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Influence of Social Ties on Knowledge Sharing Among Academics: A Qualitative Case Study

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Abstract

This study aimed to investigate the relationship between social ties and knowledge sharing among academics in a research team. A qualitative case study approach was employed, using semi-structured interviews to uncover key factors that facilitate or hinder this relationship. The findings emphasize the crucial role of social ties in facilitating knowledge sharing among academics and highlight the central role of research team leaders in promoting and strengthening these ties. Informal contexts and routines as well as in-person attendance were identified as core elements in cultivating social ties. Conversely, limited face-to-face interactions, workplace location, barriers to participation in informal activities, and differences in worldviews were identified as potential deterrents to the formation of strong social ties. We conclude that institutional administrators and research team leaders should promote shared physical and digital spaces and informal social practices, which, in turn, facilitate personal relationships and stimulate collaboration and knowledge sharing.

Keywords Social ties · Knowledge sharing · Higher education · Case study

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Introduction

Knowledge is one of the principal constituents of the new economy (Drucker, 1969). Frequently, the effective management of this key asset is closely linked to the acquisition of competitive advantages (Mahdi & Almsafir, 2014; Nahapiet & Ghoshal, 1998) and organizational survival (Asrar-ul-Haq & Anwar, 2016). Universities play a central role in both the generation and dissemination of knowledge to wider society through teaching activities, research, and knowledge transfer initiatives (Fullwood & Rowley, 2017). Despite this, university faculty appears to prioritize the public projection of their knowledge over sharing it with colleagues through collaborative practices (Fullwood et al., 2013).

Within the corporate domain, numerous scholars have examined the determinants of knowledge sharing (KS), including factors related to individuals, interpersonal relationships, and the organizational and cultural milieu (Asrar-ul-Haq & Anwar, 2016; Hernández-Soto et al., 2021; Yeboah, 2023). Authors have highlighted the central role of social ties as influential determinants of KS, rendering it a subject of particular scholarly interest (e.g., Tseng & Kuo, 2014; Wasko & Faraj, 2005).

Despite the wealth of literature on KS in different settings, scant attention has been paid to how KS develops and manifests in universities, particularly in the European context (e.g., Fullwood & Rowley, 2017; Fullwood et al., 2013, 2018). One of the few studies on this topic was conducted by García-Sánchez et al. (2019), who examined the relationship between social capital and KS at a Spanish university, elucidating the positive impact of internal ties on trust and the mutually reinforcing influence of both variables on KS within research teams. The authors operationalized the intensity of internal ties as the ratio of the numberof collaborators a researcher typically works with to the total number of members of the research team.

In this article, we report a qualitative case study that examined the relationship between social ties and KS among academics. In contrast to García-Sánchez et al. (2019), instead of quantitatively assessing the density of interconnections among members, we qualitatively assessed the relationship between knowledge providers and recipients, including their proximity or the strength of their ties (Tseng & Kuo, 2014). In doing so, we aimed to address the dearth of empirical research on KS in Western universities, with particular emphasis on the Spanish academic context.

Social Ties and Knowledge Sharing

According to the principles of social capital theory (Nahapiet & Ghoshal, 1998), social ties represent the connections among individuals in a network that result from social interactions and serve as significant antecedents of collaborative behavior (Wasko & Faraj, 2005). As posited by Brown et al. (2007), tie strength encompasses the degrees of intimacy, closeness, and mutual support within interpersonal connections. The strength of social ties determines whether individuals voluntarily engage in social relationships or not. Building upon this notion, Tseng and Kuo (2014) highlighted the reciprocal relationship that exists between tie strength and involvement in

collaborative environments. Personal connections facilitate KS, which in turn reinforces tie strength.

In the academic domain, Fauzi et al. (2019a, 2019b) shed light on the significance of social relationship networks among faculty members at Malaysian universities in facilitating KS. These authors showed that informal contexts play a central role in nurturing social ties, with researchers taking advantage of opportunities to interact during informal gatherings, breaks, or before and after formal events, such as meetings and conferences (Fauzi et al., 2019a). Building upon this, they emphasized that promoting an extensive and robust network of social relationships, both within and outside the academic institution, facilitates the reciprocal exchange of knowledge (Fauzi et al., 2019b). This sentiment was echoed in a study conducted by Jolaee et al. (2014) at three Malaysian universities, which revealed the significant influence of interwoven social networks among academics on their attitudes toward KS. The results of this study are consistent with those of Twum-Darko and Harker (2015), who conducted a case study at a university in South Africa. Furthermore, Iqbal et al. (2011), in their study of KS and innovation capacity at a Malaysian university, stressed the role of organizational support in fostering KS intentions by promoting social ties among members.

Ku (2019) argued that the social interaction network that emerges among individuals may manifest as either the strength of bonding ties or the presence of social mechanisms aimed at forging connections across different social groups. Bonding ties connect individuals who already know each other, while mediating or bridging ties unite previously unfamiliar individuals or groups (Gittell & Vidal, 1998). As described by Coleman (1988), bonding ties denote the robustness of relationships epitomized by the levels of trust, intimacy, and adherence to prosocial norms that characterize them and promote collaborative endeavors in pursuit of mutual benefit. Ku's (2019) study, which was based on a case study of KS among faculty members at a university in the United States, suggested that bonding ties are more important than bridging ties in collegial KS practices. This study showed that the cultivation of strong, intimate social ties is more attainable among individuals who share similar sociodemographic attributes (e.g., age, race, department) than among those with heterogeneous backgrounds. Consequently, homogeneity reinforces the formation of social ties and facilitates KS. However, in the increasingly prevalent context of interdisciplinary research in universities (Leahey & Barringer, 2020), particularly those characterized by high levels of heterogeneity among participants, the importance of individuals playing a mediating role in facilitating social ties and KS is acknowledged (Van Rijnsoever & Hessels, 2011). Njiraine's (2019) systematic review of KS at a university in Nairobi, Kenya, linked social ties and personal networks to the establishment of trust among individuals. Similarly, Hernández-Soto et al. (2020), in their examination of KS at a Spanish university, concluded that knowledge dissemination is facilitated by a climate of trust cultivated through interpersonal relationships among participants in the KS process.

Despite these insights, few studies have investigated the relationship between social ties and KS among academics in European universities, particularly in Spanish universities. To address this gap, this study used a qualitative case study design, focusing on a Spanish research team, to investigate the dynamics underlying the

establishment and maintenance of connections between academics and their influence on KS processes. In particular, our aims were to (a) examine the process of forming and maintaining social ties among academics within a research team, (b) assess how social ties affect KS within a research team, and (c) determine the extent to which study participants' perspectives and views align with or diverge from the literature on the relationship between social ties and KS.

Materials and Methods

Study Design

This paper reports the qualitative component of a larger mixed methods study based on survey data and interviews with academics at a Spanish University aimed at determining the influence of social ties on KS. For this qualitative component, a case study design was used (Stake, 2005; Yin, 2018) —in particular, a holistic single-case design— in order to gain an in-depth understanding of KS practices among an interdisciplinary research team. This type of design was deemed appropriate for this study because of its potential to examine complex phenomena —such as KS— in their natural setting and explore the contextual factors that surround and influence the case under study (Yin, 2018).

Case Selection and Participant Recruitment

A research team affiliated with a Spanish public university was selected as the case for the study. This selection was based on a critical case sampling strategy (Patton, 2002; Yin, 2018) that involved strategically identifying a case that would allow us to illustrate the dynamics of participation, communication, and KS among academics. According to Olmos-Peñuela et al. (2014), research teams act as fundamental structures that advance scientific knowledge by formalizing collaborative relationships among academics. Therefore, by selecting a research team as the case of study, we aimed to enhance analytical generalization (Yin, 2013), that is, the comparison of our findings with existing research on the relationship between KS and social ties in academic contexts. Thus, the focus was not on the case itself but rather on the opportunities it provided for studying KS among academics in the context of research teams.

The research team examined in this study was selected for four reasons. First, the team has an interdisciplinary nature, which is reflected in the fact that (a) its members belong to two different faculties, namely, the Higher Technical School of Telecommunications Engineers, Computer Science, and the Faculty of Education and Social Work, and (b) most of their research is at the intersection of technology and education. Second, the team members share a strong commitment to collaboration and KS, which is reflected in the common goal of improving educational practices through innovation and collaborative teaching. Specifically, within the team, problem solving is supported by both the use of technology and collaboration among

individuals with different worldviews but shared goals. Third, the team is characterized by strong social ties between its members and the realization of social activities. Finally, the team has a long and productive career with more than 25 years of experience. These characteristics make the selected research team an exemplary setting for investigating the factors influencing KS among academics.

We recruited the participants in several stages. First, we contacted the principal researcher and several senior researchers of the research team by email to inform them about the study and to request an in-person meeting. The study protocol was attached to the email. During the meeting, we explained the study's objectives and the requirements for participation and sought the approval of the principal researcher and senior researchers to conduct fieldwork within the team. The principal researcher then provided a list of email addresses of the current and former team members. This list was used to distribute the study protocol and invitations to participate in the study. Those who expressed interest in participating were scheduled for an interview with the first author.

Data Collection

Semi-structured interviews were conducted by the first author with current and former members of the research team. The interviews were chosen as the data collection method for this case study. Qualitative interviews can effectively captureparticipants' perspectives and experiences of KS and social ties, as well as gather information about contextual factors influencing the relationship between the two. In addition, the semi-structured nature of the interviews allowed us to follow a set of predetermined questions to guide the interviews with the flexibility to deviate from these questions or add follow-up questions, as needed (Bryman & Bell, 2015; Grinnell & Unrau, 2007; Kvale, 1996).

The questions included in the interview guide were based on previous literature and research on the relationship between KS and social ties. The interview guide consisted of three parts. In part one, the context and objectives of the study as well as the procedures that would be followed to ensure confidentiality and anonymity were explained to the participants. All questions about the study were answered by the interviewer at that time. In part two, interview focused on the reasons for being a member of the research team and the dynamics of participation and communication within the group, including the communication spaces and routines as well as the topics commonly discussed. Finally, part three included questions about the relationship between social ties and the exchange of knowledge among members of the research team. Through these questions, we were able to gain a contextualized understanding of the knowledge exchange processes that occur within the research team and the broader context of the university and, in particular, the mechanisms and factors that influence such exchanges.

The interviews were conducted in person, either at the research team's laboratory situated at the Faculty of Telecommunications (15) or at the Faculty of Education (4). One interview was conducted online via Skype. A total of 20 interviews with an average duration of 45 min were conducted. We continued to collect data until

we reached saturation, that is, when no additional information was obtained from participants or when no new insights were discovered (Saunders et al., 2018). Therefore, we determined the sample size as the study progressed (Patton, 2002). When selecting participants, we ensured that the sample was balanced in terms of sociodemographic characteristics, including age, gender, role within the team, and field of study. All interviews were audio-recorded and transcribed verbatim.

Data Analysis

The interview data were analyzed using Atlas.ti 8 for Mac. The three-step process for analyzing qualitative data recommended by Miles et al. (2018) was employed, comprising the following steps: (a) data reduction, entailing the categorization and subcategorization of data; (b) data display, involving the visual representation of the data; and (c) conclusions/verifying, encompassing the interpretation of data through verification procedures. A coding scheme was developed using both deductive and inductive approaches. The deductive approach involved developing codes based on the literature on social ties and KS, whereas the inductive approach involved identifying instances from the data and transforming them into codes through an iterative process. Each code was assigned a label and an operational definition (Table 1). The coding scheme was refined and clarified as the analysis progressed, in accordance with Stake's (2010) concept of "progressive focusing". The first and second authors independently coded the data to ensure consistency. Coding took place in two phases: the first phase involved generating broad initial codes, whereas the second phase involved breaking down these codes into more specific subcodes (Saldaña, 2021). After coding was completed, we developed the final themes by examining the patterns of association among the codes.

Quality Assurance and Trustworthiness

A checklist with quality criteria specific to case study research suggested by Creswell and Poth (2017) and Denscombe (2010) was used in the different stages of the study —the checklist can be found in Fàbregues and Fetters (2019). In addition, several strategies were employed to promote the credibility, transferability, confirmability and dependability of the findings (Lincoln & Guba, 1985). First, credibility was ensured through prolonged engagement of the first author with the participants throughout the data collection process. In addition, researcher triangulation was used during data analysis, particularly in the development of the coding scheme, formulation of the operational definitions of the codes, and interpretation of the findings (Archibald, 2016). Second, to establish transferability, we used "thick description" by providing a detailed account of the case and its context, the research methods, and the characteristics of the participants, as well as evidence of the participants' voices in the reporting of the findings (Younas et al., 2023). Third, to achieve confirmability, we used an audit trail to document the methodological decisions made during data collection and analysis, as well as any deviations from the study's original design protocol. Fourth, dependability was ensured by actively

Table 1 Codebook: Operational Definitions of the Codes

Code	Subcode	Description
Social ties	ST0_Emotional support	Evidence of emotional support among team members
	ST1_Leadership and social ties	Evidence of the importance of leadership in creating and maintaining social ties among team members
	ST2_Personal relationships	Evidence of the nature of personal relationships among team members (their strength, closeness, friendship, etc.)
	ST3_Social life	Examples of social activities among team members: coffee breaks, leisure, cultural and sports activities, etc
Knowledge sharing behavior	KSB1_Resources	Evidence of a team member sharing resources with the rest of the team. For example, books, articles, calls for papers, special issues of journals, conferences, etc
	KSB2_Knowledge and expertise	Evidence of a team member sharing knowledge and expertise with the rest of the team. For example, how to approach a project or thesis, or how to solve a problem

considering the potential influence of our role as academics on the interpretation of the study findings.

Results

Description of the Participants

Table 2 presents the sociodemographic data of the study participants. As shown in the table, we interviewed individuals who were either current members of the research team (n = 14) or former members who were no longer part of the team (n = 6). The inclusion of former members and administrative support staff in the interviews helped to enhance the understanding of the team as a social entity and to elucidate the dynamics of social interaction and collaborative practices within the team. Participants included the principal researcher (n = 1), senior researchers (i.e., individuals with technical expertise and autonomy to lead research projects) (n = 6), and junior researchers (i.e., graduate students and postdoctoral fellows) (n = 6). Former team members (n = 6) and administrative and support staff (n = 1) were also interviewed.

Table 2 Sociodemographic data of the participants

Participant	Field	Gender	Role	Member type
P001	Social Sciences / Law	Female	AS	Current
P002	Engineering and Architecture	Male	SR	Current
P003	Engineering and Architecture	Female	SR	Former
P004	Engineering and Architecture	Male	JR	Current
P005	Engineering and Architecture	Female	SR	Current
P006	Engineering and Architecture	Male	JR	Current
P007	Engineering and Architecture	Male	SR	Current
P008	Engineering and Architecture	Male	JR	Current
P009	Engineering and Architecture	Male	SR	Former
P010	Engineering and Architecture	Male	SR	Current
P011	Social Sciences / Law	Female	SR	Current
P012	Social Sciences / Law	Female	SR	Current
P013	Engineering and Architecture	Male	SR	Current
P014	Social Sciences / Law	Male	JR	Current
P015	Engineering and Architecture	Male	JR	Current
P016	Arts and Humanities	Female	JR	Current
P017	Social Sciences / Law	Female	JR	Former
P018	Social Sciences / Law	Male	SR	Former
P019	Social Sciences / Law	Female	SR	Former
P020	Social Sciences / Law	Female	SR	Former

Note. AS = Administrative support staff; SR = Senior Researcher; JR = Junior Researcher

Themes Identified in the Interviews

The following sections describe the three themes identified in the interviews: "Leadership and social ties", "Strength of Social Ties". Tables 3 and 4 provide quotes from junior and senior researchers for each theme, as well as the main conclusions (CO) for each theme. Each conclusion was coded and cited in the description of the findings to explicitly link the narrative in the following sections to the conclusion shown in the table. For example, the conclusion for the theme *[The principal researcher] Encourages members to get to know each othe*r shown in Table 3 was coded as T3-CO01.

Leadership and Social Ties

Both senior and junior researchers emphasized the role of the principal researcher in promoting and maintaining social ties within the research team (Table 3; T3) (T3-CO01). This perspective was notably endorsed by the senior researchers, who highlighted the initiatives taken by the principal researcher to promote informal mechanisms that facilitate the acquaintance of the team members and the sharing of personal aspects. In particular, the principal researcher was described as someone who cultivated settings for interpersonal connections amid formal procedures, such as pre- and post-work meeting interactions, thus fostering a friendly work environment (T3-CO02).

In addition, senior researchers demonstrated a proactive intent to nurture social ties within the research team, with particular attention given to welcoming new members (T3-CO05). The team collectively recognized that interpersonal relationships forged in informal settings enhance daily productivity (T3-CO01), which, according to some participants, led the principal researcher and senior researchers to consistently strive to facilitate opportunities for team members to interact. However, while junior researchers emphasized the active role of senior researchers in promoting social ties by acting as behavioral models in the informal relationship dynamics among members (T3-CO06), senior researchers reported less involvement. This perception may be due to escalating personal and professional commitments of senior researchers that interfere with their engagement in the social dynamics of the research team (T3-CO06).

A salient theme identified in the interviews was the commitment of the principal researcher and senior researchers to nurturing a culture of mutual care encompassing collaboration, KS, and altruism. As reported by one participant, "[Collaboration] in the team has been adopted as a working philosophy. This creates a fairly healthy environment for research" (P015; JR). This cultural ethos was regarded as emblematic, contributing to the cultivation of a positive work environment and influencing job satisfaction and individual performance, as expressed by another participant: "Finding yourself comfortable, feeling fulfilled and that kind of thing, I think it is much more useful" (P010; SR). Senior researchers acknowledged that they were currently less involved in promoting a collaborative culture and, more broadly, in the social life of the team due to formal duties and family obligations. In contrast, junior researchers emphasized the important role

Table 3 Leadership and Social Ties Dimension

Themes	Senior Researchers Participant Quotes	Junior Researchers Participant Quotes	Conclusions
[The principal researcher] Encourages members to get to know each other	"It is something that [the principal researcher] does consciously […]. A lot of times we talk about how things are going with your children, how your vacation went, to generate dynamics that go beyond the work itself. It is not a sharing of work knowledge, but it helps make relationships much smoother later on. The personal relationship is very important" (P010; SR)	"That topic that is […] on the border between the most serious work and the most relaxing part […] has always been one of the main ones. After the meeting with [the principal researcher], we went to a bar near here and we all talked […], so that I knew what the work dynamic was like" (P015; JR)	Both senior researchers and junior researchers highlight how the principal researcher fosters personal and informal relationships that then support daily work (T3-CO01)
[The principal researcher] Promotes collaboration and learning	"If anyone is more relevant in this type of behavior [of collaborating and sharing], of leading by example or of becoming a reference, I think for me it could be" [the principal researcher] (P005; SR)	"[The principal researcher] [promotes the philosophy of] here we help, we all share things, we attend the meetings, although perhaps it is not directly of my interest. This is how we learn: I help, and I learn too" (P016; JR)	Senior researchers and junior researchers emphasize the importance of the principal researcher in creating a culture of KS in the team (T3-CO02)
[The principal researcher] Generates a good atmosphere	"If he can, [the principal researcher] stays and has fun, of course. Because here at meals he talks about a little bit of everything in a funny way. Above all [the principal researcher] is the one who does the most in this sense" (P001; AS)	No data	The principal researcher participates in moments of relaxation as a strategy to improve social relations in the team (T3-CO03)

Table 3 (continued)

Themes	Senior Researchers Participant Quotes	Junior Researchers Participant Quotes	Conclusions
[The principal researcher] Promotes leadership in tasks as experts	"[The principal researcher] has done a bit of mediation. Because I think he is the one who knew the profiles of those of us who were there the most. […] cared about knowing a little bit what line you were following" (P020; SR)	No data	The principal researcher seems to have a broader vision and a deep understanding of each member's capabilities, which allows him to promote members to lead tasks in which they are experts. Senior researchers appear to be more focused on operational tasks (T3-CO04)
[Senior researchers] Encourage members to get to know each other	"We encourage graduate students to be in the laboratory mainly during the hours when there are more people, because that makes it easier for conversations to arise" (P013; SR) "[We contribute] by trying to be aware of the extent to which that person is or is not being accompanied by others, more equal to them" […] (P005; SR)	"They start more actively […] and then when they see that this relationship is starting to work, they walk away and let the relationship evolve" (P016; JR)	One of the pillars of the team is the building of personal relationships that subsequently facilitate daily work (T3-CO05)
[Senior researchers] Promote collaboration and learning	"So, less and less. […] we try to create an environment of collaboration between everyone in the laboratory. We try to make graduate students assume that they have to share everything with everyone […] (P005; SR)	"They are the role models. […], they are interested in informal activities and help beyond meetings or professional matters" (P016; JR) [The Senior researchers] were encouraging from the beginning […] if I had gone to a team with a competitive, individualistic environment, then I would have been the same with the people around me" (P004; JR)	Senior researchers acknowledged their willingness to achieve such a commitment, but also recognized their limitations in doing so, given their workloads and difficulties in balancing work and family. (T3-CO06)

Table 3 (continued)

Themes	Senior Researchers Participant Quotes	Junior Researchers Participant Quotes	Conclusions
[The senior researchers] create a good atmosphere	No data	No data	The absence of data may reinforce the idea that senior researchers are fundamentally involved in formal work dynamics and do not share as many moments of relaxation (T3-CO07)
[Senior researchers] Promote leadership in tasks as experts	No data	No data	The absence of data could indicate that the senior researchers are involved in their lines of work with graduate students and not in the vision and overall management of the team (T3-CO08)

Note. SR = Senior researcher; JR = Junior researcher; T3 = Table 3; CO = Conclusions; KS = Knowledge sharing; AS = Administrative support staff. Original quotes were in Spanish

Table 4 Strength of Social Ties Dimension

Themes	Senior Researchers Participant Quotes	Junior Researchers Participant Quotes	Conclusions
Close relationship	"There is a fairly close relationship in many cases" (P002; SR) "The most personal bond, of affection, friendship, increases sharing and caring a lot" (P005; SR)	"The relationship between the members of the team is very close" (P008; JR) "It is easier to share because you end up knowing the person and their needs" (P016; JR)	The use of terms such as "mob" or "family" to describe the relationship with team members indicates that both senior researchers and junior researchers perceive this relationship as close. Members associate social ties with KS. (T4-CO01)
Strong relationship	"The personal relationship that I have established with the members of the team is very intense" (P018; SR) "It is clear that [the members], who are in adjacent offices, have much more interaction and mutual influence. In addition, of course, common positions are created" (P007; SR) "Now there are fewer opportunities for informal things because the family takes up a lot of your time. You see people partying and you say, I'm missing something. I'm not going to miss being in the next paper, but I'm missing out on meeting people and having people get to know you (even outside of work)" (P010; SR)	"[The personal relationship] is very strong. It is stronger with graduate students and with those whom we share the laboratory on a day-to-day basis" (P004; JR) "A key factor here is that we spend a lot of time together. Since half past nine when we arrive, we have lunch together, we stay together and then, if we go out to have something afterwards… it is also a long time each day" (P004; JR)	Both subgroups highlight the importance of face-to-face relationships, constant interaction, and shared activities in informal settings to improve the strength of relationships with others. All of this favors the strength of relationships between junior researchers and penalizes senior researchers who participate less in team social activities (T4-CO02)
Receiving support	"When there is a problem there is support among everyone. You notice that people are lending you a hand" (P003; SR)	"There is always a concern among the rest of the people in the team that if someone has a problem, they will try to help that person" (P006; JR)	Both senior researchers and junior researchers emphasize the importance of mutual support in creating social relationships between members

Table 4 (continued)

Themes	Senior Researchers Participant Quotes	Junior Researchers Participant Quotes	Conclusions
Strength of ties	"The team is quite cohesive" (P002; SR) "There are even friendships. We know each other a lot. "It has been many years" (P010; SR) "There is no longer as much density of ties because the team is larger" (P013; SR) "Those who were the seniors then [at the beginning of the team] were younger and, not yet having family responsibilities, they also had quite a social life with us. In addition, I think that helps a lot" (P013; SR)	"If you do not include […] this feeling of friendship […] to the vast majority of the members of the team, then it would be practically impossible to explain this type of movements [Prioritizing membership in the research team over other professional projects with better economic conditions] (P008; JR)	Although senior and junior researchers agree in pointing out the strength of the ties between the members of the research team, the senior researchers state that these ties have diminished due to the growth of the group, generational differences and their lower participation in informal routines and social activities (T4-CO04)

Note. SR = Senior researchers; JR = Junior researchers; T4 = Table 4; CO = Conclusions; Original quotes were in Spanish; KS = Knowledge Sharing

of senior researchers in cultivating a culture ofcollaboration and interpersonal ties through their daily actions, rather than just verbal discourse (T3-CO06).

> "They teach with the attitude they have. It is not only in words that they want to foster a good environment, but they are actively here [in the laboratory]" (P016; JR)

Junior researchers reported that the principal researcher had a comprehensive understanding of the direction of the research team and the areas of expertise of its members. They also pointed out that he actively promoted connections between individuals to provide assistance based on their respective experiences (T3-CO04), thereby making team members authoritative sources of knowledge in their areas of expertise. Conversely, there was little evidence of such views among senior researchers, potentially indicating a greater emphasis on operational aspects such as research lines, project management, or dissertation supervision rather than strategic oversight and research team management. This apparent focus may restrict the effectiveness of senior researchers as intermediaries between knowledge providers and recipients.

Strength of Social Ties

The interview findings highlight the strength of social ties within the research team (Table 4; T4) (T4-CO01). Participants consistently identified closeness, familiarity, and egalitarianism in relationships as distinguishing qualities of the research team, evident in both formal work contexts and informal interactions (see T4). The interview responses also revealed that the strength of the ties cultivated within the professional realm often evolves into friendships, thereby promoting enhanced relationships and collaboration within the workplace. Team members acknowledged that the personal relationships they maintained facilitated KS, collaboration, and mutual support within the research team. Hence, the findings suggest an interdependency between social ties and KS (T4-CO01).

> "Of course, personal ties have a great influence and vice versa. The more information flow there is, the more links there are and the better links there are, the more flow" (P007; SR)

In addition, participants described the intensity of these relationships when characterizing the ties they formed on the research team (T4-CO02), with some emphasizing deep friendships and affection: "I feel a deep friendship and a deep affection for many people" (P018; SR). From a collective standpoint, team cohesion emerges prominently, notwithstanding references to a diminished density of ties compared with the inception of the research team. Participants elucidated various factors that influence the formation, intensity, and collective strength of these ties.

First, senior researchers placed significant importance on the duration of relationships in a historical context, whereas junior researchers emphasized that the time spent together daily in the laboratory environment enhances the depth and intensity of the ties formed.

Second, the results underscore the importance of physical spaces in stimulating interpersonal connections among members and strengthening social ties (T4-CO02). Junior researchers reported that the laboratory, often regarded as "the heart of the team" (P011; SR), plays a key role in facilitating interactions, helping them to get to know each other and cultivate deep relationships. Conversely, for senior researchers, relationships appeared to develop more prominently in physical spaces beyond the laboratory environment, such as individual offices, where proximity fosters interactions among team members.

> "There is geographical affinity of offices. […] Those who are close […] see each other much more […], drink coffee together more, talk more and form opinions and points of view together. They are different 'clusters' that are being built for different reasons" (P007; SR)

Third, the findings suggest that the collective social experiences shared by team members both inside and outside the university play a significant role in reinforcing interpersonal ties among them: "[sharing social life] I think it helped me develop strong ties with some people" (P013; SR). Indeed, junior researchers attached great significance to the value of collaborating and spending time together in the laboratory, as well as participating in extracurricular social activities, to build stronger connections with their peers.

> "[The personal relationship] with those of us here in the laboratory is greater. Additionally, because, for example, in the afternoon there's usually only us and we go out for a drink. For example, yesterday we went to play paintball" (P004; JR).

In this context, the research team established informal practices aimed at enhancing KS and strengthening personal relationships among its members (T4-CO02). These practices range from routine activities such as shared coffee breaks to regular events such as "gastronomic days, wherein we gather to dine out once a week" (P007; SR). Similarly, other initiatives were reported to welcome new international students or to commemorate special occasions. Sharing recreational, sports, and cultural activities was also consistently mentioned by participants.

> "These are opportunities to have a shared positive experience that may or may not be related to the research, but that makes you reinforce a positive connection with those people" (P003; SR).

Senior researchers reported experiencing challenges in engaging in these informal activities, often due to the need to balance personal and family responsibilities. As a result, they recognized that this barrier affected the depth of their relationships compared to those who participated more regularly in the social activities of the research team (T4-CO02).

Fourth, the results show a decrease in the overall intensity of ties compared with the inception of the research team. This decrease can be attributed, in part, to the expansion of the team over time as well as to the greater generational gap between senior and junior researchers in the present compared to the early days

of the team, resulting in fewer shared interests and hobbies. Social interactions between senior researchers and junior researchers were more robust at the inception of the research team, fostering stronger personal connections (T4-CO04).

In addition to the aforementioned factors, the interviews revealed other elements that may influence the strength of ties. The transdisciplinary composition of the team poses a challenge due to disparities in researchers' foundational training and occasional divergences in their perceptions of reality. As one participant noted, "They think differently, they express themselves differently, […] it was difficult for me at first to understand how things work" (P016; JR).

These findings highlight the importance for the team to engage in an "exchange of the philosophy of disciplines and working methodologies, of the paradigm" (P007; SR). Such engagement would not only enhance professional dynamics but also encourage closeness and strengthen relationships among members, countering forces that "contribute to disaggregation" (P007; SR).

Discussion and Conclusions

This study highlights the central role of senior researchers in fostering social ties by promoting dynamic and informal activities, which, in turn, enhance collaboration and knowledge sharing within research teams (see Fig. 1). Participants' responses suggest that personal relationships serve to fortify ties and foster collaboration and

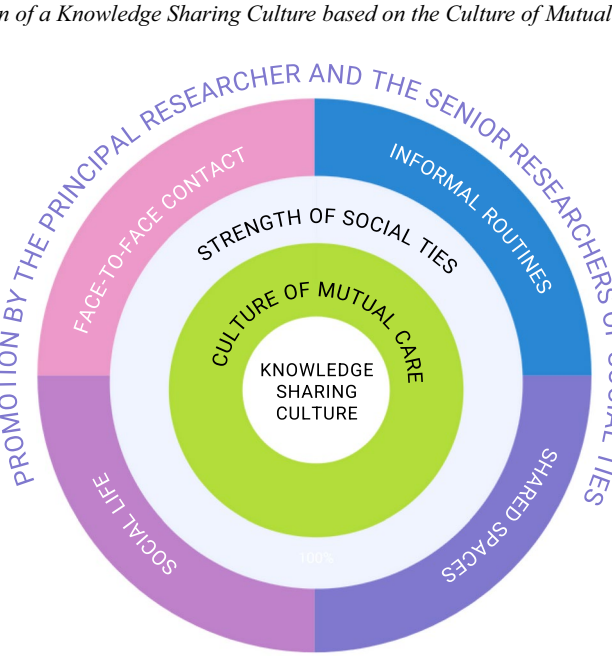

Fig. 1 Creation of a Knowledge Sharing Culture based on the Culture of Mutual Caring

KS. These findings extend the work of Al-Kurdi et al. (2020) and Twum-Darko and Harker (2015), who identified leadership as crucial for KS, . At the same time, they are consistent with the findings by Al-Husseini et al. (2021), who highlighted the importance of community leaders in cultivating a KS culture. Moreover, participants acknowledged that the transition from professional relationships to close personal ties and friendships facilitates collaboration and KS, a finding that supports previous research demonstrating that the establishment of social interaction networks fosters the exchange of knowledge among academics (Fauzi et al., 2019a, 2019b).

Furthermore, our findings indicate that the strength of social ties is closely linked to the duration and intensity of relationships, maintained through sustained daily contact. Consistent with Cross and Cummings (2004) and Fullwood et al. (2018), physical proximity and the availability of shared spaces within the team were described as playing a critical role in establishing and fortifying ties, as well as facilitating collaborative and KS activities. According to participants, the daily sharing of the laboratory space contributes to the strength of ties among research team members, although this may diminish for senior researchers who conduct their work outside of the laboratory. These results are consistent with Fullwood et al. (2018), who emphasized the significance of face-to-face interactions in KS, particularly with respect to tacit knowledge (Ramayah et al., 2014).

We also found that larger team sizes (Selmer et al., 2014) and greater generational differences may reduce the intensity of ties. This may be explained by the influence of factors such as age, disciplinary background, and individual beliefs and values in strengthening or weakening peer-to-peer relationships, as noted by McPherson et al. (2001). This tendency to associate with those most like oneself (Ku, 2019) is of particular importance within a transdisciplinary team, as it can affect knowledge transfer (Puck et al., 2007) and the strength of interpersonal relationships among members.

In our study, engagement in informal social activities has been found to strengthen ties among junior researchers while posing challenges for senior researchers, who may find it more difficult to balance family and professional commitments. The importance of informal interactions in fostering opportunities for collaboration and KS among academics has been highlighted by Fauzi et al. (2019a) and Lauring and Selmer (2011). Our findings are also consistent with those of Fullwood et al. (2018), who demonstrated that personal connections established in informal settings can alleviate the impact of transdisciplinary dynamics and departmental cultures on KS (Bozeman & Youtie, 2017; Lee, 2007).

In summary, our study contributes a nuanced understanding to the literature by illustrating how leadership not only shapes the intensity of individual relationships but also determines the overall network density within research teams, thereby actively creating a culture of mutual care that is essential for effective KS (see Fig. 1). Leaders promote facilitating conditions, such as face-to-face interactions, informal routines, shared physical spaces, and social life, which cultivate a culture of mutual care. The KS culture emerges as a component of this ethos of mutual care, fostering concern for others, interdependence, and reciprocal assistance. Therefore, the KS culture results from deliberate strategies and actions undertaken by the research team´s leadership. These insights could serve as valuable guidance

for similar contexts aimed at fostering collaborative processes of knowledge sharing and production among academics.

Practical Implications

This study offers valuable insights into the actions that universities can undertake to promote social ties and KS among academics. Universities should actively allocate time and resources to create conducive research environments, such as open-plan workspaces and digital platforms, that facilitate relationships and knowledge sharing among academics. Moreover, the promotion of informal activities both within and outside university settings, beyond regular working hours, should be emphasized. In addition, the allocation of designated common areas, such as meeting rooms or recreational spaces, can significantly facilitate face-to-face interactions and enhance the exchange of ideas and knowledge. Given the scarcity of research on social ties and KS within universities, future studies should further explore institutional-level and group-level initiatives aimed at promoting mechanisms and environments conducive to the establishment and maintenance of such ties and knowledge sharing practices among research teams and academics.

Limitations and Strengths

To our knowledge, this is the first study to examine the influence of social ties on KS among academics using a qualitative methodology. This study is timely given the lack of attention to this topic in the KS literature and the pressing need for universities to promote KS among their staff and faculty. We used a case study approach to study a purposively selected research team from a Spanish university. Although the selection of a single research team limited the possibility of generalizing the results to a larger population, it allowed an in-depth and nuanced analysis of the relationship between KS and social ties, with particular attention to the contextual dynamics that shape this relationship. Moreover, the use of a "critical case" sampling strategy (Yin, 2018) facilitated the comparison of our findings with those of similar studies in other geographical contexts. The results of our study provide new theoretical insights into KS in Western universities, particularly in the Spanish context. To increase the generalizability and applicability of the findings, future research could employ a multiple case study design across diverse university settings to examine the influence of varying institutional research cultures on knowledge sharing. Additionally, comparative studies across different countries, academic disciplines or productive sectors could uncover how contextual factors impact the formation and maintenance of social ties among researchers and knowledge workers.

Author Contribution The order of authorship has been determined based on each author's significant contributions to the tasks essential for the development of the article, as detailed below.

Roberto Hernández-Soto led the conceptualization of the article, oversaw data collection and analysis, and was responsible for writing the methodology, results, discussion, and conclusions sections. He also participated extensively in the revision and final editing of the entire manuscript.

Mónica Gutiérrez-Ortega contributed to the conceptualization of the article and data analysis and led the drafting of the introduction.

Bartolomé Rubia-Avi participated in the conceptualization of the article, managed access to the research sample, and provided methodological guidance for the study. He also took part in the revision and final editing of the entire manuscript.

Sergi Fàbregues provided guidance on reporting the methods and results sections, He also participated in the revision and final editing of the entire manuscript.

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Declarations

Conflict of Interest The authors have no conflict of interests related to this publication.

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