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The Role of Social Capital in Project Managers' Responses to Complexities

Abstract

Social capital has been demonstrated to be an important commodity for managers in project-based operations. This paper examines the role of social capital in the work of 36 managers from three engineering firms, using qualitative case data. We ask the research question 'How is Social Capital used by Project Managers in responding to complexities?' We derive an improved understanding of *how* social capital is used in responding to their context. To do this, we draw on two established bodies of work. First, we use the lived experience of the complexity faced by the managers to describe the context. Secondly, we use social capital theory to examine what elements of social capital are employed in response. The interchange between these is initially framed with 'contextual complexities' as stimulus and the 'social capital employed' as response. Our findings show the temporal dynamics of complexity, whereby responses are not isolated but dependent upon both recent experience and expectations of future events. We also show the importance of social relationships in developing valuable recursive patterns of interaction in the project context.

Keywords: project complexity, social capital, qualitative, case study, project-based organization, complexity response.

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1. Introduction

As academics involved in the study of operations and supply chain management (OSCM) and project-based operations in particular, it is not unusual to be tasked by pre-experience groups with the challenge: *what is the best way to manage a project?'* One answer, potentially viewed as spectacularly unhelpful, is *'it depends.'* The question sought certainty; the answer provided ambiguity. Yet with the opportunity to expand the answer, we can echo the development of the field of business and management, and OSCM in particular, from a Fordist 'one best way' through to the emergence in the 1960s of notions of situational dependence and contingency (e.g. Skinner's Focused Factories, 1969).

This paper picks up this theme of contingency in projects. Specifically, managerial actions as being dependent on the context in which the action takes place. Our particular interest was provoked by the assertion of managerial complexity (how difficult is something to manage?) as an important independent variable, and the accompanying choice of action in response to this complexity (Maylor and Turner, 2017). This is important issue for managers and researchers, since although we have valuable bodies of knowledge, standards, and industry- and organization-specific processes, project performance is regularly still found wanting (e.g., Maylor et al., 2023).

Managerial complexity is the *lived experience* of managers in project-based operations, a subjective assessment. It draws from a body of work which focuses on an 'inside' view of the project at that point in time (e.g., Cicmil 2009; Williams, 2005); what managers perceive as difficult or challenging is what is 'complex to them'. As a development of Maylor and Turner's (2017) framing, we consider managers' responses to complexity in terms of their use of knowledge resources. We draw on the field of intellectual capital (Swart, 2006; Turner et al,

2015), which identifies three broad categories of knowledge, namely *organizational*, *human* and *social* capital. Organizational capital refers to the knowledge embedded in the technology and processes used. This is a well-established body of work, so was not the primary focus of our study. Human capital is the knowledge residing within individuals, and is likewise, well-developed.

We focus on the role of social capital, understood as the knowledge embedded within the network of relationships (relying on a mixture of formal and informal mechanisms) individuals hold. This is well established conceptually within OSCM (e.g. Carey et al., 2011; Daghar et al., 2023; Handoko et al., 2018; Jääskeläinen et al., 2022; Krause et al., 2008; Lawson et al., 2008; Polyviou et al., 2020) and the project context (e.g. Han and Hovav, 2013; Suhonen and Paasivaara, 2011; Wen et al., 2018). It is often essential for a project manager, as the project is unlikely to be able to 'own' all of the knowledge assets necessary for the work, and so will need to draw on the wider network of relationships of its people, in the solution of problems. Despite this importance, its application as a response to situational complexity appears underexplored.

The rest of the paper is structured as follows. We first show the key literature, focusing on complexity and then establishing the importance of social capital in managing projects. We then describe our empirical work and findings from qualitative interviews with 36 managers in three project-based engineering organizations. In the subsequent discussion, we show the significance with regards to the literature, and demonstrate the effects of multiple, overlapping complexities over time. We then use our analysis to highlight the reciprocity between social capital dimensions and complexity responses.

2. Literature

We draw here on two bodies of literature. The first is that of project complexity, and we then show how the understanding of contingency can be furthered by investigating the nature of the knowledge resources, specifically social capital, used in determining responses.

2.1 Complexity

Project complexity is a multi-faceted and contested concept (Bakhshi et al., 2016; Geraldi et al., 2011; Maylor and Turner, 2017; Vidal et al., 2011). For instance, it can be both objectively and subjectively assessed, and at multiple systemic levels. At the project level the size and scope of the work being undertaken are contributors to complexity, as are the (in)actions of stakeholders and the level of uncertainty and change. Objectively, a project of size X with given characteristics may be said to have a complexity of Y, yet subjectively the experience of a manager can reduce that perceived complexity because they have worked in similar projects before, or because they put in place responses (e.g., detailed planning) to deal with that complexity. Different managers with different levels of experience will interpret the complexity uniquely. Moreover, this perceived complexity is dynamic over the project lifecycle, as a result of both exogenous and endogenous threats and change (Antonacopoulou, 2022), and the reality for managers is that their work is an intertwinement of stability and novelty (Hussenot and Missonier, 2016).

The nature of project complexity has been a challenge both for researchers and practitioners for many years (e.g. Baccarini, 1996; Dvir and Shenhar, 1998; Jaafari, 2003; Maylor, et al., 2008; Pich et al., 2002; Shenhar and Dvir, 1996; Tatikonda and Rosenthal, 2000; Williams, 1995, 1997, 1999; Xia and Lee, 2005), and this has been recognised with regard to the corresponding difficulties in managing performance (Pavlov and Michele, 2023).

Two broad approaches have been used in assessment and analysis, and authors distinguish between complexity *in* (a more objective measurement) and complexity *of* (a more subjective view based on a manager's perception) (Cicmil et al., 2009). Attributes of complexity broadly covering technical issues such as project size, budget, number of interfaces, technology, scope, organization, location, legal issues and resources have been established (Bosch-Rekveldt et al., 2011; Dao et al., 2017; De Souza Pinto et al., 2014; He et al., 2015; Senescu et al., 2013; Shenhar and Dvir, 2007; Vidal et al. 2011), but the day-to-day realities managers face cover a wider range of challenges. Some authors identify the more 'social' aspects of complexity. These emphasise that the concerns here are not just technical. It is noted that team coordination is important (Zegarra and Alarcón 2019), and that complexity makes learning in project-based firms difficult (Mainga 2017). Additionally, megaprojects (Pitsis et al. 2018) offer particular difficulties in managing a wide range of stakeholders, and similar complications occur when trying to achieve consensus on sustainability in infrastructure development (Yuan 2017).

The systematic literature review of Geraldi et al. (2011) identified five distinct forms of complexity, namely *structural*, *uncertainty*, *dynamic*, *pace*, and *socio-political*. This was followed by Maylor et al. (2013) who merged some of these in creating the Complexity Assessment Tool (CAT) looking at three primary dimensions of complexity: *structural*, *socio-political* and *emergent.* These are defined as follows:

> "(1) Structural complexity: increases with the number of people involved, financial scale, number of interdependencies within and without, variety of work being performed, pace, breadth of scope, number of specialist disciplines involved, number of locations and time-zones.

(2) Socio-political complexity: increases with the divergence of people involved, level of politics or power-play to which the project is subjected, lack of stakeholder/sponsor commitment, degree of resistance to work being undertaken, lack of shared understanding of the project goals, lack of fit with strategic goals, hidden agendas, conflicting priorities of stakeholders.

(3) Emergent complexity: increases with novelty of project, lack of technological and commercial maturity, lack of clarity of vision/goals, lack of clear success criteria/ benefits, lack of previous experience, failure to disclose information, rising to prominence of previously unidentified stakeholders, any changes imposed on or by the project." (Maylor and Turner, 2017, p.1080)

This relies on a 'lived experience' ('complexity of') approach (Cicmil et al., 2009; Williams, 2005) where complexity is determined by the manager's subjective view of the situation (the *inside view*). Hence, a particular project's managerial complexity will vary according to an individual's experience and role, is dynamic, and is not dependent upon an objective analysis (the *outside view*). This is the approach we take here also.

Although the CAT allows the identification of different forms of complexity (and hence a method of distinguishing different categories of 'complex project') an underlying theory of how to respond to these was still not available. Maylor and Turner (2017) subsequently proposed that structural complexities could be aided by a 'planning and control' response, socio-political via a focus on relationship-building, and emergent by enabling flexibility. Their workshop data, though, showed that management practices were in fact more nuanced than this and that these three approaches were not limited to their 'expected' complexity on the diagonal of the model. Examples are given in Table 1, showing that, for example, a relational approach

to structural complexity would be to prioritise relationships with key stakeholders to keep them informed of progress, and in an uncertain environment a strong focus on effective risk management and change control can reduce the likelihood of unwanted 'surprises'. Practical responses, therefore, are not limited to the diagonal of the model, and all nine elements are realistic approaches.

	Structural	Socio-political	Emergent
Planning and control	Initiating, planning and monitoring (e.g. applying earned value systems). Using an Integrated Master Schedule	Develop a communications plan. Establish project board of stakeholders.	Apply risk management and change control processes
Relationship development	Prioritise communications with stakeholders. Conduct project outreach Activities.	Engage in teambuilding activities. Invest in social capital.	Socialise changes. Increase informal communications.
Flexibility	Embrace changes from process. Anticipate change. Enable parallel development.	Manage expectations of change. Engage in joint look-ahead planning with major stakeholders	Use agile PM approaches. Encourage entrepreneurial PM.

Table 1: Relating complexities and responses (from Maylor and Turner, 2017, p.1086).

Subsequent empirical work (Antonacopoulou et al., 2022; Boehme et al., 2021; Cecchi et al., 2022; Turner et al., 2018) supported these ideas in both the supply chain and project contexts. However, as yet we lack a comprehensive view both of the prevalence of the response types in projects and of the knowledge resources that are used to enact them.

2.2 Social Capital

We draw here on the broader theory of intellectual capital, which allows an organization's 'stock' of knowledge to be analysed in terms of its subcomponents. We follow previous work (Swart, 2006; Turner et al., 2015; Swart et al., 2016) and identify organizational, human and social capital, and show the particular importance of social capital in understanding better the responses to project complexity. Specifically, we investigate the role of social capital in generating new intellectual capital as part of project work.

In terms of organizational capital (knowledge residing outside of the minds of knowers), there is a wealth of advice regarding organizational processes and tools for managing projects effectively. Key areas such as planning and control, risk and change management, governance and so forth are well documented both within organizational procedures and also from professional bodies (e.g. APM, 2019; PMI, 2021). This organizational capital is indeed important and necessary, but it can be insufficient when faced with complex challenges. We acknowledge its value but it is not the focus of this research. Similarly, human capital theory (Becker, 1964) uses economic logic to study individual decisions dealing with investments in productivity-enhancing skills and knowledge. Most definitions of human capital state that it comprises knowledge, skills, intellect and talent of individuals (i.e. the 'what you know'). Human capital is undoubtedly important (e.g. Greer and Carden, 2021; Huemann et al., 2007), and provides unique organizational value (e.g. Ray et al., 2023). However, human capital on its own does not deliver projects nor solve problems. Social capital refers to the value that relationships hold in organizations (i.e. the 'who you know'), or specifically, *"The value contained in both the structural aspects of a social network and the content of the network relationships."* (Ray et al., 2023, p.316).

The value of human capital is of course tied to social capital (Subramanian and Youndt, 2005) and although each may play a determinant role, they also operate in combination. The social capital side of complexity research, and *how* it is used in practice, appears to be underdeveloped, despite the wider topic of social capital having a long and extensive research literature.

We first look at the foundational aspects of this topic. The emergence of social capital in the explanation of firm performance, is due to the application of economic theory to sociological thought. The concept was popularised by Robert Putnam (1993) who likened social capital to a 'moral resource'. A dominant theme in the literature is that social capital originates in individual relationships and then becomes a property of a collective, an organization or a network of individuals (Bourdieu,1986). For example, Nahapiet and Ghoshal (1998, p.243) advocate that it is "the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or a social unit". Furthermore, Leana and van Buren (1999) view social capital as a resource reflecting the character of social relations within the firm. Pennings et al. (1998) extend the boundaries of social capital to include supporting relationships with other economic actors (highly relevant in a project context).

Several functions regarding the access to resources that social capital provides have been identified (Bourdieu, 1986; Coleman, 1990). First, it is regarded as a means of governing individuals' behaviour and therefore binds people together, specifically in times where complex problems are faced (Walker, et al., 1997). Second, in this context, social capital also builds identity or a sense of belonging (Nahapiet & Ghoshal, 1998; Orlikowski, 2002), such

that members of the particular network will be more likely to trust their counterparts and provide more resources without expecting 'something in return'. A degree of resilient trust is therefore developed (Leana & van Buren 1999). Nahapiet and Ghoshal's (1998) seminal model of social capital is shown in Figure 1, and is recognised as a key contribution within the social capital field (e.g. Lee 2009). The model highlights the forward path of three social capital dimensions (structural, cognitive and relational) and their use in developing new intellectual capital, as well as a feedback path. This latter point is not well investigated within the literature, and we return to this aspect later. We note that human capital is necessary as a precursor to Figure 1, since it is essential for problem-solving and knowledge-sharing.

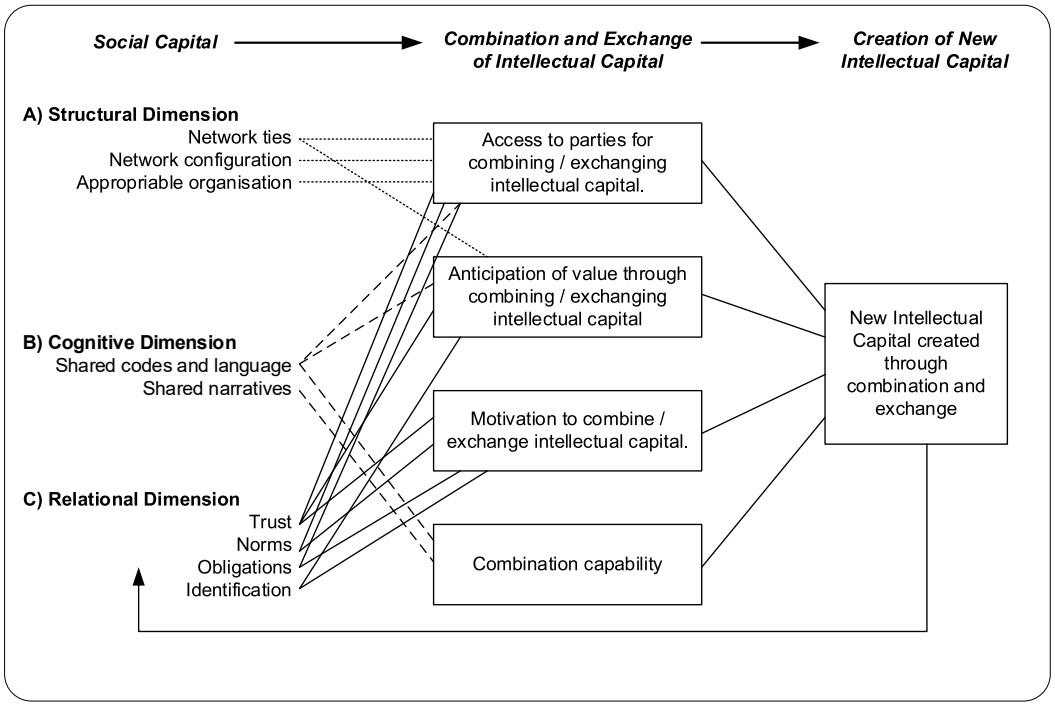

Figure 1: Social Capital in the Creation of Intellectual Capital (Nahapiet & Ghoshal, 1998)

In this model the structural dimension, or how relationships look in an organization or a network, varies along the dimensions of loosely or tightly coupled networks that are the foundation for social capital (e.g. Han and Hovav, 2013; Moore et al., 2018). The former, i.e., the structural holes approach, values network heterogeneity or weaker ties between individuals

across social units (Granovetter, 1985). The focus here is more on boundary-spanning activities and brokerage opportunities (Burt, 1992). An important dimension of the structural holes approach is that of diversity. That is, individual members will use diversity within their own knowledge sets to build relationships, thereby supporting wider innovation capability. The structural density, or tightly-coupled network, perspective argues that close relationships with frequent interaction leads to higher performance (Nahapiet & Ghoshal, 1998). This approach is regarded as most effective at the local, or within-team level, whilst the structural hole approach delivers maximum benefits to the firm at the global, or across-teams and organizational level of analysis (Reagans and Zuckerman, 2001).

The second dimension is the cognitive aspect, where shared codes and language enable effective communication and support collaboration. This is important in ensuring that knowledge is shared effectively, and that what the originator intended to communicate is actually what the receiver understands. The "sharing of context, representations, interpretations and meaning between parties … can promote synergies and reduce friction" (Daghar et al., 2023, p.576), and this is especially pertinent under conditions of complexity where lack of clarity in communication is likely to be detrimental.

The final dimension along which the various social capital approaches differ is the relational dimension, which includes consideration of the types of trust embedded in the relationships and of the norms and values which guide the relationships. Nahapiet and Ghoshal (1998) advocate that the relational dimension of social capital is influenced by the historical development of interactions. The particular dimensions that are important in their analysis of the relational nature of social capital include trust, norms and sanctions, and obligations and expectations. The elements of social capital are not independent but do interact (Hsu and Hung,

2013). Numerous authors have discussed the link between social capital and innovation, important in the project context. Advantages are shown in problem-solving (Donate et al., 2016; Kaasa 2009; Laursen et al. 2012; Subramaniam & Youndt 2005; Tsai & Ghoshal 1998), knowledge-sharing (Dutton et al., 2014; Ganguly et al., 2019), and entrepreneurial orientation (García-Villaverde et al., 2018). It is also a factor in understanding interorganizational risk management (Daghar et al., 2021), organizational performance (Felício et al., 2014; Fonti and Maoret, 2016), and plays a part in career success (Wiersema et al., 2018).

In the context of project-based organizations, Matthews and Marzec (2012) describe the development of the role of social capital, quoting Ayas (1997) in defining *"The social capital of a specific project can be represented by the relational network density, observed through the intensity, frequency, degree of informality and openness of communication patterns within the project and with all external members of the organization directly or indirectly involved"* (pp. 62–63).

Returning to the categories of social capital described by Nahapiet and Ghoshal (1998), the role of trust has long been identified (Smyth et al., 2010). This is supported by effective social ties within the team (Lee et al., 2015). Social capital has also been identified as an important facilitator for knowledge management, knowledge sharing and learning within and across projects (Bartsch et al., 2013; Mazzucchelli et al., 2021; Miković et al., 2015; Zhang and Cheng, 2015), supported by diverse social connections (Han and Hovav, 2013).

Social capital is thus integral to project working (Di Vincenzo and Mascia, 2012), both at the individual and team level (Cecchi et al., 2022; Zhang et al., 2020) up to top management behaviour (Amoako-Gyampah et al., 2018; Wang et al., 2021). Successful inter-project

working also supports programme-level resilience (Shen and Ying, 2022). Matthews and Marzec (2012) echo Soderlund (2004) in noting that including social capital in analysis shifts the consideration from an objectivist, hard systems perspective, to a richer view. However, there is limited work on the role of social capital in addressing complexity. Zaman et al. (2019) show that social and political skills moderate the effect of technical project complexity on project performance. We look to examine this deeper with a qualitative investigation to augment their quantitative study. Our research question was:

"*How is Social Capital used by Project Managers in responding to complexities?*"

Our conceptual model is shown in Figure 2:

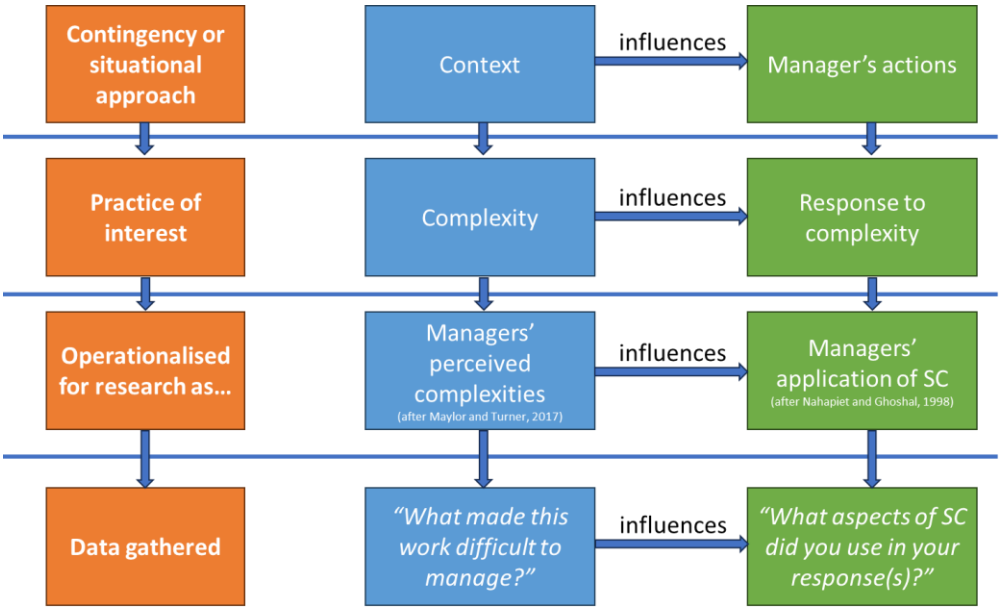

Figure 2: Conceptual model for the study

3. Method

To address our research question we used a case study approach to address a "contemporary phenomenon [. . .] within its real-world context" (Yin, 2014, p.16). This allows the researchers to obtain rich and valuable data (Soltani et al., 2014) to explore the causality of the key phenomena in the case environment, rather than merely the results (McCutcheon and Meredith, 1993). We sought to identify a sense of generality from the findings (Ketokivi and Choi, 2014)

and, in exploring the contexts of the case organizations, we looked to understand how a "combination of a number of contextual factors can make a practice a better fit" (Romero-Silva et al., 2018, p.1344). Both of the core concepts involved in our study (perceived complexities and social capital) are socially constructed, yet well defined. However, their interactions were not and as a result, we chose qualitative methods to allow us to gather rich data from respondents. Our guiding paradigm is constructivist in nature and our approach interpretive (consistent with our exploratory research question) as it was concerned with the narrative of the reasoning of the managers who contributed our data.

The core concepts have been operationalised for research on many occasions, and we employed these tried and tested applications into the development of an interview protocol. This was necessary to provide consistency as interviews would have to take place over geographically dispersed sites, and by different members of the research team. The unit of analysis was *'events in the recent experience of managers'*. By focusing on recent experience, this provided a narrative of more 'general events' rather than 'momentous events' in the entire working lives of project managers; we were concerned with a range of experiences and not just their responses *in extremis*, though we did encounter critical incidents (Flanagan, 1954) even within this semi-selective timeframe. In addition, the focus on 'recent' increased the likelihood of accurate recollection.

Paired with each situation was the action that they took and the role that social capital played in that. In the participating firms, dyadic contracting arrangements existed in which our interviewees were predominantly suppliers. The questions provided the opportunity to explore the role of social capital both internally to the project firm, and present in the relationships between individuals on both sides of the dyad.

Managers were purposively selected across three organizations. These were organizations who had previously worked with members of the research team and we knew had experience of responding to complexities over the life cycle of projects, and agreed to grant full access subject to the signing of NDAs. We interviewed general managers (who were responsible for a portfolio of projects), project and programme managers, and senior technical staff from three engineering project organizations, as shown in Table 2. Two organizations were based in UK, one in mainland Europe. Pseudonyms are used to preserve anonymity. Each interview was around an hour long and fully transcribed for analysis in NVivo.

Organization	Nature of Business	Number of Interviews
AeroCo (AC)	European aerospace parts design and manufacture.	16
MarineResearch (MR)	UK undersea research devices and operations.	11
OilEngineerig (OE)	Major UK engineering contractor in the petroleum industry.	9

Table 2: Data Sources

Data were coded after each interview, allowing the researchers to determine whether new aspects of the relationships of concern were being uncovered. A total of 1566 coded elements were identified in total. In each organization, once the first 5 interviews had been completed, new interviewees were added in batches of 2-3, until the research team were satisfied that there were no new aspects of concern and that conceptual saturation had been reached. It is notable that this took longer in the first organization than in the subsequent two, reflected by the lower numbers of interviewees in both the second and third research sites. After each coding activity, codes and themes were checked to determine if further interviews were needed. Whilst multiple

interviewers were used, the same (most experienced) person carried out the coding to ensure that the process was consistent. Extracted codes were reviewed and validated by the wider research team, and examples of these are given below.

The analysis was carried out in two stages. In the first, the particular responses were investigated to understand what the managers did in relation to the identified complexity. This would give a clearer understanding of managerial actions. The second stage was to probe the social capital aspects in situations characterised by a range of complexities, guided by the Nahapiet and Ghoshal model of Figure 1 and distinguishing the structural, relational, and cognitive aspects. The focus was the individual managerial level rather than that of the network. We noted the importance of the organizational capital used but, as indicated earlier, this was not central to our investigation. We did include questioning on human capital, looking at areas including the nature of managerial expertise, technical domain knowledge, knowledge of and in the client organization, and particular knowledge specificity. However, this was to understand its role with regard to social capital, and not to investigate human capital as a stand-alone element. We thus sought to understand not only the nature of the complexities, but the responses and the associated knowledge resources utilised.

4. Findings

4.1 Complexity

Our first task was to understand the nature of the complexities they faced. From the initial coding data, we noted that all three complexities were readily apparent. Examples from the categories identified by Maylor et al. (2013) are given in Table 3.

Complexity	Example

Structural	*"The design itself is the challenging part. You get a design for a part which is very complicated to manufacture and the goal for this project is to be able to manufacture that, but also to be able to manufacture with new technologies that can also mean costs reduction, decreasing of lead times in the production. So, quite interesting all round."* (AC)
Socio-political	*"But at the moment I feel it's all give and no take. And it's not because they're banging the table and being difficult and trying to get one up on you. It's just because, I get the impression that the culture within their company is one where bad news doesn't travel upwards. So when you tell them something they don't want to hear or they don't want to know, I don't think that gets around the team."* (OE)
Emergent	*"Your plans will have to change because of an overriding political imperative. It was rarely financial, it was always political."* (MR)

Table 3: Examples of complexities.

The three forms of response from Table 1 (planning and control, relationship development, and flexibility) were also evident, although it was interesting to note that activities coded as 'response' were not necessarily in direct response to a complexity, and that not all complexities were associated with specific solutions.

Responses	**Example**
Planning and Control	*"The standards are very strict, but just like it is in [customer], making sure that everything is perfect"* (AC)
Relationship Development	*"I spend my life talking to people, persuading people. You know, turning up with biscuits and coffee."* (MR)
Flexibility	*"I'd like to think I'm sensitive to the way the project needs to evolve. And the one thing you can't do is be rigid. You've got to, particularly with the client, you've got to pay attention to that."* (OE)

Table 4: Examples of responses.

Of the 565 complexity instances coded in NVivo, 63% were identified as structural, 31% as socio-political, and 8% as emergent. In terms of the 422 instances coded as responses, 48% were planning and control, 38% relationship development, and 14% flexibility. Given the engineering nature of the organizations' work, the focus on structural issues and planning is perhaps to be expected, but the prevalence of the socio-political complexities and relationship-based responses highlights the importance of the 'social' side even in such a technical environment. All nine of the elements from the Maylor and Turner (2017) grid were populated. Examples from the data are given below in Table 5.

	Structural (63%)	**Socio-political (29%)**	**Emergent (8%)**
Planning and control (48%)	Systems and controls to deal with the design and manufacturing processes (AC).	UK political interference regarding supplier choice on a support contract mitigated by a rigorous tender process (MR). coordinated, system (MR).	Unexpected delays required detailed planning for subsequent activities since future work schedules were delayed (MR).
Relationship development (38%)	Working with customer to devise a solution to design issues (AC).	Need to ensure a good relationship with the client when unexpected problems occur (AC).	When a major customer needs a part urgently then they will supply because they have a good relationship (AC)
Flexibility (14%)	Creativity in moving staff around when there are insufficient people to meet all the various project commitments (MR).	Accommodating redesigns at short notice to keep the client happy and support the relationship (AC)	Giving options to the scientists to see which one is best – they may have requirements that the project

			managers are not aware of (MR).

Table 5: Examples: Complexities and management responses.

We note that the central row and the central column in Table 5 are necessarily 'social', but from the interviews the other 4 (corner) elements also had strong inherent interpersonal underpinnings in order to be effective. The data coding used in the complexity analysis looked principally at social capital (structural, cognitive and relational, based on Figure 1), and we now discuss these aspects.

4.2 The Role of Social Capital and its Effects

Our initial analysis was in line with the Nahapiet and Ghoshal (1998) model and evidence of the elements within Figure 1 was readily identifiable, and we now examine the three dimensions in turn.

Firstly, when examining the function of social capital within the projects, the structural aspects may be considered as the 'foundation' of the model. For instance, an operational network is a necessary (though not sufficient) requirement for managing a major project. Internal and external networks were mentioned, and coordination between these networks achieved typically by meetings where any issues can be raised and shared as necessary. Specific teams could be also set up to work with key stakeholders

> *"So, every day at 8.30 there is a meeting with each of them [the 2 major customers], and then at 9.30 is the meeting with my boss where National and International attend and we go over any key points with him again if there are any."* (AC)

Time and frequent interaction are significant factors in building social networks. This was balanced with an informality to speak to and share information with colleagues as and when

deemed necessary. An important part of the managerial function, interestingly, was also to act to *limit* the network, and to be a point of contact and prevent unwarranted interruptions:

> *"I think my role as the project manager is to keep the client off the rest of the project team."* (OE)

A consideration within a project-based analysis is that the network structure is necessarily dynamic. A project is, by definition, time-limited, having distinct phases. Reflecting this, interviewees noted that communication networks had to be built at the start, both internally and with the client organization. This would not be static, as different phases of the project would require quite different configurations. For social capital, this implies active management, both to ensure sufficient communication opportunities among participants at the initiation, but also that these are amended as required over what may be several years of a project life cycle. Requirements change, and stakeholders (individuals, departments, suppliers) will be transient in their participation. This dynamic aspect is important in an operational structure that is not enduring. Indeed, the transient nature of some the project structural social capital was an interesting finding from the data, and seemingly underexplored within the literature.

One of the organizations realised that they had multiple ongoing technical projects at varying stages of the lifecycle with common problems but without the inter-project communication that would allow the sharing of solutions. The response was to bring in a Project Management Office (PMO) Manager (perhaps surprisingly, without a technical background) who not only ensured repeatable process and governance across the projects but also spent significant time with the managers and teams. This enabled her to identify pertinent issues and put the right people in touch with each other, helping to foster networks at the right time that previously had not been formed.

Secondly, the cognitive aspects, with shared codes and narratives (as per Nahapiet and Ghoshal, 1998, in Figure 1), were also readily apparent. An example from the data is where engineering and manufacturing teams had to work together to build a new product in the factory and jointly solve problems regarding its implementation. This kind of response was especially important where original technical requirements were imprecise or unstable – an emergent complexity. The role of social capital in avoiding or reducing the impact of emergent complexity was also clearly expressed by the participants:

> *"I engage with stakeholders to make sure that what actually they said they wanted is in fact what they want. Or if they decided to change their mind, we can deliver, we can examine the art of the possible."* (MR)

Recognising others' competence and having your own expertise acknowledged was also highlighted as important in a context where multiple knowledge domains interact.

> *"Yeah, I can sit in a meeting and know what they're talking about, and that goes a long way here."* (MR).

Finally, the importance of the relational dimension was also evident, including the role of trust. Although many of the relationships were strong enough and had sufficient trust to share bad news, some found this a difficult position to be in and could not discuss failure.

> *"So, it probably took about 6 months to build up the relationship there. And he needs to see that we've delivered, he trusts us to deliver in accordance with his wishes, and to react to his requests. I always feel my job is to make him, if I'm making him look good, then we're doing something right. And then he'll keep coming back to us and giving us work."* (OE)

Multiple norms and obligations were identified, from positive inter-team relationships to more acrimonious client-supplier relationships where expectations were different on the two sides. Again, a temporal aspect was identified, where the relationship took time to develop as part of

the work. Extreme examples were raised, such as the social environment of a ship where research projects were being undertaken under more intense circumstances than would normally be encountered. Although relationship-building is often, necessarily, a relatively slow process, sometimes major incidents and shared experiences can build deep, lasting, bonds very rapidly. As one manager recalled:

> *"Some years ago when I was in the corporate group, the CEO took us out on a couple of yachts. … one of the boats almost turned over. So, half the managers ended up in the water, but fortunately there was nobody hurt. And the good thing about that was that there was a fantastic bonding that was conjured up, nothing to do with the work environment."* (OE)

To consider the structural, cognitive and relational dimensions of Figure 1 as separate, though, is inadequate. They are necessarily intertwined, and if all three are in place then the ability to understand and deal with complexities appears to be enhanced. One manager described their project 'war room', with the right people, a common understanding of the key problems, and joint desire to solve them.

> *"The idea is there's no table and chairs. You put the information, all of the reports and information that you want, just up on the walls. So, everybody's got the same sort of base, so we decided what information needs to in the war room. What was important to manage? What were the key things? And we would spend half an hour every morning in there."* (OE)

This approach is very effective, but is used infrequently. Its utility relies on trust and openness between the client and project provider, so any distrust or animosity might severely curtail its usefulness. It is a valuable example of how social capital can aid in complexity management, even though such an implementation may initially be viewed as an illustration of primarily organizational capital.

In summary, the role of social capital is a central factor in considering how managers operate in projects. In the interviews we conducted, drawing on the Nahapiet and Ghoshal (1998) framework, the importance of the 'social' side came through very clearly, indeed several respondents explicitly stated that it was the most important part of their job.

We now consider the implications of social capital in managing complexity.

5. Discussion

The data showed that all of the dimensions of social capital, i.e. structural (e.g., meetings), cognitive (e.g., discussions to generate a common narrative) and relational (e.g., trust), were employed both in complexity responses, and also as way of pre-emptively setting the conditions before problems arose so that complexities could be addressed more readily when they were later encountered. We were also able to observe how these responses themselves strengthened all three dimensions. For example, where a problem involved reaching out to a wider network to identify potential solutions, that strengthened social ties which could then be used subsequently. Indeed, it was noted by many of the interviewees that building a relationship is easier when common experiences of problem-solving are invoked, and the shared narrative is one of jointly overcoming difficult issues. It appears that 'used well', social capital can operate as a self-reinforcing feedback loop. By 'used well' we mean that managers who recognised the value of relationships, worked hard to ensure that trust or reputation, for instance, were valued and developed in their work. The beneficial feedback loop would be balanced or otherwise negated by the effects of loss of any of the dimensions, for instance where there was a change in structural aspects. A common theme was how long it took to develop relational social capital, and how it was 'fragile' in most instances.

A second feature of the structure of the data concerned the relationship between the coded pairs of complexity and response, and the fact that these were not as clear-cut as may have been expected. Managers viewed complexities as part of a longer project narrative and were often overlapping, rather than independent. The reality of project execution, especially in a multi-project environment, was that multiple complexities and responses were often co-occurring and interwoven, often leading to 'judgement calls' and potential 'satificing' unfolding over time, rather than 'solutions'.

Whilst they had no problem making a distinction between different complexities as they emerged over time, their responses inevitably overlapped. Matthews and Marzec (2012) show how social capital can influence activity performance in operations management activities, but we propose a more nuanced and project-specific understanding given the dynamic and time-bound nature of projects. To understand better the project context, we draw on the work of Hussenot and Missonier (2016). They advise that "actors always define and act in their actual event through their engagement with past, present and anticipated events" (p.531), and this 'prehension' is applicable in our context. As discussed, complexities are often interwoven and cannot necessarily be thought of in terms of individual *stimulus-response*. Instead, there may be simultaneous, co-existing and interdependent stimuli (complexities), requiring a variety of common and specific responses. These also occur over the project lifecycle, meaning that expectations for the project may be shaped by the early stages of that particular piece of work (i.e. the particular challenges faced to date), and potentially also participants' previous experience of similar developments.

A visual example of this is indicated in Figure 2. Staff may be dealing with Event B, having just resolved Event A, while sensing the emergence of Event C and expecting a future

(unknown) Event D at some point in the future. A recent project history of, for example, inter-departmental issues, technical failures or supply chain difficulties may predispose staff to anticipate similar issues in the future. Similarly, the nature of the work may itself highlight future possible complexities. In case AC, as the development process for a new product progressed from initial concept through to final manufacturing for the client, there were many stages of analysis and test. This necessarily incorporates the possibility of the new product failing tests and needing rework and/or redesign (an emergent complexity), with the consequent stakeholder management that necessitates (socio-political). Although well-recognised as a possibility, the stimulus complexity could not be treated in isolation, as there were many other complexities (notably other projects and other customers whose products would be sharing common resources) in play at any one time. This has clear implications for the study of complexities and responses, and the need for relational as well as technical solutions in such an environment.

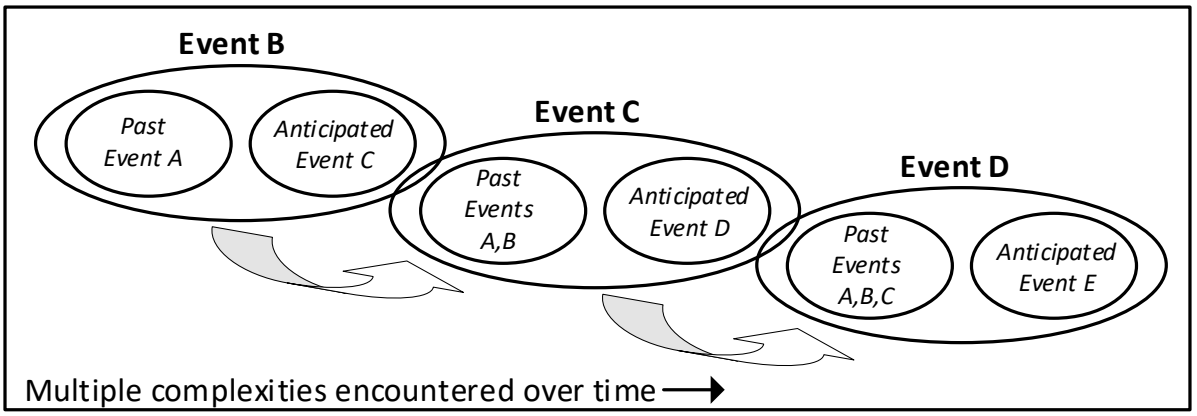

Figure 2. Adapted from Hussenot and Missonier (2016).

Sometimes a recognition of the situation can lead to appropriate solutions being implemented. The previous MR example of the introduction of a PMO to facilitate inter-project knowledge-sharing, is a good example. Within that portfolio there were many concurrent complexities, with the common response being the PMO. However, in many other instances, such a solution was not identifiable. Here, as mentioned, the pre-emptive development of social capital is

supportive of relationships that will aid resolution in the future, even if the details cannot be foreseen. A more nuanced finding was that actions are embedded within the social structure of the project team, developed over time, which necessitates a uniqueness in terms of the situated group response. The social capital elements act to generate a common understanding of the project amongst the multiple participants. This both shares knowledge and insight, and can, again, help build a common view of future risks.

Referring back to Figure 1, the forward path whereby the three component parts of the Nahapiet and Ghoshal (1998) social capital model aid complexity responses is in line with previous work. A feedback path does also exist in the model, but this does not appear to be prevalent in the literature. We believe the reverse path to be a valuable finding from the data. Successful problem-solving helps build more effective social relationships, which are likely subsequently to aid future problem-solving, and our work explicitly brings this reciprocity to the fore. Not only are the structural, cognitive and relational elements mutually reinforcing, but they support, and are in turn supported by, day-to-day operations. However, as mentioned previously, it is a positive feedback cycle that is balanced by changes, e.g., in people.

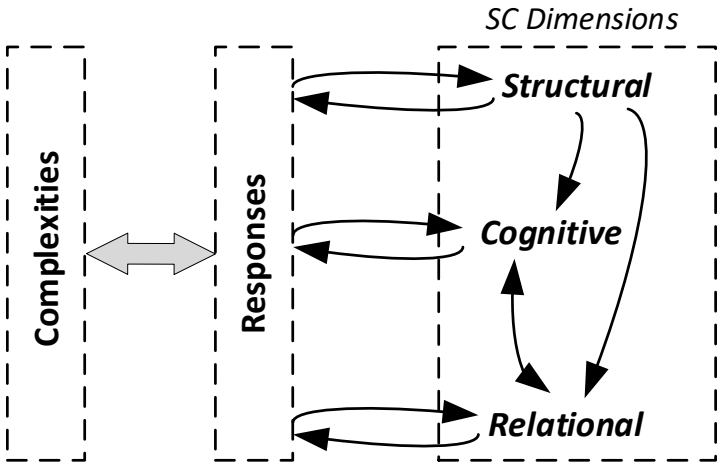

Figure 3: Reciprocity between social capital and the complexity responses

We represent this in Figure 3. The project encounters multiple, interdependent, complexities over time, which the participants must address. In line with Maylor and Turner (2017), we note that responses implemented may also create further complexities later on, so this relationship is not necessarily unidirectional. The structural aspects of social capital allow communication, and this may be considered as the 'foundational' layer, on which the others are built. This is necessary at the project outset if the participants have not worked together before, and will likely change according to the project phases and as issues are encountered. Once the initial network is established, cognitive and relational elements can be strengthened over time. Although the three facets are individually identifiable, they do not exist in isolation. They can be mutually reinforcing, especially if responses can be implemented successfully such that a positive narrative can be established. Such outcomes should not be left to chance. It is the job of managers to foster the work environment such that social capital can be built and supported, thereby increasing the likelihood of complexities being addressed effectively. This is a dynamic task involving active management over the duration of the project, and in response to events that shape the project delivery.

How, then do we understand the role of social capital in managing project complexity? We began with the framework of Maylor and Turner (2017), incorporating structural, socio-political and emergent complexities, and utilising planning and control, relationship development, and flexibility responses. We identified all nine possible permutations within our data, and noted that (perhaps unsurprisingly), there was a strong emphasis on technical issues and solutions, given the nature of the case organizations. However, analysis with a social capital lens showed the centrality of social relationships not only in in crafting responses to complexities and facilitating day-to-day project operations, but also in preparing support for future, as yet unknown, complexities.

Interestingly, a clear-cut delineation of how social capital supports complexity responses did not emerge from the data. A logical expectation might be that it would be most valuable for socio-political and perhaps emergent complexities, but this 'direct' mapping was not forthcoming from the coding. Social capital permeates operations, facilitating the dynamism of project work amongst the multiple participants. However, it operates in a flux that does not bear the deconstruction of social capital as a discrete entity for study. Our initial conceptual model sought to identify its value as the subject of our investigation, yet our data analysis showed the challenge of this conceptualisation.

The data highlighted the importance for managers to create, reshape and renew social capital as a fundamental aspect of their work. This is not 'formulaic' but involves using experience and judgement to craft an appropriate environment in what will likely be a dynamic setting. It also showed clearly that responses based on planning and control, or flexibility, are not 'alternatives' to relationship-building. Instead, they rely on social acceptance and legitimacy for implementation.

6. Conclusions

The purpose of this study was to investigate the role of social capital in managing complex projects. We offer three contributions with this work. First, we have confirmed the existence of all nine elements within the Maylor and Turner (2017) framework with an analysis of their distribution. Our coding allows a fine-grained understanding of the social capital elements used in creating the responses, yet also highlights how entwined social capital is within project working. Second, we offer insight into the temporal effects underpinning the use of social capital in supporting multiple events over the course of a project. Finally, we have identified a

reciprocal relationship between the social capital elements and the complexity responses in these development projects. This is indicated in the Nahapiet and Ghoshal (1998) model but does not appear to have been examined closely within the literature. We have expanded this logic in Figure 3 to show the effect with each of the individual elements, and also in combination. We believe these new viewpoints are useful areas of further investigation which can benefit both researchers and practitioners.

This work is limited by the use of only three cases within the engineering industry. Future studies could address the generalisability of the findings in different contexts. Investigations also incorporating the broader supply chain and longitudinally targeting individuals at different levels of the organizational hierarchy would give a richer understanding of the multi-level aspects of complexity and social capital, and how these unfold in detail over time.

For managers, this work highlights the importance of social capital in achieving effective project outcomes. This appears to be under-emphasised in both the practitioner and academic literatures, and we believe it is important to consider its centrality as a vital responsibility of managers to nurture within their projects and teams. This requires expertise and judgement, and is rarely amenable to 'simple' solutions. We have shared these ideas and findings with managers on post-experience Masters courses and with Executive Education participants, and they report that they find it beneficial as it 'legitimises' their day-to-day experience but is rarely emphasised or explored to such an extent. There is no 'one best way' to manage, but harnessing the power in social capital is a creative option for dealing with the inevitable complexities, structural, socio-political and emergent, that managers will face.

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