INCLUSIVENESS IN A DIGITIZING WORLD – INVESTIGATING ICT AND WOMEN'S EMPOWERMENT

Research paper

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Abstract

Leaving no one behind is a fundamental principle for achieving the Sustainable Development Goals (SDGs) 2030. In accordance with SDG 5 "Gender Equality", which aims to achieve gender equality and empowerment of all women and girls, this research focusses on the inclusion of women in development efforts. Specifically, we research the relationship between Information and Communication Technology (ICT) and women's empowerment. Two sequential studies are conducted. Study 1 outlines the key aspects of women's empowerment influenced by ICT via a structured literature review and the use of Amartya Sen's Capability Approach. Study 2 delineates the dynamics and future research potential of these initial findings by integrating them into a co-word analysis. Results outline the topic of ICT and women's empowerment as a relatively new field of research, which includes investigations of the relationship between ICT and "life and physical health" at its strategic heart. In addition, results outline the relationship of ICT with women's capabilities of "social relations", "education and knowledge", "paid work and other projects", and "bodily integrity and safety" to be potentially promising for further research.

Keywords: Women's Empowerment, ICT, Inclusiveness, Gender Equality, Co-Word Analysis, Literature Research, Sustainable Development Goals.

1 Introduction

In 2015, the United Nations (UN) developed the Sustainable Development Goals (SDGs), designed to structure the pursuit of sustainable development until 2030. One of the fundamental principles of the SDGs is inclusiveness i.e., leaving no one behind (Ullah, 2016; Hussain, 2016), in order to give everyone the chance to participate in and benefit from sustainable development (UNDP, 2019b; UNESCAP, 2019). SDG 5 specifically focusses on the inclusion of women in development efforts. Women are subject to multiple forms of inequality, discrimination and violence all over the world (UN, 2015b; UNFPA, 2019). Empowerment is thus integral to the inclusion of women in the process of sustainable development.

Women's empowerment is defined as the process of enabling women to take control over their own lives (Abubakar et al., 2017; Somerville, 1998; UN Women and UN Global Compact, 2011). What follows from this definition is a focus on empowerment as a process of enablement towards a situation where women have the full range of human capabilities, as proposed by Sen (1999), at their disposal (Abubakar et al., 2017; Gigler, 2004). In a digitized world, utilizing Information and Communication Technology (ICT) is crucial for the success of an empowerment process (UN, 2015b). This is also supported by SDG 5.B which suggests that ICT, in particular, should be employed to promote women's empowerment (UN, 2015b). Acknowledging the potential role of ICT in women's empowerment, researchers from multiple disciplines have investigated the topic. The resultant articles – which relate to a range of specific aspects of women's empowerment and focus different capabilities – originate from multiple domains, including medicine (e.g.,van den Berg et al., 2012), women's studies (e.g.,Sun, 2016), and also IS research (Abubakar and Dasuki, 2018). Despite the multidisciplinary nature of existing research, there are many questions left unanswered. Specifically, it is not clear how, when, and why women's empowerment through ICT occurs (Abubakar et al., 2017). The little existing empirical research claiming that ICT contributes to women's empowerment is lacking in methodical rigor and clarity (Abubakar et al., 2017; Dasuki and Abbott, 2015; Heeks and Arun, 2010). In addition, some current research even suggests that ICT has a detrimental impact on women's empowerment (e.g.,Hussain, 2016; Horeck, 2018; Kang, 2012). Responding to this status of current research, the goal of this work is to provide a holistic picture on 1) the relationship between ICT and women's empowerment and 2) the future research dynamics of this relationship.

To achieve this goal, a sequential research design, including two studies, namely Study 1 and Study 2, is applied. In a sequential research design, findings from the first study are used to inform the second study (Ang and Slaughter, 2001). The aim of Study 1 was to identify the key aspects of women's empowerment that are influenced by ICT. For this purpose, Study 1 includes a structured literature review and used Sen's (1999) Capability Approach (CA) to analyze the data collected. The aim of Study 2 was to further investigate the results of Study 1 in terms of future research potential. Hence, in Study 2 these results are subject to a bibliometric co-word analysis. Integrating the findings from both studies via a sequential research design enables us to draw stronger interferences than would a single study, and, hence, offers a holistic explanation of the influence of ICT on women's empowerment.

Our research is thus presented as follows: The next section of this paper sets the stage by providing an overview of the theoretical background. Section 3 details the method and results of Study 1. In Section 4 details of Study 2 are presented in this same order. In Section 5, the results of both studies are discussed. The research is then concluded in Section 6.

2 Theoretical Background

2.1 Empowerment

As the main focus of SDG 5, empowerment is central to international development activities (UN, 2015a; Güney-Frahm, 2018). However, defining empowerment is a complex task and a universal definition is currently lacking (Abubakar et al., 2017; Gigler, 2004; Laizu et al., 2010). The complexity of *"empowerment"* is rooted in the underlying concept of *"power"*, which according to Rowlands (1997) includes four different types, i.e., power *"over", "with", "within" and "to".* Each type of power has different implications for the concept of empowerment: Firstly, *"power over"* refers to conflictual and confrontational interactions between two or more groups. Concepts of empowerment founded on this type of power (e.g., Friedmann, 1992) focus on political and socio-economic contexts. Secondly, *"power with"* refers to a group's collective action, e.g., towards a shared goal. Empowerment, in this context, focusses on collective empowerment and social mobilization (e.g., Menchú, 1983). Thirdly, *"power within"* can be described in terms of, e.g., the self-confidence or self-awareness of an individual (e.g.,Kabeer, 1999). Fourthly, "power to" refers to the creation of new opportunities for action. This type of power explicitly involves the CA proposed by Sen (1999). Empowerment founded on *"power to"* can be described as enhancing an individual's capabilities, and has specifically been interpreted in terms of the CA, and gender (Gigler, 2004). This research draws on this fourth type of empowerment while focusing on women. Hence, empowerment is defined as a process of enablement via which women are able to gain increased control over their lives. What follows from this definition is a focus on the range of capabilities at women's disposal (Gigler, 2004; Abubakar et al., 2017). Women's empowerment should not be confused with other gender-related concepts such as gender equality. Gender equality guarantees the same rights, responsibilities, and opportunities to men and women alike (UN Women and UN Global Compact, 2011). Increasing the achievement of gender equality is emerging as one possible outcome of women's empowerment (Güney-Frahm, 2018).

Information is widely accepted as a necessary perquisite of empowerment, and new advents in technology hold great potential to facilitate the empowerment of women by increasing their access to information. Thus, in the context of international development, ICT is often presented as a tool to facilitate women's empowerment (Khalafzai and Nirupama, 2011; Kenkarasseril Joseph, 2013; Laizu et al., 2010). However, the possibility has been raised that ICT may also pose a threat to women's empowerment (e.g.,Hussain, 2016; Horeck, 2018; Kang, 2012). Research investigating relationships between ICT and women's empowerment is emerging but, at present, remains limited (Güney-Frahm, 2018).

2.2 Capability Approach (CA)

The CA was proposed by the development economist Amartya Sen (1999). It constitutes a broad framework that can be used to make normative evaluations of welfare by focusing on the freedom of individuals to lead a life they value. Thereby, the CA differs from traditional welfare economic models which typically equate welfare with monetary aspects or economic growth (Heeks and Arun, 2010; Walsham, 2017; Gigler, 2004). Two main components of the CA are *"functionings"* and *"capabilities"*. *"Functionings"* refer to "beings and doings" that an individual has already achieved, such as, e.g., being safe or being educated (Sen, 1999; Chigona et al., 2016). *"Capabilities"*, in the other hand, refer to an individual's potentially achievable "being and doings" in terms of, e.g., the various lifestyles one may lead and activities one may engage in (Sen, 1999; Walsham, 2017; Chigona et al., 2016).

The impact of technology received little attention from Sen, when he initially devised the CA. Yet the CA has since been widely recognized by fellow IS researchers. This is particularly the case among IS researchers investigating the impact of ICT on development (ICT4D) (Walsham, 2017; Dasuki et al., 2014). In this context, even Sen himself (2010) has more recently investigated ICT, focusing on the potential of mobile technologies to increase individuals' capabilities. Subsequent contributions to the literature involve both theoretical contributions and empirical applications. Theoretical contributions include work by Tshivhase et al. (2016), who review the application of the CA in the field of ICT4D.

By synthesizing existing literature, the authors identify and compare four frameworks for operationalizing the CA in ICT4D research. Another example includes Tsibolane (2016), who seeks to extend the individualistic character of the CA to include collective capabilities. In doing so, the author develops a theoretical framework that links ICT innovation to collective social wellbeing. Based on the CA, Viale Pereira et al. (2015) propose a conceptual model for investigating the impact that governmental ICT implementations have on human development. By combining two theoretical frameworks – namely, the capability approach and affordance theory – Hatakka et al. (2016) develop a framework which aims to increase understanding of the role of ICT in development.

In the case of empirical applications, existing research includes examinations of how resources translate into capabilities in a real-world context. Examples are the work of Maiye and McGrath (2010), who investigate how the introduction of an electronic voter registration system impacts development in Nigeria. The CA is employed to assess the extent to which Nigerian citizens' freedom is increased by the introduced system. In this early example of the empirical application of the CA in the context of IS, the authors explicitly state that, while the CA has received increasing attention in other disciplines, application in the field of IS remains rare. Dasuki et al. (2014) utilize the CA to foster an understanding of how the introduction of a prepaid electricity billing system increases people's access to electricity supplies in Nigeria. Another empirical application of the CA is made by Otoo and Nemati (2017) who investigate how an individual's adoption of a digital currency impacts their quality of life in an environment where access to banks is limited. Chigona and Chigona (2010) draw on the CA to highlight the role that educators in South Africa play in the introduction of ICT via their teaching activities. Elsewhere, Sahay and Walsham (2014) apply the CA to indicate how health information systems increase quality of life.

Along with their increasing uptake of the CA in ICT4D studies, researchers used the approach to evaluate the impact that ICT has on women. Robeyns (2003) provides an important contribution to this field by investigating the applicability of the CA framework in the context of gender inequality. Thereby, the author identifies fourteen capabilities from the CA as relevant to gender inequality. Finally, Abubakar et al. (2017) investigate how instant messaging technologies contribute to women's empowerment in Nigeria, and, as such, provides an example of the empirical application of the CA in the context of ICT and women's empowerment.

3 Study 1

Study 1 set out to identify the key aspects of women's empowerment that are influenced by ICT. For this purpose, a structured literature review was undertaken and Sen's (1999) CA was applied. The CA was chosen because, the United Nations Development Programme (UNDP) specifically points at the suitability of the CA for understanding and confronting the inequalities outlined by the SDGs (UNDP, 2019a). In addition, existing literature outlines its high potential to theorize the impact of ICTs on development (Walsham, 2017) .

3.1 Method

At the beginning of Study 1, a structured literature review was carried out. The data collected in the course of this review also informed the subsequent Study 2. From the Web of Science (WoS) and the Association for Information Systems electronic Library (AISeL), a corpus of 440 unique articles was initially created on October 15th 2019, using the search query (*((("ICT" OR "Information communication technolog*" OR "digital technolog*") AND ((("Women*" OR "Woman*" OR "Gender" OR "Female") AND "Empowerment") OR ("Feminis*")))*). WoS was chosen, because it has been outlined as a database, which provides a good coverage of standardized records from multiple disciplines along with accessible bibliographic meta-data (Thelwall, 2008). AISeL however, was chosen in order to also include conference articles in the analysis, which treat novel topics due to their shorter processing period, compared to journal articles (Larsen et al., 2019).

This way, we aim to draw a holistic picture of the research domain, which also reflects current developments. When searching the databases, the search was not narrowed down in any other way. In order to identify boundaries and refine the initial data collection, we examined the titles and abstracts of each record. In cases where this examination was deemed insufficient, a detailed examination of the full text of the record was carried out. Articles meeting the following inclusion criteria were considered for further analysis:

1. Women's empowerment, i.e., the ability to take control over one's own life (Somerville, 1998; UN Women and UN Global Compact, 2011; Abubakar et al., 2017) is an aspect of the article. This specifically means that articles purely measuring gender differences or gaps were not considered.
2. The article has a technological aspect, i.e., the article includes ICT which has been applied in order to enhance women's circumstances of living

If an article did not meet the inclusion criteria listed above, it was excluded from further analysis. Also, an article was excluded if author keywords were not provided. This is because, the collected data also serves the subsequent Study 2, which uses author keywords as the basis for analysis. Our final dataset comprised 42 relevant articles, 50% of which have been published since 2015. Once the relevant existing research articles had been collected, we analyzed their content in order to identify which key aspects of women's empowerment are influenced by ICT. For this purpose, we employed Sen's CA as proposed by Robeyns (2003). This is because, the author investigated the applicability of the CA framework in the study of gender inequality and found fourteen capabilities featured in the CA to be relevant in this context. In the following, existing studies are analyzed according to these fourteen capabilities identified by Robeyns (2003). Specifically, all 42 of the articles selected from the literature were carefully scrutinized for relevant statements about ICT empowering women, which we then linked to one or more of the fourteen capabilities.

3.2 Results

In the following, we summarize the results of Study 1 with reference to the identified capabilities. Each capability is first described before the articles referring to this capability are (Table 1 gives an overview). Within the 42 articles that comprised our data set, we find references to nine of the fourteen capabilities suggested by Robeyns (2003):

The first capability, "*(C.1) life and physical health,* focusses on an individual's ability to live a long and healthy life (Robeyns, 2003; Sen, 1999). The data collected includes examples of ICT use aimed to increase women's life expectancy, facilitated either before, during, or after the onset of a medical condition. Before a medical condition, women may facilitate ICT in order to access health-related information and services online (Martin and Goggin, 2016; Lupton and Maslen, 2019). During a medical condition, women may receive better and safer care through the use of IT systems, including, for example, service platforms and mobile phones which increase the degree of communication between medical professionals and patients (Nyende, 2018; Chib and Chen, 2011). Finally, after a medical condition, women may rely on internet-based self-management systems to foster re-adjustment (van den Berg et al., 2012).

The second capability, *"(C.2) mental well-being",* concentrates on the health of an individual's mental state (Sen, 1999; Robeyns, 2003). Our findings include one article stating that ICT has a positive impact on women's mental states in terms of their capabilities. A concrete example of this is a mobile banking system (m-banking) in Pakistan, through which some women have become more self-sufficient in that they are no longer dependent upon their husbands in order to access money. This change has reportedly led to an enhanced feeling of self-respect, self-esteem, and personal pride as well as a release of stress and burden on the part of some women (Kemal and Yan, 2015).

"(C.3) Bodily integrity and safety" is a capability that relates to protection from personal violence (Robeyns, 2003; Sen, 1999). With this capability, the observed impact of ICT is mixed (Horeck, 2018). On the one hand, ICT can be viewed as an additional tool of oppression used against victims. This is because tracking systems and social media can be misused as a means of (further) harassment. On the other hand,

however, ICT also can be also be viewed as a tool of liberation. This is because ICT such as online social media can help victims to stay connected to family and friends during difficult times, e.g., times of domestic violence (Dimond et al., 2011). Moreover, ICT can potentially support victims by providing digital evidence of harassment (Dodge, 2018).

Being capable of having *"(C.4) social relations"* means being able to be part of a social network (Robeyns, 2003; Sen, 1999). 12 out of the 42 articles selected relate to this capability, and demonstrate that ICT – including instant messaging services, mobile phones, and online social networks – connect women (Ghobadi and Smith, 2011; Aleke and Egwu, 2015; Crittenden et al., 2019; Abubakar et al., 2017; Abubakar and Dasuki, 2018; Dimond et al., 2011), enable them to offer social support to others (Masika and Bailur, 2015), and to engage in social activities where they can freely express their voices (Mohanty and Samantaray, 2017; Sun, 2016; Rommes, 2002). The use of ICT might also lead women to question and negotiate their roles within family or society (Chib and Chen, 2011; Oreglia and Srinivasan, 2016).

Being *"(C.5) politically empowered"* can be described as an individual's ability to participate in the process of political decision-making (Sen, 1999; Robeyns, 2003). In the articles we selected, ICT is shown to positively impact women's political participation. Specifically, ICT in the form of instant messaging services, mobile phones, and online communities enable women to voice their political views, reach out to other political members, and mobilize for a political cause (Abubakar et al., 2017; Abubakar and Dasuki, 2018; Shirazi, 2012; Spiers, 2016). In Pakistan, m-banking has also been found to spur political inclusion. This is because their use of m-banking has led to women receiving ID cards – many for the first time – which grants them the right to vote (Kemal and Yan, 2015).

The capability *"(C.6) education and knowledge"* refers to the ability to acquire and use knowledge. The existing research suggests a two-way relationship between ICT and women's ability to be educated and use and produce knowledge. Firstly, ICT gives women improved access to knowledge and relevant information, which may mean they are better informed, for example, when making decisions (Mohanty and Samantaray, 2017; Sun, 2016; Lupton and Maslen, 2019). Secondly, receiving education about ICT, via computer courses or technology learning centers, has the potential to significantly improve women's lives in terms of enabling other capabilities such as, for example, the ability to access healthcare and so improve their physical health (Goh, 2013; Khalafzai and Nirupama, 2011; Sarkar, 2019; Siddiquee and Kagan, 2006).

"(C.7) Domestic work and nonmarket care" includes taking care of dependents. The existing research presents little evidence of ICT impacting women's abilities to raise children or take care of others. On the contrary, the only research relating to this capability suggests that ICT can have a negative impact on women's abilities to perform caring roles. Specifically, this is the case for elderly Chinese women, who feel silenced in overseas video-conversations with family members due to a lack of digital skills (Kang, 2012).

The capability focusing on economic activities and other projects (including artistic ones), is *"(C.8) paid work and other projects"*. Our data set contains some articles which claim ICT can enable women's economic and non-economic projects, and some which claim ICT poses a threat to such activities. The positive claims focus on three aspects of enablement: Firstly, some suggest that, on a very general level, ICT enables women to participate in basic economic activities (Abubakar and Dasuki, 2018; Abubakar et al., 2017; Masika and Bailur, 2015; Papinejad et al., 2018). Secondly, some find that ICT is an external enabler of women's (micro)-entrepreneurship. This is because ICT facilitates service delivery, customer handling, and, as a result, revenue growth and income generation (Sundermeier et al., 2018; Moni and Uddin, 2004; Mohanty and Samantaray, 2017; Bailur and Masiero, 2017; Sathye et al., 2015; Sardar et al., 2019; Crittenden et al., 2019; Yu and Cui, 2019). Thirdly, some articles claim that ICT enables women to leverage other projects beyond the economic context (Chigona et al., 2016). For example, ICT can encourage and enable artistic expression and so facilitate artistic projects such as theater plays (Sakowska, 2018) and interactive reading experiences (Joyce and Tringham, 2007). However, in outlining three of the ways in which ICT might improve women's economic capabilities, it becomes evident that the deployment of ICT alone may not be sufficient. It is thus important that specific requirements, such as the availability of a specific level or type of ICT, are taken into account (Lechman, 2019; Güney-

Frahm, 2018; Forouzani and Mohammadzadeh, 2018). Among those articles which view ICT as a threat to women's economic activity, the focus is largely on the negative impact ICT can have on women's working conditions. Specifically, Thynne (2000) argues that the ongoing integration of technological advancements in the television production industry presents specific challenges to women's effort of combining career and family.

Finally, the capability *"(C.9) respect"* refers to respectful interaction and dignified treatment. According to Webb (2016), the use of ICT has the potential to challenge persistent gender inequalities and hierarchies and, thus, enhance the level of respect and dignity with which women are treated. However, for this to be true, specific circumstances, such as access to ICT, must again be met.

ID	Reference	Capability								
		C.1	C.2	C.3	C.4	C.5	C.6	C.7	C.8	C.9
	Total	**5**	**1**	**3**	**12**	**5**	**8**	**1**	**19**	**1**
1	Abubakar et al. (2017)				x	x			x	
2	Abubakar and Dasuki (2018)				x	x			x	
3	Aleke and Egwu (2015)				x					
4	Bailur and Masiero (2017)								x	
5	Chib and Chen (2011)	x			x					
6	Chigona et al. (2016)								x	
7	Crittenden et al. (2019)				x				x	
8	Dimond et al. (2011)			x	x					
9	Dodge (2018)			x						
10	Forouzani and Mohammadzadeh (2018)								x	
11	Ghobadi and Smith (2011)				x					
12	Goh (2013)						x			
13	Güney-Frahm (2018)								x	
14	Horeck (2018)			x						
15	Joyce and Tringham (2007)								x	
16	Kang (2012)							x		
17	Kemal and Yan (2015)		x			x				
18	Khalafzai and Nirupama (2011)						x			
19	Khan and Ghadially (2010)						x			
20	Lechman (2019)								x	
21	Lupton and Maslen (2019)	x					x			
22	Martin and Goggin (2016)	x								
23	Masika and Bailur (2015)				x				x	
24	Mohanty and Samantaray (2017)				x		x		x	
25	Moni and Uddin (2004)								x	
26	Nyende (2018)	x								
27	Oreglia and Srinivasan (2016)				x					
28	Papinejad et al. (2018)								x	
29	Rommes (2002)				x					
30	Sakowska (2018)								x	
31	Sardar et al. (2019)								x	

32	Sarkar (2019)						x			
33	Sathye et al. (2015)								x	
34	Shirazi (2012)					x				
35	Siddiquee and Kagan (2006)						x			
36	Spiers (2016)					x				
37	Sun (2016)				x		x			
38	Sundermeier et al. (2018)								x	
39	Thynne (2000)								x	
40	van den Berg et al. (2012)	x								
41	Webb (2016)									x
42	Yu and Cui (2019)								x	

Table 1. Descriptive results

4 Study 2

In Study 1, key aspects – i.e., capabilities – of women's empowerment influenced by ICT were identified. In order to gain a deeper and richer understanding of the dynamics and future potential of these capabilities, in Study 2, we integrated them into a co-word analysis.

4.1 Method

Co-word analysis is an objective, quantitative, bibliometric method. By relying upon words, the carriers of scientific knowledge, as objects of analysis (Wang and Inaba, 2009), co-word analysis operates beyond citation practices. This way, co-word analysis is able to provide a better retrieval rate than other bibliometric techniques i.e. co-citation analysis (Chen, 2003; Tijssen, 1992). Also, by relying upon words, co-word analysis provides an immediate picture of the actual content of a research field, its dynamics and trends (Ding et al., 2001). These characteristics make co-word analysis a suitable choice for achieving the goal, which includes providing a holistic picture of the future research dynamics of the relationship between ICT and women's empowerment.

Within this manuscript, co-word analysis is based on two types of keywords: 1) author keywords and 2) capabilities. 1), author keywords, are determined by the authors themselves based on the content of the respective article. Within this research author keywords are the basis of analysis, because unlike indexer keywords, for author keywords the limitation of an indexer effect does not apply (He, 1999). The 42 articles that make up our data set include 240 author keywords, 66.67% of which only occur once. This high percentage of unique author keywords might be a result of the fact that articles from different domains are included (for example, medicine, social sciences, and IS) which may use different words to signify the same construct. In terms of pre-processing, abbreviations were written out and singular and plural forms were adjusted. For 2), capabilities, the capabilities identified in Study 1 (Table 1) were taken to represent the focus of each article. On this basis, these capabilities were added to the keywords and treated as such. This procedure is similar to that of Ding et al. (2000), who added to the keywords provided words that they perceived to be important from titles and abstracts.

The desired result of a co-word analysis is to receive a set of clusters called "themes". Themes are clusters holding textual information, i.e., keywords (Cobo et al., 2011). To receive themes, an input matrix is needed and a clustering procedure needs to be conducted. Concerning the input matrix, it is to say that it contains the co-occurrence frequencies of keywords. By using R, the bibliometrix tool, and biblioshiny app (Aria and Cuccurullo, 2017), the co-occurrence frequencies of keywords were extracted automatically from the 42 articles, by counting those articles, in which two keywords appear together (Muñoz-Leiva et al., 2012). In the subsequent clustering procedure, hierarchical cluster analysis in the form of Ward's method was conducted to cluster keywords to themes. Here, the minimum frequency of

a cluster is set to a value of 2, meaning that only keywords with a frequency >2 were considered in the analysis.

To visualize the set of themes, which resulted from co-word analysis, a strategic diagram is applied. A strategic diagram combines two concepts, namely centrality and density, in order to visualize the themes of a research field along with their respective interactions in a two-dimensional diagram (Liu et al., 2014). Thereby, a strategic diagram displays the current status as well as the future dynamics of a research field (Hu et al., 2013; Callon et al., 1991). The concept of centrality, illustrates a theme's importance by calculating the interaction of a theme with other themes (Callon et al., 1991; Cobo et al., 2011; Liu et al., 2014). Centrality therefore can be defined as $c = 10 \times \sum e_{kh}$, with k a keyword included in the respective theme and h a keyword included in other themes of the strategic diagram. The concept of density, however measures the intensity of the ties between keywords within a theme and can be defined as: $d = 100\left(\frac{\sum e_{ij}}{w}\right)$, with i as well as j as keywords within the respective theme and w as the total number of keywords included in the theme (Callon et al., 1991; Cobo et al., 2011; Muñoz-Leiva et al., 2012). To avoid the limitation of a strategic diagram to be too difficult to read (He, 1999), themes are plotted according to their rank centrality and rank density. Thereby rank refers to the position a theme receives if all themes are sorted ascending according to their centrality or density value, respectively (Cobo et al., 2011; Muñoz-Leiva et al., 2012; Cahlik, 2000).

According to their respective rank values for centrality and density, themes in a strategic diagram are referred to as either a motor theme, a specialized theme, an emerging theme, or a bandwagon theme. Motor themes are located in the upper right quadrant. These themes have close internal connections (high density) and are widely connected to other themes in the field of ICT and women's empowerment (high centrality). Hence, they can be described as well-developed and attracting the interest of a well-defined group of researchers. Motor themes can be described as central to the field of research (Liu et al., 2014; Callon et al., 1991; Bredillet, 2006). Specialized themes are located in the upper left quadrant and have a high conceptual development (high density) but weak external interconnection with other themes (low centrality) (Liu et al., 2014; Callon et al., 1991; Bredillet, 2006). Hence, they can be described as being well-developed, but also as "peripheral", since being viewed as less important niche themes by the rest of the domain (Dehdarirad et al., 2014). Emerging themes are located in the lower left quadrant. Emerging themes have a low number of internal and external links and thus can be described as constituting at the margin of the research field (low density and low centrality) (Liu et al., 2014; Callon et al., 1991; Bredillet, 2006). However, some of those themes eventually might increase in importance and maturity and hence become a new research trend, attracting increasing attention. Finally, bandwagon themes are located in the lower-right quadrant. Bandwagon themes are characterized by low internal development (low density) but high importance (high centrality). This is because, bandwagon themes contain a broad variety of generic keywords, which are not necessarily linked to each other. At the same time, however, bandwagon themes are important to the research field (high centrality) due to the link of some keywords to domain-specific interests (Liu et al., 2014; Callon et al., 1991; Bredillet, 2006).

4.2 Results

The 295 keywords (240 author keywords and 55 capabilities) from 42 articles were aggregated into seven themes (Table 2). Figure 1 plots the themes on the four quadrants of a strategic diagram according to their rank values of centrality and density, as shown in Table 2. Taking T3 in Table 2 as an example, its centrality value of 10.731 and density value of 350.000 were ranked, i.e., assorted ascending according to the values of the other themes yielding a rank centrality value of 1 and a rank density value of 5. The size of the themes is dependent on the number of articles they hold. The themes are named according to the keywords (i.e., author keywords and/or capabilities) they include (please refer to Table 2 for an overview). In the following, the themes are described according to their position in the quadrants.

In our analysis, *"(T.1) women's health and social media"* is found to be a motor theme. Keywords co-occurring in this theme are the capability "*(C.1) life and physical health"* as well as the author keywords *"social media"* and *"internet*". In a motor theme, keywords are linked closely together, meaning that

articles included in this particular theme investigate social media and the internet as specifications of ICT to be used for *"(C.1) life and physical health"*. Examples of such articles include Nyende (2018), Chib and Chen (2011), both of which investigate ICT use in the context of maternal health care.

Located on the boundary between the upper right and upper left quadrants, *"(T.2) political empowerment and ICT adoption"* can be considered either a motor theme or a specialized theme. Table 2 shows the capability *"(C.5) political empowerment"* and, for example, *"adoption"* to be keywords of *(T.2)*. Another keyword within this theme refers specifically to the geographical region of Pakistan. An article representing *(T.2)* along with the keywords mentioned is Kemal and Yan (2015). The authors investigate the political empowerment of Pakistani women as a consequence of access to mobile banking. Within this research, *"(T.3) gender equality"* is also identified as a specialized theme. *(T.3)* includes no capabilities and only one author keyword – *"gender equality"*. Hence, this is a very small theme including only a few articles and involving no links to any other themes in the strategic diagram. An example of an article representing this theme is Güney-Frahm (2018) which outlines how women's empowerment seeks to establish gender equality.

Our analysis locates two emerging themes, including articles, which were published only recently. "*(T.4) bodily integrity and safety"* includes the capability of the same name *(C.3)* and the author keyword *"feminism"* as co-occurring keywords. An article representing this theme is Horeck (2018), which investigates new media for their potential to promote both violence and feminism. "*(T.5) feminism and identity"* includes the two author keywords "*feminism"* and *"identity"*. No capabilities are included in this theme. Articles representing this theme include, for example, Siddiquee and Kagan (2006), and Sakowska (2018), which highlight the development and maintenance of an individual feminist identity as one possible outcome of technological engagement and use.

Table 2 outlines two bandwagon themes. "*(T.6) e-learning in Asia"* includes the capability "*(C.6) education and knowledge"* and the author keywords *"Asia"*, *"mobile phone"*, and *"telecenters"* as co-occurring keywords. However, because keywords are weakly linked together in specialized themes, articles representing this theme only exhibit a subset of these keywords. One article that falls into this theme is Sun (2016), which investigates Chinese Women's use of an educational social media platform which provides easy access to information. *"(T.7) Economic empowerment and social relations"* includes the two capabilities, "*(C.8) paid work and other projects"* and "*(C.4) social relations"*. Sharing a theme, these two capabilities have been researched together in the past. Five articles from our data set refer to both capabilities. Notably, further keywords in this theme are the author keywords *"Nigeria"*, and *"women micro-entrepreneurs"*. An example of an article representing the theme is Abubakar and Dasuki (2018), which investigates the impact that the use of instant messaging services has on the capabilities of women in Nigeria.

ID	Theme name	Keywords		Centrality (Rank)	Density (Rank)
		Author Keywords	**Capabilities**		
T.1	Women's health and social media	Women, social media, internet, design	Life and physical health,	5	6
T.2	Political empowerment and ICT adoption	Adoption, social inclusion, Pakistan, participation	Political empowerment,	4	7
T.3	Gender equality	Gender equality	-	1	5
T.4	Bodily integrity and safety	Feminism	Bodily integrity and safety	2	4
T.5	Feminism and identity	Feminist, identity	-	3	3
T.6	E-learning in Asia	ICT, gender, China, India, mobile phones, telecenters	Education and knowledge	6	2
T.7	Economic empowerment and social relations	Empowerment, women empowerment, Nigeria, women micro-entrepreneurs, ICT gender	Paid work and other projects, social relations	7	1

Table 2. Description of themes

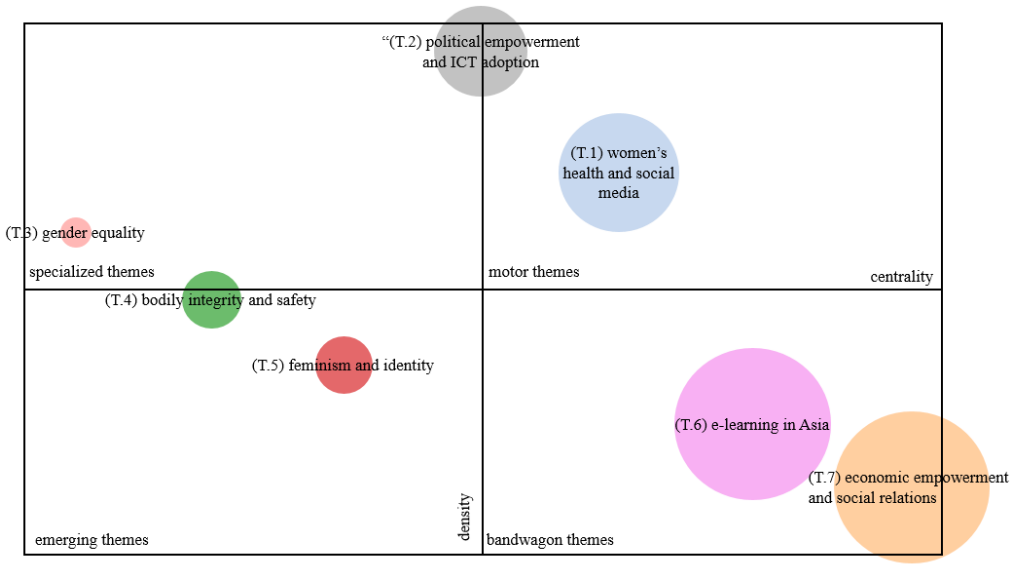

Figure 1. Strategic diagram of the domain ICT and women's empowerment

5 Discussion

In order to provide a holistic picture of the relationship between ICT and SDG 5 "women's empowerment", in this research we conducted two sequential studies, Study 1 and Study 2. Our aim in Study 1 was to identify key aspects of women empowerment that are influenced by ICT. The study thus involves a structured literature review and the use of Sen's Capabilities Approach. Study 2 aims to extend Study 1 by investigating the dynamics and future potential of our findings. Hence, results from Study 1 were integrated into a co-word analysis. From the sequential design of our research, we drew three main findings:

Firstly, we found ICT and women's empowerment to be a topic that is currently arousing the interest of researchers. This is evident in the fact that half of the works identified in our literature review were published within the last five years (2015-now). Interestingly, the publications stem from multiple disciplines and, hence, have been published in a panoply of journals and conferences. Of these, Association of Information Systems (AIS) conferences are the most common. The recent increase in interest may have been initiated by the adoption of the SDGs by all UN Member States in 2015 (UN, 2015a). The SDGs consider inclusion as a fundamental principle, with SDG 5 specifically referring to the inclusion of women.

Secondly, in terms of the status quo of the research field ICT and women empowerment, we found the capability *"(C.1) life and physical health"* to constitute the strategic heart of the field, while other capabilities i.e. *(C.10) shelter and environment"*, *"(C.11) mobility"*, *"(C.12) leisure activities"*, *"(C.13) time-autonomy"*, or *"(C.14) religion*" have not yet been considered at all. Concerning "(C.1) life and physical health", it is to say that the capability is included in a motor theme *"(T.1) women's health and social media"* and hence is closely linked to all other aspects within its theme, including, for example, social media. One possible explanation for this result is that health-related research on ICT and women's empowerment is limited to the discussion of a few prominent topics. For example, maternal healthcare is a prominent topic in the collected data (e.g.,Chib and Chen, 2011; Nyende, 2018). Concerning the capabilities, which have not been yet discussed at all, it is to say that there are many reasons that may underlie the absence of these capabilities in current research. One of many possible explanations is that ICT plays a subordinate role in the context of these capabilities. Another possible explanation is that the gender gap is less evident in the case of some capabilities *(C.11)-(C.14)*. Taking *"(C.10) shelter and environment"* as an example, existing research (e.g.,Robeyns, 2003; Lelli, 2001) does not identify significant inequalities in terms of gender. However, it may be the case that differences between men and women are simply less obvious, for example, their access to different spaces within a house (Robeyns,

2003). In the case of *"(C.11) mobility"*, it is worth noting that Saudi Arabia recently became the last country to allow women to drive, effective of 2018 (BBC News, 2018; Specia, 2019).

Thirdly, in terms of future research potential in the field of ICT and women empowerment, we find the following capabilities to be potentially promising: *"(C.4) social relations"*, *"(C.6) education and knowledge",* "*(C.8) paid work and other projects",* and "(C3) *bodily integrity and safety*". Concerning the former three *(C4, C6, C8)*, it is to say, that our analysis outlined them as keywords included in bandwagon themes. In terms of future research dynamics, this result suggests that all three capabilities are of central importance in the context of ICT and women's empowerment. We believe that the importance is driven by the evident gender gap of each of the capabilities: In terms of *"(C.8) paid work and other projects"*, women around the world hold substantially fewer managerial positions than do men (Hussain, 2016). Referring to *"(C.4) social relations"*, engaging in online social networks in terms of voicing opinions is still perceived a challenging task for women in some countries (Sun, 2016). Finally, when it comes to *"(C.6) education and knowledge"*, gender inequality between women and men in developing countries results in a third fewer females than males receiving primary education (Hussain, 2016). However, even if important, existing research investigating the capabilities (C.4), (C.6) and (C.8) can be described as underdeveloped. This is because, the capabilities are included in bandwagon themes, which are generic, immature aggregates containing aspects only weakly linked to each other (Callon et al., 1991; Hu et al., 2013). There are many explanations for this. One possible explanation is that fellow researchers from various domains have frequently investigated all three capabilities. This prior research involves a panoply of multidisciplinary contexts, research questions, and methods, each of which is only weakly linked to the capabilities *(C.4), (C.6), (C.8)*. Taking "*(C.8) paid work and other projects"* as an example, our data set features 19 related articles which represent, for example, the humanities (Mohanty and Samantaray, 2017), women's studies (Moni and Uddin, 2004), economics and sociology (Lechman, 2019), business (Crittenden et al., 2019), and information systems (Sundermeier et al., 2018). We believe that, if the capabilities C4, C6, and C8 receive respective investment from researchers, those capabilities might increase in density and eventually may become the strategic heart of the field.

The latter capability *"(C3) bodily integrity and safety"* and the positive as well as negative role of ICT therein, represents an emerging and potentially promising theme for future research. (*C3)* is an aspect of an emerging theme, which may gain importance and maturity in the future and hence give rise to new trends and developments. This finding supports SDG 5, specifically SDGs 5.2., and 5.3, which call for the elimination of violence and harmful practices against women (UN, 2015b). One example of a new thematic emergence from *(C.3)* is the current proliferation of violence against women that is being facilitated by digital technologies. As Horeck (2018) reveals, violence against women is spreading at an alarming rate through online social networks, for example, in the form of inappropriate content. At the same time, however, new digital technologies can also provide new forms of evidence which might be considered in the course of judicial processes (Dodge, 2018).

Thanks to these three main findings, the contribution of this research is both theoretical and practical in nature. In terms of its theoretical contribution, the research provides an understanding of the relationship between ICT and women's empowerment, which is unprecedented in its scope, breadth, and depth. The sequential research design, incorporating two studies within the same inquiry, enabled us to make stronger inferences than would the use of a single research method, and, consequently, led us to our main findings. The insights our research provides will further understandings of the relationship between ICT and inclusiveness – framed as a fundamental human value – as it is experienced by women. In addition, our insights will also guide future research activities as it outlines emerging themes for impactful research. In terms of its practical contribution, our research serves society in several ways: Firstly, it provides a global mapping of research on ICT and women's empowerment illustrated by real-world examples. This can be information can be harnessed by practitioners in order to increase understandings of how the potential of ICT can be leveraged in support of women's empowerment. Secondly, the foregrounding of *(C.3) "bodily integrity and safety"* as an emerging theme is of consequence to operators of online social networks and policy-makers who are responsible for ensuring adequate measures are taken to protect women from online violence, and for making digital evidence of abuse

available in the courtroom. Used effectively, ICT can help to protect women from the threat of further violence. Thirdly, the identification of future research dynamics and trends on a meta-level will spark future research which will, in turn, strengthen the position of women as equal partners in the process of sustainable development.

6 Conclusion

To achieve full inclusion in the process of sustainable development, women need to be afforded control over their own lives. This research applies a sequential research design including two studies in order to support women's empowerment by pointing out the relationship with ICT. We find ICT and women's empowerment an emergent field of research, which includes investigations of the relationship between ICT and "life and physical health" at its strategic heart. Besides, we find the relationship of ICT with women's capabilities of *"(C.4) social relations", "(C.6) education and knowledge",* "*(C.8) paid work and other projects",* and "(C3) *bodily integrity and safety*" to call for further research. Thereby it is to say, that the impact of ICT on women's *bodily integrity and safety* is also an emerging research topic. The uptake of the emerging research topic may be spurred by the fast spread of digital technologies and its implications on women's bodily integrity and safety (Horeck, 2018; Dodge, 2018).

Thematically, this research provides a picture of ICT and women's empowerment, which is unprecedented in scope, breadth, and depth. Practically, the findings can serve the creation of, for example, safer environments for women via increased awareness of violence against women online such as the #MeToo movement or the #NiUnaMenos movement (UNDP, 2019a)

Researching the influence that ICT has on women's empowerment is a task which is not without limitations, and our study leaves room for further contributions by future research: Firstly, it is possible that the data collection process may have been subject to bias due to the particular search strings developed or the particular online databases and inclusion criteria used to identify relevant articles. In addition, the literature research, despite being unrestricted in terms of publication outlets, includes neither a forward nor backward search. Further research involving extended search parameters and further online databases might enhance the overview of the topic. Secondly, the analysis in study 1 is based on Sen's (1999) CA. This approach however, is not the only way of investigating aspects of development and their relationship to ICT (Walsham, 2017). Hence, future research should draw on alternative approaches to advance the findings outlined in this research. Thirdly, our method in study 2 is co-word analysis, which is based on words as the carrier of knowledge. This focus may involve some imprecision as a result of, for example, idiosyncrasies of the use of English language in different publications (Ritzhaupt et al., 2010). Hence, future research should further test the applicability and generalizability of our results by conducting further analyses. Fourthly, due to the limited availability of space, in this current research we have been unable to elaborate on ICT or on other factors relevant to women's empowerment, such as access to ICT, and socio-cultural factors (Abubakar et al., 2017).

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