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Bridging gaps to promote networked care between teams and groups in health delivery systems: a systematic review of non-health literature

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ABSTRACT

Objectives: To assess non-health literature, identify key strategies in promoting more networked teams and groups, apply external ideas to healthcare, and build a model based on these strategies.

Design: A systematic review of the literature outside of healthcare.

Method: Searches guided by Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) of ABI/INFORM Global, CINAHL, IBSS, MEDLINE and Psychinfo databases following a mind-mapping exercise generating key terms centred on the core construct of gaps across organisational social structures that uncovered 842 empirical articles of which 116 met the inclusion criteria. Data extraction and content analysis via data mining techniques were performed on these articles.

Results: The research involved subjects in 40 countries, with 32 studies enrolling participants in multiple countries. There were 40 studies conducted wholly or partly in the USA, 46 wholly or partly in continental Europe, 29 wholly or partly in Asia and 12 wholly or partly in Russia or Russian federated countries. Methods employed included 30 mixed or triangulated social science study designs, 39 qualitative studies, 13 experimental studies and 34 questionnaire-based studies, where the latter was mostly to gather data for social network analyses. Four recurring factors underpin a model for promoting networked behaviours and fortifying cross-group cooperation: appreciating the characteristics and *nature of gaps* between groups; using the leverage of *boundary-spanners* to bridge two or more groups; applying various mechanisms to stimulate *interactive relationships*; and mobilising those who can exert positive *external influences* to promote connections while minimising the impact of those who exacerbate divides.

Conclusions: The literature assessed is rich and varied. An evidence-oriented model and strategies for promoting more networked systems are now available for application to healthcare. While caution needs to be exercised in translating outside ideas and studies, drawing on non-health ideas is useful in providing insights into other sectors.

Strengths and limitations of this study

- This is a large systematic review of the non-health literature applying strategies originating outside of healthcare to counterbalance healthcare insularity and for learning to develop more connected, networked systems of care.
- It creates a model for facilitating networks.
- It provides strategies stakeholders can adopt to increase networked collaboration between and across teams and groups.
- Findings need to be interpreted with caution, as always when applying ideas and evidence from other sectors to healthcare.

BACKGROUND

Introduction

Healthcare has been criticised, implicitly or explicitly, for being inward-looking.[1–3] There are exceptions to this general rule. Attempting to apply aviation knowledge to medicine,[4–6] generic quality-improvement methods to health systems[7 8] and basic science techniques to medical research[9] are cases in point. A failure to resort to ideas, theories or evidence from outside the sector can lead to claims of tunnel vision, blinkeredness or insularity. Those who have difficulty exploiting external solutions may be unduly resistant, merely uninformed or using defensive routines[10 11] aimed to protect the status quo or to save face in the light of external evidence that could otherwise alter their practice or worldview.[12] Recent work argues for the importance of going outside healthcare to understand the mechanics of its networking.[13] Relatively new ideas have been imported from or influenced by other sectors, including interprofessionalism[14 15] and its close cousin multidisciplinarity,[16 17] systems thinking,[12 18] 'small world'

networks,[19] culture-change models[20] and teamwork[21 22] (eg, through virtual teams[23–25]).

There are many examples from sociology or systems theory which can be drawn on to understand networking, or more broadly, to promote collaborative concepts. Table 1 provides definitional guidance for the key terms used. Of particular interest, Weick's original idea of tight and loose coupling,[26 27] for instance, raises attention to the relative flexibility or rigidity of organisational structures. To understand coupling, Weick hypothesised that events, departments, groups and other organisational entities can be tightly bound or more loosely connected depending on the cultural characteristics of the organisation, the technical rules imposed on people and the extent to which those in authority attempted to induce tightness or looseness. In tightly coupled organisations, the tendency is to be rules-governed, prescriptive and to operationalise control mechanisms. In loosely coupled organisations, people have more scope to exercise discretion and may be relatively autonomous decisionmakers.

Taking a different but related track, early network theorist Granovetter[28] examined the ties between people in networks. In social network theory, people are depicted as nodes and the connections between them as lines between the nodes. People can be connected directly (one degree of separation between them) or less directly (two or more degrees of separation between them). Those with strong ties between them are those who are typically connected closely, who know each other within a group, or who have first order relationships. They directly know, relate to and deal with each other. Weakly tied people are less directly connected. They are acquaintances, those on 'nodding' terms, and friends-of-friends—those who can be sought out for help or information beyond people's immediate social circles.

The problem and attempts to induce more networked behaviours to date

What is common among the competing theoretical paradigms, such as Weick's and Granovetter's hypotheses, is the degrees of connectivity or extent of fragmentation between networking or potentially networking groups. Effective communication and relations across organisational teams and groups are by no means universal. In healthcare, the professional divides,[29 30] entrenched subcultures,[31 32] organisational silos,[33 34] isolated cliques, uncommunicative teams, poorly relating groups, and disconnected wards, units and departments[35 36] are often the norm. Unfortunately, examples of effectively networked or collaborative care in health settings, such as Wagner's chronic care model,[37 38] the patient-centred medical home[39 40] and local initiatives, such as the collaborative care model for Alzheimer disease,[41] are relatively isolated instances, but exemplify how more joined-up behaviours can be encouraged.

The popular response in health settings to address this type of problem, involving attempts to induce greater levels of networking, has been to study, promote or induce teams or microsystems,[42] fortify within-group cooperation,[43] nurture better internal relationships[44] or promote productive, trusting interactions.[45] There have also been attempts in some health sectors to encourage clinical networks across delivery systems.[46–49] However, progress has been slow. There remain many striking examples of fragmented healthcare organisations and systems,[50–52] poorly performing services[53] or dysfunctional cultures.[54 55] Few, if any, healthcare policymakers, managers, clinicians or researchers have failed to experience these. Fragmentation is also evident in sectors outside healthcare, but there are also studies of interconnected systems and studies of networking from these sectors. These can inform the thinking of healthcare insiders, and are the focus of this paper.

Aims

To apply learning from other sectors to healthcare, the paper takes a specific focal point. Intensifying efforts to create better internal teamwork does not logically improve *cross*-team behaviours. Building connected systems of care is likely to need greater understanding of behaviour at the edges of, and gaps between, teams and groups, rather than how well they work internally. The legendary quality improvement thinker W Edwards Deming's ninth point in his 14 key principles for organisational transformation in *Out of the crisis*[7] is the exhortation to "break down barriers between departments". The aim, therefore, is to figure out how to join groups together collaboratively across pre-existing divides and barriers. There are sporadic examples of how to do this in healthcare.[13 35 56 57] However, this is a wicked problem, and more work is needed.

A recent review of between-group behaviour in healthcare identified 13 studies,[35] concluding that fragmented systems and services are prevalent, and that individuals with roles that promote interaction across teams and groups, such as clinical opinion leaders or those with high levels of sociability, represent potential forces in forging greater levels of connectivity. In order to document a wider range of ideas and possibilities, this review builds on that work and the research it synthesised by examining non-health literature on gaps, disconnections, weak ties, social spaces and structural holes between teams and groups on the one hand, and the edges and boundaries of these on the other. The aim is to identify and apply lessons on cross-group activities from outside the health sector. Following this, a model will be developed to provide insights into how to promote more joined-up, networked care.

METHODS

Literature search

Systematic review procedures adopted conform to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines[58] and have been

Table 1 Definitions

Term	Definition
Absent tie	Where individuals or groups are in close proximity but remain disconnected, or have the opportunity to connect, but do not do so
Between-group behaviour	The activities and psychological relationships across two or more groups—closely related to the concept of intergroup dynamics
Boundaries	The perimeters of a social entity (SE), differentiating those who belong and those who do not. Language, dress, and rituals are often used to create boundaries
Boundary spanners	People who bridge two or more SEs, enabling exchange of information or communication
Bridges	Those who span otherwise isolated SEs
Cliques	Small inclusive circles of people with shared interests, who systematically exclude outsiders
Collaboration	The act of working together over time to share information, knowledge or resources in order to achieve mutual aims, goals or objectives
Collaboration in healthcare	This can be construed at several levels: cooperative, joint effort manifesting across departments, wards and units; across professional groupings of doctors, nurses and allied health professionals; across relationships between clinicians, managers and policymakers; across healthcare organisations or sectors; or across macro, meso and micro components of the system
Connectors	People linking two or more SEs
Cooperation	Working together to meet mutual aims in a more short term superficial manner than collaboration
Cosmopolites	Persons with wide-ranging interests and interactions
Coupling	Links, connections or pairings between individuals or groups; these can be tight or loose
Degrees of separation	The number of connections between any two people. The famous phrase 'six degrees of separation' refers to the theory that any person on earth is no more than six steps away from any other person
Disconnections	Disjunctions, breaks, inconsistencies or disparities between two or more SEs
Edges	The borders or outside limits of an SE
Fragmentation	The splintering or breaking up of groups often on the basis of politics, or differing cultural or subcultural perspectives
Gaps	The spaces, breaks or openings between two or more SEs
Groups	Individuals conjoined or located proximally, or considered or classed together as an SE, typically sharing a common identity and creating mutually recognised obligations
Identity	The group's or person's conceptualisations of their individuality, affiliations or characteristics
Influence	The capacity or actuality of exercising power in order to shape, control or manipulate something or someone
Integration	Where individual and group effort is coordinated, and the usual barriers to collaboration or cooperation have been reduced
Interactive relationships	The members of two or more SEs interfacing, mingling or exchanging information
Joined-up healthcare	Collaborative, integrated efforts across formal or informal organisational or service boundaries to thereby tackle shared issues
Liaisons	People who shuttle between SEs, enabling relations and communication
Loose coupling	The somewhat detached or distant connections, links and relationships between individuals and groups. When social entities are loosely coupled there is said to be a degree of flexibility
Mavens	Folks with a wide circle of contacts across multiple SEs
Microsystems	Small-scale ecological components of a larger system within which people work, interact and network
Networking, social	The practice of extending connections or relationships among pre-existing or new, or weak or strong ties in social systems
Networks, social	Sets of connections, relationships or ties among individuals. Social structures comprising nodes representing individuals or groups describing relationships and flows of information between them
Opinion leaders	Influential individuals to whom others turn to for advice or information
Organisational silo	A bounded organisational arrangement with limited interaction with other groups, units or divisions
Reciprocity theory	People will respond in kind to others. Positive examples are gift exchange or returning acts of kindness with kindness; negative examples are retaliation or returning hurtful acts equivalently
Social identity theory	An account suggesting that people's self-concept is grounded in their views about their membership of one or more social groups. This is reflected in how they behave, how they identify with others and understand themselves
Social networks	A group of interconnected people who exchange information, resources, contacts or experience
Social space	The gaps, holes or weak ties between SEs
Strong tie	Where two or more individuals or groups are directly connected in a close relationship

Continued

Table 1 Continued

Term	Definition
Structural holes	Interpersonal gaps in networks; in Burt's theory, they provide opportunities for players in competition to bridge the discontinuities and create social capital or improved relationships with other players
Subculture	Within a larger culture, a smaller group differentiating from the larger host culture with distinguishable beliefs, interests or behaviours
Teams	People coworking interdependently, sharing accountabilities, meeting the needs of their customers and themselves by purposefully accomplishing goals. When performing effectively, teams are seen as performing such that their outcomes are greater than the sum of the performance of individual members
Teamwork	The combined activities of a group of people working effectively toward common ends
Tertius gaudens	"The third who enjoys": the party who benefits from competing or quarrelling with others
Tertius iungens	"The third who joins": the party who connects network members
Tie	Connections between people (individuals or groups) such that they can readily share or transmit information, culture, goodwill or enmity
Tight coupling	SEs which are closely adjacent or tightly connected to each other. Tightly coupled groups are typically seen as rules-bound and prescriptive
Tit-for-tat	The way players respond to others, particularly in game theory, with equivalent retaliation
Trust	Faith, belief or confidence in the reliability, truth, capacity or ability of someone
Weak ties	Those with whom people are relatively poorly connected, for example, acquaintances

documented elsewhere.[13 59] A comprehensive literature review aiming to assess papers published until June 2012 was conducted by interrogating the ABI/INFORM Global, CINAHL, IBSS, MEDLINE and Psychinfo electronic literature databases since their inception, closely following a published guide to systematic reviews in healthcare.[59] By utilising brainstorming techniques, a mind-mapping exercise, previous research,[13] and a preliminary review of the literature, the following search terms were generated: 'social boundar*', 'group boundar*', 'network boundar*', 'social network boundar*', 'social group boundar*', 'liminal boundar*', 'social edge*', 'group edge*', 'network edge*', 'social network edge*', 'social group edge*', 'liminal edge*', 'social space*', 'group space*', 'network space*', 'social network space*', 'social hole*' and 'structural hole*'. Selection criteria restricted the target references, depending on database, to 'human', 'English language' and 'scholarly journals'.[13]

Literature review

Citations, abstracts and complete references that where available were downloaded into Endnote X5, a bibliographic software management package. Of the 9025 references found in the search, 7908 remained after duplicates were removed and these were narrowed further to 842 research articles by excluding non-empirical work. All empirical research designs were included to provide an overview of the types of studies being conducted. The sample of references was further refined by subjecting these to scrutiny by three independent researchers. The articles had to fulfil three criteria: including work specifically related to cross-social groupings and clusters (eg, teams, groups and networks) in social spaces (eg, structural holes, weak ties and gaps), at the borders (eg, edges, boundaries) and in specific places (eg, in industries, organisations, communities, schools and churches). All papers were assessed against the inclusion criteria by two reviewers (JT and DD initially, and in a second round, by JB and DM, see acknowledgements), who assessed study quality and met to reconcile any disagreements, discussing these until consensus was reached.

Literature analysis

The remaining references which met the inclusion criteria (n=219) were then further restricted to 2005-June 2012, emphasising relative recency. Apart from some older papers that were considered key to the topic area, two papers were added via snowballing (n=129), and the sample separated into health (n=13) and non-health (n=116) subsets. The review of the health literature was published[35]; the systematically-oriented review of the non-health literature is the subject of this paper.

RESULTS

Content analysis

A Leximancer content analysis[60] applying data mining techniques to the 116 research papers yielded key concepts (table 2) and themes (figure 1), identifying the number of times each concept was used, indicating how widespread it prevailed in the literature and its relevance to the overall sample. Concepts in the Leximancer terminology (see table 2) are clusters of words that relate together, similar to those that would be found in a thesaurus. Themes are groups of concepts sharing commonalities or connectedness. Thus, concepts are more fine grained and themes are more broad language

Table 2 Ranked list of key concepts and connectivity in the literature on organisational social spaces, networks, boundaries and holes

Concepts	Count	Relevance (%)	Concepts	Count	Relevance (%)
Network	4851	100	Technological	900	19
Social	3656	75	Collaboration	899	19
Capital	3506	72	Practice	884	18
Knowledge	3260	67	Contacts	860	18
Research	2467	51	Behaviour	846	17
Used	2384	49			
Study	2316	48	Market	831	17
Information	2309	48	Terms	825	17
Related	2200	45	Public	822	17
Work	2070	43	Form	819	17
Group	2014	42	Systems	813	17
Management	2012	41	Units	799	16
Different	2008	41	Context	795	16
Organisation	1805	37	Integration	770	16
Relationships	1785	37	Approach	770	16
Individuals	1731	36	Design	755	16
Ties	1712	35	Significant	744	15
Structure	1695	35	Task	744	15
Positive	1660	34	Impact	740	15
Effects	1648	34	School	732	15
Sharing	1519	31	Following	726	15
Members	1417	29	Service	722	15
Process	1404	29	Building	709	15
Interactions	1386	29	Others	709	15
Learning	1378	28	Community	709	15
Time	1320	27	Paper	702	14
Identity	1295	27	Particular	688	14
People	1264	26	Negative	687	14
Employees	1252	26	Theory	676	14
Performance	1238	26	Boundaries	663	14
Support	1225	25	Transfer	662	14
Business	1211	25	Control	659	14
Activities	1177	24			
Innovation	1176	24			
Case	1132	23	Power	634	13
Team	1132	23	Identities	631	13
Available	1113	23	Common	628	13
Role	1106	23	Local	608	13
Organisational	1099	23	Environment	605	12
Model	1094	23	Education	592	12
Data	1087	22	Trust	592	12
Analysis	1085	22	De	589	12
Including	1079	22	Students	585	12
Resources	1078	22	Government	575	12
Development	1074	22	Perspective	567	12
Communication	1051	22	Policy	561	12
Industry	1026	21	Places	561	12
Culture	1020	21	Spaces	552	11
Project	1018	21	Workplace	522	11
Experience	1014	21	Economic	506	10
Participants	987	20	Software	502	10
Cooperation	964	20	Sense	491	10
Personal	939	19	National	451	09
Example	930	19	Global	408	08
Change	918	19	Academic	406	08
Value	909	19	Social	397	08
Based	904	19	White	203	04

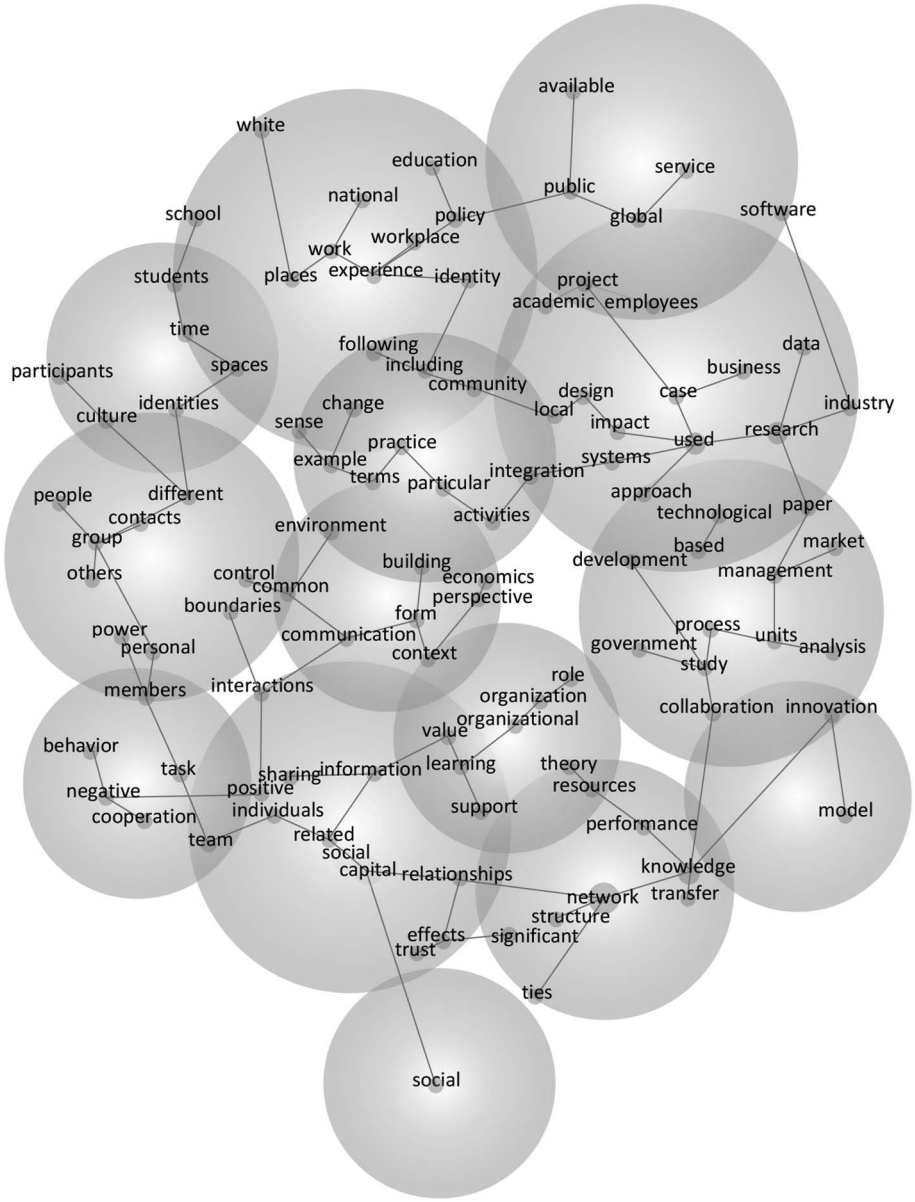

Figure 1 Map of key themes in the literature on organisational social spaces, networks, boundaries and holes.

clusters. In the Leximancer thematic map of the literature (figure 1), each circle is a theme and each dot a concept, with the connecting lines illustrating how related they are.

The central concepts and themes show that the literature repeatedly discusses *networks*, *social*, *capital* and *knowledge* in *social* context, emphasising *collaboration* and *cooperation*. It is centrally about *communication*, *work* and *activities*, and their *management* in *groups* or *organisations*.

Systematically-oriented review

The 116 studies were systematically reviewed. Full papers were assessed by two independent researchers (JB and DM, see acknowledgements) and a random sample checked by a third (CW, see acknowledgements) and the key features abstracted (see online supplementary table S1). Common themes were identified using grounded theory, following the procedure outlined by Glaser and Strauss.[61] The researcher and supporting reviewer (JB and DM, see acknowledgements) assessed the papers until these themes emerged as the most commonly occurring premises.

The research involved subjects in 40 countries, with 32 studies enrolling participants in multiple countries. This literature includes 40 studies conducted wholly or partly in the USA, 46 wholly or partly in continental Europe, 29 wholly or partly in Asia and 12 wholly or partly in Russia or Russian federated countries. Methods employed included 30 mixed or triangulated social science study designs, 39 qualitative studies using various social science methods (interviews, ethnography, focus groups), 13 experimental studies (in psychology laboratories, for the most part) and 34 questionnaire-based studies, the last category mostly to gather data for social network analyses. Many studies were theoretically informed, particularly concerning group and team theories, and many drew on constructs from social network theory.

DISCUSSION

Overall, this research synthesised wide-ranging studies centred on the core constructs of networks, gaps and fragmentation across gaps in organisational settings. What does it indicate to those hoping to induce more productive networked structures, and apply that knowledge to healthcare?

The literature in perspective

Understanding how teams and groups interact across their boundaries, through formal and informal members operating at the edges and relating to each other to a greater or lesser extent collaboratively or competitively, is a crucial phenomenon to understand. Organisational gaps and boundaries underpin the mechanisms by which behaviours, practices, attitudes and values spread; how innovation diffuses and cultural characteristics permeate into systems; and how ideas, knowledge and messages translate and migrate across systems and subsystems.[62–65] Barriers and obstacles to creating joined-up teams and groups are omnipresent.[31 32 34 56] In one study, obstacles manifested as three types—psychological, situational and social—and women perceived more barriers to networking across teams and groups than did men.[66 67]

Taken together the results show that, as a general rule, teams and groups tend to promote an inwardly-focused identity. Strong in-group norms and behaviours operate within teams and groups. People not only identify with the group to which they belong, but their psychological well-being is often bolstered by their membership, particularly if their group is perceived to be prestigious or beneficial to them.[68] Members will collectively draw mental or physical boundaries around themselves, circumscribing their group. People also perennially favour their group: the manifestation of in-group bias is strong and seemingly ubiquitous.[69] Professions and organisational units, for example, almost always support and favour internal members over their counterparts in external professions or units. Indeed, who is in or eligible for membership, and who is not is in large part what defines a team or group. The phenomenon does not stop there. Teams and groups seem to be characterised by tacit or explicit knowledge about their membership or who is eligible for membership, and can readily identify those who are not members.[69] This poses considerable problems for those seeking to encourage networked behaviours and collaborative structures.

People then align themselves, and identify closely with their own team or group.[70] Teams and groups often demand or uphold loyalty from members. Deviants or those who are antigroup or antisocial can be subject to various forms of punishment[71] such as being frowned on, gossiped about, left out, shunned or treated as being disloyal. These, among other determinants signifying identity, can lead to strong 'us and them' perspectives vis à vis other groups. Outgroups are often treated indifferently, unsympathetically or suspiciously.[68 72 73] There can be prejudice, enmity or even hostility between groups.[69 74] All told, this state-of-affairs calls for active strategies to promote collaboratively-oriented systems. However, can disparate teams and groups actually be joined-up by active agency into more expansive networks?

A four-factor framework for collaboration across teams and groups

From the literature assessment and content analysis, a framework synthesising and integrating the current state of knowledge was derived. Figure 2 provides four core factors for appreciating networked efforts: understanding the nature of gaps, using the leverage of boundary spanners, stimulating interactive relationships and exerting power via external influences. These were frequently occurring common factors embedded implicitly or accounted for explicitly in the included literature. Within each factor, various strategies with utility for sponsoring networked collaboration across teams and groups are evident.

The figure depicts two social entities interfacing each other across an organisational divide. These could be, for example, two wards or two organisational units; or a group of doctors interfacing with another group of doctors; or a group of nurses or allied health professionals, working adjacent to each other. They are bounded, and will have greater or lesser levels of communication, connectivity or interactivity between themselves across the social space delineating them as separate groupings. The question is how to bridge the gap and thereby, help to promote networked connectivity. With that in mind, we turn to a brief description of the four factors and how these operate according to the synthesised studies in the non-health literature. This provides us with lessons about networking and how it operates elsewhere.

The *nature of gaps* (social or physical spaces, structural holes, disconnected ties) between teams and groups can be characterised and this information used to help join-up those who are unduly divided. Gaps can clearly act as barriers to knowledge and information exchange.[63 75–77] However, gaps can also be useful: structural holes in networks,[78 79] for example, offer opportunities for bridging behaviours. Once these gaps are recognised, people can begin to act to close gaps between teams and groups. All in all, a moderate level of spacing between teams and groups in complex social systems seems optimal in promoting interaction.[80 81] Too many gaps or too wide the spacings between groups can indicate disunity or disintegration, which makes it hard to enhance linkages. Too few gaps, and narrowness increases the risk of poorly formed localised identities or the system being overconstrained, with no breathing space between the team or group. Building effective relationships across gaps or structural holes looms[78 79 82] as an important activity in joining-up teams and groups. Collaboration and partnerships can be encouraged by

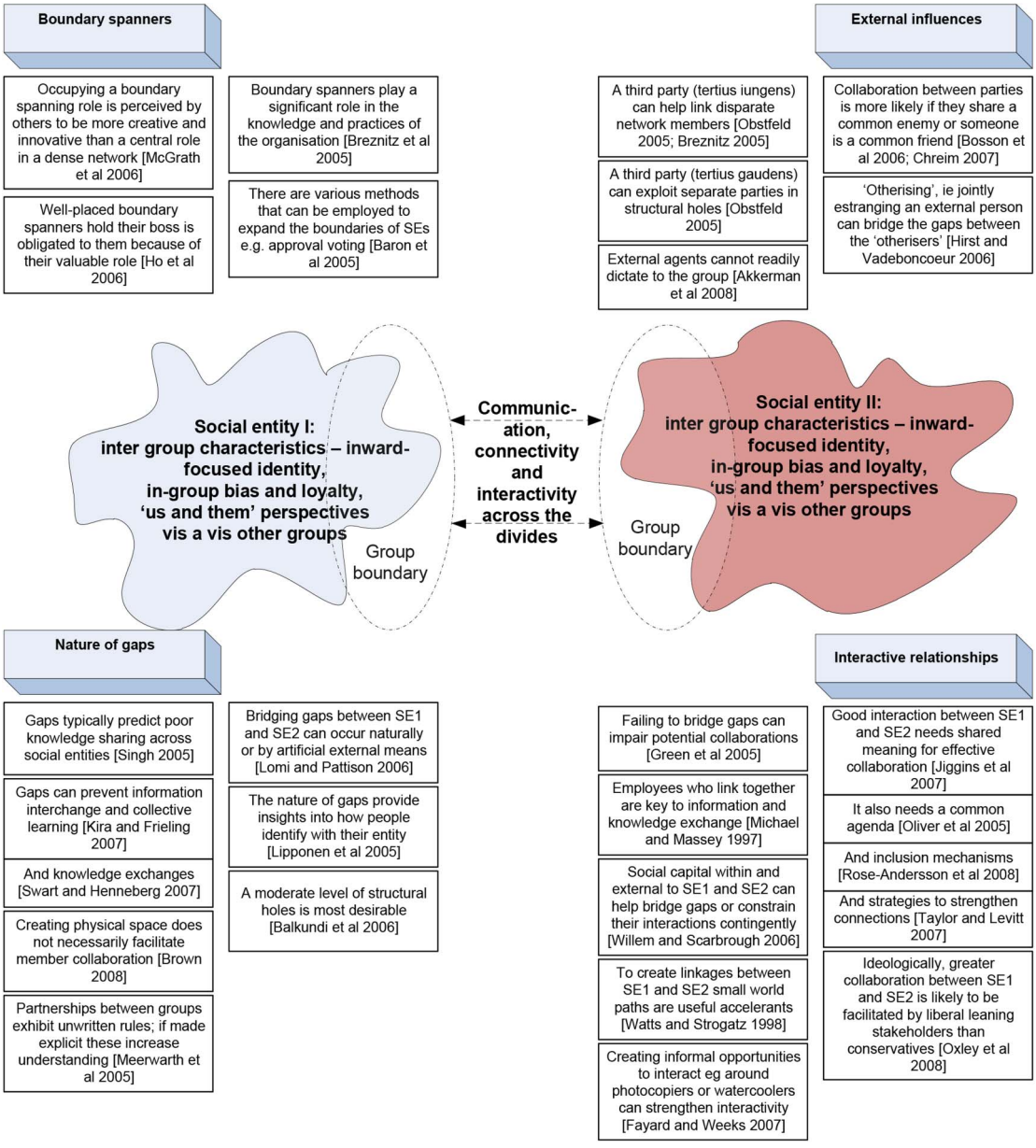

Figure 2 A conceptual framework for networked behaviours.

understanding the nature of the outgroup and intergroup behaviours,[68] and the unwritten rules between groups such as those that inform each potential partners' views on their own and the others' strengths, limitations and capabilities.[83 84] Wenger's work on communities of practice[85 86] and its application[87 88] is a case in point.

Boundary spanners depending on the circumstances can bridge two or more groupings, and enable exchange and communication. Such roles are often highly regarded and those occupying them can make a valuable contribution in promoting connections between people and groups.[89] Useful initiatives to promote boundary crossing include: identifying those with facilitation skills,[90] or encouraging potential bridge-builders (those who span or straddle otherwise isolated teams and groups), connectors (people actively linking two or more teams and groups), liaisons (people who shuttle between teams and groups, enabling relations and communication), mavens (folks with a wide circle of contacts), opinion leaders (influential individuals to whom others turn to for advice or information) or cosmopolites (persons with wide-ranging interests and interactions). However, boundary spanners, in the process of fulfilling their role by bridging gaps inevitably alter relationships, and by their efforts to join-up two previously divided groups can create different boundaries and gaps elsewhere. Interestingly, liberal-leaning rather than conservative-leaning individuals are more likely to bridge gaps or boundary span, and advance collaborative activities.[91] Gatekeepers play an important protective role in healthcare. For example, in some countries, general practitioners prevent patients from unnecessarily

entering specialised healthcare and being over-serviced. However gatekeepers,[92] blockers and manipulators can inhibit boundary-spanning behaviours. They need to be identified and their negative influences negated or minimised if networked, collaborative behaviours are to be realised.

This leads to the challenge of how to stimulate *interactive relationships*. Recurring ideas in the literature include: building joint social capital by emphasising mutual goodwill across teams and groups;[74 93] formally linking otherwise disparate groupings together;[92] providing informal opportunities to inter-relate,[77 94] including creating commonly-available public space in which to intermingle;[25 95] promoting dialogue and shared meaning between groups;[96] agreeing on joint agendas;[97] striving for inclusivity;[98 99] supporting social diversity[100] and generally encouraging, over time, connections and exchanges between teams and groups. These strategies can, depending on the circumstances, strengthen communication and information exchange. Leaders who support informal social activities and promote social ties, for example, after-work activities, can improve productivity and particularly, intergroup functioning and performance.[101] People who have strong relationships across teams and groups, and are embedded in the larger organisational culture are less likely to signal an intention to leave their organisation,[102] and this can be important in building long-term connectivity. Trust is an important commodity in linking teams and groups;[103–105] so building up of trust is an important endeavour. Taken together, these strategies can help connect teams and groups. The right strategy-mix will need to be determined by formal and informal leaders and members of the teams and groups themselves, and are often defined by the context.

External influences can also play a bridging or dividing role. A *tertius iungens* agent ('the third who joins') who builds bridges can help facilitate group interaction, but a *tertius gaudens* agent ('the third who enjoys') can exacerbate existing divides, exploiting these for his or her own benefit.[78 79 106] While there is some support for the notion that outsiders cannot readily dictate to teams and groups,[67] other work suggests that group members who share a common enemy[107 108] or jointly emphasise their distance from or aversion to other groups, thereby differentiating themselves,[109] will be more likely to collaborate with each other. This has been a long held belief: if, as the old Arab proverb states, "the enemy of my enemy is my friend" then it is also likely to be the case that "my friend's enemy is my enemy". Whether or not this is so, teams or groups sharing a negative attitude about or a perceived threat from a third party will be likely to move closer to each other.[107]

Some key theoretical perspectives

Various theoretical perspectives can be mobilised to explain these empirical findings and the four-factor model. We have specifically encountered two: Weick's tight-loose coupling helps us to understand the extent to which characteristics, such as rules or discretion, are at work in having greater or lesser effects on connectivity between teams and groups. Granovetter's strong and weak ties asks whether people adjoining each other are in a direct relationship, or more distant from each other, that is, merely acquaintances. Either theory can help to some extent illuminate networked patterns of behaviour, and suggest mechanisms to strengthen interactions.

Two other theoretical accounts stand out in further explaining the model. The phenomenon of 'us and them' is a subset of social identity theory,[108 110–112] which suggests that humans have strong self-concepts tied to needs for belongingness with those in their in-group, and seek to identify with, be part of or embrace the attitudes and behaviours of their fellow group members. Consequences foreshadowed by social identity theory include robust bias in favour of the in-group, and preferential treatment for fellow members. In-group members are often seen to be estranged from, prejudiced about, competing with, scapegoating or even hating those in out-groups. Clearly, there can be strong pressures or motivations to affiliate with one's group and to distrust, treat warily or actively dislike other groups. Antidotes, such as those described in the conceptual framework for networking (figure 2), will likely need concerted, longitudinal effort to tackle 'us and them' feelings and behaviours. Even then, gains are not likely to be huge.

Another mechanism underpinning networking is described by reciprocity theory, also known as tit-for-tat,[113 114] which predicts that teams and groups will retaliate equivalently. Tit-for-tat theory suggests that the way group members treat those in other groupings, whether badly or well, is more than likely to be reciprocated. This is exemplified by many game theory studies[100] and much of the literature from the earliest time period, for example, "do unto others as you would have them do unto you" and "an eye for an eye and a tooth for a tooth". Successive iterations of reciprocity can readily hard-wire into collaboration or hostility. This phenomenon is strongly related to trust.[77 115] An optimal response pattern for collaboration across teams and groups seems to be: always start relationships cooperatively, do not be the first to defect, and practise forgiveness when wronged.[114]

Of course, there are other theoretical accounts which could be developed to help understand groups' relationships. These include explaining how some teams or groups come to be especially good at connecting with nearby teams or groups compared with others who are not; the mechanisms of affiliation across teams and groups when it spontaneously occurs; specifying how one group comes to be dominant and another subservient; and concepts of mutuality versus rivalry, manifesting most frequently as cooperation versus competition. Each of these is likely to be fruitful to a greater or lesser extent in contextualising the relationships between

teams and groups, and could be useful gateways to further research.

The nature of gaps and boundaries, and applications in healthcare

The core ideas of gaps, boundary spanners, interactive relationships and external influences found in the literature review are very well suited to the analysis of healthcare. There are concrete implications for healthcare settings.

Gaps interfering with joined-up services, a key feature of health systems, are very hard to bridge. Gaps can be the physical area between one department and another, the silos operating to structurally delineate medicine, nursing and allied health staff or the temporal divides that separate two or more groups working shifts. These can also emerge as the conceptual gulf between the attitudes of people in one part of the healthcare organisation or system and another. Gaps often manifest as the cultural differences demarcating one unit or professional group ('us') and the other ('them'). All organisations create barriers and partitions which inhibit or prohibit collaboration because of specialisation, myopic internal focus or tribalism. Problems arise where this interferes with effective organisational functioning or the delivery of good care.

Boundaries are phenomena of interest if we have to learn to bridge gaps and create better networked systems of care. Boundaries can be sharp and obvious, as between hospitals and nursing homes or amorphous and unclear, as when two or more organisational groupings remain as separate entities, but share resources, leaders, staff or physical space (eg, different specialists; physicians and nurses; or day and night shift staff). In healthcare there are formal organisational gaps, that is, 'you are department A and we are department E', and physical or location gaps, that is, 'we work here and you, behind that partition, across the corridor, on another floor, or in another building, are over there'. There are conceptual gaps, manifesting in differentiable mental models, that is, 'you think that way, but we don't'. And there are behavioural gaps, as in 'this is how we dress, speak, and practise, compared with you'. Gaps can be emotional, for example, two teams who have come to detest each other and are poles apart, or conceptually different, as in the gap between achieving a 'personal best' in a team developing a new model of care and a rival teams' normal, everyday performance. However, categorised gaps and boundaries distinguish teams and groups, and define where one ends and another begins. For those seeking to influence the health system to thereby create networked care, these gaps and boundaries should not be ignored. Instead, by identifying the nature of gaps and boundaries, we can begin to focus on the efforts that are needed to join them up, and create more synergistic effort to improve care for the benefit of patients. This is perhaps the major lesson to take home from this review.

LIMITATIONS

Systematic reviews including this one are limited by the constraints of the inclusion criteria, in this case the terms and the date of the review period (2005–June, 2012). Applying ideas from other settings to healthcare may pose challenges.

CONCLUSIONS

This systematically-oriented review provides an assessment of a large volume of non-health literature, presenting a four-factor model and strategies for translating insights and ideas to the health sector. It sought to facilitate access to external thinking as an antidote to health sector insularity, and as a way of understanding how to build more connected, networked systems of care. While caution is warranted in translating unmediated ideas and evidence from other sectors to healthcare, drawing on outside ideas to tackle hard problems is useful in at least providing insights and seem to be overdue.

These findings may be of benefit to healthcare stakeholders seeking greater levels of networked collaboration. However, no one should doubt the immense challenges facing those seeking to build more productive networking across healthcare delivery systems.

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Supplementary table 1: Characteristics of included studies [n=116]

Study	Methods	Participants, duration	Context	Findings	Theoretical paradigm; disciplinary perspective	Key message about social spaces, boundaries and structural holes
Akker-man et al (2008)	**Study design**: triangulated qualitative study. **Focus:** case studies of deliberately organised communities of practice. **Method**: questionnaire; three logs completed by the external project partners; project meeting recordings. **Analytic approach:** case study analysis.	**Number**: 15 intended communities of practice; external project partner and broker for each group. **Type**: small and medium sized companies in the tourist sector. **When**: ~2005.	Europe; businesses were located in seven countries.	It is important that communities of practice, rather than an outsider, define objectives and action plans in order for activity to be meaningful. Shared history contributed to the development of shared activity.	Communities of practice applied to professional settings.	People outside a social space cannot readily co-ordinate that social space. Once a group has formed and a common agenda established, people outside the group's boundaries can work with the group, but their ideas are secondary to the group's needs.
Allen-Collinson (2009)	**Study design**: exploratory study of research administrators. **Focus:** the workdays of university research administrators. **Method**: questionnaire; semi-structured interviews. **Analytic approach:** interview data analysis.	**Number**: 27 interviews. **Type**: research administrators across 19 universities. **When**: Questionnaire administered in 2000; interviews conducted in ~2008.	United Kingdom.	The role of research administrators spans the boundaries of research and administration. Research administrators reported experiencing three exclusionary practices: 1.Negative labelling. The language used to describe administrative staff eg. 'support staff', reinforces the academic hierarchy. 2. Rendering invisible. Research administrators are obliged to remain silent during research meetings unless they are explaining or clarifying regulation or procedure issues. 3. Stigmatising and blaming. Research administrators felt 'othered' at times by both research and administration staff.	Social and personal identity.	People whose jobs span the boundaries of two or more groups often do not completely identify with any group. This can be isolating, however they value the fluidity of their identity. They have a high degree of social agency as they promote the aspect of their job that aligns with the most prestigious group, and engage in work that distances themselves from the less prestigious group.
Au and Marks (2012)	**Study design**: triangulated qualitative study. **Focus:** case studies of seven virtual teams. **Method**: in-depth	**Number**: 42 staff in seven virtual teams in four companies. **Type**: staff in virtual teams in an international shipping	United Kingdom, USA, Brazil, Singapore, Malaysia and Myanmar.	Most employees identified more strongly with their local colleagues than their virtual team, due to similar work habits, cultural practices and proximity. Employees perceived no impact of national culture on their team identification, however	Occupational culture; social identity theory.	It is necessary to create shared goals within virtual teams to promote a shared identity and discourage inter-group comparisons.

	interviews; observation; formal documentation and email exchanges. **Analytic approach:** thematic qualitative analysis.	company; a company providing technology solutions to the energy sector; a company importing and exporting floor varnish; and a chemical solution provider. **When**: ~2010.		language barriers and different work practices prevented employees from identifying with their virtual team. The study found little evidence that a strong identification with the team leads to a strong identification with the organisation. The significant conflict and communication problems in virtual teams did not impact on employees' identification to their organisation.		Managers intent on promoting strong ties within virtual teams need to focus on mitigating the negative effects of perceived cultural differences.
Balkundi et al (2006)	**Study design**: questionnaire survey. **Focus:** 19 organisational teams. **Method**: questionnaires; document analysis. **Analytic approach:** analysis of attitudinal data.	**Number**: 295 employees divided into 19 teams, with an 88% response rate. **Type**: manufacturing staff divided into shift teams and support teams. **When**: ~2002.	A manufacturing company in the USA.	Teams with a moderate proportion of social network structural holes have high productivity compared with teams with low or high proportions of structural holes. Large teams and teams that existed for a short period of time had relatively more structural holes compared to long-established or small teams. Ethnic or gender diversity within teams made no difference to the prevalence of structural holes. Teams with greater age diversity had fewer structural holes. Structural rather than demographic diversity had significant effects on team performance.	Social network theory, structural holes.	A moderate level of structural holes within a work team is desirable for good team performance because a team with few structural holes is likely to hinder a team's innovation, while a team with many structural holes is likely to have coordination problems.
Baron et al (2005)	**Study design**: questionnaire survey and presentation of case scenarios. **Focus:** internet users' and university students' voting habits. **Method**: in two experiments, hypothetical scenarios were created and questionnaires administered. **Analytic approach:** attitudinal data analysis.	**First experiment Number**: 96 people. **Type**: internet users between the ages of 18 and 60. **When**: ~2003. **Second experiment Number:** 112 students from two universities. **Type:** university students from University of Pennsylvania and St Lawrence	**First experiment:** hypothetical scenario completed by internet users who found the questionnaire through search engines and links and paid $3 to complete it. **Second experiment:** USA; students from University of Pennsylvania and St Lawrence University.	Approval voting (saying yes or no to multiple options, rather than voting for one option) minimises people's tendency to vote parochially, and increases support for the option that is in the collective interest.	Political science, voting intentions.	There are methods that can be employed to expand the boundaries of a network or group. In a political context, approval voting increases the likelihood a group will think outside its boundaries by increasing the likelihood people will vote for the option that is for the common good.

		University. **When:** ~2003.				
Berggren and Silver (2009)	**Study design**: multiple case studies. **Focus:** entrepreneurial activity, business climate and their relationship with bridging business and politics networks. **Method**: in-depth interviews; data collected from Statistics Sweden and the Confederation of Swedish Enterprise. **Analytic approach:** triangulated case study analysis.	**Number**: three municipalities; 120 interviews. **Type**: 90 managers and owners of small and medium-sized businesses; 30 other stakeholders. **When**: 2002 – 2007.	Sweden.	The level of entrepreneurial activity and perceived business climate significantly differed in the three municipalities. The creation of business networks and their value to local businesses depend on the structural, relational and cognitive history of each municipality. Politicians hold a more positive view of the quality of dialogue between entrepreneurs and politicians.	Social network perspective; social capital.	Bridging business and political networks allows for more effective communication, and entrepreneurs gain more respect for politicians. A bigger network encourages the involvement of more actors that increases skills and mutual resources.
Birru (2011)	**Study design**: survey. **Focus:** horizontal inter-firm co-operation. **Method**: structured interviews based on a prepared standard questionnaire. **Analytic approach:** statistical data analysis (SPSS).	**Number**: 100 firms. **Type**: small and medium-sized leather shoe manufacturing firms. **When**: 2007 – 2008.	Ethiopa; Addis Ababa.	89 of the 100 firms reported they have a cooperative relationship with the other firms, primarily for the purpose of accessing resources to overcome their internal resource limitation. Proximity of firms, family ties and common regional background of families are the top three factors firms consider when choosing with whom they will collaborate. 88 firms reported facing barriers to collaboration, the most significant being a negative perception to competition and a lack of trust to partner firms. Religion and ethnicity have a less significant impact on collaboration.	Social network perspective; occupational cooperation and collaboration.	Horizontal inter-firm collaboration is recognised as a learning space, where ideas and knowledge are shared and developed. Factors that encourage cooperation are geographical closeness, family ties and a shared regional family background. Factors hindering collaboration are negative perceptions of competition and a lack of trust.
Bosson et al (2006)	**Study design**: survey of people's recall and ratings of feelings towards others. **Focus:** negative and positive attitudes of close friends. **Method**: participants' construction of ratings scales. **Analytic approach:** analysis of ratings.	**First study** **Number**: 30 men and 90 women. **Type**: participants between the ages of 16 and 25. **Second study** **Number:** 29 men and 59 women. **Type:** university	USA; at a south-western university.	Although people commonly believed that friendships are more likely to develop through shared positive attitudes rather than shared negative attitudes, a shared dislike of someone promoted closeness more effectively than a shared liking of that person, when the feelings are weakly held. Mutual feelings that are strongly held, whether positive or negative, foster a strong connection between the two people. Friendships are most likely to develop if two people share a negative	Social cognitive perspective.	Boundary construction is likely to occur when people share strong attitudes about something. When the attitudes are weakly held, a mutual negative attitude is more likely than a mutual positive attitude to promote closeness and leads to the construction of

		students. **Third study: Number:** 31 men and 74 women participated, 28 men and 69 women included in the final sample. **Type:** university students between the ages of 17 and 40. **When**: ~2003.		attitude about someone, and positive attitudes about nonperson things.		boundaries.
Bosworth (2009)	**Study design**: social science mixed methods. **Focus:** rural in-migrants (people who have moved at least 30 miles as adults). **Method**: qualitative interviews based on an earlier survey. **Analytic approach:** social science mixed methods assessment.	**Number**: 40 interviews. **Type**: rural micro-business owners. **When**: ~2007.	England.	Rural in-migrants have significantly higher education qualifications than local business owners. A high level of education enables entrepreneurship, provides essential business skills, and enhances learning and networking skills.	Social capital; knowledge transfer.	The introduction of people with high social capital into a community creates new opportunities for sharing knowledge and raises awareness of the diversity of skills and networks. Personality mobility is a primary facilitator of knowledge exchange.
Breznitz (2005)	**Study design**: case study. **Focus:** Israeli military MAMRAM unit. and CRP School. **Method**: open-ended interviews; document analysis. **Analytic approach:** case study analysis.	**Number**: 80 interviews. **Type**: Israeli IT industry leaders; former officers of MAMRAM and CRP School; founders of software programming and software engineering in the military and state apparatus; managers/co-founders of leading private professional schools. **When**: 1999 – 2000.	Israel.	The military is found to provide a collaborative public space, thereby playing a vital role in the success of the Israeli software industry. The military, within the Israeli IT industry, provides: social networks and networking opportunities, software development, training and human capital and knowledge sharing opportunities.	Cluster and network theory; systems of innovation theory.	Network brokers, whether individuals, a team or a company, play a significant role in the knowledge and practices of the organisation.

Broad-bridge (2010)	**Study design**: narrative study. **Focus:** senior retail managers' human capital. **Method**: biographical interviews. **Analytic approach:** interview data analysis.	**Number**: 17 interviews. **Type**: 11 men, 6 women. **When**: ~2008.	United Kingdom.	Managers reported human capital as being critical to their career development. The study found that accumulating human capital is inextricably linked to social capital. Men and women are equally aware of the importance of built and borrowed social capital, however they acquire and use it differently.	Social capital theory; gender perspective.	Social capital is integral to career development. Men and women recognise the importance of social capital in their careers. Men are more strategic in acquiring social capital and use networking techniques strategically. Women network for social support to create a barrier to a male-dominated work environment.
Brown (2008)	**Study design**: before and after study. **Focus:** staff interactivity at a furniture manufacturer company. **Method**: framed field experiment. **Analytic approach:** two weeks of detailed observations; spatial network analysis.	**Number**: one furniture manufacturing company. **Type**: research and development staff at a furniture manufacturer company. **When**: ~2006.	United States of America.	The study designed revamped workplaces. The redesigned workplace had the opposite of the desired effect – collaborative activity decreased, not increased because inconvenience to attend formal meetings and fewer chance meetings occurred. Thus more needs to be done to increase collaboration than creating collaborative spaces.	Organisational communication.	The physical creation of social spaces does not necessarily facilitate collaborative behaviour. Structural holes and weak ties cannot be strengthened by the creation of a collaborative space alone.
Bshary et al (2008)	**Study design**: experimental, ethological. **Focus:** cleaner-fish. **Method**: field observations and field experiments. **Analytic approach:** analysis of observational and field data.	**Number**: 12 pairs of cleaner-fish in the field observations; 10 pairs of cleaner-fish in the aquarium experiments. **Type**: cleaner-fish. **When**: 2006.	Field observations conducted at a national park in Egypt. Aquarium experiments conducted at a Great Barrier Reef research station in Australia.	Cleaner-fish work together to eat ectoparasites off clients. They cheat by eating mucus. If a cleaner-fish eats mucus from a client, the client is likely to leave. If a pair of cleaner-fish work together for the option that is best overall, they provide a better service than one cleaner-fish does acting alone. Females cooperate more than males in pair situations, but male and female cleaner-fish working by themselves exhibit similar behaviour, i.e. there was no significant difference in clients' responses when interacting with an independent male or female cleaner-fish.	Game-theory.	In cleaner fish working as a team provides better service quality and maximises mutual gain than working individually. Cooperation counts.
Carter et al (2009)	**Study design**: social science mixed methods. **Focus:** racial integration in education case	**Number**: 750 American students and 912 South African students	United States of America; South Africa.	The schools studied revealed a disconnect between racial policy and practice. Educational actors reproduce social and	Social boundaries; organisational culture.	Boundaries need to be properly utilised to tackle racial segregation.

	studies. **Method**: ethnographic, interview; survey data. **Analytic approach:** ethnographic analysis.	in four high schools. **Type**: multi-racial and desegregated schools. **When**: 2004, 2007, 2008.		symbolic boundaries in routine school practices. This emphasises the macro-micro tension between racial integration policy and perceived group interests.		Social boundary construction and maintenance occurs through language, extracurricular activities, friendships and subjects studied. Physical boundaries such as organising a classroom by race impede policies of integration.
Castilla (2011)	**Study design**: longitudinal case study. **Focus:** employee evaluations completed by managers. **Method**: longitudinal personnel data on managers and their employees. **Analytic approach:** statistical analysis.	**Number**: 5,104 employees. **Type**: Support staff at a large, private service-sector company. **When**: 1996 – 2003.	United States of America.	Independent managers disagree more than structurally or socially connected managers in their evaluation of the same employee's performance. To a lesser extent, demographic similarity between managers and employees decreases disagreement in managers' performance ratings of an employee.	Social network theory.	Managerial influence and horizontal homophily can be better indicators for understanding managerial disagreement in employee performance evaluations than vertical homophily.
Chae et al (2005)	**Study design**: triangulated qualitative study. **Focus:** case study of knowledge management of employees. **Method**: structured interviews; semi-structured interviews; electronic communication; document analysis. **Analytic approach:** triangulated case study analysis.	**Number**: Three full-time employees reporting directly to the associate dean, one full-time employee reporting indirectly to the associate dean, two senior systems analysts, a webmaster, computer equipments specialist. **Type**: IT department staff of Mays Business School at Texas A&M University. **When**: ~2003.	United States of America; Texas A&M University.	Five paradoxes are evident in knowledge management contexts, namely belonging, i.e. how integrated people feel; knowledge, i.e. employees' awareness and understanding; organising, i.e. how knowledge is structured; network, i.e. how people are linked; and knowledge management systems, i.e. the way knowledge is organised and led.	Social-practice perspective; social network theory; actor network theory.	Examining the edges and overlaps of knowledge management in an organisation highlights any problems in the network. These problems can then be addressed, which will lead to the enhanced performance of individuals, teams and organisations.
Chen and Li (2005)	**Study design**: experimental study.	**First study Number**: 98 Chinese	**First study** China: students from Zhejiang	In a mixed-motive business scenario, Chinese participants made fewer	Culture theory.	In a business context, cultural orientation is a

	Focus: Chinese and Australian university students. **Method**: presentation of scenario. **Analytic approach:** game theory situations.	students and 86 Australian students. **Type**: university students. **When**: ~2001. **Second study Number:** 151 Chinese students and 122 Australian students. **Type:** Chinese university students studying introductory organisational behaviour and Australian university students studying social psychology. **When:** ~2001.	University; Australia: students from the University of New South Wales. **Second study** Hong Kong: students from a major university; Australia: students from the University of New South Wales.	cooperative choices than Australians did. Chinese showed more cooperation with fellow citizens in foreign locations than at home, but treated foreigners just as competitively in different territories whereas the opposite was demonstrated by Australians. Individual cultural values mediated these differences. Australians are more horizontally individualistic, which was associated with higher cooperation, whereas Chinese were vertically individualistic, which was associated with lower cooperation.		predictor of co-operation.
Choi et al (2011)	**Study design**: cross-cultural survey. **Focus:** college students' networks in social networking sites. **Method**: online questionnaire. **Analytic approach:** analysis of questionnaires.	**Number**: 589 university students. **Type**: 349 American students; 240 Korean students. **When**: ~2008.	United States of America; Korea.	Although there were some similarities in American and Korean students' use of social networking sites, i.e. a similar pattern of usage, culture was a strong moderator. American students have larger and looser networks with a greater number of weak ties, whereas Korean students had smaller, denser networks with a generally equal number of strong and weak ties. American students reported more bridging social capital from their networks, but there was no significant difference between the level of bonding social capital.	Cross-culture theory; social network theory; social capital.	Social networking sites can enhance bridging and bonding social capital, but the type of capital is most improved and the effect on the network is culturally determined. It is essential to consider the effect culture has on networks.
Chreim (2007)	**Study design**: narrative study. **Focus:** staff at drilling/production companies. **Method**: semi-structured interviews conducted	**Number**: interviews with 29 members of the organisation. **Type**: non-managerial staff, staff in	United States of America; drilling/product-ion service sector of the oil and gas industry.	At the time of acquisition of their organisation, the production and drilling staff viewed the acquisition as either enhancing or threatening their identity, stabilising or destabilising their identity, continuing or discontinuing their identity. Social and temporal factors	Organisational identity; narrative perspective.	When two groups are brought together through external means, social and temporal factors effect group integration. The perception of a common

	over two time periods. **Analytic approach:** comparative analysis; interview data analysis.	middle and senior management. **When**: 2003 and 2004.		influenced staff's identity interpretations. The production staff were significantly more positive and progressive in their identity themes than the drilling staff. The second round interviews showed a convergence of views. The parent company was seen as a threat to identity by both the production and drilling staff, and the middle managers seen as the heroes in their attempt to maintain a family atmosphere.		opponent promotes group bonding.
Clopton (2011)	**Study design**: survey. **Focus:** teams of student athletes. **Method**: survey questionnaire. **Analytic approach:** statistical analysis of survey data.	**Number**: 570. **Type**: undergraduate student-athletes. **When**: ~2009.	United States of America; 23 National Collegiate Athletic Association colleges and universities.	The study examined the value of social capital in relation to team performance. There was a significant link between social capital and team performance. This link was more significant than the link between team performance and the previous year's performance.	Social capital theory.	Relational social capital (e.g. trust) can significantly predict a team's performance. This presents an opportunity for groups, teams and organisations to build, support and enhance relational social capital.
Cooper and Haines (2008)	**Study design**: experimental, presentation of tasks to participants. **Focus:** university students using group support systems (GSS) for decision tasks. **Method**: task presentation followed by questionnaire to gauge responses. **Analytic approach:** experimental, questionnaire, mixed method, triangulated analysis.	**Number**: 240 university students divided into 59 groups. **Type**: undergraduate students enrolled in business courses. **When**: ~2005.	United States of America; students at a public university.	The study examined how participants understood others in a shared workspace. Decision quality and consensus of groups employing GSS can be significantly influenced by workspace awareness. Insight awareness, which is increased by behaviour awareness, increases consensus and decision quality. Behaviour awareness may entirely mediate the relationship from presence to insight awareness. Similarly insight awareness may fully mediate the relationship from behaviour awareness to decision quality and consensus. A chat room had a positive influence on presence awareness but no significant impact on insight awareness.	Social cognitive perspective.	Understanding members' ties in a GSS context is essential for effective coordination and knowledge sharing.
Daly et al (2010)	**Study design**: mixed methods exploratory case study. **Focus:** social networks of teachers in five	**Number**: 196 staff across five schools. **Type**: teachers in under-	United States of America.	The five schools were undergoing a system-wide reform to improve students' performance. However the uptake, depth and spread of change varied between the	Social network theory.	Social networks significantly promote or hinder reform efforts. It is therefore necessary to

	schools in an under-performing school district. **Method**: online survey; semi-structured interviews. **Analytic approach:** social network analysis.	performing schools. **When**: ~2007.		schools, depending on the social networks within each school.		engage social networks in addition to implementing the technical aspects of a reform.
Daming and Jie (2010)	**Study design**: case study. **Focus:** entrepreneurial migrants. **Method**: interviews; observation. **Analytic approach:** narrative analysis.	**Number**: over 4,000 students. **Type**: a private school where students are all children of transient workers. **When**: ~2008.	People's Republic of China; Weiyuan Island.	This paper studies the experiences and the social mobility process of migrants who are transforming themselves from hired labourer to business owners. The migrants use their original social networks for funding. They establish new social networks for information sharing and external resources.	Social network theory; social mobility; social displacement.	Migrants seeking to move upwards in their social mobility establish a new social space. Entrepreneurial migrants are on the edge of urban society both politically and socially. Consequently their migration is not complete.
de Haan and Leander (2011)	**Study design**: ethnographic study. **Focus:** othering and social spaces in multi-ethnic classrooms. **Method**: video data of classroom interactions **Analytic approach:** ethnographic analysis.	**Number**: two schools. **Type**: one school in the Netherlands, focusing on interactions between Dutch and minority students; one school in the USA, focusing on interactions between African-American and White European-American students. **When**: ~2008.	United States of America; the Netherlands.	The school space is used to deny a common history. Homeland spaces are used to build inter-ethnic knowledge to try and establish status relationships. There were distinct majority/minority boundaries. Students create representations and alignments of spaces in the classroom, but outside of the classroom they are reluctant to identify with any geography.	Social space; identity.	Explicit identification with a particular social space may result in social exclusion.
de Toni and Nonino (2010)	**Study design**: case study. **Focus:** key roles in informal organisational networks and their contribution to performance. **Method**: questionnaires; semi-structured	**Number**: 192 employees. **Type**: employees of a knowledge-based enterprise in the information systems industry.	Italy; units operating in four cities.	This study finds a new key informal role called *pilus prior.* A *pilus prior* is someone that combines problem solving, expertise and accessibility characteristics. Other key informal roles include opinion leaders, central connectors, bottlenecks, experts, consultants, and helpful people.	Social network theory; organisational structure.	Pilus priors are the informal emerging leaders in an organisation who outperform their colleagues. They assume the role of 'informal manager' and informally coordinate activities and transfer their

	interviews. **Analytic approach:** social network analysis.	**When**: ~2007.				knowledge to other colleagues.
Dokko and Rosen-kopf (2010)	**Study design**: social science mixed methods. **Focus:** the effect of job mobility on an organisation's influence. **Method**: data from the Communications Standards Review and the Telecommunications Industry Association (TIA) attendance records, meeting minutes, panel data. **Analytic approach:** statistical analysis of data.	**Number**: 186 firms. **Type**: firms participating in the TIA standards setting process for wireless telecommunica-tions. **When**: 1991 – 2000.	United States of America.	Employing people with high levels of social capital increases the organisation's social capital, which increases its influence. This effect is mitigated if multiple people maintain an inter-firm relationship. Organisations do not necessarily experience a loss when an employee with social capital leaves the organisation. Redundancy and strategic change moderated the negative effect of losing employees on an organisation's social capital, but this effect did not carry through consistently on influence.	Organisational culture; organisational networks; social capital.	New employees can carry social capital, in addition to human capital, as they move across boundaries of an organisation. Organisations can use hiring people as a shortcut to increase their social capital, which can increase the organisation's influence.
du Toit and Quayle (2011)	**Study design**: exploratory study. **Focus:** the effect of contact with other races on racial prejudice. **Method**: online questionnaire. **Analytic approach:** analysis of questionnaires.	**Number**: 74. **Type**: South Africans. **When**: ~2009.	South Africa.	General contact, direct contact and extended contact with people of other races significantly reduced prejudice. Direct contact (personally knowing a member of a multi-racial family) was more effective at reducing prejudice than general contact.	Contact theory; intergroup relations.	Increased contact between members of different groups can improve intergroup attitudes. Moreover knowing an in-group member has close ties with an out-group member can promote more positive intergroup attitudes.
Efferson et al (2008)	**Study design**: experimental, participants solving a coordination problem. **Focus:** players' preferences in coordination games. **Method**: observations of two coordination games. **Analytic approach:** laboratory-based experiments; social science mixed methods.	**Number**: 100 people. **Type**: **When**: ~2006.	Switzerland.	In an evolutionary setting, in-group favouritism significantly related to cultural groups, not trivial groups. The evolution of favouritism displays cultural selective pressures.	Evolutionary social science; game theory.	Culture is a predictor of the creation of social spaces, which leads to in-group favouritism.
Ellis et al (2005)	**Study design**: experimental, participants engaged in	**Number**: 65 four-person action teams	United States of America.	Task-and-team generic training had a positive impact on participants'	Social cognitive perspective.	Appropriate teamwork training is effective in

	simulation games. **Focus:** action teams. **Method**: observation; multiple choice exam. **Analytic approach:** laboratory games; social science mixed methods.	(34 control and 31 trained). **Type**: university students enrolled in an introductory management course. **When**: ~2002.		declarative knowledge, which led to the development of important skills such as teamwork competencies, planning, collaborative problem solving and communication skills. Key team members' knowledge is of particular significance for team effectiveness.		bridging gaps within a group, which leads to improved performance by that group.
Farina (2010)	**Study design**: exploratory study. **Focus:** network position and specialisation of actors. **Method**: data on all syndicates formed by actors. **Analytic approach:** analysis of data.	**Number**: 279 underwriting syndicates; 186 observations. **Type**: syndicates formed by actors in the investment banking industry. **When**: 2003 – 2005.	Europe.	Individuals occupying a central position in their network enhance their organisation's performance. The benefits of a central position are diminished by occupational specialisation.	Information networks; strategic management.	The effect of occupying a particular position in a network on performance is dependent on the characteristics of the organisation. It is essential for managers to assess an organisation's ability to acquire external information and knowledge in order to make changes based on organisation alliance portfolios.
Farshchi and Brown (2011)	**Study design**: case study. **Focus:** knowledge and communication links among team members in the construction industry. **Method**: online questionnaire. **Analytic approach:** social network analysis.	**Number**: 17 team members. **Type**: project team of a planning and engineering consultancy. **When**: ~2009.	United Kingdom; United States of America; Canada; Middle East; Australia and Asia.	An isolated failure in part of a team's network had a major impact on the project they worked on. The failure was caused in part by a lack of collaboration across disciplines. Social network analysis provided practical benefits for knowledge transfer among team members.	Social network theory; knowledge management.	Multi-disciplinary projects are vulnerable. A failure occurring in one sub-network can jeopardise the entire project. A mechanism to address mid-project failure in social networks needs to be devised. Trust and strong relationships often don't have time to develop due to the nature of project teams. Relationships are created, staff move on and new relationship must be formed.
Fayard and Weeks (2007)	**Study design**: qualitative field study. **Focus:** staff interactions in the photocopier room	**Number**: numerous participants and 16 interviewees.	France.	Photocopier rooms afford opportunities to interact informally. Social elements of privacy and proximity and social designation need to	Organisational culture; theory of affordances.	Informal interactions in the workplace create opportunities to strengthen weak

	in three companies. **Method**: observations; video tape analysis; in-situ interviews. **Analytic approach:** ethnography.	**Type**: employees in a research centre, commercial publishing house and business school organisations. **When**: ~2004.		be considered in studies of informal interaction.		ties, bridge gaps in networks, and offer a creative space for the generation of new ideas.
Gächter et al (2008)	**Study design**: experimental. **Focus:** participants in public goods games earning credits for performance. **Method**: two time-period public goods experiments. **Analytic approach:** laboratory social science.	**Number**: 207 people divided into groups of three. **Type**: **When**: ~2006.	United Kingdom	Punishment increases cooperation and thus individuals and groups are better off overall. In the 50-period experiments, the average net earnings were significantly higher in the majority of punishment groups than no punishment groups. The opposite was true for the 10-period experiments. The costs of punishment reduce over the longer term.	Evolutionary social science.	Costly punishment in a newly formed group increases in-group cooperation and groups are better off overall. Punishment is rarely needed once cooperation has been established.
Green et al (2005)	**Study design**: ethnographic study. **Focus:** Infocities project – information and communications technologies in the public sector. **Method**: observations of project participants, attending planning meetings and workshops. **Analytic approach:** social science mixed methods.	**Number**: seven cities; one co-ordinator for each city. **Type**: European public sector; city councils and governments. **When**: 1998 to 2000.	Seven European cities; largely based in Manchester, United Kingdom.	The European Union projects used information and communications technologies for political place making. The city councils and governments felt a sense of urgency to establish the projects and the difficulties the organisers perceived emerged from a tension between imagined networks and imagined communities. Participant's views of the networks they were in were idealised.	Network theory; place-making perspective.	Networking initiatives that overlook gaps, boundaries and disconnections often lead to deficient networks.
Håkan-son et al (2011)	**Study design**: exploratory case study. **Focus:** knowledge intermediation and core intermediation competences in an innovation intermediary company. **Method**: semi-structured interviews. **Analytic approach:** triangulation of case study data.	**Number**: not specified. **Type**: senior management, authors. **When**: 2007 – 2009.	Australia.	Three sets of underlying intermediation capabilities are evident: network spanning capability, organisational memory, and credibility and skills as a mediator.	Innovation intermediation; knowledge intermediation; social network theory.	Successful knowledge brokerage requires spanning network boundaries, skills and positive reputation as a mediator, and efficient organisational knowledge management systems.

Hamzah (2010)	**Study design**: multiple case studies. **Focus:** the importance of social capital dimensions in facilitating the development of intellectual capital. **Method**: open interviews. **Analytic approach:** within-case and cross-case triangulated analysis.	**Number**: 35 engineers from three companies. **Type**: ICT companies. **When**: ~2008.	Malaysia.	Structural capital is the most important dimension for intellectual capital development. Structural and relational capital facilitate knowledge sharing and as a consequence, intellectual capital development.	Social capital; structural capital; knowledge sharing.	Structural, relational and cognitive capital all have a significant impact on the development of intellectual capital. Engineering organisations need to structure employees suitably to enhance relationship development.
Hatala and Lutta (2009)	**Study design**: before and after study. **Focus:** individual and group knowledge sharing. **Method**: pre-questionnaire, suggested interventions, post-questionnaire. **Analytic approach:** social network analysis.	**Number**: 70 employees in three locations for the pre-test, 78 employees in three locations for the post-test. **Type**: mid-size engineering consulting company. **When**: ~2007.	Canada; Ontario.	Information sharing is essential for organisations to maintain a competitive advantage and to increase profits. This paper proposed an information sharing model that can help organisations map their existing patterns of knowledge sharing. The pre-test outlined the social support mechanisms that could increase knowledge sharing. The organisation did not implement every recommended intervention, consequently the impact on information sharing was minimal.	Organisational structure; knowledge sharing.	Organisations should explicitly determine employees' networks and connectivity. This enables the organisation to monitor relationships to increase collaboration, information exchange and mitigate the potential loss of connections caused by a staff member leaving the organisation.
Hawass (2010)	**Study design**: survey. **Focus:** the determinants of reconfiguration capability. **Method**: questionnaire. **Analytic approach:** analysis of questionnaires.	**Number**: 83. **Type**: managing directors of British software firms. **When**: ~2007.	United Kingdom.	Reconfiguration capability is combining knowledge to create new products. A firm's successful reconfiguration capability is dependent on its ability to continuously develop and maintain technological alliances, close ties with suppliers, customers and rivals.	Knowledge management; resource management; knowledge sharing.	Effective reconfiguration capability is dependent on a collective learning approach that encourages employees to integrate their knowledge and experiences.
Hennala et al (2011)	**Study design**: survey. **Focus:** pilot study targeting the idea generation phase of the innovation process. **Method**: idea generation forum; online questionnaire. **Analytic approach:**	**Number**: 28. **Type**: potential customers of the organisation. **When**: 2007.	Finland.	The authors introduce an open innovation model. The model involves four elements: the openness and diversity of the idea generation network, the brokering of the process, the virtual nature of the environment, and using elements to increase the amount and quality of the ideas. Open innovation requires external actors to	Structural holes; innovation; network theory.	It is valuable to include external knowledge early in the innovation process, particularly from potential users of the innovation.

	constructive research approach.			play a more significant role in an organisation's innovation process.		
Henrich et al (2006)	**Study design**: experimental; ultimatum and punishment games. **Focus:** adults from 15 populations. **Method**: three field experiments. **Analytic approach:** experimental; game theory data.	**Number**: 1762 adults from 15 populations. **Type**: adults from diverse populations. **When**: ~2004.	15 populations across five continents.	All populations are prepared to deliver costly punishment as unequal behaviour increases, but the extent of this punishment varies significantly. Costly punishment is positively related to altruistic behaviour.	Evolutionary social science.	Costly punishment is evident across a range of populations, but the extent of this punishment varies significantly between groups.
Herr-mann et al (2008)	**Study design**: experimental, the public goods game, with and without punishment. **Focus:** university students. **Method**: public goods game experiments; post experimental questionnaire. **Analytic approach:** cross-societal analysis.	**Number**: 16 participant pools totalling 1120 university undergraduates. **Type**: university students. **When**: ~2005.	Participants from 16 cities; Boston, Melbourne, Nottingham, St Gallen, Chengdu, Zurich, Bonn, Copenhagen, Dnipropetrovsk, Seoul, Istanbul, Minsk, Samara, Riyadh, Athens, Muscat.	All groups demonstrated anti social punishment of co-operators, but the magnitude of the punishment varied substantially. The more prevalent antisocial punishment was in a group, the lower the levels of cooperation.	Evolutionary social science.	The nature and extent of antisocial punishment between cultural groups varies significantly.
Hirst and Vade-boncoeur (2006)	**Study design**: multiple case studies. **Study 1** **Focus:** case study of a Language Other Than English Year 7 class. **Method**: interviews with teachers; video and audio tapes. **Analytic approach:** case study analysis. **Study 2** **Focus:** reengagement programs. **Method:** formal and informal interviews; spatial mapping. **Analytic approach:** case study analysis.	**Study 1** **Number**: LOTE class and their Indonesian teacher. **Type**: Year 7 students and their Indonesian teacher. **When**: ~2003 **Study 2** **Number**: 6 reengagement programs; interviews conducted with 64 young people, 8 outreach workers, 6 program leaders, 14 program	**Study 1** Australia; upper primary school in low socioeconomic regional area of northern Australia. **Study 2** Australia; Queensland.	Power structure authorised the construction of racial spaces in the classroom. The students positioned the teacher as the Other. Positive reengagement occurred when the social space of the school was reconstructed, instead of focusing on processes that displaced teachers and students.	New managerialism; social spaces.	Examining the space between two groups affords the opportunity to develop effective ways to bridge the gap.

		representatives. **Type**: young people, outreach workers, program leaders and representatives. **When**: ~2003				
Ho et al (2006)	**Study design**: social science mixed methods. **Focus:** friendship and advice networks of staff in a research unit. **Method**: in-depth interviews; questionnaire. **Analytic approach:** social science mixed methods.	**Number**: 55 employees. Interviews conducted with top management and key personnel. Survey was administered to all employees with an 84% response rate. **Type**: management team; research scientists; technical and support staff. **When**: ~2003.	China; 17-month-old research unit of a larger firm.	People well placed in a network hold that their employer is obligated to them. Boundary spanning activities conducted in the advice network was positively related to an employee's perception of the balanced and transactional obligations of the organisation. A cohesive network in the friendship network was positively related to an employee's belief of the organisation's balanced and transactional obligations. Employees did not believe their employer had relational obligations.	Social network theory.	Employees engaged in boundary-spanning activities in informal social interactions in the workplace believe that their employer has more obligations to them than do employees who do not engage in boundary-spanning activities.
Janicik and Larrick (2005)	**Study 1** **Study design**: social science mixed methods. **Focus:** students' knowledge of missing relations. **Method**: ego-centred network questionnaire; network learning task. **Analytic approach:** analysis of data. **Study 2** **Study design**: survey. **Focus:** students' knowledge of missing relations. **Method**: questionnaire; network learning conducted 8 weeks after	**Study 1** **Number**: 40 students. **Type**: Master of Business Administration students. **When**: ~2003. **Study 2** **Number**: 24 students. **Type**: Master of Business Administration students. **When**: ~2003. **Study 3** **Number**: 80	United States of America; business school.	Some people are good at learning about their incomplete networks. Students learned geographical relationships more quickly than social networks. Participants who declared a high number of missing relations in a previous social network recalled incomplete social networks more readily than participants who reported a low number of missing relations. Incomplete networks have implications for information, knowledge and resource exchange. A person with the ability to identify missing relations can position themselves as a network broker or can use their knowledge to make decisions for their organisation.	Social psychology of network learning; social network theory.	A person's ability to recall networks with a high number of structural holes can increase their social capital and reputational power.

	the questionnaire. **Analytic approach:** data analysis. **Study 3** **Study design**: social science mixed methods. **Focus:** students' knowledge of missing relations. **Method**: questionnaire; social network or geographic network learning task. **Analytic approach:** data analysis. **Study 4** **Study design**: social science mixed methods. **Focus:** students' knowledge of missing relations. **Method**: two network learning tasks; two questionnaires. **Analytic approach:** analysis of data. **Study 5** **Study design**: social science mixed methods. **Focus:** students' knowledge of missing relations. **Method**: social network questionnaire **Analytic approach:** analysis of data.	students. **Type**: Master of Business Administration students. **When**: ~2003. **Study 4** **Number**: 60 students. **Type**: undergraduate students. **When**: ~2003. **Study 5** **Number**: 40 students. **Type**: Master of Business Administration students. **When**: ~2003.				
Jiggins et al (2007)	**Study design**: case study. **Focus:** case studies of post-crisis responses in the water sector in three ongoing projects. **Method**: documentary	**Number**: three on-going projects. **Type**: farmers; organisational partners; Dutch water	The Netherlands.	Conflict and differing views between management and stakeholders on water resources resulted in them exploring different forms of organisation and governance. Knowledge management was recognised as a key activity for transformational change.	Organisational crisis and renewal.	It is important for networks that form out of necessity to establish shared meaning in order to operate effectively.

	analysis; interviews; focus groups; participant observation; consultancy and expert advisory work; interactive events. **Analytic approach:** observation analysis using the Hurst cycle.	management. **When**: 2000 to 2004.				
Johnston et al (2010)	**Study design**: multiple case studies. **Focus:** the role of higher education institutions (HEI) in industry and how knowledge is transferred across boundaries. **Method**: semi-structured interviews. **Analytic approach:** case study analysis.	**Number**: 35 interviews. **Type**: academic and non-academic decision makers involved in HEI-industry relations. **When**: 2007 – 2009.	United Kingdom.	There are seven social processes that impact on HEI-industry knowledge transfer and exchange practice: the importance of network intermediaries; flexibility and connectivity of network structures; encouragement of network participation; establishing trust through shared understanding; active network learning; strengthening cooperation through capacity building; and culture change.	Knowledge transfer; innovation.	In order for knowledge transfer and exchange activities to be effective, policymakers must carefully consider the social processes that affect collaborative innovation and work practices. Social processes are often highly complex and elusive.
Kenny and Fahy (2011)	**Study design**: survey. **Focus:** the relationship between network resources and international performance of enterprises. **Method**: questionnaire. **Analytic approach:** statistical analysis.	**Number**: 154 firms. **Type**: high tech small- to medium-sized enterprises in the telecommuni-cations and internet services. **When**: ~2008.	Ireland.	Network human capital resources are positively related to a firm's international performance. Network resource combinations and international performance are not significantly related.	Network theory; resource-based view.	A network's resources may be as important as the structure of a network. It is critical to identify and review the resources that are essential to international performance.
Khoja and Maran-ville (2009)	**Study design**: survey. **Focus:** intra-firm networks. **Method**: questionnaire. **Analytic approach:** statistical analysis.	**Number**: 75 managers. **Type**: managers from 55 companies in 23 different industries. **When**: ~2007.	United States of America.	Strong intra-firm networks facilitate the accrual of a business's intellectual capital. Units connected by reciprocity and cohesion facilitates tacit knowledge transfer.	Social network theory; knowledge sharing.	Intra-firm networks' relational characteristics allow organisational units to exchange and combine tacit knowledge and knowing capabilities.
Kira and Frieling (2007)	**Study design**: international comparative case study. **Focus:** case studies of two Finnish packaging companies.	**Number**: 45 employees; 11 general and production management representatives. **Type**: staff;	Finland; two companies operating in the package-supplier sector.	Socio-technical influences in the companies resulted in greater employee autonomy, job enlargement and job enrichment – three elements supportive of individual learning. Employees participated in collective learning, however some	Individual and collective learning; workplace learning theory.	Disconnections in the workplace hinder collective learning. The gap between employees and bureaucrats can prevent employees from

	Method: observations; semi-structured interviews. **Analytic approach:** quantitative and qualitative data analysis of ethnographic and survey data.	management; machine operators. **When**: ~2004.		organisational practices had a detrimental effect on collective learning. The organisation did not provide the physical space to facilitate collective learning and collective learning opportunities initiated by employees were often not taken up by management.		fully contributing to collective learning and organisational development.
Kreijins et al (2007)	**Study design**: explorative study of students in courses; questionnaire. **Focus:** students in a distance education course. **Method**: self-reporting sociability scale questionnaire. **Analytic approach:** social science mixed methods.	**Number**: 35 students in a course with 25.7% response rate; 26 students in another course with 69.2% response rate; 93 students in a third course with a 53.8% response rate, plus questionnaires from two drop outs. **Type**: students enrolled in three distance education courses. **When**: ~2004.	The Netherlands; Open Universiteit Nederland distance education courses.	Social interaction is a key element in collaboration and learning. The Sociability Scale had high internal consistency, and therefore has the potential to be a valuable means to assess the sociability of computer-supported collaborative learning environments.	Social presence theory; social affordance theory.	In order to establish an effective social space, it is important to examine the existing network structure of an organisation.
Lakha (2005)	**Study design**: ethnographic study. **Focus:** case study of transient Indian computer professionals. **Method**: focus group meetings; in-depth interviews. **Analytic approach:** case study analysis.	**Number**: Over 50 Indian employees in the company; 24 people participated in the focus groups; interviews with 6 team supervisors and one liaison officer. **Type**: senior managers; Indian computer professionals. **When**: 2003 – 2004.	Australia; Melbourne.	Managers and employees had significantly different views on communication, largely due to the different organisational cultures in Australia and India. Employees saw the transnational workplace as an opportunity for professional development. If an employee felt his or her career was developing, they experienced greater workplace satisfaction than those who did not experience professional development. Employment instability was of concern to some employees. Co-workers often socialised both inside and outside of work.	Transnational social spaces; organisational culture.	Transnational social spaces do not constitute the breaking down of national and social boundaries. More needs to be done to bridge these divides.
Lavie and Drori (2012)	**Study design**: triangulated qualitative study.	**Number**: 268 questionnaires. **Type**: university	Israel.	No relationship exists between knowledge creating and application. Internal collaboration promotes	Knowledge management; resource-based view;	Collaboration facilitates knowledge creation and

	Focus: the effect of collaboration and internal resources on knowledge and innovation in university research programs. **Method**: questionnaire; interviews; archival data. **Analytic approach:** triangulated qualitative analysis.	scientists involved in nanotechnology research programs. **When**: 2007 – 2008.		knowledge creation, while external collaboration with industry partners promotes knowledge application. Internal resources can complement or substitute for collaboration dependent on the degree of collaboration.	collaboration; innovation.	application only up to a point. Excessive collaboration produces challenges and conflicts, which can hinder the collaboration process. Collaboration's impact on knowledge creation and application is determined by the availability of internal resources.
Levin et al (2011)	**Study design**: survey. **Focus:** dormant social ties. **Method**: two questionnaires. **Analytic approach:** social network analysis.	**Number**: 129. **Type**: executive MBA students. **When**: ~2007.	United States of America; Canada.	Reconnecting with dormant ties leads to all the benefits typically associated with weak and strong ties i.e. efficiency, novelty, trust and shared perspective.	Social network theory; knowledge transfer; social capital.	Former social ties can be a valuable source of knowledge and social capital.
Liefner and Henne-mann (2011)	**Study design**: qualitative study. **Focus:** spatial configurations of knowledge networks. **Method**: co-authorship data, network maps construction. **Analytic approach:** analysis of data.	**Number**: 16,156 articles, 3,134 nodes connected by 25,293 edges. **Type**: optical technology (OT) knowledge networks. **When**: 2005 – 2007.	People's Republic of China.	The Chinese OT knowledge network develops around national actors. This demonstrates that no individual foreign actor holds a dominant position in the network, rather than a lack of international connectivity.	Knowledge sharing; network theory; spatial configurations.	The interrelations between agglomeration and network positions is relevant in knowledge networks and may also apply to different kinds of socioeconomic actors. These interrelations may vary over time depending on the nature of the network and spatial concentration.
Lin et al (2011)	**Study design**: triangulated qualitative study. **Focus:** the influence of network structural embeddedness on the design of alliance governance. **Method**: secondary data collection; questionnaire;	**Number**: 208. **Type**: strategic alliances in 141 semiconductor firms. **When**: 1998 – 2002.	Taiwan.	Social, hierarchical and market networks are investigated. The degree of structural embeddedness in a network is influential. Structural embeddedness moderates concerns about transaction hazards. Market network embeddedness effects are not significant.	Structuration theory; social network theory.	Structural embeddedness moderates concerns regarding opportunistic behaviour, thus making it an effective element in an emerging economy.

	face-to-face interviews. **Analytic approach:** social science mixed methods.					
Lipponen et al (2005)	**Study design**: survey. **Focus:** shipyard subcontractor employees. **Method**: questionnaire. **Analytic approach:** questionnaire analysis.	**Number**: 201 questionnaires, with an effective response rate of 57%. **Type**: shipping yard employees. **When**: ~2003.	Finland; shipping yard.	Examined the extent to which employees identified with or were committed to their organisation. Intergroup competition, intergroup contact and perceived discrimination were not significant predictors of identification profiles. Perceived group prestige was the most significant predictor of identification, but subgroup contact and size were also important predictors.	Social identity; organisational commitment.	Gaps between groups of employees do not predict the extent to which employees identify with their organisation.
Loh et al (2010)	**Study design**: survey. **Focus:** the role of culture in the relationships between boundary permeability, cooperation and work group identification. **Method**: questionnaire. **Analytic approach:** analysis of questionnaire responses.	**Number**: 134 employees. **Type**: 87 Singaporeans, 47 Australians working in multinational organisations. **When**: ~2008.	Australia and Singapore.	Culture moderated the relationships between boundary permeability, cooperation and work group identification. Boundary permeability was slightly positively related to cooperation but not to work group identification. Singaporeans formed groups with less permeable boundaries than Australians.	Social identity; cross-cultural theories.	Groups with permeable boundaries have higher levels of cooperation. Culture plays an important role in the relationships between boundary permeability, cooperation and work group identification.
Lomi and Pattison (2006)	**Study design**: survey. **Focus:** individual dyads of inter-organisational networks. **Method**: questionnaire. **Analytic approach:** questionnaire analysis.	**Number**: 106 organisations; 46,498 employees. **Type**: 11 core organisations and 95 unique first tier organisations in the automobile manufacturing industry; producers and suppliers. **When**: 1995.	Southern Italy.	Various forces are at work in the formation and continuation of networks. There was a lack of independence between organisational dyads. Network ties are formed through both natural and formal processes.	Organisational networks.	Inter-organisational network connections can form naturally as well as by external means.
Lupina-Wegener et al (2011)	**Study design**: case study. **Focus:** merger of two pharmaceutical organisations. **Method**: semi-structured	**Number**: 38 interviews; 890 questionnaire responses. **Type**: executives, managers,	Mexico.	Sub-group members largely had a shared identity of the new organisation. The fear that organisation's could lose their pre-merger identity were not realised. The sub-groups were able to sustain their identities, realise the	Social identity theory.	Shared identity can develop successfully when two or more organisations merge, despite different perceptions of the

	interviews, questionnaire. **Analytic approach:** social science mixed methods.	support staff and medical representatives in the pharmaceutical organisations. **When**: 2008 – 2009.		value of each group and had access to resources.		integration process. The development of a deep-structure identification where the new identity becomes incorporated in employees' identities can facilitate a successful shared identity. Contradictory perceptions may represent a natural stage of building a shared identity.
McGrath et al (2006)	**Study design**: survey of staff. **Focus:** advice relationships of executives at 20 entrepreneurial software companies. **Method**: questionnaire; open-ended interviews. **Analytic approach:** analysis of attitudinal data.	**Number**: 36 companies met inclusion criteria; 20 executives agreed to be interviewed; 17 provided detailed responses. **Type**: executives of small software companies; most were founders of their companies. **When**: ~2004.	United States of America; Greater Pittsburgh, Pennsylvania.	People who shared information with diverse contacts were viewed as being more innovative. Two-thirds of advice relationships were reciprocal. Mutual trust is vital for successful relationships. Executives with a high number of structural holes were perceived as significantly more innovative than executives with few structural holes.	Economic exchange perspective; social perspective.	People who perform a boundary-spanning role are perceived as being more innovative than people who are in dense networks.
Meer-warth et al (2005)	**Study design**: organisational culture study. **Focus:** General Motors partnership rules. **Method**: interviews; feedback sessions. **Analytic approach:** content analysis of coded unwritten rules.	**Number**: 33 interviews were conducted. **Type**: managers and technical experts from the Alcan-GM and BP-GM partnerships. **When**: 2001.	United States of America; General Motors in Warren, Michigan; Alcan in Farmington Hills, Michigan and Kingston, Ontario; BP in Naperville, Illinois.	All participants made rules, but did not realise partnership rules existed until informed by researchers. Rules highlighted the similarities and differences in partnership focus and showed how companies viewed partnerships. BP-GM had a similar view of partnership, whereas there was more variation between Alcan-GM views of partnership.	Organisational culture.	Examining the gaps between organisational partnerships reveals both participants' understanding of how partnerships should work, and their lack of recognition of unwritten rules.
Mehra et al (2006)	**Study design**: employee survey. **Focus:** leaders' internal and external social ties. **Method**: exploratory	**Number**: 88 group leaders, with a 92% response rate; 10 high-ranking supervisors. 336 sales	United States of America.	The number of social ties a group leader had among peers and in their own group positively related to that leader's group's performance. The number of social ties a group leader	Social network theory.	The centrality of a group leader has implications for the performance of their group and their reputation as a leader.

	interviews; questionnaire. **Analytic approach:** data analysis of questionnaires, interview texts.	representatives participated in the sociometric questionnaire. **Type**: Group leaders, high ranking supervisors and sales representatives at a financial company. **When**: ~2003.		had among peers and their own group positively related to their reputation among peers and subordinates respectively. A leader's social ties to supervisors negatively related to that leader's reputation among subordinates.		
Michael and Massey (1997)	**Study design**: survey of staff. **Focus:** self-reported communication networks of staff. **Method**: questionnaire. **Analytic approach:** social network analysis.	**Number**: 36 employees. **Type**: Sawmill employees. **When**: ~1995.	United Sates of America.	Effective communication in the sawmill was essential to its performance. It is imperative to identify employees that have high centrality in the organisation, as they are the key to effective communication and knowledge flow.	Social network theory.	Identifying employees who link internally is essential for the efficient and effective flow of communication and knowledge in the workplace.
Mih-hailova (2009)	**Study design**: case study. **Focus:** two service sector companies. **Method**: structured and semi-structured individual and group interviews. **Analytic approach:** case study analysis.	**Number**: 58 employees (36 from Company B; 22 from Company A). **Type**: administrative personnel; sales managers; technical managers; specialists. **When**: 2007.	Company A has headquarters in Estonia, with branches in Latvia and Lithuania. Company B has headquarters in Russia and operates in Ukraine, Belarus, Azerbaijan, Mongolia and Uzbekistan.	National culture differences are not significantly important to workers' satisfaction levels with virtual work. On a seven-point scale, the average Estonian satisfaction level with virtual work arrangements was 3.8, and the Russians was similar at 3.5. Occupational culture is a better predictor than national culture of employee virtual work satisfaction.	National and occupational culture.	Cultural gaps are not predictors of employee satisfaction with virtual work.
Mih-hailova (2007)	**Study design**: survey. **Focus:** companies' use of information and communication technology (ICT) in the Estonian service sector. **Method**: questionnaire. **Analytic approach:** analysis of attitudinal data.	**Number**: 226 Estonian service sector organisations (2207 respondents). **Type**: many respondents were managers. Respondents worked in 12 different types of service organisations including sales/marketing, accommodation	Estonia.	Less than 5% of the Estonian service sector's workforce were involved in virtual teamwork or have flexible working conditions. Overall, people were satisfied with ICT usability, but this could be increased with more flexible work conditions. Employees would prefer to choose the time of their work over the place of their work. Employees used MSN, forums and videoconferencing significantly less than face-to-face communication. Face-to-face communication	Occupational culture.	ICT is an effective tool for connecting virtual teams, but employees prefer face-to-face communication.

		/food and governmental institutions. **When**: 2006.		was the preferred method of communication and brought the highest level of satisfaction, followed by phone and email communication.		
Mortati and Cruick-shank (2012)	**Study design**: field activity. **Focus:** entrepreneurs' social networks. **Method**: application of NETS (tool introduced in this paper); interviews; questionnaires. **Analytic approach:** analysis of data.	**Number**: 22 firms. **Type**: High-tech, small to medium enterprises (SMEs). **When**: ~2009.	United Kingdom.	NETS is the design unit represented by the minimum and necessary individuals in a network utilised by a firm to achieve a certain goal. Entrepreneurs utilise the most beneficial nodes in their network to solve a problem. The paper introduces a design-inspired tool that assists the exploration of a wide variety of relationships to develop an innovation strategy.	Social network theory; organisation innovation.	Design could facilitate the bridging of the gap between academic research and everyday practice. A design-inspired tool can foster intra- and inter-firm innovation and transformation.
Moynihan and Pandey (2007)	**Study design**: survey. **Focus:** employees' turnover intentions. **Method**: self-administered questionnaire. **Analytic approach:** various statistical techniques applied to questionnaire data.	**Number**: 12 organisations from the same labour market. The total sample size was 531 and 326 responded; an average of 27 respondents per organisation. **Type**: Five private non-profit organisations; seven public organisations. 10 were human services organisations. **When**: 2005.	United States of America.	People who feel they fit in are more likely to stay. Employees' sense of co-worker obligation is significantly negatively related to turnover intention (63% of workers rating themselves at the maximum end of co-worker obligation never sought job opportunities at the time, compared with 28% of workers who responded at the mean). The more person-organisation (P-O) congruence, the less likely that worker will consider leaving the organisation in the long-term. P-O congruence was more significant in the long-term than the short-term.	Social network perspective.	If an employee has a strong social network within their organisation, they are more likely to stay with the company.
Ng and Chow (2009)	**Study design**: survey. **Focus:** the impact of demographic, organisational and attitudinal factors on females' instrumental networks. **Method**: questionnaire. **Analytic approach:** analysis of questionnaire data.	**Number**: 91 staff. **Type**: managers from various service industries. **When**: ~2007.	Hong Kong.	Married women are more likely than single women to have a cross-gender instrumental network. Women who believe women possess leadership qualities are less likely to network with men. Women are also less likely to network with men when there are more women in top management positions in an organisation. A cross-gender network reduces a woman's turnover intention.	Organisational networks; gender studies.	In organisations where leadership positions are male-dominated, instead of breaking the existing network, organisations should aim to promote qualified women to top management level, providing subordinate women with an alternative source for their

						instrumental network.
Nickels and Verma (2008)	**Study design**: international comparative attitudinal research. **Focus:** Canadian, Indian and Japanese police officers. **Method**: questionnaire; interviews. **Analytic approach:** exploratory factor analysis.	**Number**: 500 questionnaires distributed in Canada, with 384 responses. 850 questionnaires distributed in Japan, with 630 responses. 1300 questionnaires distributed in India with 957 responses. **Type**: police officers. **When**: ~2004.	Canada; India; Japan.	There are universal attitude structures and some role differentiation cross-culturally.	Organisational culture.	Attitude structures across cultural boundaries have some similarities. Differences tend to occur on the 'big questions', e.g. the appropriate role and functioning of a police society and personal questions on individual motivations.
Obstfeld (2005)	**Study design**: social science mixed methods. **Focus:** employees' involved in automotive design. **Method**: survey; ethnographic observations; self-reports; interviews. **Analytic approach:** triangulated data assessments.	**Number**: surveys administered to 440 employees, 152 responded. Interviews conducted with 26 middle managers. **Type**: engineers, designers and managers from a Detroit automotive manufacturer. **When**: ~2002.	United States of America; Detroit.	Tertius iungens activity (the introduction of a third party in a network grouping) was evident in most efforts of innovation. Social ties are significantly positively related to innovation involvement. Social knowledge, length of employment and education level are significantly positively related to employees' involvement in innovation. Technical knowledge and innovation are not significantly related.	Social network theory; structural holes theory.	Filling structural holes in an organisation has the potential to create new structural holes by changing the structure of the network.
O'Gor-man and Evers (2011)	**Study design**: triangulated case study. **Focus:** the influence of the Irish Government's seafood support agency (Bord Iascaigh Mhara (BIM)). **Method**: face-to-face interviews with industry experts; semi-structured interviews with managing directors of the firms; secondary documentation. **Analytic approach:** case study analysis,	**Number**: three firms. **Type**: the firms produce and market shellfish products internationally. **When**: 2004.	Ireland.	Export Promotion Organisation (EPO) BIM played a significant role in the internationalisation of the three firms. BIM increased the firms export capacity by contributing resources and adopted an information mediation role between the firms and their international customers.	Social network theory.	EPOs can help new and small businesses expand internationally through the provision of resources and information sharing between entrepreneurs and external network partners.

	critical incident technique.					
Oliver and Mont-gomery (2005)	**Study design**: case study. **Focus:** full transcript of 1994 meeting of the self-formed Jewish lawyers association. **Method**: network analytical methods. **Analytic approach:** content analysis.	**Number**: 87 members of the Jewish lawyers association; 29 speech-givers. **Type**: members of the self-formed Jewish lawyers association. **When**: meeting took place in December 1944, the research of the meeting took place ~ 2003.	Israel; Jerusalem.	When forming a group, it is important to set a common agenda. Successful boundary construction relates to both membership and domain boundaries. The use of Hebrew in courts was the most central topic evident in the transcript, followed by limiting membership numbers. The war and Holocaust were not central topics, highlighting the priority of boundary construction.	Boundary construction.	The successful creation of a social space relies significantly on the setting of a common agenda.
Oxley et al (2008)	**Study design**: experimental. **Focus:** adults' physiological responses to unanticipated stimuli. **Method**: survey; physiological experiments. **Analytic approach:** analysis of physiological data.	**Number**: 46 adults. **Type**: adults with strong political views. **When**: 2007.	United States of America.	There was a correlation between physiological reactions to threat and political opinions. Adults with a high interest in protecting one's group had an increase in skin conductance when presented with threatening stimuli. Adults with less interest in protecting one's group showed significantly less skin conductance. Conservatives perceived threats more than liberal, left-leaning participants.	Socialisation.	People with similar political attitudes who are interested in protecting their group have similar physiological responses to threats. Conservatives' physiological response is higher than individuals with more liberal political views.
Patel (2007)	**Study design**: ethnographic study. **Focus:** the role of culture in the viability of international alliances. **Method**: semi-structured ethnographic interviews; field studies. **Analytic approach:** triangulated qualitative analysis.	**Number**: 48 interviews. **Type**: managers in companies in 25 Indo-French alliances. **When**: 2004.	India; Indo-French alliances.	In Indo-French alliances, culture was considered by many managers to be a factor of failure, not success. Context, rather than culture, was the predictor of behaviour according to some managers. Hierarchical and competitive solidarities were interdependent. Egalitarian solidarity linked hierarchical and competitive solidarities.	Douglasian cultural theory.	Cultural differences tend to be cited as a factor of failure, not success, in international alliances. Establishing links across cultural boundaries requires the creation of hierarchical, competitive and egalitarian rules.
Peltonen (2011)	**Study design**: qualitative field study. **Focus:** architectural development and space production in a	**Number**: six interviews. **Type**: two architects and four employee-	Finland; University of Oulu.	While the designers of the university purposely built a central hallway for chance encounters, many employees noted they avoided this route in order to get to their destination more quickly, as the hallway was	Actor-network theory; spatial-social analysis.	When creating physical space, it is important to remember that it will often be interpreted differently by users of the

	university. **Method**: participant observation; interviews, architectural articles and documents. **Analytic approach:** ethnographic.	users. **When**: ~2008.		often crowded. Employees also redecorated their spaces and rearranged the furniture with the purpose of distancing the spaces from the architects' guidelines.		space over time. Architects may design a space for a particular purpose and users will adapt this to suit their needs.
Petruz-zelli et al (2010)	**Study design**: longitudinal case studies. **Focus:** collaborative R&D relationships established by three universities. **Method**: mapping of each university's knowledge-based network. **Analytic approach:** multiple case study analysis.	**Number**: three universities. **Type**: universities selected on their location and number of R&D relationships. **When**: 2000 – 2007.	United Kingdom; London.	This paper studied the capability of three universities to collect and diffuse knowledge. Strong inter-organisational ties and an explorative learning behaviour of a university positively impact a university's knowledge mobility.	Knowledge transfer, knowledge gatekeepers.	Organisations should seek new information and knowledge at a gradual pace to become more effective knowledge collectors and disseminators. Strong inter-organisational ties promote a trustworthy environment for knowledge-sharing.
Presutti et al (2011)	**Study design**: social science mixed methods. **Focus:** geographical, social and cognitive proximity's impact on knowledge acquisition between start-up firms and customers. **Method**: open interviews; data collection; face-to-face structured questionnaire. **Analytic approach:** network analysis.	**Number**: 54 small high-tech firms. **Type**: a cluster of electronic sector start-up firms. **When**: 2004 – 2005.	Italy; Rome.	Close geographical proximity reduces the probability of a start-up acquiring knowledge from the customer. A start-up is more likely to exploit knowledge acquired from a customer if the customer is not located near the start-up. High levels of social proximity between the customer and start-up increases the likelihood the start-up will acquire the customer's knowledge. A high level of trust in the customer/start-up relationship increases the chance the start-up will exploit knowledge for innovation. Strong cognitive proximity positively and significantly impacts knowledge acquisition and exploitation.	Knowledge management; strategic management; proximity.	In the case of local start-up firms, geographical proximity does not sufficiently facilitate knowledge acquisition and exploitation. Thus a start-up's knowledge method benefits from a geographically diverse network. Social and cognitive proximity positively influence a start-up's knowledge acquisition and exploitation.
Randel and Ranft (2007)	**Study design**: survey. **Focus:** the social ties of staff from financial services and consumer products firms. **Method**: questionnaire.	**Number**: surveys administered to 288 employees from 19 organisations, effective sample size of 219. **Type**: staff,	United States of America.	People are differentially motivated to be involved and have relationships with colleagues. The more job facilitation motivation and relationship motivation an employee had, the more socially included they felt in the workplace. Job facilitation motivation had a	Social network perspective; rational action perspective.	Individuals motivated to maintain workplace relationships that enhance their personal friendships and relationships that benefit their

	Analytic approach: questionnaire analysis.	managers and vice-presidents from financial services firms and consumer products firms. **When**: ~2004.		significantly stronger relation to knowledge sharing within the organisation than relationship motivation. Employees who had high job facilitation motivation and engage in knowledge sharing were more likely to have turnover intentions.		success on the job contribute to their feeling of belonging at work.
Rank and Tuschke (2010)	**Study design**: comparative case study. **Focus:** cooperation networks and perceived influence networks of managers. **Method**: face-to-face interviews. **Analytic approach:** network analysis.	**Number**: 109 executives in two multinational firms. **Type**: executives who hold a position in the top two levels of management. **When**: ~2008.	Germany.	This study examined the effects of perceived influence and friendship on cooperation between top executives. Perceived influence and friendship ties between two managers significantly increases the likelihood that these managers will collaborate with each other. If two managers who are cooperating are also friends, the importance of the partner's perceived influence reduces.	Intra-organisational networks; cooperation.	A manager that considers another manager to be influential or a friend is more likely to collaborate and share strategic resources with that manager. Managers tied for instrumental purposes face the risk of behaving opportunistically, whereas friendship ties reduce status differences and the chance of a manager not pulling their weight.
Rejeb-Khachlouf et al (2011)	**Study design**: survey. **Focus:** the influence of personal networks on the transfer of good practices between member firms of an inter-organisational network. **Method**: face-to-face questionnaire. **Analytic approach:** various statistical analyses applied to data.	**Number**: 55 individuals. **Type**: key members of small and medium enterprises belonging to export consortia. **When**: 2008.	Tunisia.	Absorptive capacity has the most important impact on access to strategic resources, followed by network size and strength of ties. Strong ties negatively impact access to resources.	Knowledge transfer; strategic perspective' social network perspective.	Good inter-firm practices are primarily transferred through an individual's absorptive capacity. Resource sharing is more common in people with broad networks, and weak ties are important in the development of an individual's absorptive capacity.
Reitman (2006)	**Study design**: in depth open-ended interviews. **Focus:** white, African-American and Asian software employees. **Method**: open-ended interviews; document analysis.	**Number**: 30 male employees. **Type**: white, African-American and Asian software industry employees.	United States of America; Seattle.	White employees' desired racial invisibility in order to cleanse racial politics from the workplace. Thus a "whitewashing" of the workplace was evident.	Critical white studies; feminist geography; antiracist studies.	Racial space in the workplace is ignored in favour of racial invisibility.

	Analytic approach: grounded theory narrative coding.	**When**: 2002 to 2003.				
Rhodes et al (2008)	**Study design**: survey. **Focus:** organisational knowledge transfer of research and development firms that participated in the Technology Research Development Program. **Method**: questionnaire. **Analytic approach:** analysis of quantitative survey results.	**Number**: 111 respondents from 651 firms. **Type**: senior management – Chief Executive Officer; Chief Financial Officer; Chief Operating Officer from the register of the Industrial Technological Research Institute. **When**: ~2005.	Taiwan; organisations that participated in the Technology Research Development Program initiated by the Industrial Technology Institute.	This paper examined how learning related to organisational performance. Learning intention and absorption capability of organisational learning had the greatest positive effect on knowledge transfer. Six elements of social capital (core knowledge, network connection, relationship strength, relation quality, shared values and common norms) should be considered as separate entities as they had different effects on knowledge transfer.	Organisational learning; knowledge transfer; social capital.	An employee's centrality is not as important as the organisation's learning processes for effective and efficient knowledge sharing.
Rose-Andersse n and Allen (2008)	**Study design**: action research. **Focus:** case study of staff communication at an engineering consultancy. **Method**: questionnaire; open-ended interviews. **Analytic approach:** quantitative and qualitative analysis of data.	**Number**: 25 employees. **Type**: staff at a Norwegian engineering firm. **When**: ~2005.	Norway.	The organisational change process was complex and the dynamics of employee relationships regularly changed. Collaboration is enhanced by including all employees in the development of communication strategies.	Complex systems thinking; cultural-historical activity theory; intercultural communication.	Increasing collaboration between groups via inclusion mechanisms and establishing a common agenda is vital for the success of organisational change and development.
Santos et al (2008)	**Study design**: experimental simulation. **Focus:** simulations in laboratory games. **Method**: administration of the public goods game. **Analytic approach:** laboratory findings.	**Number**: 100 in silico simulations. **Type**: simulation. **When**: ~2007.	In silico simulation.	Social diversity introduced into a game produces collaboration, despite pressures to compete.	Evolutionary game theory; social network theory.	Diverse social spaces increase within-group collaboration.
Schleimer and Riege (2009)	**Study design**: embedded case study. **Focus:** knowledge transfer between identical but globally dispersed units of an organisation.	**Number**: 24 managers in six events and exhibitions units. **Type**: senior and middle managers in	Australia, China, France, Germany, Singapore, United Kingdom.	Managers identified five elements that are most influential for intra-unit and inter-unit knowledge transfers. These are the strength of networks, the formality of networks, absorptive capacity, learning adaptiveness and communication channels.	Social network perspective; production innovation.	Knowledge applicability has a more significant impact than strength of ties on the knowledge seeking and transferring behaviours of identical but

	Method: information interviews with experts, semi-structured interviews. **Analytic approach:** social science mixed methods.	events and exhibitions units in BMW. **When**: ~2007.				globally dispersed units. A combination of strong and weak ties promotes effective knowledge transfer across borders.
Shantz et al (2011)	**Study design**: case study. **Focus:** job-search methods used by male and female engineers as a cause of gender segregation. **Method**: archival data collected from the organisation's Senior Engineering Technician applicant data catalogue. **Analytic approach:** statistical analysis.	**Number**: 100 applicants' data. **Type**: data of 18 female and 82 male applicants for the role of a senior technical engineer. **When**: ~2009.	United Kingdom.	Women have less social capital than men in the male-dominated profession of engineering. Men were significantly more likely than women to be offered a position as a senior engineer. One reason for this is that women did not network with boundary spanners as a key means of searching for a job. Word of mouth was the most frequent job-search method used (35%), followed by internet sites (22%), recruitment agencies (22%) and other (21%).	Gender studies; social capital theory; network theory.	Networking with people is more beneficial for job seekers than relying on non-human resources such as newspapers or internet sites for job related information. As women tend to network with women, and men with men, women are less likely to be offered a job in male-dominated professions.
Sherif et al (2012)	**Study design**: qualitative study. **Focus:** researchers' social networks, specifically the capacity of electronic open networks and closed interpersonal networks on social capital and knowledge. **Method**: semi-structured interviews. **Analytic approach:** social science mixed methods.	**Number**: 27 researchers **Type**: researchers from management information systems and marketing fields, from ten different institutions. **When**: ~2010.	United States of America.	Electronic networks have a significantly higher impact on structural and cognitive social capital and a less than moderate impact on relational capital. Multiple aspects of functional roles is a significant factor in allowing electronic communication to accumulate social capital and to facilitate the transfer of explicit knowledge among network ties.	Knowledge transfer; social network theory; social influence.	Engaging with community services is a key way to establish relationships and build social capital. An individual is more likely to build social capital once they have proved their competency in different areas, and are more likely to exploit it to build absorptive capacity.
Sherman and Keller (2011)	**Study design**: case study. **Focus:** inter-unit task interdependence. **Method**: structured interviews; questionnaire. **Analytic approach:** case study analysis.	**Number**: 20 branches with an average of 16.35 employees in each unit; 327 questionnaires administered (92% response rate). **Type**: Department of Defence responsible for	United States of America.	Managerial perceptual error in the assessment of inter-unit task interdependence led to deviations of the predicted modes of integration. These deviations occurred in around one third of cases and negatively affect coordination performance.	Organisational integration.	It is important to distinguish between structure and process to avoid errors of perception. Management education and development, as well as diagramming business processes will reduce the likelihood of

		global logistics support. **When**: ~2009.				errors.
Singh (2005)	**Study design**: social science mixed methods. **Focus:** patent citation data. **Method**: document analysis. **Analytic approach:** social science mixed methods assessments.	**Number**: 323,820 actual citations; 2,217,171 control citations. **Type**: patent citation data. **When**: ~2002.	Patents based in the United States of America.	Knowledge sharing was significantly higher within an organisation or region as compared to between organisations or regions. The existence of interpersonal ties significantly increases the likelihood of knowledge sharing.	Unified network framework; knowledge sharing.	Gaps between organisations or geographic locations indicate a lack of knowledge sharing, compared to intra-organisation knowledge sharing.
Smed-lund (2010)	**Study design**: case study. **Focus:** network structures of knowledge flow within teams. **Method**: online questionnaire. **Analytic approach:** social network analysis.	**Number**: 10 employees. **Type**: directors, managers, secretaries and specialists of real estate investments in an insurance company. **When**: 2006.	Northern Europe.	Network structures of knowledge flow differ for different tasks. This case study found evidence for the theory that there are ideal network structures according to the type of task at hand. A hierarchical structure is the best network structure for routine tasks, core-peripheral for development tasks, and ego-centric for idea generation tasks.	Knowledge management; knowledge transfer; organisational structure; networks.	There is no ideal knowledge structure for a team. The structure will determine how well a team's innovation and performance of routine tasks. A team has multiple knowledge network structures. These vary according to the type of task teams are working on. When mapping or reviewing knowledge network structures, it is important to consider all structures.
Su et al (2009)	**Study design**: case study. **Focus:** supplier-distributor relationships in a Chinese channel context. **Method**: face-to-face interviews; supplier-distributor data. **Analytic approach:** triangulated analysis.	**Number**: 395. **Type**: dyads of matched sales and purchase managers. **When**: ~2006.	People's Republic of China.	Channel communications in emerging markets are embedded in economic and sociocultural environments. The authors identify three embedding elements, i.e. task environment, social relations, and institutional norms. A boundary spanner uses dependency, social capital and cultural values to influence channel communication.	Social capital; organisational culture.	Coercive influence strategies promote relational dissatisfaction, whereas non-coercive strategies facilitate embedded channel communications. Economic actions are embedded in social relations and also nurture personal ties, empowering boundary

						spanners to use interpersonal influence in channel communication.
Sullivan and Marvel (2011)	**Study design**: survey. **Focus:** entrepreneurs' networks. **Method**: questionnaire. **Analytic approach:** analysis of questionnaires.	**Number**: 174. **Type**: new small and medium sized enterprise (SME) founders. **When**: ~2008.	United States of America.	An entrepreneur's business-related knowledge is positively related to the number of workers in their SME. Entrepreneurs who have a greater number of network ties employ more people than those with a lower number. As an entrepreneur enhances their knowledge, his/her firm can grow only if they have a large number of ties.	Resource-based view; social network theory; knowledge management.	Entrepreneurs with a large number of network ties have more employees and are in a better position to acquire knowledge advantages.
Swart and Henne-berg (2007)	**Study design**: exploratory analysis of entrepreneurial knowledge. **Focus:** knowledge nets of entrepreneurs. **Method**: theoretical sampling; constant comparison; in-depth interviews. **Analytic approach:** grounded theory approach.	**Number**: six interviews and 20 supplementary interviews with relevant actors. **Type**: university researchers; entrepreneurs; incubator managers; university innovation managers; innovation fund administrators. **When**: ~2004.	United Kingdom; entrepreneurial activities related to the University of Bath or its incubation or science park.	The authors develop the 3C model to address the dynamic nature of entrepreneurial knowledge nets. Knowledge exchange, knowledge structure and network dynamics are the three central elements of the model, which span three phases: conceptualisation, commercialisation and cultivation. Knowledge exchanges formed for short term, functional goals in order to fill structural holes. These developed quickly and were destroyed quickly.	Structural network theory; knowledge management.	Sharing knowledge across boundaries is essential to understand the features of knowledge management.
Taylor and Levitt (2007)	**Study design**: Cross-national investigation. **Focus:** project networks in the construction industry. **Method**: ethnographic interviews; direct observation; review of primary and secondary documentation review. **Analytic approach:** analysis of qualitative and attitudinal data.	**Number**: Three applications of 3D CAD; 82 interviews conducted in 82 firms (31 in Finland; 51 in USA). **Type**: The project networks consisted of an owner, architect, engineer, general contractor, numerous subcontractors and fabricators. **When**: ~2004.	United States of America and Finland.	Work allocation differs in US firms and Finnish firms. Relational stability, interests, boundary permeability and agent for project network change are the key elements to consider when innovation misaligns. Finnish project networks had strong relational stability, whereas the US had shorter term relationships and had weak relational stability. US interests were at the firm level, which exacerbated the misalignment resulting in innovation being more slowly diffused. Finnish interest was at the network level, leading to faster innovation distribution.	Inter-organisational network theory.	Examining the links that connect different networks and organisations is the key to fast and effective diffusion of knowledge.

Teng and Song (2011)	**Study design**: survey. **Focus:** solicited/voluntary knowledge sharing in relation to task, culture, technology and knowledge management processes. **Method**: questionnaire. **Analytic approach:** exploratory analysis.	**Number**: 149. **Type**: MBA students. **When**: ~2008.	United States of America.	Solicited knowledge sharing behaviours is evident in task routine and open communication. Voluntary knowledge sharing behaviours are promoted by perceived unity. The use of technology played a significant role in both forms of knowledge sharing. Solicited knowledge sharing will lead to increased voluntary sharing.	Knowledge management; knowledge sharing.	Voluntary knowledge sharing is more proactive than solicited knowledge sharing. Knowledge managers would benefit from monitoring knowledge sharing. To increase the practice of voluntary knowledge sharing, managers should facilitate activities to develop solidarity.
Terra-cciano et al (2005)	**Study design**: survey. **Focus:** national character of culture members. **Method**: questionnaire. **Analytic approach:** analysis of data.	**Number**: 3,989 people from 49 cultures. **Type**: Men and women from 49 cultures. Mostly students; with some data from other adults as well. **When**: ~2006.	Six continents.	Perceived traits of national character were significantly higher than assessed traits, which puts the accuracy of stereotypes in question. If stereotypes are accurate at all, they are overly exaggerated. Men and women essentially had the same description of a typical member of their culture.	Cultural studies.	The gap between self-reports of national character and perceptions of national character needs to be examined to promote accurate beliefs about national character.
Tonge (2008)	**Study design**: triangulated qualitative study. **Focus:** personal contact networks. **Method**: in-depth, semi-structured interviews; repertory grids. **Analytic approach:** social science mixed methods.	**Number**: Seven United Kingdom public relations agencies; 21 practitioners (15 women and six men). **Type**: seven directors or owner-managers, seven managers, seven junior executives. **When**: ~2006.	United Kingdom public relations sector.	Public relations professionals recognised 17 psychological, situational or social networking drivers and actions barriers. While women recognised all barriers, men only experienced seven of the barriers. Negative perceptions and low expectations were the most common barriers for both men and women. Men expressed a higher percentage (83%) of low expectations than women (47%). 17% of men cited reluctance or apathy as a barrier, compared with 47% of women.	Social network theory; gender study.	Women experience more psychological, situational and social barriers to networking than do men.
Tretyak and Popov (2009)	**Study design**: case study. **Focus:** large-scale European network; inter-firm relations of Russian	**Number**: 35 Russian researchers and researchers in a European	Europe; Russia.	Open knowledge exchange occurred in both cases, as did network growth. There are three benefits to adopting open knowledge exchange: reputation gains,	Knowledge management; network theory.	Developing interpersonal rather than inter-organisational research networks can

	researchers. **Method**: secondary data; peer-reviews of conference presentations. **Analytic approach:** social science mixed methods.	network. **Type**: European network investigating innovation policy. **When**: ~2006.		reciprocation, and recipients' positive actions based on the knowledge received.		facilitate achievement in an academic context.
Tuomela and Salonen (2005)	**Study design**: exploratory pilot study. **Focus:** business unit connections. **Method**: semi-structured staff interviews. **Analytic approach:** network analysis.	**Number**: interviews conducted with 25 people in the exploratory pilot study. **Type**: Corporate headquarters of a financial services group: HR and CRE clients; the FM service provider; site managers of service. Telecommunications service provider company: HR and FM clients and key account managers; site managers. Real estate investment company: property manager; business uni directors; service provider representatives. Technology park: managers; FM service provider; site managers. **When**: ~2002.	Finland.	Formal ties in a network service organisation are vital for intra-organisation communication, and network brokers produce stronger links between strategic planning and operational service delivery.	Social network theory.	Understanding essential ties in an organisation is fundamental to understanding roles within an organisation. Formal networks are imperative to the bridging of gaps between and within organisational departments.
Uline et al (2009)	**Study design**: case study. **Focus:** interaction between a built environment and its occupants.	**Number**: two schools **Type**: one urban; one rural. **When**: ~2006.	United States of America.	The learning climate of the school is defined by interactions between the original design of the school, the everyday reality of the buildings and space, and the occupants of the space. Qualities to emerge as central to the interaction	Organisational space; design.	Design plays an important role in reinforcing the social environment of an organisation. Design can facilitate a sense of belonging and

	Method: individual, focus group, walk-through, and photo interviews. **Analytic approach:** triangulated case study analysis.			between the built environment and building occupants include: movement, aesthetics, play of light, flexible and responsive classrooms, elbow room and security.		sense of collective commitment.
Van Fenema and Räisänen (2005)	**Study design**: case study. **Focus:** distributed project as a multi-site temporary organisation. **Method**: semi-structured interviews, site observations, photographs. **Analytic approach:** triangulated qualitative analysis.	**Number**: **Type**: executives; managers and key users. **When**: ~2003.	Company headquarters in the United States of America. Manufacturing sites in China, Malaysia, Japan, Thailand and Singapore.	Organisational and relational infrastructure in a temporary and distributed organisation ensured time was saved because the employees had a shared work history and did not have to establish new work practices for collaboration. This organisational knowledge was valuable for resolving issues across organisational units.	Current and retrospective-longitudinal perspective; organisation theory.	Strong social networks within a temporary and distributed organisation are essential for the successful performance of that organisation.
Vough (2012)	**Study design**: qualitative case study. **Focus:** employee identification with their team, organisation and profession. **Method**: face-to-face interviews; observation; archival data. **Analytic approach:** case study analysis.	**Number**: 31 employees. **Type**: architectural firm. **When**: ~2009.	United States of America.	The author identifies four themes of how employees make sense of their identification: similarity, familiarity, benefits, and investment. Individuals rely heavily on interpersonal relationships. Organisational identification was described based on the organisation's prestige, mission and support. Professional identification was explained in terms of professional archetypes, work satisfaction, and professional norms about work/life balance.	Organisational identity.	Individuals construct their identity differently depending on their source of identification – be it with their team, organisation or profession. Sensemaking in identification is the result of primary experiences with a target, in conjunction with sense giving.
Wagner and Vorm-busch (2010)	**Study design**: case study. **Focus:** expatriates social networks and role as facilitators and managers. **Method**: semi-structured narrative interviews. **Analytic approach:** case study analysis.	**Number**: eight. **Type**: German managers who are establishing and managing branch offices in Russia. **When**: ~2007.	Russia.	The relationship between head office, branch office and the market places contradictory demands on expatriates. Formal network structure does not assist entrepreneurs in resolving these conflicts, thus they rely on interpersonal ties and informal networks.	Micro-sociological view; network structure.	Although expatriates are faced daily with competing demands, they have access to unique resources. Expatriates facilitate shared meaning, redefine an organisation's relationships and promote trust among employees. Systematic integration is achieved through a combination of local and global interaction.

Watts and Strogatz (1998)	**Study design**: experimental. **Focus:** models of a worm, power grid and graph of film actors. **Method**: modelling. **Analytic approach:** modelling systems dynamics.	**Number**: n/a. **Type**: various networks. **When**: 1997.	Analysis of small-world properties of various graphs.	Small-world properties, popularly referred to as six degrees of separation, manifest in many networks. This affects the spread of information, e.g. infectiousness of diseases or communication.	Small-world networks.	Networks exhibit small-world characteristics, or shortcuts across nodes, mean that e.g. infectious diseases, information and communication can transmit efficiently through critical paths.
Whelan et al (2010)	**Study design**: case study. **Focus:** knowledge transfer. **Method**: questionnaire; semi-structured interviews. **Analytic approach:** social network analysis.	**Number**: 38 engineers completed the survey; 10 interviews. **Type**: engineers in a medical devices research and development group. **When**: 2007.	Ireland.	It is uncommon for an individual to have the capacity to acquire and disseminate all external knowledge. Specialised individuals acquire external knowledge, while a separate group of individuals specialise in disseminating that knowledge. This is largely as a result of the prevalence of information and communication technologies.	Knowledge management; knowledge transfer.	Mangers should allocate an uneven amount of resources to individuals who occupy positions that contribute the most to the strategic success of an organisation. Successful knowledge management and transfer relies is dependent on the translation process.
Whitson and Galinsky (2008)	**Study design**: experimental. **Focus:** illusory pattern perceptions of participants. **Method**: social science mixed methods. **Analytic approach:** six experiments were conducted.	**Number**: various participants. **Type**: various participants of three experiments. **When**: ~2006.	United States of America.	Participants who experienced a lack of control desired structure and had more illusory pattern perceptions than participants in control. Self affirmation decreases illusory pattern perceptions.	Cognitive theory.	People experiencing a lack of control are more likely to perceive patterns or relationships in stimuli or data, e.g. illusory perceptions.
Wickram-asinghe and Weli-witigoda (2011)	**Study design**: survey. **Focus:** social capital dimensions. **Method**: questionnaire. **Analytic approach:** statistical analysis of data.	**Number**: 105. **Type**: software developers. **When**: 2006.	Sri Lanka.	The most significant dimensions of social capital that significantly predict knowledge sharing as well as various job-related benefits are social relations, the number of networks of which an individual is a member, and the frequency of intra-network interaction.	Social capital; knowledge sharing.	Firms would benefit from monitoring, developing and facilitating relationships between employees and external stakeholders. This would enhance knowledge sharing.
Willem and	**Study design**: survey.	**Number**: 358 cooperative	Belgium.	Cooperation and informal coordination are important	Knowledge management;	Social networks are key to the

Buelens (2007)	**Focus:** cooperative episodes between departments in public sector organisations. **Method**: questionnaire. **Analytic approach:** social science mixed methods analyses.	episodes between departments in over 90 public sector organisations. **Type**: government institutions, public sector institutions and state enterprises. **When**: ~2003.		features of organisations which share knowledge. Lateral coordination had a significant positive impact on intensity and effectiveness of knowledge sharing. Informal coordination positively related to effective knowledge sharing, but not to the intensity of knowledge sharing. Informal coordination, knowledge sharing intensity and effectiveness was positively related to power games.	organisation theory.	diffusion of knowledge in organisations.
Willem and Scar-brough (2006)	**Study design**: social science mixed methods. **Focus:** cooperation between units of two companies. **Method**: semi-structured interviews; open-ended interviews; questionnaire; data collection. **Analytic approach:** comparative analysis of multi-methods data.	**Number**: Company Finco: 20 unit heads were interviewed; Company Enerco: interviews with three senior managers; two middle managers. 108 respondents answered the open questions. **Type**: senior, middle, junior management staff in various departments such as IT; communications ; HR. **When**: ~2003.	Company headquarters in Belgium, with foreign divisions across Europe.	Social capital is important in knowledge sharing. Overall social capital increased knowledge diffusion. Instrumental social capital resulted in a selective form of knowledge sharing, as this form of social capital was associated with power and opportunism. Thus social capital was both an enabler of and a barrier to knowledge diffusion.	Social capital perspective.	Social capital can both enable and be a barrier to boundary spanning and the sharing of knowledge.
Wolff and Kim (2012)	**Study design**: survey. **Focus:** the impact of personality traits on networking behaviours. **Method**: online questionnaires. **Analytic approach:** statistical analysis.	**Number**: 351. **Type**: 176 German members of a university based online panel. 175 UK residents who opted to participate in online surveys by a UK company. **When**: ~2009.	Germany and the United Kingdom.	This study examined the relationship between the Big Five personality traits and networking. Extraversion and openness to experience are related to networking behaviours. Extraversion is more significantly related to creating rather than maintaining or using ties. While openness to experience is related more closely to maintaining rather than using ties and is not related to creating ties. Agreeableness is related to internal, not external networking. Conscientiousness and	Five Factor Model of personality; network theory.	It is important to consider an individual's personality traits, in particular their extraversion, openness to experience and agreeableness in order to facilitate effective networking behaviours and opportunities. Individuals should adapt their networking behaviours to suit their personality

				emotional stability are not related to networking behaviours.		dimensions.
Yao et al (2009)	**Study design**: survey. **Focus:** managers' support ties. **Method**: pilot interviews; questionnaire. **Analytic approach:** analysis of data.	**Number**: 250. **Type**: Chinese managers in nonstate-owned enterprises (NSOEs) and state-owned enterprises (SOEs). **When**: 2003 – 2004.	People's Republic of China.	Managers of SOEs have more government ties than managers in NSOEs. Managers also have more ties with the government if they are managers of larger firms or have had prior government experience. This paper proposes the structural inducement thesis, i.e. a structural arrangement facilitates the emergence of common identity, rituals and routines that lead to social ties.	Social network theory.	The divide between hierarchy and social ties cannot be fully bridged. Managers in NSOEs aiming to network with government should enter into formal joint ventures with those who are already part of the government hierarchy.
Zhang (2010)	**Study design**: field study. **Focus:** research group structure. **Method**: semi-structured interviews. **Analytic approach:** grounded theory approach.	**Number**: 22 senior scientists; 16 junior researchers. **Type**: interviewees were part of one of twenty-two stem cell research groups. **When**: 2008.	People's Republic of China; Beijing, Tianjin, Shanghai, Hangzhou, Changsha, Guangzhou.	Respondents identified Chinese research teams commonly missing a 'middle layer'. This reduces the team's research scale and efficiency. Teams comprise of transitory, inexperienced post-graduate students. An increase of small research teams has created social boundaries in resource distribution and knowledge sharing.	Organisational structure.	It is imperative to consider team structure to ensure efficiency and to promote knowledge and resource sharing. Creating many small teams over one larger team can promote boundaries, which impede information exchange and resource sharing.
Zhang and Cantwell (2011)	**Study design**: exploratory study. **Focus:** the impact of two business group networks on firm innovation and global learning. **Method**: collecting the patenting activity of each firm. **Analytic approach:** analysis of patent data.	**Number**: 131 firms. **Type**: industrial firms. **When**: patent data collected from 1969 – 1995.	Japan.	Horizontal business networks facilitate knowledge exploration whereas vertical business networks promote knowledge exploitation. Vertical networks rather than horizontal networks promote global learning, as they more easily allow the coexistence of open international networks.	Network theory; innovation.	It is important to not only consider the strength of ties and embeddedness of a network, but also the underlying inter-firm linkage mechanisms, as these impact network innovation.
Zheng et al (2011)	**Study design**: survey. **Focus:** the relationship between dynamic capabilities on innovation in networks. **Method**: seven point Likert questionnaire.	**Number**: 218. **Type**: manufacturing firms. **When**: 2008 – 2009.	People's Republic of China.	This paper conceptualises dynamic capabilities as consisting of acquiring, generating and combining knowledge resources. A significant positive relationship was found between dynamic capabilities and innovation. Knowledge acquisition and generation indirectly contribute to innovation.	Dynamic capabilities; network theory.	Dynamic capabilities have a significantly positive influence on an organisation's innovation. Network embeddedness is a precursor to dynamic capabilities.

	Analytic approach: statistical analysis.					
Zhou et al (2010)	**Study design**: survey. **Focus:** the impact of social ties on knowledge transfer. **Method**: questionnaire. **Analytic approach:** egocentric network research analysis.	**Number**: 152 surveys administered. **Type**: MBA students with a full-time job. **When**: ~2008.	People's Republic of China.	Strengthening instrumental and expressive ties between co-workers increases trust and the likelihood they will share knowledge. Instrumental ties are more important than expressive ties in explicit knowledge transfer. However expressive ties are not significantly more important than instrumental ties in the transfer of implicit knowledge.	Knowledge management; knowledge transfer, social network theory.	Trust is a vital factor for effective knowledge transfer. Managers can facilitate trust and knowledge sharing among co-workers by promoting formal and informal intra-organisational networking, enhancing their instrumental and expressive ties.
Zou and Yilmaz (2011)	**Study design**: experimental; simulation-based exploratory study. **Focus:** conditions that facilitate increased innovation. **Method**: simulation model. **Analytic approach:** analysis of simulation.	**Number**: 100 simulations. **Type**: simulation. **When**: ~2009.	United States of America.	Centrality is key in determining innovation performance. Weak ties are better facilitators of innovation than strong ties.	Communities of practice; innovation; network theory.	A model used to generate social networks based on knowledge creation processes exhibit high centrality and low density, two key factors in promoting innovation.