Impact Investing in Information Technology Business

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Abstract

Impact investing is one of most prominent investing strategies that pursue to generate measurable environmental and social effects in addition to profits. Despite the growth of the impact investing market and plausible results of information technology (IT) solutions and services, impact investments in the IT markets have been scarce and there has been very little research of the phenomenon. This study presents a multi-vocal literature review (MLR) to narrow the gap between the practitioners and scholars and provides results for further research avenues. The study reviews 374 literature sources in total using pre-selected keywords which were analysed using thematic and content analysis. Results indicate that IT related impact investing is increasing frequently in practice, but there is paucity of research of the phenomenon. The results of the study also propose three main discourses in IT related impact investing. Current practices and research converge technology, business management and impact investing infrastructure discourses. In addition, the study displays the most prominent technology sectors in the field. The study proposes that impact investing is a prominent phenomenon among the practitioners, and especially IT start-ups are establishing significant solutions for social and environmental impact, whereas scholars are neglecting the phenomenon.

Key Words: Impact investing, information technology, multi-vocal literature review, start-up, IT business

Introduction

Impact investing is one option for industries and economies to pursue sustainability initiatives. It is an investment method for pursuing both financial return and social and environmental benefits (Bugg-Levine & Emerson, 2011; Jackson 2013). In recent years interest in impact investing has noticeably increased, with different parties and organizations such as governments and universities giving the concept more attention. (GIIN, 2020; Harrington, 2020.) There is existing research addressing definitions and explaining the phenomenon (Bugg-Levine & Emerson, 2011; Hebb, 2013; Jackson, 2013; Thorpe, 2016), surveying the state of knowledge and research (Clarkin & Cangioni, 2015; Agrawal & Hockerts, 2019), providing explanatory case studies (Quinn & Munir, 2017; Mersland et al, 2020) and empirical studies (Glänzel & Scheuerle, 2016) in the field of social and economic sciences. Despite increasing academic preoccupation towards impact investing in economic and social sciences, the concept has not yet been studied extensively in the field of information technology (IT) and information systems (IS) and multidisciplinary studies in that field are lacking. In addition, further research on to understand the concepts, methods (Höchstädter & Scheck, 2015) and techniques involved in impact investing, as well as its advantages, disadvantages, and suitability for businesses in general has been called (Agrawal & Hockerts, 2019).

IT has become a significant part of almost every industry and is one of the most profitable and rapidly evolving sectors in the world. Innovations such as the Internet of Things (IoT), robotics, augmented reality (AR), and virtual reality (VR) are changing the fundamentals of IT operations and services. Disruptive technologies like blockchain (Ahram et al, 2017; Barbosa, 2021; Fortkort et al, 2021) represent not only new business opportunities, but also novel solutions for conducting impact investing operations. It is very likely that use of these disruptive technologies will extend to sectors that are close to social investing, such as clean energy, agriculture, conservation, education, finance, and healthcare. The social

spectrum of IT related impact investing is intensifying since digital business models increasingly regard social goals (Jablonski & Jablonski, 2021). In addition, technology's potential to reduce emissions is already significant as it is estimated that digital technology can reduce global emissions by 15 % (World Economic Forum, 2019).

Despite the substantial potential of impact-oriented IT initiatives and digital business models (Caputo et al, 2021; Jablonski & Jablonski, 2021), the current funding for IT innovations is still usually secured by traditional financing, alongside several alternatives like crowdfunding. I believe that further research and acknowledgement of specific research themes and ongoing discussion within the field are essential to accelerate IT related impact investments. It is also likely that the flow of more sustainable and purposeful business will expand and intensify by adapting novel IT concepts which utilize impact investing based methods as a funding. Still, literature does not merge the knowledge of technology and impact investing in a consistent way. It is therefore crucial to understand how IT can enable and support impact investing. For example, we need to understand how and when impact investing is a useful form of finance, and what it requires from the organization's perspective, or what are the most important stakeholders in the market. Further, we must comprehend how impact investing can be utilized in the technology sector, and if it is already being exploited, what the exact results have been.

Main contribution of this study is to fill the gap between the research and the practice by evolving the confluence between technology sector and impact investing initiatives. Study aims to do that by describing the concept of impact investing and reviewing the current state of research of the topic by means of multi-vocal literature review. In addition to published academic research, this study incorporates non-published literature which enhances the understanding of the phenomenon, and importantly offers practitioners perspective into the discourse.

Study endeavours to survey the role of impact investing in the context of IT to understand how it relates to IT investments, and focuses on impact investing from an organizational perspective, especially by looking at information technology start-ups, currently some of the most notable drivers of change. Study presented in this paper identifies the key discourses of IT related impact investing, which are used to drive the discussion. In addition, this study surveys the most notable types of technology related to impact investing as well as distinguishes specific organizational types in the field. This study aims to present a body of knowledge for further research on the topic as well as tools for practitioners of impact investing.

The structure of this paper is as follows: Background section presents a definition and background of impact investing along with a discussion of how it is used within the IT domain. Then multi-vocal literature review (MLR) methods are examined more closely. The methodology used in this study is presented after that. Next section presents the results of the study. The conclusions and limitations of the study, as well as areas in need of further investigation, are discussed in the final section.

Background

Definition and Background of Impact Investing

Impact investing is a part of a larger concept of responsible investing which has gained popularity in recent decades, with the term itself becoming widespread in 2007 (Bugg-Levine & Emerson, 2011). While it is relatively simple to describe the conditions required for impact investing to take place, a uniform definition (Höchstädter & Scheck, 2015) and understanding of the term is missing (Clarkin & Cangioni, 2015). Further, scholarly analysis of the field of impact investing is rather meagre (Jackson, 2013; Agrawal & Hockerts, 2019).

Impact investing refers to investments that are conducted to generate positive and measurable social and environmental benefits alongside financial return (GIIN, 2022). This means that investments must generate financial return on capital or at least a return of capital. Bugg-Levine and Emerson (2011) define impact investing as an investing practice that pursues financial returns as well as social and environmental benefits. This implicitly necessitates intentional contribution to positive social or environmental impact. Jackson (2013) defines impact investing as an emerging industry of finance including networks, standards, and metrics which enables social and environmental investing, and which is driven by proponents such as foundations, wealthy individuals, family offices, investment banks, development finance institutions, and dedicated impact investment funds. He sees impact investing as a part of a larger transition towards collaborative investing, thriving from the inadequacy of traditional capitalism. Jackson (2013) distinguishes three definitive components of an impact investing which are intent, impact, and theory of change. Intent relates to investors intention to acquire impact whereas impact itself is considered as the objective result of impact initiatives. Theory of change discloses the outcomes of the impact investments and strives to answer the questions of what concrete changes can be achieved by impact investing. Finally, mechanisms for traceability and measurability are major prerequisites for impact investing, as the effects of investments must be regularly measured and reported (Eurosif, 2012; GIIN, 2016; GIIN, 2022). It is essential that definitions explicitly distinguish impact investing from traditional venture philanthropy and charity actions as impact investing invariably aims for monetary profits.

As the popularity of impact investing has rapidly grown, new options have appeared, and there are a variety of ways to execute impact investing as a result. The simplest way for investors to participate in impact investing is to create a portfolio of companies striving to create positive social and environmental impacts (Jackson, 2013). In addition to direct private investments, private investors can create impact investments via their own foundations or venture philanthropy channels. Over the last decade, an entire ecosystem has been developing around impact investing largely due efforts made by the Global Impact Investing Network (GIIN) (Jackson, 2013). This ecosystem includes, for instance, standards for reporting outcomes of impact investing, such as the Impact Reporting and Investment Standards (IRIS), and agencies for rating investments, such as the Global Impact Investing Rating System (GIIRS) (GIIN, 2020). Also, independent initiatives, such as GSG (Global Steering Group for Impact Investment) has been launched to drive and amplify the growth of impact investing (GSG, 2018). Global Steering Group for Impact Investment (GSG) is a global organization operating in the EU and over 30 countries worldwide. Goal of GSG is to foster knowledge, practice, and an ecosystem of impact investing. (GSG, 2022.) Further, non-governmental organizations, religious institutions, and pension and insurance companies are making impact investments (GIIN, 2016; GIIN, 2022).

Estimated impact investing market size was USD $715 billion in 2019, and market growth is forecasted to be strong in future. In addition, target rates for impact investments are reaching market-rate returns with most investments (GIIN, 2020). Hence, impact investing appears to be a notable mean of investing and a remarkable alternative for traditional invest-

ment goals. Further research regarding impact investing would therefore benefit investors as well as economists to understand, monitor, and predict future economics more comprehensively.

Impact Investing in IT and IS

There are several studies discussing the relation of IT and impact investing, but most of them focus on predicting future development instead of delivering proven understanding of the phenomenon or fostering the body of knowledge in the field. In addition, existing research only refers to technology solutions instead of holistically surveying the field and explaining how technologies are contributing to major problems. Apart from a few key studies, research regarding IT and IS research paradigms is little.

Existing literature mentions some topical disruptive technologies like blockchain that are changing the field of economics and sustainable business, and generating discussion (Bengtsson & Ågerfalk, 2011; Mettler, 2016; Barbosa, 2021; Fortkort et al, 2021). Recent research analysed impact investing based digital business models and the results indicate that social impact and economic profit reinforce each other, and the consolidation of social impact necessitates conscious recognition of social value aspects in the organization's business model (Jablonski & Jablonski, 2021).

The concept of impact investing conforms to the triple bottom line (TBL) framework, an accounting concept that considers three types of 'bottom line': social, environmental, and financial (Slaper & Hall, 2011). Information systems (IS) research has considered this topic from a green IT perspective, where the focus has been on resources and operations (Bengtsson & Ågerfalk, 2011; Dao et al, 2011). While more traditional management-based perspectives and frameworks are still valuable, they do not contemplate new technologies nor new means of fostering organizations in a way that drives change in the field of technology. Impact investing, therefore, takes a broader view of environmental sustainability and social equality.

Multi-Vocal Literature Review (MLR)

MLR is a form of literature review that considers published and unpublished literature (Garousi et al, 2016). Unpublished literature, also called grey literature, includes sources such as blogs, videos, websites, and white papers (Garousi et al, 2019). According to Haddaway et al. (2015), grey literature also includes academic theses and reports produced by organizations, like government papers. For the purposes of clarity in this review, white papers are included into the category of their own. The MLR method, recently recognized among software engineering researchers, assumes that significant knowledge of a subject may be gleaned from grey literature sources. In this way, MLR aims to narrow the gap between practitioners and scholars (Garousi et al, 2016). Although it emerged rather recently, the MLR framework has been recognized as having several phases and subphases, with the former having been identified by Garousi, et al (2019) as planning, conducting, and reporting on the review. MLR planning consists of establishing the need for grey literature and defining the goal of the literature review. The review is then conducted following sub-phases that include an informal pre-search, the search process, a selection of sources, source quality assessment, data extraction, and data synthesis (Garousi et al, 2019). In conducting research for IS, grey literature can provide an understanding and evidence of a subject that published literature would obviate in the process. This particularly applies to emerging research areas.

Methodology

This study was completed to investigate the state of existing literature on the concept of IT related impact investing and to introduce preliminary results of the little researched topic. Study was conducted by means of MLR. Although the study was conducted as an MLR, the research process also followed systematic literature review (SLR) guidelines as presented by Snyner (2019) to enhance the quality of the review. Finally, the present study may be defined either as a semi-systematic review or as an integrative review, as it possesses features of both. A thematic and content analysis was conducted during the study's data synthesis to define how research on the topic has progressed. This is characteristic of a semi-systematic review. On the other hand, the study aims to increase the understanding of a relatively immature and emergent research field, as well as structure the theoretical framework around the topic, rather than simply providing an overview or description of it. Both are features of an integrative review (Snyder, 2019.) In addition, applying with the guidelines benefits the quality of research overall.

Defining the Need for Multi-vocal Literature Reviews and Setting Research Questions

Due to the novelty of the scope of this research, it was completed using the MLR method following guidelines introduced by Garousi et al. (2019). In the MLR planning phase, a rationale for using the MLR method is provided, and research questions (RQ) are defined (Garousi et al, 2019). For this study, it was determined that existing literature about impact investing is scarce due to its relative novelty. Since MLR is suitable for identifying current perspectives and for bridging the gap between formal and non-academic literature (Garousi et al, 2019), it was selected as a method for acquiring as large and as on-topic a collection of literature as possible to answer the RQ's. Garousi et al. (2019) also define seven questions for determining whether the MLR method is appropriate to the research context. In the present study, almost all answers to these questions were 'yes,' except for questions four and five. The prescribed methodology states that the research process must include primary studies to address the RQ; extraction of data to be able to answer the RQ; and a data analysis phase conducted in a way that the RQ will be answered (Garousi et al, 2019). Here, a primary study was conducted to explore the current comprehension of the topic and then the following RQ's were selected to increase the understanding of the topic, and to bridge the gap between practitioners and academics. Points of interest for this study were the current situation of research of the phenomenon, state of knowledge among practitioners, framing the topics and discussions related to the phenomenon as well as recognition of the most prominent technology solutions within the research agenda. Research questions of this study are as follows:

RQ1: What is the current state of IT related impact investing research, and how is impact investing adopted within the field of IT?
RQ2: What are the most prominent discourses within IT related impact investing?
RQ3: What are the most important technology sectors related to impact investing?

Search Strategy

Literature review was conducted between June 2019 and December 2021 and new literature that met the criteria was analysed during that time frame. Search strategy proposed by Ga-

rousi et al. (2019) was followed. According to Garousi et al. (2019), there are several ways of executing the search process. General web search engines and specialized databases can be used, individuals can be contacted, and a method called 'snowballing', which includes looking at reference lists and backlinks, can also be employed. For the purposes of this study, general web searches and snowballing techniques including the use of backlinks were employed. Google Scholar was used for inquiries of academic papers, books, and white papers. Google Scholar provides a plausible amount of academic research (Delgado López-Cózar et al, 2019), and hence is a convenient tool for literature review. University of Jyväskylä's library search was used for inquiries of academic research as well as grey literature. Google search was used for all literature types, but in most cases, results included grey literature as anticipated. An informal pre-search was conducted to define plausible search strings. It is also important to define stopping criteria for the search process beforehand to avoid data exhaustion resulting from the vast amount of search results. We used four different search terms and only the first 120 search results were included for review.

Selection of Search Terms and Source Selection Criteria

Keywords and search terms were selected based on the research topic. As the research concerns impact investing in the field of information technology, search terms included these individual words and combinations thereof. Further, as start-up companies are pivotal catalysts for change and thus central to this research, plural 'start-ups' was also included in the searches. The literature review was conducted systematically following four steps.

First, literature on the subject matter, in the form of academic papers, was sought out using primarily Google Scholar. Search terms for Google Scholar searches included the following search terms: 'impact investing software,' 'impact investing information technology,' 'impact investing technology,' and 'impact investing technology start-up.' The search terms were either required to appear in the source's title, abstract, or keywords, or the source's connection to the topic had to be implicitly noticeable. Second, relevant academic publications, books and essays from the university library's search authored by significant authorities were reviewed using the same search terms as above. Third, general Google searches were conducted to gather further relevant information from different sources including blogs, reports, news articles, company websites, and third sector organizations. Finally, the snowballing technique was used: literature singled out in the first three steps was used to investigate the topic further and to identify new sources.

In this study, effort-bound stopping criteria (Garousi et al, 2019) were established. For Google and Google Scholar searches, the first 30 search results were considered. When using the snowballing technique, three levels of references were explored. This criterion was justified by the fact that the most valid literature sources are often among the first results. Including more search results in the review would have impeded the focus of the study and would have been too laborious for research to be properly conducted.

The MLR methodology includes criteria for source selection. The criteria can be based on authority of the producer, methodology used in the literature, objectivity, date, position in the field, novelty, impact, or format (Garousi et al, 2019).

The first criterion for source selection was format: material had to be in a written form. In addition, material could not be an advertisement or promotional in nature. The second criterion was the authority of the producer: material had to be written by an identifiable person or organization. The third criterion was connected to the second in that it addressed objectivity: grey literature had to be publicly available. The fourth and fifth source selection criteria were novelty and date. Sources published in 2010 or later were included in the study. The sixth criterion was methodology, which specified that material should cover specific questions or have a clear aim. The seventh and final criterion was impact, which also included position. The impact of a source was evaluated based on the number of times it was cited and/or backlinked, as well as how high the source was ranked in the public search engine. MLR methodology underlines the importance of assessing the quality of sources (Garousi et al, 2019). For this study, the quality assessment was conducted early in the source selection process.

Results

This section presents the results of the study based on the MLR methodology. Literature sources that were subject to the MLR are presented in Tables 2, 3, and 4. The tables present information on all primary sources including type of literature, title, and brief description. For the purposes of this study, literature sources were divided into three different segments: research, grey, and white. Whereas white literature is commonly included in grey literature, in this paper white literature is put into its own category on purpose. By using this categorization, I believe that the context of the sources is more distinct and easier to follow and evaluate. Study proposes primary conceptual contributions (PCC) to the RQs. PCCs are communicated throughout the findings section.

Findings

RQ1: What is the current state of research regarding impact investing in IT, and how is impact investing adopted within the field of IT?

Literature searches supported assumptions on the novelty of the topic, as the number of suitable results in Google Scholar searches was low. Of the 120 search results, only four are research publications. The second phase included searches for relevant books and essays from the University of Jyvaskyla's library search, which includes all the institution's printed and electronic resources. Surprisingly, just one of the sources met the MLR criteria. Grey literature searches in the third phase yielded most of the matches out of 120. Several sources were excluded from the study due their evident connection to marketing or promotion. Finally, snowballing techniques revealed several interesting sources and topics concerning green and disruptive technologies for instance, but among these only two met the MLR criteria.

Results indicate that while impact investing has already been adopted in the field of IT and is increasingly being used as a method in the business domain, research on the subject is still meagre. Results also indicate a perceptible disproportion between academic and grey literature findings—there is a clear deficiency of research and academic literature on the topic. Again, results from grey literature indicate that there is rising interest for influential investing in the IT business domain, as well as increasing attention being given to so-called green technology.

PCC1: Research into impact investing in the context of the field of IT is limited and immature while interest in the impact investing is increasing among the practitioners.

Based on the findings of the study, impact investing has already

been adopted or recognized as a practical investing method by several IT organizations. The MLR results identified 38 high-tech companies or organizations that could be categorized as impact-investing organizations by virtue of their intention to generate positive environmental or social impact. Interestingly, most of these organizations were counted as technology start-ups. Most of the companies mentioned in the literature combine different technological solutions in their innovative products or services; in all instances, IT was either an important or crucial part of the solution, or a software product or service was the actual offering.

PCC2: Practitioners have already adopted or utilized impact investing in their financing and many of them are start-ups initiatives.

In addition, an emergent organization type called "impact start-up" was distinguished from the older results. Mentions of impact start-ups were recognized more in the later phase of the research. It seems that established terminology for the field is still evolving, and novel appellations are introduced especially among the practitioners. It is likely that terminology considering impact investing in the IT context will expand and mature in the future.

PCC3: Terminology for the research field is still evolving and new appellations are introduced.

RQ2: What are the most prominent discourses within IT related impact investing?

Thematic division is used for review of the state of literature holistically and for communicating the findings of this research. By examining the discussions from the literature, three distinct but usually interconnected discourses can be derived. This study also identifies several key categories inside each discourse and deliver findings related to literature of each discourse. In addition, all discourses were thematically analysed to identify technology sectors and results of this analysis are reported later in RQ3.

First discourse concerns technology. Sources that mainly discuss specific technological solutions or technology sectors, were classified as technological solutions discourse of impact investing. Total of four categories were distinguished within the technology discourse: actual impact and effectiveness of solutions; trade-off between impact targets and economic return; impact investing promoting technologies and disruptive technology.

Second discourse discusses business management, which includes business models and financing for technology companies and organizations. Sources that took management and administration as well as finance operations into account were considered to address the business management discourse. Impact investing as a method (Bugg-Levine & Emerson, 2011), (Clarkin & Cangioni, 2015) is at the heart of business management. Thus, assessing and evaluating business management and functions of organizational administration is important when aiming to understand how the sector is progressing and how it can be promoted further. Total of six categories were distinguished within the business management discourse: barriers of technology start-ups; role of accelerators and incubators in impact investing ecosystem; role funders in impact investing ecosystem; impact-oriented business models; ethical challenges related to impact investing and disruptive technology.

Sources focusing on stakeholder perspective and specific collaborative platforms of impact investing were assigned to the infrastructure discourse. Third discourse can be defined as a synthesis of support organizations, non-governmental organizations (NGOs), governments, and other relevant stakeholders. Total of four categories were distinguished within the infrastructure discourse: role of funders in impact investing ecosystems; collaboration in impact investing ecosystems; disruptive technologies and impact investing promoting technologies.

PCC4: The concept of IT related impact investing can be derived into three discourses: a technological discourse, a business management discourse, and an infrastructure discourse.

Using the presented three-discourse framework, it is possible to describe the status of current research on and practices of IT related impact investing. All three discourses intersect and are related as they comprise important themes from other discourses. In addition, they share the mutual category of disruptive technology. The three discourses of impact investing in the IT business are presented in Figure 1 (p. 20).
Most of the categories mentioned in this study are already explored in academic research, but not necessarily in the context

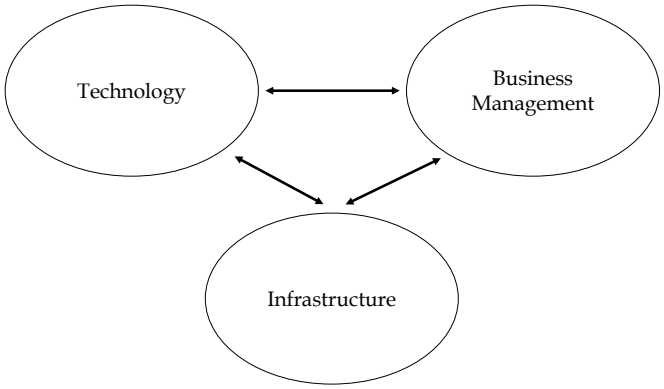

Figure 1. Discourses of impact investing in IT business.

of impact investing. This study merges perceived categories to the existing impact investing research. Actual impact of technology solutions related especially to educational technologies (ed-tech) and perceived benefits of private sector solutions such as ed-tech mobile applications. Benefits and challenges of ed-tech are studied in the field of technology (Mehdipour & Zerehkaf, 2013) and in education (Groff & Mouza, 2008; Riasati et al, 2012). It is essential to regard the real impact of other technology types as well and critically assess their appropriateness. Trade-off between social values and economic return or dual value is a recognized issue in prior research (Austin et al, 2006; Evans, 2012; Doherty et al, 2014; Arena et al, 2018), and it is a crucial debate in fostering impact investing initiatives. Impact investing promoting technologies such as blockchain is already studied in IS and IT research in general (Nofer et al, 2017), and from application perspective (Ahram et al, 2017), but research related to impact investing platforms is scarce.

Disruptive technology acts as a leverage for impact solutions and emerging business models. Disruptive technology research has long roots (Danneels, 2004; Kostoff et al, 2004) and some specific technologies are studied extensively, especially in the field of e-health (Mettler, 2016; Meskó et al, 2017). Still research regarding the relation of impact business models and disruptive technologies is important to help us understand how to develop effective business applications which are based on novel

technology solutions.

Impact investing promoting technologies have been studied especially in the context of investment and transaction platforms (Mendell & Barbosa, 2013; Fortkort et al, 2021). Barbosa (2021) has studied blockchain's relevancy in impact investing by the means of case study. Barriers or challenges of innovative start-ups have been studied in IS (Bosch et al, 2013; Giardino et al, 2015), and management research (Hyytinen et al, 2015; Salamzadeh & Kesim, 2015). Role of accelerators and incubators is studied within the impact ecosystem paradigm (Roundy, 2019), further there is emerging research considering impact incubator and accelerator characteristics and fundamentals (Bergmann & Utikal, 2021). Impact investing finance is studied in existing research (Hebb, 2013; Agrawal & Hockerts, 2019) and considered in few impacts ecosystem related research (Bukharina & Onyshchenko, 2019; Roundy, 2019), although there is little or no research regarding the relevance and importance of different funder types within the impact investing ecosystem.

Albeit sustainable business models are recognized by academics (Stubbs & Cocklin, 2008; Schaltegger & Wagner, 2011; Bocken et al, 2014), impact business models and especially digital impact business models are little researched, aside from research by Jablonski and Jablonski (2021). Ethics and moral questions around impact investing must be considered as a part of more ample discussion around business ethics and ethical investing. Still, specific impact investing related ethical features exist and those attributes should be researched more comprehensively. Examples of these are the actual impact of applications such as ed-tech (Groff & Mouza, 2008; Riasati et al, 2012), greenwashing (Delmas & Burbano, 2011), and intentional misleading of impact investors by impact funds (Findlay & Moran, 2019). Collaboration in impact investing ecosystems is broad theme which has been studied in general (Islam, 2021), and especially from the regional perspective (Acevedo & Wu, 2017; Bukharina & Onyshchenko, 2019; Roundy, 2019)

PCC5: There are a total of eleven categories within the three main discourses of impact investing, and disruptive technology is relevant for each discourse.

In addition, it can be concluded from the results that social and environmental aspects of impact investing are present in IT related literature and literature supports the conception of a triple bottom line (Slaper & Hall, 2011).

PCC6: Social and environmental impact discourses are perceptible in the IT related literature.

Technology Related Literature

Technology literature includes seven grey literature sources and two white literature sources. Literature is presented in Table 1 (p. 21) with reference, title, and description as well as our findings and key category.

Reference	Title	Description	Findings	Category
Barshay, 2018 (grey)	"3 lessons from data on how students are actually using educational apps and software at school"	Discusses the usage and effectiveness of educational apps and software in schools.	Based on tests reported in the article, educational apps and software are necessarily not as effective to contribute to learning as believed.	Actual impact and effectiveness of solutions.
Barshay, 2019 (grey)	"Impact funds pour money into ed tech businesses"	Discusses educational impact investment called Classcraft and discusses the role of impact investing as a contributor to education technology.	Number of private funded educational technology solutions is rising, but there is not enough evidence for the effectiveness of educational technology.	Actual impact and effectiveness of solutions.
D. Capital Partners, 2013 (white)	"Impact Investing in Education: An Overview of the Current Landscape"	Surveys the landscape of education impact investing, centralizing to identify potential areas for intervention by impact investors.	Impact investing in education has significant potential to provide quality education more broadly, but there is a trade-off between financial returns and actual impact, especially in low-income areas.	Trade-off between impact targets and economic return.
DCosta, 2019 (grey)	"Scaling Impact Investing Using Blockchain Technology"	Discusses the role of disruptive technologies, such as blockchain, in building impact investing ecosystems.	Blockchain technology can be utilized to create more transparent and trustworthy transaction ecosystems for impact investing.	Impact investing promoting technologies.
Field, 2020 (grey)	"Impact Investing and Technology: A Multifaceted Relationship"	Discusses a wide variety of innovative technology solutions creating positive impact. In addition, technology solutions can increase impact investing.	Innovative technology contributes to agriculture, energy, and health technologies. Automated investing platforms and data analysis are making impact investing more common.	Impact investing promoting technologies.
Maretich, 2018 (grey)	"Impact investing in disruptive technologies"	Discusses the role of disruptive technologies in making more efficient and effective investments.	Orchestrated cloud computing, AI, and machine learning are accelerating processing power and generating more accurate analytics as well as bringing organizations and customers closer to each other.	Impact investing promoting technologies.

Petrick, 2014 (white)	"Impact Investing in education"	Discusses the role of impact investing in education. States that the usage of the technology is important in improving educational quality and efficiency.	Educational systems should source impact investing deals more broadly, focusing on business models and innovations creating tangible outcomes is the key. Investors should conclude their position on the trade-off between financial returns and impact before entering the markets, and measure and evaluate the actual social impact.	Disruptive technology. Trade-off between impact targets and economic return.
Silicon Canals, 2020 (grey)	"This fintech startup helps investors evaluate the impact of their portfolios on society & planet; raises €12.8M"	Discusses a fintech startup company which develops solutions for analysing social impact of companies and investments.	AI solutions can be utilized in the sustainability assessments and markets for sustainability measurement are expanding.	Impact investing promoting technologies.
Tiger 21, 2021 (grey)	"Agricultural Technology Impact Investing: What You Need to Know"	Discusses the impact of technology solutions as well as hardware and software solutions on agriculture.	Hardware and software will be prominent sub-sectors in the ag-tech field as stagnation of traditional agriculture companies provides opportunity to innovative startup companies.	Disruptive technology.

Table 1. Technology Related Literature.

Management Related Literature

Business management literature includes four published research, eleven grey sources, and two white literature sources. Literature is presented in Table 2 (p. 22) with reference, title, and description as well as our findings and key category.

Infrastructure Related Literature

Infrastructure discourse includes three grey literature sources and three white papers. Literature is presented in Table 3 (p. 24) with reference, title, and description as well as our findings and key category.

Reference	Title	Description	Findings	Category
Arena et al, 2018 (research)	"Unlocking finance for social tech start-ups: Is there a new opportunity space?"	Discusses the financial models of technology-driven technology startups and suggests the concept of social impact investing (SII).	SII concept incorporates three specific areas for further research; demand and supply matching, accountability issue, and regulatory framework.	Barriers of technology start-ups.
Baddour, 2020 (grey)	"Impact investing through early-stage tech startups"	Discusses investing in early-stage technology startups on a general level.	There are too few impact investors with long investment horizons.	Barriers of technology start-ups.
Bozorgzadeh, 2019 (grey)	"Impact investing is driving the most exciting emerging technologies"	Discusses the role of impact investing in promoting new high technology and technology startups.	Startup accelerators and incubators significantly support impactful start-ups in creation of impact innovations.	Role of accelerators and incubators in impact investing ecosystem.
Carpenter, 2017 (grey)	"Social Impact Investing Is Attracting New Funds As Well As New Startup Ideas"	Discusses the state of Impact Engine annual showcase. Impact Engine comprises over 30 ventures including clean energy ventures, clean tech startups, and healthcare solutions.	Number of impact investing funds is rising, and they operate in a variety of technology sectors and markets.	
Clancy, 2017 (grey)	"Salesforce dedicates $50 million to impact investments"	Discusses Salesforce investing money in impact investing. Salesforce has created a fund of $50 million dedicated to software startups creating solutions for equality and clean energy.	Purpose centric investments among the corporations are increasing but still in minority.	Role funders in impact investing ecosystem.
Csernyik, 2020 (grey)	"Future Returns: Investing in Tech for Good"	Discusses impact or mission driven technology investments in general.	Stresses two highlights for impact investors; talented people are moving to impact companies, mission-driven customers define successful businesses, and the amount of non-dilutive capital in the markets is increasing.	Role funders in impact investing ecosystem.

European Investment Bank, 2020 (white)	"Technology can transform impact investing"	Discusses the overall state of impact investing in the technology sector. States that deployment of technologies can enable social innovation models. Writer expects the growth of new technology-enabled impact ventures.	Impact business models are not compatible with traditional venture capital models. New ways and mindsets are needed to create scalable impact business models. Efficiency of digital technology, collaborative platforms and deep tech solutions are key factors in deployment of scalable impact business models.	Impact oriented business models.
Forbes, 2018 (grey)	"Impact Investing: The Billionaires Building Change"	Discusses billionaire impact investors and their ambitions for impact investing.	Wealthy individuals are interested in purpose centric investing. They are contributing to the sectors of healthcare, poverty, education, and technology overall.	Role funders in impact investing ecosystem.
Gidron et al, 2021 (research)	"Impact Tech Startups: A Conceptual Framework, Machine-Learning-Based Methodology and Future Research Directions"	Proposes a new organizational category of impact tech startup (ITS) and discusses machine learning based algorithms for identifying such companies from startup databases.	Handling of personal data and greenwashing are ethical issues related to impact startups.	Ethical challenges related to impact investing.
Jablonski & Jablonski, 2021 (research)	"Impact Investing in Digital Business Models"	Discusses the role of social impact as a key factor in the creation of digital business models.	Social value should be recognized in the business model and socially attractive business models are more successful than traditional business models. In addition, there is a strong relationship between social and economic aspects.	Impact oriented business models.
Koshovets & Frolov 2015 (research)	"Impact Investing as a 'Basic Innovation' for the Global Economy and Finance System Post-Crisis Transformation"	Discusses the transformation of the new global financial and economic system.	Future technological development will be even more centralized and technological inequity will increase but developing countries will be involved in production chains.	Ethical challenges related to impact investing. Impact oriented business models.
Miller, 2018 (grey)	"The Intersection of Impact Investing and Technology Startups"	Discusses the role of impact investing and technology startups in solving future problems.	Technology investing will deliver a more sustainable future.	Role funders in impact investing ecosystem.
Pothering, 2020 (grey)	"The role of impact investors in early stage agtech investing"	Discusses the outlooks and the role of impact investing finance on funding agricultural technology.	Agriculture needs technology solutions, but software business models do not necessarily adapt to features of agricultural markets.	Impact oriented business models. Barriers of technology start-ups.
Reid, 2022 (white)	"Impact investment: How technology can make a difference"	Discusses technology's role in society's transition towards more sustainable business. Introduces three technology companies: Vulog (mobility), Azimo (finance), and Softatutor (education).	Creating actual impact takes time and technology will be a catalyst for change in societies.	Impact oriented business models. Disruptive technology.
Ross, 2019 (grey)	"Tackling climate change — an investor's guide"	Discusses software technologies that drive sustainable development in agriculture and that reduce food waste. Discusses several investing principles related to sustainable investments.	Impact investing in technology incorporates some risks for investors, which need to be considered.	Role funders in impact investing ecosystem.
Simon & Barmeier, 2010 (grey)	"More than Money: Impact Investing for Development"	Discusses the current state of impact investing in developing countries.	Clean energy and technology could be potential sectors for impact investing. In addition, there is an information gap between businesses and investors in terms of impact investing.	Impact oriented business models. Disruptive technology.

Welsh, 2019 (grey)	"20 Tech-For-Social-Good Startups to Watch As Tech Nation Tackles Signs Of The Sector Stalling"	Discusses startups contributing to impact investing. Presents 20 technology startups generating social good. Among others, startups operate in sectors of transport, health, education, and crowdfunding.	Purpose driven economies will become more common in future as technology solutions driving the change are highly scalable.	Impact oriented business models.

Table 2. Business Management Related Literature.

Reference	Title	Description	Findings	Category
ADB, 2020 (grey)	"ADB Unveils Venture Platform to Invest in Impact Technology Startups"	News article discussing new venture capital fund to finance impact technology startups.	New ventures operate differently compared to traditional venture capital funds and foster the emerging startup field.	Role of funders in impact investing ecosystems.
Bucak, 2021 (grey)	"Where fintech and ESG meet: How investment apps can drive impact investing"	Discusses digital impact investing platforms which make sustainable investing easier and attract new investors into the markets.	Digital impact investing platforms are attracting attention, but the number of investments is still relatively low.	Role of funders in impact investing ecosystems.
Danske Bank, 2021 (white)	"Nordic Impact Startups 2021"	Discusses Nordic impact startups ecosystem.	Impact investing ecosystem is intensifying in Nordic countries and venture capital funding of impact startups is constantly rising.	Collaboration in impact investing ecosystems. Role of funders in impact investing ecosystems.
Minevich, 2021 (grey)	"20 Leading Social Impact Platforms Making a Difference with Digital Potential"	Discusses social impact platforms leveraging digital solutions.	Non-profit and for-profit impact investing platforms are leveraging impact companies which contribute to environmental and social problems on a global scale.	Collaboration in impact investing ecosystems. Role of funders in impact investing ecosystems.
Uwanaka, Ojobo & Chude, 2021, (white)	"Impact Investing: A brief General Analysis from the Nigerian Perspective"	Discusses Nigerian impact investing ecosystem. Raises technology solutions developed in the Nigerian impact investing ecosystem.	There are several ecosystem related challenges to impact investing in Nigeria, but also the potential for impact investing markets is immense. Solutions to tackle the challenges are also ecosystem based.	Collaboration in impact investing ecosystems.
Uzsoki & Guerdat, 2019 (white)	"Impact Tokens. A blockchain-based solution for impact investing"	Discusses the utilization of blockchain technology solutions for impact investing transactions. Ten case studies are presented in the article.	Blockchain technologies such as impact tokens can remove obstacles for impact investing transactions and enhance the trust in impact investing markets.	Collaboration in impact investing ecosystems. Disruptive technology. Impact investing promoting technologies.

Table 3. Infrastructure Related Literature.

RQ3: What are the most important technology sectors related to impact investing?

To answer the RQ3, the content analysis for the MLR literature sources was conducted. Results indicate several perceptible technologies related to impact investing as it currently stands. These technologies and the different fields in which they are being developed contribute to environmental and social problems with different emphasis are presented in Diagram 1 (p. 25).

The results indicate that the main contributing sectors were education and e-learning with nine organizations, and healthcare with eight organizations. Companies and entities promoting sustainability and pursuing solutions to restrain climate change and providers of impact investing platforms were in third place with five organizations. There were four contributors of payment technology recognized. Other sectors included sustainable development and agriculture with three, housing solutions, transportation, communication, employment, and aid service with one case each. It must be stated that impact targets often overlap, as innovative products or services provide more sufficient

solutions for people and are simultaneously more sustainable to produce. For example, investing in infrastructure, housing, and transportation technologies cannot rigidly be divided into only one impact category alone.

PCC6: The sectors in which technological developments are most prominent to impact investing markets are e-learning, health, alleviation of climate change, and investment infrastructure.

Discussion

This study defines the status of impact investing research in the field of IT, IS and management by following MLR guideline which examines written sources in the form of published academic literature and grey literature. The MLR method offers a broader approach to the rarely covered topic of impact investing than traditional academic literature review, as the number of publications on the topic is still relatively low despite its importance.

Findings of this study suggest that impact investing is still a rather novel concept in IT and IS research, and the amount of academic literature and research on the topic is low. Results support perceptions by Clarkin and Cangioni (2015) and strengthen the notion of overall scarcity of impact investing research. Again, movement in impact investing is accelerating in the business domain and among the practitioners, and the amount of related grey literature has increased significantly in recent years with the overall interest in the topic. Although IT investments in impact investing are still rather low, the investments made in the IT sector are becoming more common all the time. In the light of the conspicuous growth of the impact investing market, the volumes for IT-related impact investing are anticipated to grow substantially.

MLR findings indicate there are three distinct but interconnected discourses of IT related impact investing. Main discourses perceived in this study are technology, business management, and infrastructure. In this study a total of eleven discussion categories are recognized within the discourses. Categories can be used for establishing direction and avenues for further research. Based on the results, proposed topics for further research include practitioners' willingness for trade-offs between impact and profit, business models and revenue models of impact start-ups, application of emerging technology innovations and models, and theories considering the foundation and building of impact start-ups. It seems that impact investing fosters technological evolution and the occurrence of disruptive technology solutions, both of which transform businesses and generate new ways of solving major problems.

There are several discipline-specific features in IT and IS research such as rapid evolution of technological solutions, centralization of competence in the markets, and the difference between traditional and digital business models and their scalability. In addition, the lifecycle of business models may differ notably between digital and traditional service-oriented businesses. Existing body of knowledge cannot cover these discipline-specific attributes and we need more research from IT and IS traditions. There is also a need for further multidisciplinary studies as innovative impact initiatives expand to many fields of research such as management, social sciences, IS and business ethics.

This study demonstrates several interesting and growing segments of technology within the scope of impact investing. The most common technologies are e-learning and education and health technologies, as well as technologies related to sustainable consumption and emission reduction. Other technologies are investments in infrastructure such as impact-oriented

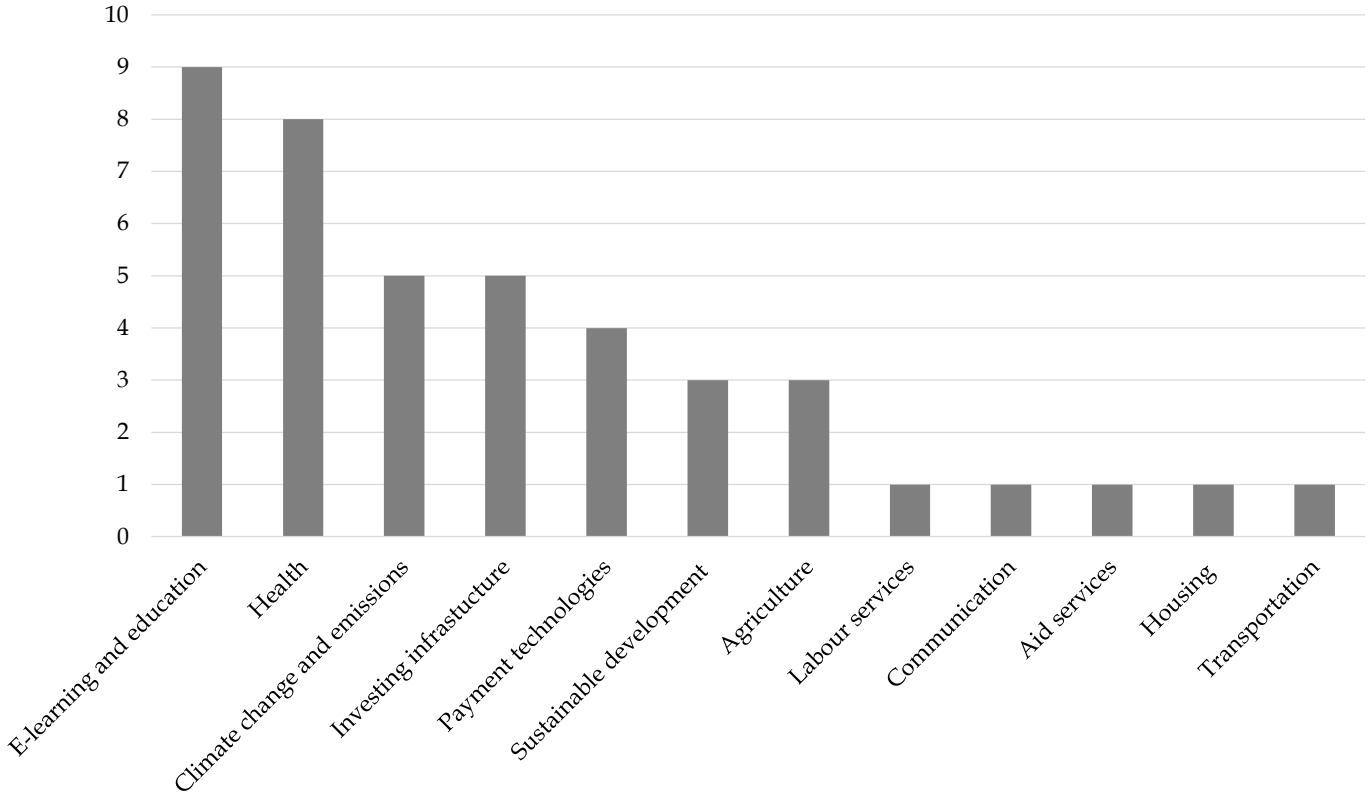

Diagram 1. Impact Investing Technology Sectors.

crowdfunding platforms, payment technologies, sustainable development, labour services, communication technologies, aid services, housing, transportation, and accounting and reporting technologies. Mentioned fields of technology contribute to solutions for both social and environmental issues. Recognition of potential markets and technologies may amplify new business opportunities for impact investing markets and increase social and environmental impact.

There are several limitations to this study due to the study's limited scope and scarcity of existing peer reviewed academic literature as well as novelty of the topic. In addition, the MLR methodology used for this study is still evolving due to its relative immaturity. Thus, there are also several limitations related to the MLR itself (Garousi et al, 2016; Garousi et al, 2019).

Defining frameworks for impact investing related business would be crucial to promote the growth of impact investing in the IT sector further. As IT innovations are often invented and accelerated by start-ups, it would be wise to support and promote impact investing based methods by these entities, especially since such models do not currently exist. Technological innovations could serve as a significant contributor to solutions for environmental and social problems. By becoming involved in impact investing, this contribution may be amplified, as it takes non-financial benefits into account as an essential part of the business. Evident disproportion between practitioners' interest and academic research poses challenges to expansion of impact investing and hence it is essential to cover that gap in the future.

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