highly developed awareness of these processes and can therefore handle complex requirements and terminology effectively: '[...] We explain to the person seeking help what they have to say there so that they get what they need' (I3). This awareness also reflects a sensitivity to wording, as I2 describes:

'[...] What do you write so that the insurer directly understands what is meant? Do we really have a compensation claim? And sometimes a bit of sensitivity is required. Not to deceive the insurer in order to receive a compensation that you

are not actually entitled to, but simply to ensure clarity. Insurance German is just not a common language virtue' (I2).

- **Process awareness.** At I5, employees streamline their workflow by identifying procedural efficiencies when handling healthcare claims:

'Actually, I have to submit each invoice individually here, but I just take one and enter the invoice data [...]. I then add the other invoices, and they are all reimbursed, too' (Field notes Friday).

- **Organizational awareness.** I2 explains that he knows whom to work with, selecting from multiple customer-facing actors and departments in each respective case:

'Of course, we have at least one key account manager at every single company who is the go-to guy [...] because if we ever have pain [and] are dissatisfied with something. [Otherwise] of course, every insurer has its own departments, usually a property division, a pension division, or a life insurance division, a division for workforce protection. You can also contact them directly. You don't call the key account manager about every nonsense' (I2).

7.5.2 Investigating infrastructuring practices

So far, we have examined common perceptions, challenges, and coping strategies of all five intermediaries in their work arrangements and associated conflicts. In the following, we focus on bridging practices related to infrastructure, which we captured narratively in the interviews and explored in greater depth during our fieldwork. When presenting the results on work practices involving infrastructure, the data from the fieldwork predominate due to its higher level of detail, while we aimed to highlight both the commonalities and the differences also within the interview data.

7.5.2.1 Work materiality matters

The cooperative work of an intermediary manifests itself materially in the exchange, processing, archiving, monitoring, and reviewing of various artifacts. We found a range of material artifacts where, on the one hand, materiality plays an important role in the work, and,

on the other hand, discontinuities between different media have to be bridged (these will be covered in the following section).

Media discontinuity. In both the field observations and the interviews, we noted numerous media discontinuities in the intermediaries' work. These discontinuities can be understood as breaks in the information flow, occurring when data must be transferred manually between incompatible media or systems, as exemplified by the following observation from Thursday:

'She has opened a document in Microsoft Word on the screen, with two binders in front of her, copying documents. Handwritten notes are being made on a document with a pen. She is copying information from another sheet in the binder' (Field notes Thursday).

Here, employees manually bridge the heterogeneous materiality of this work, converting artifacts into the correct format for further processing, as the following notes demonstrate:

'When mail arrives from former customers, it is scanned and sent to the contact person via email' (field notes Monday); 'At their workplace, some employees run back and forth in the office [...] From desk to colleague, to scanner, to printer, etc.' (ibid).

For this reason, the work was observed as highly error-prone: 'The work is not difficult, but you can make mistakes very quickly. "Wrong table, wrong column"' (quoted from I5-E7; field notes Monday) (see Figure 19).

Digitization of paper. To streamline often highly manual, human-executed tasks and minimize potential errors, a common objective at all intermediaries is to digitize all (all incoming) mail and messages. As the CEO of I5 states, '[...] we are currently working on scanning the entire incoming mail [...]'. This digitization effort also allows I5 employees to work from home with their laptops, eliminating the need to transport physical binders.

At I2, all paper-based customer documents are digitized by employees during the inventory process and stored in the customer app: 'They are simply photographed via an app and immediately stored with us—we call it the consultation folder [...]' In some cases, this digitization must also be carried out by the client when forwarding documents (cf. section 7.5.1.3), which is '[...] usually a photo [...]' (I1). Meanwhile, I4 (as well as I2) provides customers with appropriate technology for this practice: 'Yes, we have users who come home and just lay their documents on the scanner, press the AI button, and then it is just in the application'.

‘Originals’. In some cases, the availability and exchange of certain documents in a suitable ‘original’ format also play a crucial role. In the office, original documents are perceived as important to keep and share with certain insurers who explicitly require the original invoice, which is perceived as the only genuine representation of valid information. This creates a conflict with digitization goals, as at I5 such documents remain exclusively in paper form. Consequently, ‘originals’ can only be exchanged via postal mail or in a face-to-face meeting, which, as observed at I5, results in a heavy reliance on postal communication (see Figure 20a-c).

Nevertheless, consistently articulating artifacts as ‘originals’ can be a challenge in cases of geographical distance with the client, as I5-E2³⁸ explained with an example: ‘A general power of attorney is held by the son in Australia. The original would be needed here [in Germany] to sub-authorize the company’ (field notes Friday).

Usual examples of ‘originals’ are:

- the ‘original’ paper-based powers of attorney (see Figure 16), which are often notarized (only possible in paper form, as digital certificates are not used),
- the ‘original’ invoice issued by a biller, or
- diplomas, certificates, and other documents belonging to the client and stored on their behalf.

I2 returns as many original documents as possible to the client, as they may be needed decades later, for example, upon retirement: ‘Because these are also partly pieces of evidence that are needed in the event of an insurance claim. If I want to cash out a policy, then I usually still have to send an original insurance certificate back to the insurer’.

Example: ‘original invoices’. When billing health services to health insurance companies and subsidy insurance funds, it can be important which organization receives a copy or the original of an invoice. I5-E7 comments: ‘The health insurance company gets the original. We make a copy and file it in our office’. If the public subsidy fund is involved, it receives the original invoice, the health insurance receives a copy, and another copy is placed in the client’s folder. This results in three copies for the same billing application. If a medical supply store or

³⁸ We pseudonymized the 14 employees of I5 observed during the fieldwork, including one of the authors acting as an observer, by assigning identifiers ranging from I5-E1 to I5-E14.

pharmacy is also involved, the number of copies increases accordingly (see multiple copies side by side in Figure 19a).

However, we noticed different perceptions of what qualifies as an ‘original’ and when an ‘original’ is required—among the employees of I5, the other intermediaries, and interacting organizations. Aside from hand-signed copies, we were unable to identify any distinction between an original and a copy in the case of machine-generated artifacts.

I5-E6, for instance, provides another explanation that shows the complex and varying perceptions of originals across different cases: ‘You need an original for some health insurance companies or subsidy insurance funds. [However, some also accept it], even if it is a copy. You may only need the originals for your tax return’.

Follow-up inquiries during the interviews revealed not only varying characteristic properties but also that these requirements typically originate from the organizations themselves, as demonstrated by the previous quote and the following statement from the interview with I2:

‘Interviewer: What do originals mean?’

Interviewee: Yes, they should be notarized. For the client, it actually doesn’t mean anything. But there are certain companies which, unfortunately, still insist on receiving a notarized original.’

Different degrees of digitalization. The processes of the different organizations across various industries, and thus also within the intermediaries, are digitalized to varying degrees. While I1 and I2 can partially rely on more digital collaboration within their relatively homogeneous and well-established business transactions, only a few activities at I3 and I5 are fully digital, as the following quotes illustrate. At I1 and I2, however, processes related to industry-driven operations tend to be largely digital, whereas those involving consumer-driven operations remain predominantly non-digital.

‘So via our digital application route [...]—I just press send—it automatically goes to our head office for application entry, automatically to the insurer and automatically to the client’s [online] portal’ (I2).

‘Usually, orders are transmitted via an API, and therefore this is not a classic correspondence, but rather correspondence is only required when it comes to other actions that the user communicates to us so that we can transmit them on their behalf’ (I1).

‘Whether I actually receive the documents digitally from my health insurance company is a bit of a matter of luck’ (I4).

Monitoring and tracking. I5 records internally all client-related actions, as well as their clients’ income and expense statements, customer contacts, and orders, digitally in Excel spreadsheets (see Figure 19). In contrast, I1–I3 make use of specialized software. I5-E7 emphasizes that monitoring and tracking of workflows and finances are crucial: ‘[...] if you don’t do this or check the invoices, people will lose thousands of euros’ (field notes Tuesday). I5-E7 continues later with a wrong reimbursement from an insurer: “‘Where did [the health insurance company] get the figures from? I’ve given up trying to understand.” An invoice amount is entered in an Excel spreadsheet. The Excel table is only about the incoming invoices’ (field notes Tuesday).

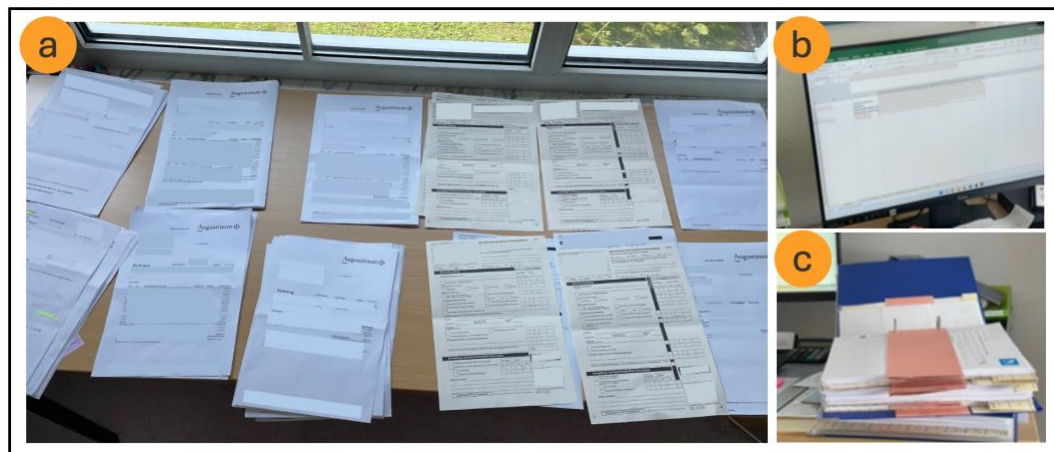


Figure 19: Different materialities of artifacts at I5

The requirements regarding materiality when cooperating with organizations lead to varied uses of infrastructures, as we show in the following chapter.

7.5.2.2 Use of communication infrastructure

Despite the messy heterogeneity of communication, we were able to identify some patterns in the use of different communication media. I2 attempts to quantify the various media used: ‘Let’s break it down: 10% customer portal, 20% email, WhatsApp is maybe 30, 30% phone, 5% Instagram, 35% phone’.

Here, across these diverse and fragmented systems—ranging from old to new, digital to analog—we observed various bridging practices employed by intermediaries to achieve interoperability.

In the first stance, we observed that the choice of the communication system for mutual interaction is primarily determined by the organization they cooperate with: ‘[S]ometimes by fax, sometimes by email, sometimes by postal mail. It depends on the health insurance companies’ (I5). The quote from I1 shows that an intermediary must choose another medium if the preferred one is not available: ‘So, a partner or a provider who doesn’t like us won’t provide us with an [API], and then it’s up to us to communicate this in other ways’.

Online portals, applications, and APIs. The intermediaries primarily prefer to use online portals or APIs to cooperate on service claims. These are perceived as efficient options for transferring information securely and with minimal effort:

‘Fortunately, you can do it online with the [health insurance company]. It doesn’t necessarily save time, but you don’t have to print it out [,] scan it [...], describe it, upload it, check it again, enter the company details and insurance details.’ (quote of I5-E6; field notes Tuesday).

Depending on the industry sector, intermediaries—particularly I5, as we observed—can gain access to specific portals to perform self-service on behalf of their clients.

- **Consumer-directed portals and APIs.** Within customer or citizen portals, I5 logs in using the client’s credentials to initiate service cases. This includes uploading, for instance, accident-related artifacts for car insurance, submitting medical invoices for health insurance, or managing commodity contracts—extensions, cancellations, adding options, etc. rather than intermediaries, an intermediary employee must act as the consumer, making it indistinguishable to the system whether actions are performed by a consumer or on their behalf. Only rarely have we observed intermediaries being granted their own dedicated access to such portals.

At the intermediaries, these portals are typically accessed exclusively via a web browser on a PC, as using a smartphone or tablet app would require a more complex infrastructure. However, some organizations provide access only through smartphone applications, rendering these tools unusable for intermediaries:

‘The apps that the health insurance companies have are designed for a person to make a submission using a smartphone. We can’t do that. We can’t have 50 smartphones lying around here’ (quote of I5-E3; field notes Friday).

- **Special case: online banking.** In our observations, banking portals play a unique role. Some banks do not offer online access for accounts linked to representatives as legal entities, but only to natural persons. As a result, all accounts managed by I5 are grouped under one access that is personally granted to the CEO, encompassing the clients' accounts, her private accounts, and business accounts. Consequently, bank account transactions at I5 are carried out exclusively by the CEO (or a deputy), rather than by the respective client managers. Unlike the previously described case of shared access to online portals, banks can precisely track who performs each account action. However, the intermediary lacks a multi-tenant structure that would allow for proper separation of accounts.

Email. Alongside their preference for using online portals and APIs, intermediaries also favor the use of electronic mail. It is utilized not only for intra-organizational coordination between employees within an intermediary but also as a preferred medium for inter-organizational communication. However, the perception at I5 is that emails have certain technical and organizational weaknesses:

- (1) Emails are typically unencrypted and offer no protection against access by unauthorized third parties. For this reason, according to the interviewees, other media—such as postal mail, which provides organizational layers of security through envelopes, or fax, which intermediaries and organizations perceive as being encrypted—are often preferred.
- (2) Only digital artifacts can be exchanged via email, whereas 'original' documents are often required.
- (3) Emails lack a legally valid proof of delivery, unlike fax or postal mail with tracking and tracing (see also I2's quote on missing terminations below).

Postal mail. As already discussed, cooperation still relies heavily on paper: '[...] And since online banking is not available, the (bank) transfer form must be signed and then sent by mail later' (Field notes Tuesday).

- **Inbound.** I5 receives a high volume of paper-based mail daily, most of it through forwarding orders via the postal authority (cf. section 7.5.1.3). Paper-based artifacts received are carefully archived to ensure that relevant information and evidence remain available for their clients, as also reflected in I4's statement about providing a 'peace-of-mind feeling'. Whenever possible, these artifacts are scanned, digitally processed, and shared via email, as illustrated by I5-E1's interaction with care facilities: 'I have

this letter. One of your colleagues took a photo of it, and now [referring to another third person] he has it in his email box' (quote of I5-E1 talking on the phone; field notes Wednesday).

Even in the highly digitized business of I2, they still receive postal mail: 'Sure, I also still get things by postal mail'.

- **Outbound.** However, a significant number of artifacts continue to be exchanged via postal mail, as this communication medium is used when others do not work or are not accepted by the organizations (due to data protection, processes, authentication, etc.). I5, in particular, frequently falls back to postal mail:

'I5-E6 has a customer at [health insurance company] and she can upload the forms online in her browser. [...] With the subsidy insurance fund, this still works by postal mail.' (field notes Tuesday).

The postal service was observed as a communication system that was always reliable for bureaucratic activities.

Consequently, I5's office is designed and well-equipped specifically for handling postal correspondence, with a range of supplies such as envelopes of various sizes, stamps, a postal scale, payment forms, and outgoing mail bins (see Figure 20a-c). By contrast, the industries where I1 and I2 operate are largely reliant on digital communication, as I1 notes: 'We hardly have any paper, unless someone sends us something by postal mail, which doesn't happen very often. But of course, we have [...] a lot of email communication in all directions, and with that we have the digital equivalent of paper [...]' (I1).

Phone. The telephone is used for short-term matters and minor consultations in which instant feedback is needed. It is particularly effective for emphasizing urgencies and following up on unanswered inquiries:

'M7 receives a call. 'Yes, I can come to you tomorrow. Tomorrow is urgent, yes?' [...]' (field notes Thursday).

'[...] with the therapists it's almost exclusively the telephone. [...] We always have to call them anyway. [...] Because they can only be reached by phone. So, of course, we always have a certain amount of time pressure. [...] When it comes to specialist appointments, we use online portals simply followed by the telephone' (I3).

‘[...] via telephone, because this is perhaps the fastest way to contact them’ (I2).

Fax. The fax machine demonstrates with its functionalities a balance between the advantages of fully digital email communication and the traditional paper-to-paper practices of postal systems. Field observations and interviews show that it remains highly popular and widely used in the medical sector and for legal matters. It enables the direct transmission of paper-based documents without additional steps such as scanning or printing, which are typically required for online portals or emails, thus avoiding media discontinuities from the scanner to file management on the computer, to email programs, and printers. It is perceived as operating in real-time, providing delivery confirmation, and offering perceived security features. In our field observations, the fax machine was regularly used to contact healthcare facilities (see Figure 20d). The characteristic of delivery confirmation, for example, was highlighted by I2 in the interviews: ‘[There is] perhaps a termination [of a contract] that has not been processed because the fax [...] allegedly did not arrive, but you had proof of transmission. Then you have to send this proof of transmission again’.



Figure 20: Artful preparation for handling paper-based artifacts

In this varied use of communication infrastructures—including digital portals and interfaces, email, postal mail, phone, and fax—we observed a tendency to revert to more conservative / traditional yet effective media. This phenomenon, along with the other findings, will be discussed in the following.

7.6 Discussion

As we have shown through the bridging practices of the five intermediaries, they constantly manage various conflicts arising from their work arrangements and the infrastructures they

engage with. Using a combination of interviews and field observations, we uncovered these practices and made them visible and understandable to the CSCW community.

Our findings reveal interconnected phenomena on two different levels, offering a comprehensive perspective on intermediaries' bridging work, which we discuss in the following. These insights contribute to a deeper understanding of the challenges, digitalization, and interoperability issues shaping intermediaries' work, which is becoming increasingly significant for cooperation in consumer markets.

In line with CSCW studies on boundary-spanning work (Tushman and Scanlan 1981; Gasson 2006), our research sheds light on the work practices of intermediaries as a relational world that is interdependent with the inter-organizational work from the arena of—favored or conflicted—work arrangements with consumer households and the organizations they interact with (cf. Clarke and Star 2008). Through this research approach, we gained a 'social' perspective on the work arrangements of five intermediaries, as well as insights into their artfully integrated 'techniques' and technologies in practice (cf. Suchman 1996). In combination, both perspectives draw an interwoven picture of 'what the bridging work is about'.

Following Olsen and Olsen's (2014) distinction between 'social' and 'technical' bridging, we analyze below how the predominantly human-executed, manual bridging practices identified in our study address socially conflicted work arrangements as well as technically conflicted infrastructures. Finally, we derive implications for CSCW research.

7.6.1 Bridging social conflicts within the work arrangement

The work of intermediaries faces challenges on a social level, particularly regarding visibility, acceptance, and conflicts of interest with organizations, as evidenced by the breakdowns that have led to various coping strategies.

In cases of industry-driven intermediation, the middleman is usually installed by the industry it serves (cf. 're-intermediation' in Chircu and Kauffman 1999; Wigand 2020). Hence, the intermediary faces fewer conflicts of interest, goals, or objectives. Their primary focus is often on technical bridging, while organizations and intermediaries tend to negotiate norms for mutual support and processing (Dennis and Valacich 1999). On this basis, organizations and intermediaries can establish professionalized, inter-organizational cooperation infrastructures, as is common in cross-boundary B2B cooperation—for example, enterprise resource planning (ERP), supply chain management (SCM), or customer relationship management (CRM)

systems (Lee and Schmidt 2017). We identified such professionalized infrastructures at I1 and I2 in the energy, finance, and insurance sectors.

However, in our study we were especially interested in the socio-structural impediments in the emerging field of consumer-driven intermediation, where intermediaries act on behalf of consumers and their obligations. In contrast to traditional brokering activities, these consumer-driven activities are considerably more prone to conflict, sometimes escalating into breakdowns (Mcgrath 1991; Dennis and Valacich 1999). Here we found that on the one hand, intermediaries bridge conflicts of interests that consumers face in realizing their interests. On the other hand, they encounter new structural obstacles, such as not being seen or accepted as legitimate representatives. As a result, they must bridge not only conflicts between consumers and organizations but also those arising within their own work. These impediments may result from unintentional or systemic issues caused by (misaligned) heterogeneous systems or procedures, or from intentional nudges (e.g., dark patterns) designed to influence consumer behavior.

Table 24: Coping strategies

Coping strategy	Conflict	Characteristics	Type of measure
Use of comprehensive general powers of attorney	Unrecognized or untrusted work arrangements	Working with specialized artifacts issued as: • paper-based • notarized and form and articulated via: • postal mail or • face-to-face meetings for the purpose of authorization, overcoming mistrust, and establishing common ground (cf. Olson and Olson 2014)	Social measure
Redirection of communication	The Intermediary is not incorporated in the communication process	• Utilizing forwarding orders with the postal authority to redirect communication to the intermediary • Setting alternative email addresses accessible by the intermediary	Adversarial interoperability
On-site involvement		Obtain information or collect artifacts that consumers only have at their premises by: • visiting consumers at home (by the employees), or • asking consumers to take photos or forward artifacts	Adversarial interoperability
Utilizing awareness		Anticipating or identifying patterns in cooperation regarding missing information, (contract) changes, or latent breakdowns, as well as tracking and monitoring actions	Social measure
Change of communication medium	Technically incompatible systems	Switching the communication media and transforming artifacts to postal mail, fax, or telephone when other media, such as online portals, API-calls, etc. fail	Backward interoperability (see next chapter)

Social measures. To address such intended or unintended hurdles, we identified two distinct approaches among the intermediaries. The first relies on social measures (cf. Olson and Olson 2014). Our findings show that intermediaries employ specialized artifacts, such as comprehensive written powers of attorney, to articulate the newly formed work arrangement and clearly authorize themselves as representatives, thereby overcoming mistrust and

establishing common ground (see Table 24). Moreover, messy practices and diffuse communication media—with multiple channels or contact persons—necessitate greater efforts to maintain clarity and efficiency. For intermediaries, it is crucial to track and monitor the processes of organizations and to anticipate patterns of issues that consumers are likely to face. In this respect, intermediaries perform ‘anticipation work’/ ‘anticipatory work’ (Barley 2015; Steinhardt and Jackson 2015; Cohoon et al. 2023) to foresee and proactively mitigate potential problems (Johansen et al. 2016). They rely on expense spreadsheets, collect emails from campaigns of specific vendors, and use similar methods (see awareness in Table 24).

Adversarial interoperability. The second approach is more challenging to implement, particularly when organizations deliberately pursue ‘dis-intermediation’ strategies (cf. Chircu and Kauffman 1999) to benefit from direct customer interaction and sales. Conflicts on this level cannot be resolved simply by ‘improving cooperation’ for both sides but can still be addressed through adversarial ‘hacks’ and workarounds, as identified in this study. The term ‘adversarial interoperability’ describes a concept ‘[...] that’s when you create a new product or service that plugs into the existing ones without the permission of the companies that make them [...]’³⁹.

In this way, when social issues cannot be resolved through social measures alone, adversarial measures help bridge this gap. As existing conflicts become visible, along with coping strategies to mitigate underlying cross-boundary breakdowns (Easterbrook 1996; Abraham and Reddy 2013; Lee and Schmidt 2017), we observed the extent to which adversarial interoperability is employed. Examples include redirecting communication by using forwarding orders from the postal authority or positioning themselves as a doctor’s office on brokerage portals, as seen at I3 (see Table 24).

7.6.2 Bridging technical interoperability gaps within the infrastructure

Regarding the technical infrastructure, we identified several concrete bridging practices that intermediaries use to achieve interoperability. Using the metaphor of an intermediary building a bridge between two parties, these practices can be related to Carlile’s (2004) model of ‘transferring’, ‘translating’, and ‘transforming’ in cross-boundary knowledge work (cf. Stevens

³⁹ Cory Doctorow via Electronic Frontier Foundation. 02.10.2019.

<https://www.eff.org/deeplinks/2019/10/adversarial-interoperability>; see also

<https://www.urbandictionary.com/define.php?term=Adversarial%20interoperability>, last access 10.03.2025.

et al. 2009). While information or artifacts are ‘transferred’ via the bridge, additional techniques are performed on the bridge when heterogeneous systems of consumer households and organizations have incompatible artifacts that must be ‘translated’ or ‘transformed’—as observed in practices like scanning, printing, and copying. These activities are highly manual and labor-intensive. Within these practices, we identified the recurring phenomenon of ‘(situated) backward interoperability’, which we discuss below.

When exchanging artifacts or communicating within infrastructures, employees at intermediaries can choose among a wide variety of media (Hüllmann 2022). While CSCW has extensively studied media choice (Daft and Lengel 1986; Fulk et al. 1987; Trevino et al. 1987; Trevino et al. 1990; Dennis and Valacich 1999; Braun et al. 2019; Ishii et al. 2019; Ishii et al. 2019), our findings add new insights regarding intermediaries’ consumer-facing work. If a preferred medium for cooperation (e.g., online portals or APIs) is unavailable, another medium (e.g., postal mail or phone) is frequently used as a fallback (see Figure 21). The unavailability of a preferred medium can stem from technical issues (e.g., availability, material constraints, security, or legal concerns) or social factors (as discussed above).

(Situated) backward interoperability. We define the term ‘backward interoperability’ in reference to the concept of ‘backward compatibility’ in computer science, where systems maintain compatibility with older applications by falling back on basic functions (cf. Bowker and Star 2000, p.35). With backward interoperability, we found a consistent pattern across all intermediaries, as illustrated by this central quote from the field notes: ‘[...] And since online banking is not available, the [bank] transfer form must be signed and later sent by postal mail’.⁴⁰

To achieve interoperability, intermediary employees often manually convert artifacts into formats acceptable to either the systems of the organizations or those of the consumers. In choosing an appropriate fallback medium, rather ‘conservative’ media are used. The Intermediaries state that, while they prefer online portals, brokerage platforms, API-based exchanges, or email, they most often resort to postal mail or phone calls, as was particularly evident in our findings and discussions at I5, I2, and I3. This finding corresponds with characteristics such as availability, accessibility, efficiency, and capability, which media richness theory typically attributes to either traditional or modern media (Dennis and Valacich 1999; King and Xia 2007; Ishii et al. 2019). It also reflects aspects such as symbolic meaning

⁴⁰ This might also explain the longevity of fax machines, as it’s a common fallback mechanism when other means of electronic cooperation fail.

and the ability to convey importance (e.g., postal mail) or synchronicity (e.g., phone calls) as described in the literature (Trevino et al. 1987; Dennis and Valacich 1999).

However, since the issue is far more complex—as evidenced by our field observations and the variety of perspectives discussed in the literature—we do not propose a new (static) approach to media choice within infrastructures. Instead, we introduce the phenomenon of situated ‘backward interoperability’ as a contribution to the existing theoretical landscape.

With this phenomenon, we aim to harmonize rational and social constructions while incorporating situated action (Suchman 1987) in the tradition of CSCW. For example, although employees at an intermediary prefer to use online portals to submit health insurance claims, they often lack access and instead fall back on fax or, more commonly, postal mail. If there is no response to a submitted claim after some time, they follow up by phone (see Figure 21a). We found that postal mail is the most frequently used and consistently accepted medium for insurance claims, as it appropriately satisfies bureaucratic requirements (cf. ‘formal record-keeping’ Weber 1922).

However, no single medium can be defined as the ‘most conservative’ or the ‘richest’ in terms of being the most ‘backward interoperable’ as implied by media richness theory (Daft and Lengel 1986). For instance, submitting an insurance claim cannot be done via phone or in a face-to-face meeting, making postal mail the only viable fallback. Conversely, I3 also prefers online portals but often resorts to phone calls to schedule appointments for clients when all other channels—even postal mail—fail (see Figure 21b).

Therefore, IT system design should account for (situated) backward-interoperability features, enabling intermediary employees to choose context-appropriate options for inter-organizational work—typically using postal mail for verifiable bureaucratic processes or the phone for rapid feedback due to its synchronicity.

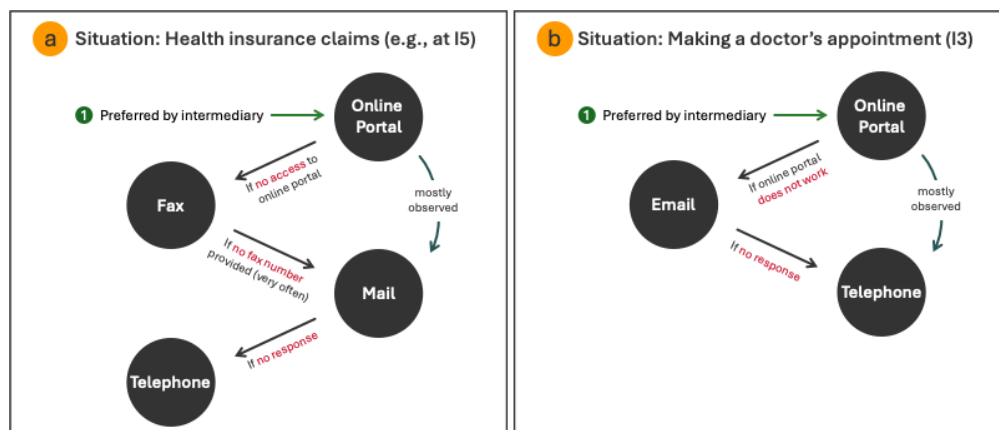


Figure 21: Situated backward interoperability

We address this in the following section on implications for CSCW research as a technical consideration, while also incorporating socially driven perspectives.

7.6.3 Implications for CSCW research

Finally, we would like to reflect on how CSCW research can contribute to addressing the challenges inherent in the (bridging) work of intermediaries. Our findings highlight areas for improvement within the design of cross-boundary infrastructures in consumer markets regarding the inclusion of intermediaries, which can be enhanced through existing CSCW research and concepts. At the same time, the identified bridging practices may also serve as a valuable resource for informing future CSCW system design and development.

(Re-) designing smart powers of attorney. The use of general powers of attorney issued in highly conservative and official formats as specific artifacts, can be considered a best practice to ‘[reduce] the complexity of articulation work and [alleviate] the need for ad hoc deliberation and negotiation [...]’ (Schmidt and Simone 1996). The more explicitly and conservatively these powers of attorney are materialized, the more likely they are to be accepted.

However, requiring notarized, paper-based general powers of attorney from every client may pose a challenge for scalable, digital business models. We therefore propose exploring the design of smart artifacts for this purpose, which meet the requirements of their traditional, paper-based counterparts. Smart powers of attorney could leverage recent innovations, such as blockchain-based smart contracts or certificates issued by mechanisms similar to, for instance, certificate authorities (CAs) used in internet authentication. Here, several CSCW and HCI studies have already examined the integration of blockchain-based smart contracts, for instance, for identity management, trusted coordination, transactions, and negotiation (Kow and Lustig 2018; Nissen et al. 2018; Prinz 2018; Yau and Patel 2020).

Such digital artifacts could support infrastructuring by being transparently visible online, articulated entirely in digital form, updated in real time, and integrated into API-based authentication for various CSCW systems. Future work could build on the bridging practices identified in this study and integrate them into the design of such systems.

New actors in CRM. Our findings show that intermediaries often struggle to be recognized as legitimate middlemen in many cases of consumer-driven activities. To address this, we noted explicit and extensive articulation efforts directed toward each organization, as well as additional measures involving clients to redirect their communication through the intermediary. While these strategies were successful in some instances, they frequently failed.

With this insight in mind, one design need would be to implement representation rules within organizations' CRM systems to account for intermediaries—either by forwarding copies of all relevant communication or by fully directing communication across all channels to them. However, when organizations are unwilling to enable this, strategies of adversarial interoperability, as identified in our study, should be considered. These strategies represent a valuable resource for design needs in customer interactions, which CSCW studies are also likely to explore (Ren, 2010; Xu, 2025).

Furthermore, to support the practices of adversarial interoperability, a dedicated IT system could be developed that operates between the intermediary and the consumer, enabling a more structured and seamless exchange of artifacts. Future CSCW studies could further explore, design, and evaluate intermediation-facilitating technologies, translating the (bridging) work identified in this study into proven and concrete design principles.

Access to APIs and online portals. Efficient cooperation across organizational boundaries depends heavily on IT infrastructure, enabling interaction via user interfaces of online portals or APIs for system-to-system communication. In industry-driven brokerage portals, it is common for intermediaries to commission products through APIs, as noted by I1 and I2. However, in consumer-driven activities, we found that intermediaries often lack access to similar portals and struggle with applications designed exclusively for smartphones.

Multi-tenant use presents a particular challenge: 'The apps that the health insurance companies have are designed for a person to make a submission using a smartphone [...] We can't have 50 smartphones lying around here'. For this reason, a design need is for consumer-directed systems of organizations to grant intermediaries access to online portals and to develop digital interfaces for representative legal entities—not just for natural persons, as we found in online banking. Here, web browser-based solutions could facilitate multi-tenant work.

Integration of backward interoperability in CSCW systems. However, where organizations deliberately avoid or are unable to enable such integration and streamlined exchanges, the concept of backward interoperability becomes an important consideration for the design of CSCW systems. It offers a way to cope with the respective conflicts that CSCW research has examined for decades within infrastructures from both technical and social perspectives (cf. Easterbrook 1996; Olson and Olson 2014; Hüllmann 2022).

In this context of backward interoperability (and its counterpart, forward interoperability), several solutions already exist in Germany to digitize and integrate postal communication into email-like interfaces, such as caya.com, d.velop postbox, or POSTSCAN of the German postal

authority.⁴¹ These services allow firms to receive postal communication in a ‘forward’ interoperable format and process it digitally. While this does not eliminate the need to work with ‘originals’, they can still be obtained from these providers when required and processed manually. In this regard, CSCW system designers should explore ways to integrate additional communication infrastructures—such as fax, phone, and API calls—into cohesive workflows.

Rethinking ‘originals’. Moreover, our findings reveal varying—and sometimes contradictory—perceptions of what constitutes an ‘original’ and why it is required, particularly concerning machine-generated artifacts. We argue that the necessity of exchanging (paper-based) originals between organizations and intermediaries (as well as with consumers) should be reconsidered, thereby touching upon CSCW’s long-standing tradition of examining media appropriateness (Daft and Lengel 1986; Fulk et al. 1987; Rice 1993; Dennis and Valacich 1999; Ishii et al. 2019).

Information privacy and security. Certain topics, such as the use of powers of attorney, the need for original documents, accreditation within CRM systems, and access to interfaces, raise legitimate and important privacy and security concerns for individuals, which could, of course, be exploited by malicious actors. These concerns may also be used as arguments by those who oppose the involvement of intermediaries.

This issue should therefore be addressed with appropriate care and further supports the need for smart, verifiable powers of attorney, since cryptographic methods or trusted authorities can provide greater tamper-proof authenticity than paper-based artifacts, as discussed above. Future CSCW research has the methodological toolkit to explore safer yet more practical approaches than those relying on paper.

7.7 Limitations

As demonstrated above, we examined the prevailing work arrangements of five selected intermediaries across different contexts to understand their common work practices, challenges, and interoperability issues, aiming to ultimately facilitate improvements and share best practices. In doing so, we aimed to create a diverse sample to enable an initial description of archetypical social and infrastructural commonalities across various organizational boundaries. Therefore, this research lays a foundation for considering the role of consumer-driven

⁴¹ <https://www.caya.com>; <https://www.d-velop.de/software/d-velop-postbox>; <https://www.deutschepost.de/de/p/postscan.html>, last access 10.03.2025.

intermediaries in fostering cooperation within consumer markets and their various bridging efforts. However, future research is encouraged to expand our work to include additional, specific contexts and thus deepen the extent to which there are other peculiarities or what this means for certain sectors. In this respect, our study has some limitations in terms of our sample and our methods.

Despite the challenge of recruiting companies in this particular field to take part in our study and to speak to us openly and confidentially about their views, we were able to motivate five founders for interviews and conduct extensive field research with one firm. Although the sample of five interviews is rather small, we spoke to founders who have known their firm since it was founded, know their practices as they have performed these themselves, and have tried out various strategies. These firms represent hundreds to thousands of consumers, who in turn correspond with a variety of organizations, giving each intermediary a large corpus of actors with which to interact daily. However, the study is also based on the principles of qualitative research, resulting in a limited sample size that does not allow for quantitatively supported generalizations. Furthermore, a one-week observation in a firm may also represent a short period of time, but the researchers have already known this firm for years from other research projects and knew where to look during the observation of office practices. However, even the combination of the five interviews with the field observation allowed us to achieve theoretical saturation regarding the main categories.

Finally, it should be noted that we only interviewed firms from central-western Germany. It would be interesting to study such practices in other regions and legislations, especially outside the EU.

7.8 Conclusion

This study uncovered the often unrecognized bridging work of intermediary firms that support the work of consumers as they fulfill their obligations as consumers or citizens toward organizations. This work involves a substantial amount of human, manual labor, which intermediaries strive to streamline and reduce more efficiently. In doing so, intermediaries face social conflicts within their work arrangements and technical conflicts within their infrastructure. We presented several coping strategies that mitigate underlying breakdowns and discussed how these conflicts can be resolved through social measures or addressed with design improvements related to (smart) powers of attorney, ‘originals’, CRM systems, privacy and security concerns, and access to and interoperability of CSCW systems. If this is not desired by

an organization, we demonstrated how intermediaries make use of ‘adversarial interoperability’ or ‘backward interoperability’.

When designing CSCW systems for (private or public) organizations interacting with consumers, it is essential to be aware of these conflicts on a social or technical level and take them into account accordingly. Intermediaries working with organizations that deliberately refuse or are unable to resolve such conflicts should incorporate concepts of adversarial interoperability or backward interoperability into their CSCW system design.

“The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it” (Weiser 1991).

8 Research Outcome

The research process of this dissertation began with an abductive inference following the problematization of consumers’ work and linking it to the observation of potentially work-supporting emerging technologies.

Between these two pillars, I moved back and forth between a problem space of work to be done and a solution space of existing designs and design implications (cf. Mey and Mruck 2011, p. 192). This iterative movement enabled me to better understand consumers’ information systems and to derive implications for their improvement, especially regarding their technological components. Through the dialectical interaction of problem space and intervening solutions, I was thereby also able to examine how existing designs can in turn give rise to new challenges (cf. Orlikowski 1992).

The subsequent analysis of this persuasive, everyday work builds on a rich foundation of theories from various research communities, ranging from household labor to consumer and market behavior. Using a retroductive inquiry and a socio-technical lens, I developed a new perspective on this work through qualitative studies (Studies 1 and 4) that provide depth and quantitative studies (Studies 2 and 3) that extend and structure the knowledge across a broader scope.

Building on the empirical insights, this chapter develops an integrated research outcome that brings the dissertation’s contributions together into an encompassing socio-technical synthesis. Their subsequent discussion and contributions to the academic discourse is guided by the overarching research questions (RQ1 and RQ2) derived at the outset of this dissertation.

8.1 Understanding consumers’ work as boundary practice

In doing so, I first collect a comprehensive socio-technical understanding of consumers’ work and examine how technologies are involved in providing work support. I therefore organize the

central findings of my four studies (Sections 4–7) along the four dimensions of Socio-Technical Systems Theory (Emery and Trist 1960; Bostrom and Heinen 1977; see Figure 22): structures and people within the social system (cf. RQ1), and tasks and technologies within the technical system (RQ2).

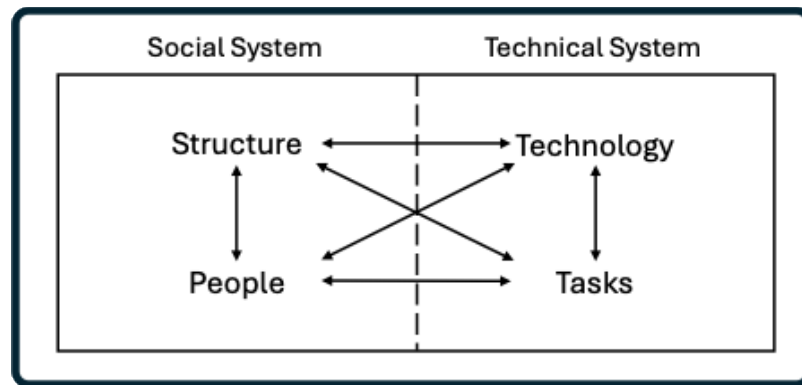


Figure 22: Dimensions of Socio-Technical Systems Theory (Bostrom and Heinen 1977)

I begin with considerations of the social system:

RQ1) How can a socio-technical lens advance our understanding of consumers' work in order to inform the design of work-supporting information technology?

Interwoven internal and external information systems. Overall, across the four studies, I examined the activities consumers perform within their physical and economic households. To manage their consumption, consumers rely on systems and mechanisms that enable them to coordinate activities within the household, collaborate with household members, and coordinate the acquisition of goods through market cooperations. Accordingly, internal systems shape the consumption-related tasks household members carry out to satisfy their needs as part of household production. At the same time, these internal systems are tightly coupled with the tasks involved in market transactions at the household boundary—shaped by interactions with “the digital firm” (cf. Laudon and Laudon 2022).

As the empirical work has shown, both internally and externally directed activities rely on the same systems. For example, handling invoices simultaneously organizes internal needs, structures the division of labor and financial accounting, and completes external payments as part of a transactional commitment. In doing so, these systems enable “collecting, structuring, processing, providing, communicating, and using” information (Krcmar 2015 p. 22) and can

therefore be understood as information-managing systems. In this context, the invoice itself serves as an information artifact and is collected, structured, processed, etc. throughout the invoicing system observed in Study 1.

Such ubiquitous physical, mental, or digital information systems are abundant in households. Considered jointly through the perspectives of household administration (Daminger 2019) and market transactions (Williamson 1989; Clement et al. 2019, pp. 153-204), these diverse information systems can be situated within an overarching frame of five major phases: (1) anticipating tasks or upcoming needs, (2) identifying, searching, and comparing options, (3) deciding, negotiating, and agreeing, (4) monitoring arrangements, and (5) modifying arrangements, renegotiating, or handling emerging problems.

Building on different strands of literature that have so far largely separated internal and externalized consumer activities, I integrate activities within the household and those directed toward the market into an overarching chain of consumption management in Figure 23. The figure illustrates how activities within the household connect with those related to the market, overlap with them, and are therefore interwoven.

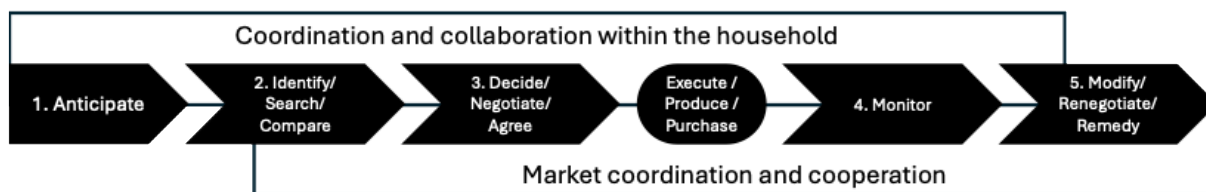


Figure 23: An integrated chain of consumption management
(inspired by Williamson 1989; Clement et al. 2019; Daminger 2019)

Within this integrated frame, the first phase, inspired by intra-household management perspectives with Daminger (2019) as a prominent reference, reflects a purely internal step. The subsequent phases combine internal and external tasks, depending on whether a need can be satisfied through household resources and arrangements or must be met through acquiring (semi-manufactured) goods or services on the market. Thus, identifying and deciding may draw on internal resources, but they may also involve searching for market offers, choosing among alternatives, and negotiating with household members or market actors (Williamson 1989; Clement et al. 2019, pp. 153-204). Outcomes of internal production or market purchases are monitored within the household, while modifications may be carried out internally or externally.

As observed in Study 1, an invoice can represent the outcome of an agreement or the contractual agreement itself. It helps monitor ongoing services and serves as evidence of

contractual obligations that have to be fulfilled, or as documentation for warranty and remediation claims.

These managerial activities relate to a range of domains, such as managing health, insurance, government affairs, and tax matters, etc. and they also structure cross-cutting procedures such as document management (including invoices) or problem handling. I categorized such tasks in Study 2. Various information systems underpin these task categories, already involving work-supporting technologies as examined in Study 3.

In Study 4, we observed intermediaries operating across different task domains such as finance and insurance, household utilities including electricity, gas, and water, and health services. Through their (bridging) work practices and associated information systems, these intermediaries support consumers' work and, at a more abstract level, constitute a form of infrastructure for market coordination and cooperation. This infrastructure can become part of consumers' socio-technical systems by serving as technology for facilitating the search for and comparison of offers, working toward agreements, monitoring ongoing arrangements, and modifying them when needed (cf. Figure 23).

8.1.1 Structures

By following the invoice as a boundary object between the consumer household and the digital firm (cf. Star and Griesemer 1989) and as an artifact conveying information to be processed, I gained initial insights in study 1 into the structures of consumers' work within the household. Drawing on the follow-the-artifact approach in Study 1, I used CSCW concepts to uncover structural aspects of this work, including coordination mechanisms (Schmidt and Simone 1996) and organizing/ ordering systems (Vyas et al. 2016). I captured their spatio-temporal organization, underlying ordering principles, and their meanings for consumers, with attention to the appropriate use of technology. Such structures, as elements of households' internal organization, are also emphasized by economists such as Pollak (1985, pp. 581-582).

Spatial structure. While prior research on money work has examined manifold financial mechanisms (Ferreira et al. 2015; Snow and Vyas 2015; Vyas et al. 2016; Perry and Ferreira 2017), the studies of this dissertation also uncovered procedural steps in the spatial organization of processing and storing invoices in Study 1.

As shown, invoices are handled through mixed media, including emails, postal mail, notes written on envelopes, and receipts, with numerous additional media observed in Study 4. Consumption-management tasks are organized spatially and temporally through these artifacts. By following the invoice, I observed that invoices arrive through different channels, digital or

paper-based, enter various input buffers, and move via several processing stages into intermediate or long-term storages. These processing stages manifest as spatial structures in physical locations such as on kitchen tables, desks, cabinets, or dressers for analog artifacts, and as email inboxes and (sub) folder structures in the digital realm.

The observations reveal that, in a household an invoice on the kitchen table or a shopping list attached to the refrigerator is rarely placed there by chance. Instead, they are part of a coordinating information-processing system. Their location often carries meaning, typically serving a reminding or storing function.

Moreover, in Study 3, I captured at an overview level among 617 surveyed German consumers, how this primarily cognitive work is spatially distributed across the household, often prevalent in spaces that are predominantly perceived as leisure spheres. Accordingly, 40% of this work occurs in the living room, 20% at the kitchen table, and 25% in the home office. This indicates that such work takes place in environments not designed solely for work, where ergonomic considerations of professionalization intersect with aesthetic considerations of the living space. This tension between leisure and work purposes requires designers of work support systems to account for the absence of dedicated ergonomic work environments.

Temporal structure. These spatial structures also follow temporal paths. Invoices, for example, first remain in input buffers for hours or days, then persist in intermediate storage for days or weeks, and finally reside in archives for years. Accordingly, the structures of invoice processing constitute the household's organizational memory as a financial and transactional aspect. Moreover, consumers pursue different goals through these temporal structures, such as short-term tax preparation at the end of the year and long-term documentation for warranty or contractual-fulfillment claims.

Messy and fragmented activities. Study 1 also made evident that the structures consumers rely on are shaped by these spatio-temporal dynamics and are fragmented across the household sphere. They extend across co-existing physical and paper-based, mental, and digital systems, producing a certain messiness that spans multiple places and relies on diverse media and their materialities. This work is also temporally fragmented, such that processing time is not necessarily identical with working time, as processing steps are distributed over time. For instance, an invoice that is opened and read may later be processed further and, in the meantime, placed in a visible location as a reminder for the next opportunity.

Thus, these structures are more mixed up through diverse, only partly reflected routines than governed strategically, due to consumers' situated (Suchman 1987) and often bounded rational behavior (see section 2.1.3; e.g., Simon 1955). Another reason may lie in their structural

coupling with external systems of digital firms or public authorities, whose heteronomy shapes consumers' practices (more in section 8.2.3). For instance, whether an invoice arrives by postal mail or email affects the subsequent processing. Consequently, external, bureaucratic demands shape consumers' information systems and can amplify their messiness. Accordingly, within Study 2, we developed interpretations suggesting that different task categories are characterized by different degrees of autonomy and heteronomy.

Ordering principles. Despite the messiness and heterogeneity of the spatio-temporal structures observed across households and their members, several recurring patterns were consistently present. First, we were able to distinguish archetypical forms of archives, such as well-sorted folder archives and unsorted LIFO stacks of papers stored in boxes, reflecting a trade-off between sorting effort and retrieval effort. Second, the ordering principles underlying storage and processing stages were typically chronological, thematic, or alphabetical. Input buffers were naturally chronological, whereas archives, when well-sorted, tended to be thematic, alphabetical, and/ or chronological.

While input buffers are more strongly shaped by firms, consumers become increasingly autonomous toward the end of the processing chain in their ordering principles applied. Consumers also adapt artifacts originating from different systems so that they fit into their own arrangements. For example, in Study 1, some participants printed invoices received by email in order to integrate them into their paper-based systems.

In Study 4, we also observed how intermediary firms collect transactional artifacts and sort them into comparable ordering systems as an early step in their involvement. Some intermediaries described this service as assembling an "emergency folder", in which essential materials for contractual relations and official documents are stored.

Structures within technology design. Technologies intended to support this work need to take the observed structures into account. In line with calls from socio-technical and consumer informatics, HCI design should emphasize the structure of these practices (cf. Stevens et al. 2018; Wulf et al. 2018), including their spatio-temporal aspects, their fragmented and situated messiness across the household sphere, and their ordering principles. It should also accommodate the co-existence of multiple systems, such as paper-based and digital ones.

Naive digitalization efforts may, at best, have no effect or, worse and conflict with the structures underlying consumers' practices and thereby harm them (cf. Harper and Sellen 1995; Pritchard et al. 2015). Rather abstract or purely rationalistic tools may likewise fail by overlooking these characteristics identified.

8.1.2 People

Within these structures, highly heterogeneous individuals—such as family members—in countless unique households are involved in this work. These individuals are shaped by diverse sociodemographic characteristics and a wide range of personal values and attitudes. Despite this heterogeneity, throughout this dissertation, I identified several recurring patterns that characterize the human dimension across people.

Beyond temporal burden. In Study 2, we sought to assess the effort required from consumers across various consumption-related tasks. Since measuring time (as done in ATUS, MTUS, HETUS, and ZVE; see section 2.1.1) provides only a rather value-neutral basis for assessing effort (Pollak and Wachter 1975) and moreover has strong limitations (Winkler and Ireland 2009), we applied methods for measuring work satisfaction. Building on evidence in the literature regarding related emotions such as stress or anxiety (Offer 2014; Robertson 2017; Daminger 2019; Dean et al. 2022), we also collected ratings of mental load and satisfaction for each task category, and compared these ratings—together with self-reported time estimates—across socio-demographic factors. Combined with qualitative insights from Study 1, the findings show that generic statements are difficult to make, although a few patterns and statistically significant insights were possible.

Some individuals find certain topics satisfying or easy, while others do not like them or attribute neither positive nor negative evaluations. Across the 617 German consumers surveyed in Study 2, we observed variation in satisfaction and mental load across task categories. But, however, neither temporal burden nor mental burden served as an indicator of a low satisfaction. On the contrary, some tasks were perceived as satisfying despite high mental or temporal load. We interpret these results as reflecting differences between tasks perceived as enjoyable and tasks perceived as burdensome.

Furthermore, Study 1 again showed that many routines take the form of taken-for-granted practices, framed as a virtue or a duty shaped by upbringing or societal norms, and are therefore neither questioned nor reflected upon. We interpret this from the general tendency toward neutral work satisfaction ratings observed in Study 2, as, from a rational perspective, any form of active engagement should be perceived either as a negative burden or as a positive activity, each associated with a corresponding motivation and attitude toward the work. Another explanation for the rather neutral rating of work satisfaction could be that some activities involve a high degree of external determination and bureaucracy, or heteronomy, such as tax

filing, whereas others, such as shopping, are characterized by greater autonomy, as discussed above.

Work styles. Potentially shaped by attitudes toward specific tasks and personality characteristics, different work styles emerge in domestic systems and influence both structure and technology use. For example, in Study 1, participants processed invoices either (a) immediately, (b) at the next opportunity, or (c) as late as possible. These styles are coupled with the structures we observed, such as pre-processing buffers that serve as reminders to continue at the next opportunity or allow artifacts to fade into the background until much later processing. These work styles add a behavioral component to consumers' information systems that should be considered.

Division of labor. We also identified different principles of division of labor within families' invoice-management information systems as part of a collaborative effort. These included division by topic, competence, specialization, dispatching, or "who pays what". For example, invoices were often handled by the person who was also the contractual partner, such as one partner taking responsibility for household utilities, including electricity, water, or heating. Otherwise, tasks were allocated based on household members' competence or specialization.

In this context, consumption management constitutes collaborative work within family organizations that can be supported but also disrupted by technology. For instance, shared calendars are common and enable families to coordinate appointments (Kaye et al. 2014). Shared email accounts, by contrast, are often used as a workaround that allows multiple household members to access messages from external parties such as firms or public authorities when customer communication does not support multiple users. Accordingly, in Study 4, we also observed that limited support for multi-tenancy in customer-facing systems provided by digital firms can pose challenges, particularly when one person acts as a representative for another (see more in section 8.1.4).

User groups. Socio-demographic differences revealed noticeable patterns that form distinct user groups. For example, we found differences in work satisfaction and task categories (Study 2) as well as differences in technology use (Study 3).

In Study 3, we distinguished between stationary users, who tend to work in well-equipped home offices using desktop computers, and mobile users, who more frequently perform tasks on smartphones. The former group was more often male, whereas the latter was more often female, younger, or had lower levels of education. Prior research likewise points to gender differences in technology use, including mobile use, and earlier work on household information systems reported gendered patterns in technology use as well (Davenport et al. 1996).

Age differences were also evident. Younger adults reported both higher mental burden and higher satisfaction and showed a higher degree of digitalization in their work. Older adults, by contrast, reported lower mental burden and slightly lower satisfaction and relied more strongly on paper-based technologies. Study 3 further suggested a group of innovative users characterized by early adoption of digital and intelligent tools, often among younger, well-educated individuals and among those with either high or low (not medium) incomes.

In Study 1, we also observed that invoicing requires a form of accounting competence that is acquired over time and shaped by personal meaning. Relatedly, more positive or negative attitudes toward a topic can influence how it is allocated to a person within the household division of labor. Moreover, our quantitative survey in Study 2 showed that individuals with higher education or income did not report lower mental workload, yet their work satisfaction was among the highest. One explanation may be that higher income is associated with more consumption work, as a higher budget enables consumption beyond deficit needs and toward self-actualization, enjoyment, or hobbies (Maslow 1943; see also Boden et al. 2024, p. 49). This may also help explain why higher satisfaction emerges in specific task categories, which are discussed in the next section on tasks.

8.1.3 Tasks

In socio-technical systems theory, structures and people constitute the social system, whereas tasks and technologies constitute the technical system (see Figure 22). Building on the social-problem perspective emphasized in RQ1, I now extend the discussion with RQ2 by incorporating tasks and technologies, examining how different technologies can support consumers' work for task domains.

RQ2) What role do existing information technologies play in consumers' work across different task domains, and how does this enhance our understanding of consumers' support needs?

By initially focusing on only one aspect of the broad area of consumption management in study 1, namely accounting through invoicing, the broader picture remained underexplored.

Various task domains. In the academic literature, consumption-related tasks have so far been mentioned only selectively and illustratively, largely in qualitative studies (e.g., Mederer 1993; Emens 2015; Daminger 2019). Therefore, in Study 2, I sought to develop an almost comprehensive overview of consumers' managerial tasks. Together with colleagues, I focused

on tasks related to economic household administration and market transactions. Drawing on task collections from the literature and our own deductive derivation, we identified twelve task categories (see section 5.3, Table 6):

1. Commodity products transactional (shopping planning),
2. Commodity products recurring (Contract management),
3. Household services transactional (e.g. repairs in the house),
4. Household services recurring (e.g. recurring babysitters),
5. Governmental affairs,
6. Tax affairs,
7. Insurance management,
8. Health management (excluding health insurance),
9. Household accounting,
10. Private asset management,
11. Document management, and
12. Problem management.

When developing this classification scheme, we found it difficult to establish non-overlapping, disjoint task categories, since many domains intersect and some activities could plausibly be assigned to more than one area. Such distinctions may also be difficult for respondents to separate cognitively. For example, handling health insurance could be placed under insurance or health management, and tax affairs can be difficult to distinguish from other governmental matters.

Despite these challenges, the task categories remain useful for assessing this work's different activities and their characteristics, so that work support can address patterns in their particularities. In Study 4, we encountered several of these categories again in the business models of the five participating intermediaries, with one focusing on searching for, concluding, monitoring, and changing utility contracts (No. 2 above), another centering on managing finances and insurance (Nos. 7 and 10), a third supporting health management separately from health insurance (No. 8), a fourth focusing on document management (No. 11), and a fifth operating across multiple task categories. It shows that these different task categories correspond to different types of businesses.

Single transactions versus recurring activities. Within the twelve categories, we distinguished between one-time transactions and recurring activities related to commodity

products (Nos. 1 and 2) and household services (Nos. 3 and 4). This distinction matters because recurring activities extend over time and require sustained attention, such as keeping track of contracts, usage, billing cycles, and changing conditions. In our data, recurring activities were perceived as imposing higher mental load, which may reflect ongoing monitoring and oversight requirements and thus higher transaction costs.

The emotional dimension. Assessments of the twelve categories confirmed the “white-collar” nature of these activities.⁴² Respondents indicated that the work is predominantly cognitive, although some categories were rated as more emotionally involved. For example, managing long-term contracts (No. 2) or tax affairs (No. 6) was rated most strongly as cognitive rather than emotional or physical, whereas private asset management (No. 10) and shopping planning (No. 1) were still primarily cognitive but showed a stronger emotional component. This suggests that some tasks impose mainly mental and rational demands, while others involve more emotional elements, such as shopping planning or wealth management. Moreover, shopping planning and wealth management were associated with the highest satisfaction, regardless of their mental workload. One explanation may be that these domains can involve self-actualization, enjoyment, or hobby-like engagement and may be shaped more by consumer autonomy than by heteronomous bureaucratic demands, as discussed before.

Pain priority through four quadrants. Study 2 also revealed differences in satisfaction and mental workload across the task categories. We assigned the twelve task categories to four developed quadrants: (I) “Easy, fun work”, (II) “Hard work but enjoyable”, (III) “Simple but disliked work”, and (IV) “Hard and unsatisfying work” (Figure 9 and 24).

This evaluation helps identify priority “pain points” in consumers’ work for targeted work support. The category with by far the highest burden (Quadrant IV) is tax affairs, followed by problem management, other government affairs, and the management of long-term contracts. Insurance lies near the boundary between “hard work” and “hard but satisfying work”.

At the same time, mental burden does not necessarily imply that people dislike an activity. Wealth management, for example, combines high mental workload with relatively high satisfaction. Tasks perceived as low burden include shopping planning and bookkeeping, which were associated with low mental workload and high satisfaction. Taken together, these findings suggest that complex, highly cognitive task categories shaped by heteronomous bureaucratic requirements, such as taxes, long-term contracts, insurance, and problem resolution with

⁴² “white-collar” “[relates] to people who work in offices, doing work that needs mental rather than physical effort” <https://dictionary.cambridge.org/dictionary/english/white-collar> (last accessed August 2025)

providers, represent priority areas for work-support interventions—as they characterize key pain points.

A social approach within household collaboration (e.g. informed by sociological perspectives) could involve assigning these tasks to those who can perform them better (competence) or prefer to perform them (specialization by enjoyment). Another approach could involve supporting these tasks through technology design so that complex, highly rational, and unsatisfying activities are simplified. Moreover, within the ongoing digital transformation, various technologies also shape these tasks and the related forms of household collaboration.

8.1.4 Technologies

As “surprising solutions” (cf. “surprising fact” Peirce 1935, CP 5.189) identified at the very beginning of the research process, a variety of potentially supportive technologies already exists in the form of digital solutions in consumer markets. As these offerings are manifold, many of them can be mapped onto the twelve task categories identified above, which consumers must address in everyday life.

Basic technology within the household. Within my retroductive research design, it was initially necessary to take a step back and examine the existing basic technologies used in households before turning to the novel and innovative business models of intermediation.

In Study 1, I observed in the field how paper-based and digital technologies coexist in supporting invoicing practices. Different media formats were integrated into, and shaped, the respective structures, for example through printing, scanning, or parallel storage in email archives and paper-based binders. Study 3 additionally provided an overview of these basic technologies, similarly, showing that paper-based and digital tools are used almost equally, with digital tools holding slightly higher relevance in current use. Office software such as calendar applications, word processing, and spreadsheet tools was widely used, alongside email, phone, and postal mail, with online search engines showing particularly high usage. These tools are integrated into household structures, as we observed in Study 1 and as has been shown in other ethnographic fieldwork on money coordination (Ferreira et al. 2015; Snow and Vyas 2015; Vyas et al. 2016; Perry and Ferreira 2017).

In Study 3, I also identified socio-demographic differences in the use of these basic technologies, such as a tendency for men to rely more on (stationary) desktop computers and for women to rely more on (mobile) smartphones. These differences informed the user groups described in the people section (section 8.1.2).

These user groups, such as stationary and mobile, also point to different work environments. Stationary work is rather performed in office-like settings at home, typically at a desk and on a computer, that is, in more professionalized workspaces that can be increasingly oriented toward ergonomics and efficiency. Mobile use, by contrast, is more often carried out on a smartphone, for example on a sofa, and thus outside work-like environments. Such environments are characterized by mobile media and reflect a more ubiquitous overlapping with leisure activities. Tools, including specialized domestic software, therefore need to be designed for these settings.

Furthermore, the observed messiness and fragmentation of structures, the diversity of technologies in use, and the variety of work environments, triangulated in depth in Study 1 and in breadth in Study 3, suggest that there is not a limited “set of tools” (cf. Mitchell et al. 2008) but rather a broad and rich repertoire.

In this context, I was able to show that basic tools for search and information work are particularly important, corresponding to Phase 2 of the integrated chain of consumption management (identify, search, compare) discussed above. Search engines were the most frequently used applications, and comparison portals and apps emerged as prominent examples of specialized software.

A set of specialized software. In addition to basic tools, consumers use a broad variety of specialized software. Just as activities in digital firms are supported by specialized IT applications, such as CRM systems or SCM systems, consumers likewise use specific tools for their activities within the economic household. For illustration, Figure 24 assigns selected apps from the Google Play Store⁴³ to the task categories across the four quadrants (see also Mau et al. 2023, pp. 80-92). This mapping of tasks and technologies can be understood as an exemplary qualitative task–technology fit (Goodhue and Thompson 1995).

For hard and unsatisfying work in Quadrant IV, the selection includes tax apps (Taxfix; WISO Steuer), passenger-rights claim apps (Flugärger), finance and contract-monitoring apps (Finanzguru; Aboalarm; Volders; Outbank), comparison and brokerage portals (Check24; Clark; Verivox), and government ID apps (AusweisApp). In the “simple but disliked work” quadrant III, apps for medical appointments (Doctolib; Jameda) are prominent, a task category also addressed by Intermediary 3 in Study 4, and document-management apps such as Fileee, which relates to the work supported by Intermediaries 2, 4, and 5 in Study 4. In Quadrant I (“easy and enjoyable work”), shopping platforms and apps (Amazon; Bring!; REWE; KaufDA)

⁴³ <https://play.google.com/> (last accessed December 2025)

and bookkeeping apps (Haushaltsbuch; Splitwise; Moneyfy; Finanzguru) digitize day-to-day shopping and money management. In Quadrant II (“hard but enjoyable work”), private asset management (Trade Republic; Scalable Capital) and household services (Helpling) are particularly prominent.

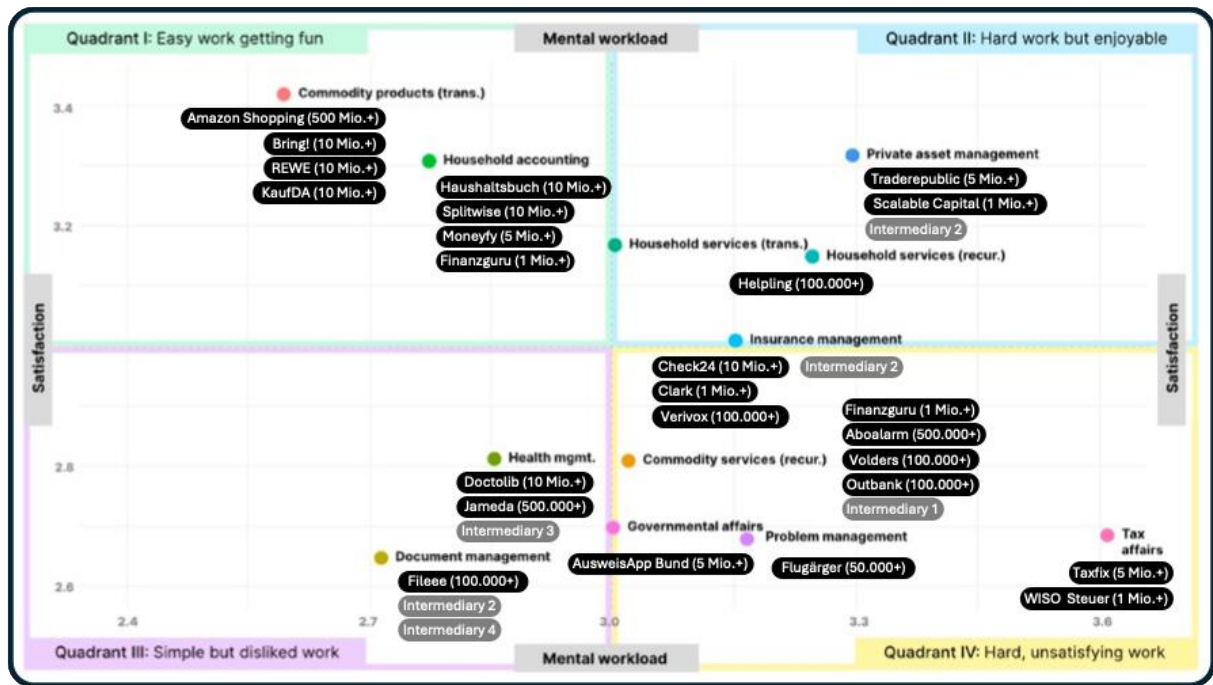


Figure 24: Task-category burden across four quadrants, with selected Google Play Store apps (total downloads in parentheses until December 2025) and Study 4 intermediaries.

Looking only at the rough download counts in the Google Play Store does not allow firm conclusions about the priority of pain points across task categories, since enjoyable activities may also generate substantial app demand, just as disliked work does, and not every task requires a mobile app as adequate work support. Nevertheless, many areas include apps with high download counts (e.g., 5 Mio.+), although the underlying reasons for demand likely differ across categories. For example, in Germany, obtaining a specialist appointment as a publicly insured patient often requires using appointment platforms such as Doctolib and Jameda, since appointments are scarce and some health facilities rely primarily on these digital booking channels.⁴⁴ In addition, the apps shown have been on the market for very different lengths of

⁴⁴ <https://www.aerzteblatt.de/news/digitale-terminvergabe-mittlerweile-standard-e19c819d-2bc4-4c8b-a695-b4f19aa784b9> (last accessed December 2025).

time. Flugärger, for instance (50.000+ downloads), was released just in late 2019,⁴⁵ whereas WISO Steuer and its predecessors date back to 1991.⁴⁶

Because of both its long history and the hard and unsatisfying nature of the work associated with tax affairs (see Figure 24, bottom right), tax software emerged as a prominent example of burdensome work and was among the most frequently reported types of specialized software in Study 3. It was followed by customer portals and comparison portals. Specialized software thus already permeates households today and continues a tradition of rather unrecognized household rationalization and professionalization (cf. “Frankfurt Kitchen” Kuhn 1998).

Search and comparison, VRM, and intermediation. Beyond basic technologies within the household, specialized apps and online platforms also facilitate market coordination. Comparison portals are widely used. Examples such as Check24, Verivox, and Clark support identifying, searching, and comparing offers (Phase 2) as well as negotiation and agreement (Phase 3) within market-directed activities of the integrated chain of consumption management (see above, see also Clement et al. 2019, pp. 153-198). Contract-management functions, for example in Check24, Finanzguru, Aboalarm, Volders, and Outbank, consolidate contracts and support the monitoring of vendors, thereby enabling intermediation between the consumer household and the digital firm.

In this role, prior literature frames such tools as reducing search costs and supporting more competent and well-informed purchase decisions, consistent with Clement et al.’s discussion of intermediation (2019, pp. 153-198) and Mitchell et al.’s (2008) argumentation on VRM as a means of more needs-based marketing. In Study 4, we observed this logic in practice. Intermediaries took over work for consumers by collecting and sorting documents, such as invoices, as part of document-management (see Intermediary 2 and 4 in Figure 24). Moreover, some intermediaries monitored recurring contracts, tracked budgets and expenditures, and carried out accounting tasks. Others not only monitored ongoing contracts but continuously adjusted them so that consumers would automatically remain in favorable conditions (Intermediary 1 in Figure 24). Thus, intermediaries (or VRM tools) also support activities in Phases 4 and 5 within the consumption management chain. However, this service has a price and is also associated with additional effort, and thus costs.

⁴⁵ https://rp-online.de/digitales/apps/flugaerger-app-entschaedigung-bei-verspaetungen-leichter-durchsetzen_aid-46328575; (last accessed December 2025).

⁴⁶ <https://www.spiegel.de/politik/schleichwerbung-in-wiso-a-63e05cc0-0002-0001-0000-000008955034> (last accessed December 2025).

On the one hand, these intermediary businesses are financed through a range of business models, including hourly fees, freemium offerings, and commissions. For example, the service of search and comparison platforms are also typically paid through commissions, which consumers ultimately pay indirectly through the product price (Oehler 2021c). From the consumer perspective, their prices can be understood as an explicit monetary counterpart to the costs of market coordination (Arrow 1969; Williamson 1989) and household production (see “full price” or “shadow price” Becker 1965). In this context, outsourcing consumers’ work makes these costs visible and measurable through the payment of external labor. Furthermore, In Study 4, we observed that when household-related tasks are performed by specialized workers or intermediaries, they are carried out in professionalized office settings oriented toward efficiency and ergonomics, in contrast to consumers who perform this work in household environments that often overlap with leisure spheres. In addition, intermediaries may benefit from scale effects and more routinized relationships with vendors, enabling more efficient exchange. Regarding the latter, professionalization through the intermediaries can potentially reduce the overall costs of market coordination (cf. Pollak 1985) or all actors, even when intermediary services involve additional fees for consumers.

New work arrangements. But, on the other hand, Study 4 showed that this shift of work introduces new efforts and costs for both intermediaries and consumers. Intermediaries form and enter a new type of work arrangement between consumers and firms. They must perform bridging work to maintain interoperability across the different socio-technical systems of firms (vendors), intermediaries, and households. Consumers often need to forward communications and provide access to documents, while intermediaries must continuously articulate their work arrangements with the digital firm (the vendors).

As we observed in Study 4, this dynamic depends strongly on how intermediaries are perceived and integrated within specific industries and by the respective firm. Here, I distinguish between industry-driven and consumer-driven intermediation, with the latter representing a more novel approach that is, to date, harder to establish vis-à-vis digital firms and therefore demands additional articulation work in order to be recognized and integrated into the work arrangement. The intermediaries are themselves affected by the messiness of external influences, including the various channels, artifacts, and procedures of the digital firms (vendors) they face, especially in a consumer-driven mode.

From the perspective of intermediation theory (Clement et al. 2019, p. 156), the expectation that intermediaries reduce contact and therefore coordination costs, as described by the Baligh–Richartz effect (Baligh and Richartz 1964; see also Toporowski 1999), contrasts with the newly

emerging (bridging) efforts required for intermediaries to integrate themselves into the newly formed work arrangement.

Moreover, intermediation business models entail a risk in the form of conflicts of interest between what best serves the consumer and what best serves the intermediary's business model. In this regard, traditional industry-driven intermediaries, which often function as product brokers, are a particular cause for concern, as critically discussed by Oehler (2021c, p.266) and Mundt and Scheidgen (2021, p. 525).

Intermediaries constitute infrastructure. In performing their bridging work to enable interoperability, they provide a kind of market infrastructure for cooperation between consumers and digital firms. They therefore bridge breaks between multiple communication media across the information systems of the three actors. I refer to the infrastructure they serve, in an abstract sense, as technology, including basic tools, applications, software, and (digital) services. When mediating transactions between consumers and digital firms as part of market coordination and cooperation, digital or human-performed services examined in Study 4, and partly captured in Study 3, can be conceptualized as intermediation performed by intermediaries (Clement et al. 2019, p. 153-198). These intermediaries entail their own socio-technical systems, yet, from the consumer perspective, they can function as part of the technological component of consumers' socio-technical systems in this abstract sense.

8.2 Contributions and conclusions

Building on the perspectives discussed above, I derive contributions and conclusions for IS research on consumers' work by directly addressing the research questions (RQ1 and RQ2) and then abstracting from these two dialectical pillars to formulate cross-cutting implications. In doing so, I briefly discuss how this perspective can extend IS's traditionally firm-centered focus by more closely integrating consumer informatics (Stevens et al. 2019; Boden et al. 2024).

8.2.1 Contributions of the socio-technical inquiry of consumers' work

The opposing pillars of the problem (RQ1) and supporting technology (RQ2) initially form a dialectical relationship. Through abductive inference, the retroductive inquiry moves from observed technologies back to the underlying problem. From this problem, it then derives implications for the design of these technologies, as is common in many problem-driven approaches of technology design (see section 3.1).

The research questions reflected this back and forth between the two pillars by simultaneously looking toward the other question in a connecting way: understanding the work in order to inform design, and examining the role of technology and tasks in addressing consumers' needs. Along these research questions, the studies produced a series of insights that now allow me to show how my research contributes to them:

RQ1) How can a socio-technical lens advance our understanding of consumers' work in order to inform the design of work-supporting information technology?

As I have shown, the socio-technical lens reveals this work to be a boundary practice that interweaves internal household administration with externally directed market transactions, executed through fragmented information systems that span physical, mental, and digital media. It enriches our understanding of the mechanisms and systems of consumers' work by focusing on its structures, the people involved, the tasks to be accomplished, and the technologies used. By applying Socio-Technical Systems Theory (Bostrom and Heinen 1977) along its social dimensions (structures and people), I uncovered spatio-temporal work structures within households, as well as ordering principles, goals, and strategies that technology design should support rather than override.

A central insight emerging from this perspective is that consumers' information systems are shaped less by autonomous design than by reactive adaptation to external systems. Whether an invoice arrives by postal mail or email or which forms of evidence a tax authority requires is decided outside the household (see Study 1). Consumers therefore rarely shape their information systems strategically and instead configure them in response to the heteronomous demands of digital firms or public authorities. This is also reflected in the differing degrees of autonomy and heteronomy across task categories developed in Study 2. From this observation, I propose treating heteronomy as a design variable in its own right. Work-supporting technology for consumers is therefore not primarily a productivity instrument but, more fundamentally, a mechanism to cope with institutionally caused heteronomy. It helps to absorb, translate, and re-organize externally imposed structures so that consumers retain overview, reaction capability, and the kind of consumer sovereignty that consumer-oriented strands of literature have long argued for (e.g., Clement et al. 2019, pp. 153-198; Oehler 2021c) . This potentially reframes the

design intent from efficiency toward the protection of consumers' agency vis à vis the systems they have to cope with.

Drawing on insights from the social sciences, the social system can be understood partly through empirically documented challenges of humans in everyday life (e.g., sociology), as well as through theoretical conceptualizations of household production (e.g., Home Economics) and market-oriented coordination (e.g., Transaction Cost Economics). These perspectives describe, in their respective vocabularies, different forms of managerial work related to consumption, such as (household) labor (Daminger 2019), (transaction) costs (Williamson 1989), and (full) price (Becker 1965). Unlike these perspectives, which propose their own potential solutions, such as a fair redistribution of labor, the conceptualization and modelling of costs, or the establishment of rules and institutions, the socio-technical perspective focuses on addressing current activities and the systems utilized (see section 2.1.4). It therefore provides a practical rather than normative perspective. Instead of prescribing how things ought to be, it examines how work is actually carried out and builds on this understanding by evolving technologies that enhance consumers' systems—a perspective that CSCW traditions bring to this research.

Given the messy accumulation of practices, the externally shaped structures, the temporal patterns, and the heterogeneous actors who carry out this work and experience it as enjoyable or burdensome to varying degrees, etc., socio-technical research cannot pursue holistic solutions. Instead, it must account for coexisting, hybrid, and highly interoperable systems, which makes prescriptive design difficult and keeps research in this domain rather descriptive in a first step. In a further step, this research can inform the design for consumers' everyday work within specific tasks and user groups, a line of inquiry to which my studies pave the way both through their categorization of tasks and user groups and through methodological insights such as following artifacts in the home or observing intermediary practices.

My activity-based research approach (cf. Pollak and Wachter 1975), which takes the messiness of everyday work practices as a design resource, allows interventions that empower existing real-world systems and mechanisms. In this context, I conceptualize the associated activities as cognitive, coordinative, and cooperative work to be (computer-) supported. In doing so, the socio-technical lens also shifts the disciplinary scope of IS research itself. The classical objects of the field, such as CRM, ERP, SCM, and related enterprise systems, end at the boundary of the

firm, while their household-side counterparts have so far remained largely outside the discipline. However, as my four studies document, consumers carry out functionally analogous managerial work within their households. The asymmetry between firm and household therefore lies not in the nature of the tasks, but in the tools, routines, specialization, and institutional recognition that surround them. From this observation, the household emerges as a legitimate organizational form for IS research, not only as a domain of end user adoption or “user experience”, but as a site of managerial work that warrants its own systems oriented vocabulary—a direction that consumer informatics research has likewise begun to argue for (cf. Stevens et al. 2018; Wulf et al. 2018).

To investigate this work empirically, I applied established methods from CSCW and HCI that have previously been used in contexts such as money or family organization practices (Kaye et al. 2014; Snow and Vyas 2015; Vyas et al. 2016; Perry and Ferreira 2017; Lewis and Perry 2019). Following artifacts in the home, such as invoices, proved a productive method for revealing underlying structures and their meanings. Artifacts such as sticky notes, wall calendars, coin jars (Vyas et al. 2016), but also invoice documents (Study 1) carry different functions within the household, including triggering, reminding, or enabling family workflows, as well as realizing bureaucratic and organizational memory.

Following invoices as artifacts not only supports conceptualizations in IS research but may also inform other applied domains, such as the division of household labor, purchasing decisions, or financial management. In the latter case, “uneconomical household management” as one cause of over-indebtedness (cf. Section 1) may arise from or be reinforced by disrupted or insufficient information systems/ mechanisms. Invoices, as exemplary artifacts, may become part of the problem if they remain unattended, disappear, or are overlooked, leading to mismanagement and, for instance, over-indebtedness.

The externally caused or technologically situated messiness within households’ systems involving members, places, artifacts, and storage practices must be mastered by the consumers. For example, a consumer must establish an integrated view that goes beyond their immediate wallet, taking into account numerous “buy now, pay later” microcredits as well as invoices lying on the kitchen table that the spouse may still need to pay. These structures and also consumers’ individual working styles are also central to transactional behavior (cf. Pollak 1985), for

example reminding oneself of automatically renewing contracts as legally designed by providers or choosing the most effective communication channel to customer service.

Taken together, the socio-technical lens advances our understanding of consumers' work in two concrete ways that directly inform technology design: (1) it identifies heteronomy as a design variable that work-supporting technology must explicitly address rather than ignore, and (2) it reframes the household as an IS environment in its own right, with its own structures, people, tasks, and ordering principles.

RQ2) What role do existing information technologies play in consumers' work across different task domains, and how does this enhance our understanding of consumers' support needs?

Various information technologies are already part of consumers' socio-technical information systems and form a broad, pluralistic, and heterogeneous repertoire rather than a bounded "set of tools" (cf. Mitchell et al. 2008). These technologies range from coexisting paper-based and digital basic tools, such as calendars, spreadsheets, email, and search engines, to a growing landscape of specialized apps and intermediary services that map onto the twelve task categories of consumer work identified in Study 2. Empirically, I was able to show how these technologies enable consumers' office type work (cf. Emens 2020) by forming a basic office infrastructure, for example word processing, email, and telephony, and which types of tools consumers in Germany actually use across socio-demographic groups (Study 3).

Building on this empirical base, priority pain points for tool design are those task categories combining high mental burden with low satisfaction, such as tax affairs, problem management, governmental affairs, long term contracts, and insurance.

Moreover, one can map existing tools onto these categories as a qualitative task-technology fit (Goodhue and Thompson 1995; see Figure 21) as useful tool landscape. I observed across my studies that this toolbox repertoire spans both self-managed and externally managed tools. Regarding the latter, (consumer-driven) intermediaries extend consumers' socio-technical systems by performing bridging and articulation work across the different phases of the transaction process (Baligh

and Richartz 1964; Toporowski 1999; Clement et al. 2019, pp. 153-198). This bridging work can be understood as a form of “infrastructuring” (Pipek and Wulf 2009), through which various intermediaries keep the (economic) systems running and themselves are part of the broader infrastructure landscape consumers rely on.

Empirically, I was able to show how such intermediation supports market coordination in practice (Study 4). Conceptually, intermediaries can be understood as the consumer-side equivalent of integrated enterprise application systems such as CRM or ERP within firms, and they approximate the theoretical idea of VRM (Mitchell et al. 2008). However, they are realized as a new socio-technical component on the consumer side. By collecting documents, sorting them into comparable ordering systems, monitoring contracts, and adjusting them on the consumer’s behalf, intermediaries not only support (as classical officeware or paper-based systems would) but actively resolve externally caused messiness within their respective task domain. Intermediaries thereby contribute to restoring consumer sovereignty against the heteronomous demands identified in RQ1. In this sense, the dissertation moves intermediation as well as VRM from a normative proposal to an empirically observed practice.

This empirical view, however, also reveals new challenges that arise in the cooperative work arrangements when intermediaries enter. They must become accepted and visible to firms, integrate themselves into the communication process between consumers and firms (e.g., through adversarial interoperability), and connect incompatible technical systems (e.g., through backward interoperability). These challenges must be addressed either in the design of the social and technical systems themselves or in the bridging work between them.

Furthermore, the involvement of intermediaries makes the costs of consumers’ work visible in a way they previously were not. The bridging work generates additional effort for intermediaries, and these costs ultimately reappear for consumers in the sense of a “full price” or “shadow price” (Becker 1965) or as “net tariffs” (Oehler 2021c). What classical intermediation theory frames as a reduction of coordination costs (cf. Baligh and Richartz 1964; Clement et al. 2019, pp. 153-198) is empirically more accurately described as a shifting and partial reformation of these costs. Whether the overall balance is positive for consumers depends on how well intermediaries integrate into the existing socio-technical arrangements between household and digital firm.

Taken together, the role of existing information technologies in consumers' work can be summarized in three major contributions that directly enhance our understanding of support needs. First, consumers operate not with a bounded toolset but with a heterogeneous and growing repertoire that spans paper and digital, basic and specialized, self-managed and externally managed tools, requiring support to be designed for coexistence rather than consolidation. Second, mapping tools to task categories along the dimensions of mental burden and satisfaction reveals concrete priority areas for support. Third, intermediaries are best understood as an infrastructural component of consumers' socio-technical systems rather than as external service providers. This conceptual move not only empirically validates concepts such as VRM but also reveals shifted coordination costs and new dependencies that any further design work must take seriously.

Finally, by building on these dialectical findings, I was able to generate empirical evidence supporting the causal logic of the abductive inference introduced at the beginning of the research process (Section 1.3).

The evidence collected throughout the studies yields several key insights for IS research and positions consumer informatics, in combination with epistemological tools from CSCW and HCI, as a complementary perspective alongside the traditional business-centered focus of (German-shaped) business informatics. Both perspectives examine economic work procedures—one within firms, the other within the small productive organizations we call households.

8.2.2 Productive organizations but no small digital firms

Building on the finding that the household is a legitimate organizational form for IS research, a next step is to consider how robust this analogy is. Economic theory has long invited the comparison. Becker (1965) speaks of a “small factory”, Pollak (1985) and Williamson (1989, p. 165) of “family firms”, and the households' purchase of semi-manufactures (Becker 1965; see also Lancaster 1966) may encompass activities analogously to a firms' procurement of intermediate goods. Following this comparative impulse, I followed the thesis to position the increasingly digital consumer household within an increasingly digital world as a small organization in comparison to digital firms.

A small body of work in IS research has already used labels such as “home information systems” or “household information systems” (Davenport and Higgins 1995; Lawo et al. 2021).

Such framings can suggest that consumers might manage households in similarly planned, rational, and monitorable ways, if only they adopted information technology tailored to their needs. This view resonates with a longer tradition of domestic technologies, from household appliances to (now smart) washing machines, kitchen devices, and refrigerators, and with the idea that these devices could be integrated into a management-oriented application architecture of the smart home. In such a vision, machines would increasingly support not only physical activities like washing, preparing meals, and cooking but also cognitive processes through software, including need anticipation, supplier relationships, financial accounting, and contract management, within an integrated “household application architecture”. Drawing on Laudon and Laudon’s enterprise application architecture (2022, p. 82), one could therefore derive an analogous illustration for the consumer household (see Figure 25).

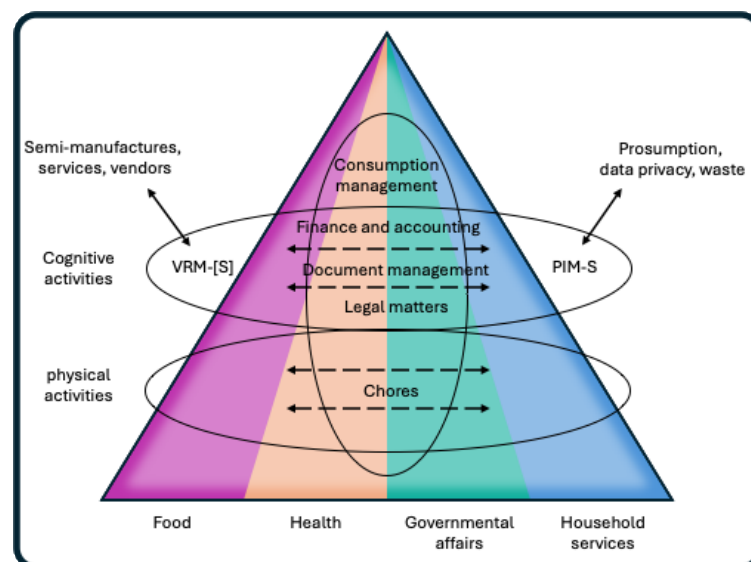


Figure 25: Households’ consumption functions and application architecture adapted from Laudon and Laudon (2022, p. 82)

Here, sequences of blue-collar and white-collar activities run from left to right, spanning across different task categories. On the left side, VRM systems (Mitchell et al. 2008) support market coordination and cooperation in procurement activities on the market (Clement et al. 2019, pp. 153-198). On the right side, they may also extend into the of households’ external “products” that firms themselves use, for example, personal data generated through social media use. This raises the question of whether the integrated chain of consumption management developed in Section 8.1 can be understood as a counterpart to firms’ value creation chains, along which “family applications” or “household applications” could be integrated through process analysis, similar to enterprise settings.

However, this vision is likely to appeal primarily to early-adopter smart-home enthusiasts, for example as part of their lifestyle or among a small group of particularly conscious households (Hargreaves and Wilson 2017, pp. 110-115). Such lead users, driven by strong personal motivation, may bring individual rationalized innovations into their households and contribute bottom-up to the consumer market with their “user innovations” (cf. Von Hippel 2005). Beyond this niche, however, an integrated household architecture remains, much like the long-promised paperless office, more a normative idea than near-term reality (Briscoe 2022). My investigations again showed that consumers’ work practices are anything but planned, fully rational, or carried out as “office-like” activities in corporate-like environments.

While workplace studies from CSCW and related communities were analytically useful, they helped demonstrate that consumer households are characterized by situated messiness as well as bounded-rational orderliness and voluntariness. Against this backdrop, an architecture of households with neatly separated thematic areas, activities, and horizontal or vertical structures, akin to those used to model firms, may constitute an oversimplification. Unlike firms and their organizational logics, consumers do not think in these categories, and even academic discourse does not do so consistently. Work practices are more often lived, largely unreflected routines than prescribed tasks.

Moreover, hierarchical models are similarly ill-suited. Although household labor is distributed across multiple people, it typically involves only one or two individuals who simultaneously engage in both white-collar and blue-collar dimensions of domestic work. There is no formal supervision and no professional management. The governance is familial. Any modeling that treats the household as a small firm would inevitably neglect this informality and the lived, largely unreflected character of household routines.

Two consequences follow for IS research. First, consumption-related managerial work within households differs in several important respects from management work in firms. Future work on consumer households should prioritize the investigation of specific everyday practices (Boden et al. 2024, pp. 4-5, 72-75) over the application of normative process models (see also Pollak and Wachter 1975). While rational models of transaction phases (Clement et al. 2019, pp. 152-198) or time allocation (Becker 1965) can provide theoretical orientation and support conceptualization, consumers’ work practices permeate household life. As the example of processing an invoice illustrates, they cut across thematic areas ranging from insurance and shopping to finances, bookkeeping and accounting, legal matters, contract monitoring, and the simple act of remembering a payment.

But, second, the ongoing digital transformation across firms and markets, and thus households, may gradually give the idea “managing the digital household” more substance in the longer run (cf. within a “Third Wave” Toffler 1980). The business world already transforms their work practices that can spill over into domestic contexts. When socio-technically appropriate, people import practices learned within digital firms into their homes, including spreadsheet routines, everyday email communication, and principles of digital document filing, and adapt them to household life. IS research can not only observe this societal process as a movement from (digital) firms but also actively shape it from the perspective of consumers and their households.

8.2.3 Socio-technical market coordination and cooperation

With regard to consumers acting at the boundary of their household, the state of the art and its theories often describe consumers as weak and structurally dependent actors in the economy who transact in markets where certain effects can lead to market failure. A common solution (rooted primarily in New Institutional Economics) lies in societal and economic regulation through institutions that establish fair market conditions. This solution remains valid, but its effectiveness is constrained by the precondition that institutional arrangements themselves require ongoing work (Section 2.1.3).

A socio-technical analysis adds further explanation and intervention to this challenge. The social system and the technical system can be located within both households and firms, and their socio-technical systems intersect in market-related cooperation. Households are shaped more strongly by firms’ systems than the other way around, and Figure 26 illustrates this asymmetric overlap.

Socio-technical issues intra-household. Within the household, this perspective brings to light issues that prior literature has tended to treat in isolation. Sociology, for example, has emphasized social tensions such as the fair division of labor (Hochschild 1989; Ciciolla and Luthar 2019; Daminger 2019; Aviv et al. 2025), while technical systems were less considered for such social settings. The studies in this dissertation show that both layers are simultaneously at play. Specific design requirements for invoice management, for example (Study 1), can guide the appropriation of technology for a given task, but they do so within a social arrangement that is itself shaped externally.

Moreover, consumers’ structural dependence on firms (cf. Dujarier 2016) helps explain how household “messiness” emerges in the first place. As market-facing systems become increasingly heterogeneous in their digitalization, the resulting coexistence of multiple internal

systems becomes harder to integrate technically and harder for consumers to keep track of cognitively. As concluded above, a holistic design approach therefore appears more normative than practical, and a task-oriented approach is the more realistic path forward.

Socio-technical issues in the market. At the boundary of the household, the socio-technical perspective also provides a way to structure challenges in the transactional cooperation between consumers and vendors along the same two layers. Following Olson and Olson's (2014) distinction between conflicts that must be resolved socially and those that must be resolved technically, market cooperation can be analyzed as shaped by both. Here, intermediaries constitute infrastructure to bridge socio-technical challenges.

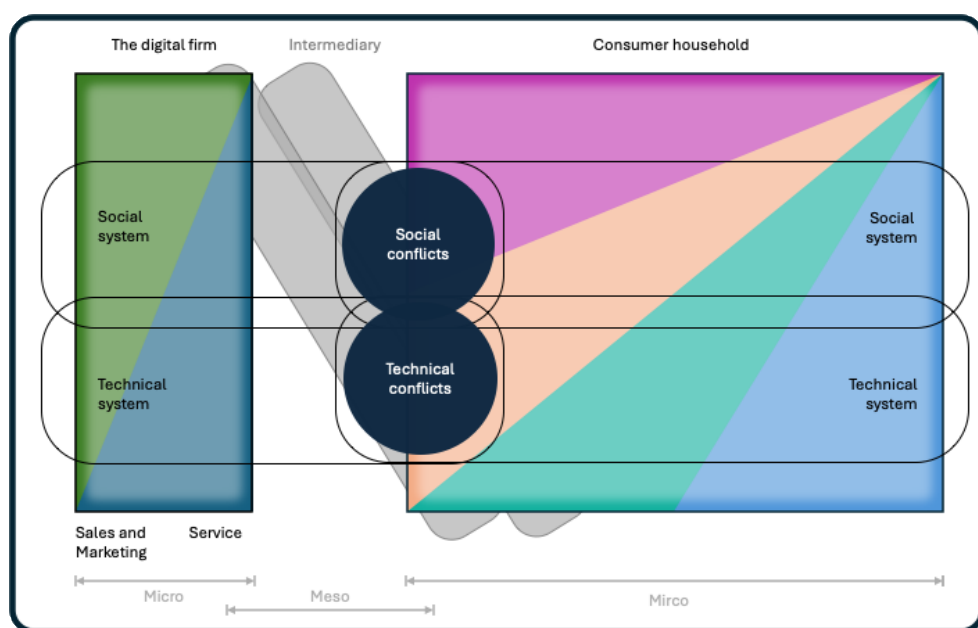


Figure 26: Socio-technical coordination and cooperation of households and digital firms

Some conflicts arise at the technical level between incompatible technical systems. Intermediaries respond to these through measures such as “backward interoperability”, undertaking the effort to make a digital firm’s technical system interoperable with the household’s (as well as with their own).

Other conflicts are social and connect to well-known economic effects of market failure such as principal-agent conflicts, markets for lemons, or “phishing for fools” (Jensen and Meckling 1976; Akerlof 1978; Akerlof and Shiller 2015). Where firms deliberately reject or obstruct cooperation with external systems, intermediaries respond through technical measures, social measures, or combinations of both. One social-layer measure observed in Study 4 is “adversarial interoperability”, through which intermediaries bridge conflicts of interest against the resistance of the firm.

Taken together, intermediation is therefore not a technical infrastructure for market cooperation but a socio-technical one. It brings its own socio-technical system that bridges those of households and firms (cf. the underlying “grey layer” in Figure 26). Continuing the argument of Clement et al. (2019), the fieldwork in Study 4 shows how this bridging is concretely accomplished through the work practices performed inside intermediary organizations.

9 Conclusion

This dissertation has shown how consumers rely on information systems to manage and coordinate consumption within the household and in cooperation with the digital firm. In doing so, it provides a first systematic investigation of the connection between household- and market-related administrative work and the technologies and services used.

Within IS research, individual theories already address the benefits of intermediation in markets and the support of money work from a consumer perspective. The problem space of household labor, its cognitive-administrative dimension, and consumer behavior has otherwise been addressed more separately by economic and sociological theories, whose solution approaches have primarily emphasized institutions and fair market rules.

Against this background, the analytical lens of IS research, with its socio-technical perspective, offers a new way of understanding the challenges consumers face in managing daily life and consumption. I have shown how my four studies conducted for this dissertation, using a mix of qualitative and quantitative methods, contribute to insights into structural and human aspects of the social system as well as task- and technology-related aspects of the technical system, both within consumer households and in market cooperation with the digital firm. The retroductive inquiry employed assesses this thematic area by moving iteratively between a problem space and a solution space.

I demonstrated how closely intertwined household work is with the socio-technical aspects of market cooperation. To carry out this heteronomously shaped work, consumers' complex information systems consistently employ technology, ranging from basic tools such as pen and paper, smartphones, computers, and officeware to more specialized solutions including dedicated software, online platforms, and intermediary services. Consumers use this broad repertoire across tasks that are functionally comparable to business functions in digital firms, even though the household itself differs from a firm in its informal governance, its bounded-rational practices, and the absence of professional management. While these basic tools possibly provide work support, intermediaries bring their own socio-technical components into consumers' work arrangements and have been shown to alleviate socio-economic challenges for consumers and to strengthen consumer sovereignty against structural dependence. Their integration into the cooperative setting, however, can also introduce new interoperability issues

and may, from a holistic economic perspective, shift rather than reduce overall coordination costs.

Beyond these specific findings, the dissertation contributes to the further conceptual foundation of Consumer Informatics by also systematically reflecting established IS concepts against the socio-technical reality of consumers' work.

“(5) ‘And tell me, Kritoboulos’, he said, ‘would the skilled household manager not also make use of tools, by which he accomplishes his work? And if the tools were well suited to the task at hand, would he not manage the household better by their use?’

*‘Yes, by Zeus!’”*⁴⁷

⁴⁷ Fictive continuation of Xenophon’s *Oikonomikos*, composed in the style of the original Socratic dialogue.

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