An investigation into design and performance of supply chains for public procurement projects

Andrea Genovese[1], Jon Morris[2], S.C.L. Koh[1], Adolf Acquaye[3]

[1]Sheffield University Management School
University of Sheffield, Sheffield, UK
{a.genovese, s.c.l.koh}@sheffield.ac.uk

[2]Technische Universitat Dresden
Dresden, Germany
jonathan_clive.morris@tu-dresden.de

[2]Kent Business School
University of Kent, Canterbury, UK
a.a.acquaye@kent.ac.uk

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Abstract

This study provides new insight into current and emerging supply chain approaches and related power relations deriving from public procurement processes within Local Authorities (LAs). Drawing on a mixed-method empirical research (involving data from LAs across the Yorkshire and Humber region of the United Kingdom) this research examines stakeholder pressures, paying particular attention to principal-agent and dependency relationships between public sector and private companies in public procurement projects. Resource Dependency Theory is used as the theoretical framework to support the study. The paper presents and critically evaluates across a set of dimensions, four models of supply chain archetypes deriving from the implementation public procurement projects. These archetypes identify key stakeholders and determine power relations between main contractors, sub-contractors, government agencies and LAs for the delivery of public sector projects.

The research carried out in this paper can inform practice, policy and research in aiding public organisations such as LAs in the design of projects before the procurement stage. Also, the research provides useful insight on how the procurement process can serve as a mechanism for LAs to manage activities of agents in order to achieve a range of objectives.

Keywords: Public Procurement, Supply Chains, Supply Chain Archetypes

1. Introduction

Over the past 30 years the prevailing political ideology in Western Europe has moved away from economic planning approaches towards a reduction of state intervention. This trend has had profound implications also on the functioning of Local Government and on the delivery of essential services.

In the UK Local Authorities (LAs) are responsible for delivering over 700 public services including housing, health, waste collection, schools, and building controls (Local Government Association, 2011). The provision of these services is usually arranged in collaboration with contractors and suppliers, hired through public procurement exercises. Within the current economic and political context, the belief that introducing market mechanisms could help to improve the standard and efficiency of public services has led to the growing implementation of Private Finance Initiatives (PFI) and Public-Private Partnerships (Entwistle, 2005; Micheli and Neely, 2010; Walker and Andrews, 2013). Especially in the prolonged austerity era following the 2008 financial crisis, PFIs and PPPs have been proposed as a source of generating financial savings for Local Authorities (LAs) (Entwistle, 2005; Morris et al., 2017), and as a way to mobilise greater private sector involvement for risk-sharing and innovation (Lonsdale, 2005; Skelcher, 2005).

Despite an urging of financial restraint and austerity in the provision of public services, public procurement is still thought of as a mechanism to address societal, environmental and economic challenges (Sönnichsen and Clement, 2020). However, the growing levels of privatisation and outsourcing can have deep and profound implications on the services that LAs are responsible for providing (Salamon, 2002; Hodge and Greve, 2007; Lombard and Morris, 2012), and the ability to address societal, environmental and economy challenges. A strong vision and strategy to engage with the procurement process would enable LAs to achieve these objectives through closer collaboration with contractors and suppliers (Andersen and Rask, 2003). For example, this could be achieved through configuring projects to support local development, for example by using locally based Small and Medium Sized Enterprises (SMEs) (Pickernell et al., 2011; Loader 2013; Vecchiato and Roveda, 2014). However, Flynn and Davies (2015) highlight how financial pressures, and a need to show compliance with regulations have led to a disconnection between the rhetoric of supporting local economies in public projects and the realities of project delivery. The latter often favours larger companies and economies of scale and this tendency has been exacerbated by a culture of risk aversion and the reduction of specialist procurement

employees as part of cost saving measures. The result is public procurement decisions increasingly being made by individuals principally employed in other roles (Flynn and Davies, 2015).

This research investigates how public bodies organise and contract firms to deliver large scale publicly funded projects whilst trying to generate local economic benefits under the context where austerity has largely reduced the resources available for LAs (Innes and Tetlow 2015). This research is timely given the recent questioning of public-private partnerships in the UK following the liquidation of Carillion, the UK's largest private contractor in public service delivery and a calling into question the value of overreliance on private finance initiatives involving large scale companies (Smith, 2018; Brady, 2019) . While other fields have considered the power relations between public and private agencies, our research investigates the nature of these power relations within the context of supply chain management when studying the effectiveness of procurement practices and the necessity of managing stakeholder relations (Murray, 2009), particularly those involved within the supply chain of the project undertaken.

In this context, this research explores, through a focus on case studies from the Yorkshire and Humber region of northern England in the UK, how the procurement process can serve as a mechanism for LAs to manage stakeholders and the activities of agents to best achieve a range of economic and social objectives. A multi-method approach with multiple phases of engagement with key stakeholders is utilised to answer the following main research questions:

- Which are the distinctive supply chain archetypes related to public procurement-driven projects?
- What are the distinctive interactions and power relations among stakeholders which characterise each of the archetypes?
- How do these emerging archetypes perform across multiple social and economic objectives?

To address these issues the paper is structured as follows: the next section focuses on a literature review about public procurement strategies, also exploring the underlying theoretical framework of resource dependency theory (encompassing stakeholder and principal-agent relations) and governance ideologies. Research methods are presented in section 3, with the results of empirical findings presented in section 4, allowing for the identification of emerging

supply chain archetypes. Section 5 discusses the findings from a theoretical point of view, enabling conclusions to be presented in section 6.

2. Literature Background: Public Procurement and Supply Chain Management

In the European Union, public procurement accounts for 16% of the total GDP of member states (Lega et al., 2013; Gobbi and Hsuan, 2015). As such, effective management of the procurement process by LAs can help in achieving several objectives, such as regional development and support of SME suppliers rooted in the local community (Pickernell et al., 2011; Williams, 2014, Harland 2019). Sönnichsen and Clement (2020) emphasise the possible benefits of public procurement-led projects to society and economy, while emphasising the possibility of minimising impact on the environment, drawing on definitions from the United Nations and European Commission.

Despite guidelines from supra-national organisations, these types of objectives raise the complexity levels in public procurement when compared to scenarios based on lowest-cost (Sönnichsen and Clement, 2020). For instance, achieving social objectives through the engagement of local SMEs might mean breaking down projects into smaller lots. However, this action can be viewed as being stifled by procurement regulations. For example, the Economically Most Advantageous Tendering (EMAT) method (Costantino et al., 2012; Bergman and Lundberg, 2013) prescribed by EU regulations for selecting winning bids, requires explicit weightings for characteristics including quality, price, environmental impact, after sales assistance, maintenance and life cycle costs (UK Government, 2013). This has implications for the objectives of public procurement actors and the subsequent organisation of supply chains to best achieve locally beneficial, sustainability related objectives and the stakeholders in which they must deal with.

2.1 Public Procurement and the Realisation of Social, Environmental and Economic Objectives

The formal regulations for public procurement set the guidelines that the contracting authority must adhere to organise the different actors and authorities to deliver projects. Previous research in Public Procurement have emphasised the need for a sector level perspective to

understand how supplier business models fit within a competitive procurement process (Caldwell et al., 2005). This however reveals a tension between the political and legal developments to regulate public procurement processes which prioritises delivering value for money (Morris et al. 2017; Patrucco et al. 2019), and the cut-back in procurement expertise which aid the design of tender documentation and procurement practices to facilitate the involvement of local SMEs (Love et al., 2017). These cut-backs in procurement expertise have reduced LA abilities to play an active role in managing supply chains of public projects and accelerated a trend toward off-the-shelf procurement strategies and PPPs where also administrative tasks are outsourced to private contractors (Lember et al., 2011; Sanderson et al., 2015), who benefit from economies of scale.

Within public procurement therefore we can view several supply chain management (SCM) challenges, such as those highlighted by Stamatiou et al. (2019). LAs need to mobilise temporary, fragmented supply chains characterised by firms conducting specialist activities. The information exchange between two firms is characterised as taking place mainly during bidding and contract negotiations, subsequent communication and monitoring channels vary widely according to the final configuration of contractors involved in the project (Ronchi, 2006; Stamatiou et al., 2019). Studies such as those from Pagell and Wu (2007) draw on the ideas of innovative practices which can help realise social, environmental and economic objectives within a framework of public procurement as an off shoot of traditional supply chain management. These lessons can be applicable to the public procurement process, particularly as wider societal considerations are expected to be considered in projects delivered through public-private partnerships (Hueskes et al. 2018). These can involve longer-term relationships and involve the use of supply chain management activities such as supplier development programmes (Rodriguez et al. 2016).

Ronchi (2015) extends this further to take a multi-perspective view of upstream and downstream actors and match different models from contractors and subcontractors to manage suppliers, promoting individualised approaches for each project and deal with the unstructured relationships with internal and external actors (Patrucco et al., 2019). Within these perspectives we can see that there is a realisation that public administrations are requiring appropriate control and management systems to achieve performance measures which deviate from traditional cost measures (Patrucco et al. 2016). LAs should ensure that they are able to create systems that ensure suppliers are adopting the goals and objectives of the LA and equip staff with the necessary knowledge and capabilities to manage this process and to develop, maintain

and enhance such monitoring systems (Pagell and Wu, 2009), and also identify opportunities to break-up projects into smaller, manageable lots in order to increase SME involvement. Investing in procurement expertise is therefore crucial to avoid sub-optimal outcomes where procurement decisions are made in a manner that is disconnected from achieving long-term objectives. However this exposes the tensions in the supply chain management of public procurement projects, as strong environmental, societal and economic performance is often at odds with the legislation and financial support put in place to deliver value for money (Hueskes et al. 2018).

2.2 Local Authorities and Supply Chain Planning

The contemporary role of LAs in public procurement is increasingly associated with organising finances and partner firms and the overall structure of supply chains (Williams, 2014; Flynn and Davies, 2015; Morris et al., 2017). LAs are therefore serving in a role that aims to perform well on measures of profit and loss (e.g. value for money), whilst also maximising social and environmental performance (Pagell and Wu, 2009; Patrucco et al., 2017). Previous studies highlight that gaining the benefits of lower prices and economies of scale through centralized framework agreements is possible but this may lead to LAs unable to deliver on social and environmental performance (Karjalainen, 2011).

The tension between these objectives is also reflected in governance arrangements, which lead to an agency theory view of organisational relations (Coles et al., 2001), where public authorities at multiple levels face challenges in effectively organising their procurement processes. While a dominance of public-private partnerships and outsourcing can be observed at a local level, there still exists the opportunity for LAs to play a much more active role in the provision of services and in the organisation of projects. More interventionist approaches (based on active economic planning) can be seen at a LA level, procuring their own materials and employing sub-contractors to carry out specific tasks as opposed outsourcing the entire package of work to one company (Entwistle, 2005; Garrone and Marzano, 2015). In this sense, the LA can take on a prominent role as the project planner and manager, also orchestrating the whole supply chain, and still achieving optimal efficiencies and optimal scale of operations (Garrone and Marzano, 2015). This could be particularly apparent in Local Authorities which are run by political parties which are less aligned to neo-liberal ideologies (Alonso and Andrews, 2020). Little evidence, however is presented on how, at a local level, planning-based

ideologies translate into procurement practices and supply chain management and organisation of public projects, in an era in which PPP and PFI approaches represent the dominant model. This can link to identifying different archetypes linked to the different ways in which LAs orchestrate their public procurement processes and related supply chains.

In a theoretical sense, we can conceptualise this challenge facing LAs from numerous different perspectives. Previous research has considered, for example the use of Resource Orchestration Theory in framing supply chain integration practices (Liu et al., 2016), which theorises that superior performance in organisations is based on the deployment of resources to achieve competitive advantage. Here LAs can act as knowledge-agents to combine the expertise and networks within their organisations to build strategic capabilities when striving to achieve a wide range of objectives. Other perspectives emphasise the principal-agent nature of the relationship between LAs and their contractors through the lens of agency theory (Uenk and Telgen, 2019).

Our research focuses on the power relations between authorities and their stakeholders and the resources required, in terms of service provision and supply chain orchestration. In order to determine how LAs can manage key stakeholders in the supply chains of public projects through the procurement process, and achieve a wide range of objectives, we adopt the theoretical framework of resource dependence theory (RDT) (Nienhüser, 2008).

2.3 *Stakeholders and Resource Dependency Theory*

The challenge for LAs therefore is to identify which stakeholder concerns are of most importance and how these can be addressed within the confines of public procurement projects to deliver socially beneficial outcomes. Stakeholders refer to a group of actors who have a stake in a specific issue or system (Hill and Jones, 1992). In public procurement projects these include contractors, suppliers, customers, governmental bodies, political groups, trade associations, trade unions, communities, financers, employees. Each possess the power to affect the procuring organisation and can influence the SCM practices employed. Drawing on stakeholder theory (Freeman, 1984), it is possible to explain and predict how an organisation functions with respect to relationships and influences that exist in the organisational environment (Freeman, 1984). Thanks to their capability of capturing complex and multi-level interactions which go beyond dyadic relationships (Rowley, 1997), stakeholder-led approaches

have been widely used within supply chain contexts in order to explain the configuration of suppliers and material flows (Co and Barro, 2009; Sarkis et al., 2010; Wu and Pagell 2011). For instance, they have been adopted by Genovese et al. (2013) and Elias (2016) to critically examine the complex interactions between public and private agents within specific supply chains related to public-procurement projects. Designing "power vs stake" tools (such as the one provided by Elias, 2016) can highlight opportunities to control stakeholder behaviour. This can be addressed at the stage of project specification, through clear definition of the project, costs, materials, and the deliverables to be met. This can help to mitigate situations where powerful stakeholders are assumed to become the dominant voices in project orientation (Rowley and Moldoveanu, 2003). It can also enable LAs to identify the urgency, legitimacy and power of stakeholders and their demands (Elias et al., 2002) in order to design tailored and specified contracts which satisfy and manage these different organisations. However, the use of *off-the-shelf* procurement may not have sufficient definition in the specification to ensure that LAs are able to meet their wider objectives and exert power on contractor firms to achieve their wider goals and distinguish between the different typologies of stakeholder demands.

Imbalances of power between stakeholders in supply chains can be also analysed through the lens of RDT, which shares many similarities with the stakeholder approach (Sanderson et al., 2015; Walker et al., 2015). Previous studies of RDT have concentrated on the power and dependence which exists across networks of organisations and consider resource control as a source of power (Rowley, 1997). Considering RDT in the context of the management of stakeholder networks consider the shape, form and characteristics of these networks and the individual attributes of the participants involved (Rowley, 1997). Such a framework recognises the firm's interdependence on external and internal contingencies but provides a framework for explaining the actions of organisations and the management of their stakeholders, considering the management of power relations between principals and agents (e.g. local authorities and contractors) (Davis and Cobb, 2009), organisational trust (Ketchen and Hult, 2007) and dependencies (for example autonomy and legitimacy).

When applied to supply chains, RDT can shed light on the dynamics and power relations surrounding supply chain behaviour, capacity management, risks, trusts and relationships of key stakeholders with the principal (Hillman, 2009), informing the choice of optimal configuration of supply chains. In the context of public procurement, LAs need to obtain the necessary external resources controlled by private stakeholders and manage the power relations with regards to the activities of contractor firms (the agents in the principal-agent relationship)

to ensure alignment with the interests of the principal (i.e. the LA itself) (Wiseman et al., 2012). Conflicts that arise include information asymmetry and different attitudes towards risk and are characteristics of a resource-dependent scenario (Ciliberti et al., 2011). The basic arguments of RDT can be summarised as:

- Organisations depend on resources;
- Resources originate from organisational operational environment;
- Resources required by one organisation are often controlled or owned by other organisations;
- Resources are a basis of power and this power and resource dependence are directly linked;
- Legally independent organisations can therefore depend on each other, as specified in procurement contracts.

The power relationship between LAs and their first-tier contractor firms is based on the LA's dependence on its contractor's resources, skills, and capabilities to deliver its public projects. Within a RDT perspective, the core argument is that organisations collaborate because they alone lack the critical competencies (or ability to develop them in a timely fashion) to complete certain tasks (Selsky and Parker, 2005). Under this framework, organisations voluntarily partner primarily to serve their own interests (e.g., acquire needed resources) but also to address social concerns (Selsky and Parker, 2005). This draws on traditional views of supply chains with resource dependence, which suggest that each agent in the supply chain will attempt to exert power to avoid becoming dependent on other organisations and increase the dependency of other organisations on them (Ketchen and Hult, 2007). This helps to understand the process that the procurer finds, selects, and manages supplies, and to identify and analyse the level of interdependency and power differences between the parties.

We expect that more powerful organisations can exploit their power to suppress partner organisations, but that the design of contracts can re-align relationships to mitigate power imbalances and negate organisational weaknesses. The concept of RDT fits with the aims of supply chain managers – namely to develop an orderly pattern of resource flows and reduce uncertainty for managing partners (Pfeffer, 1981; Bode et al., 2011). Additionally, the networks, relationships, and information flows that LAs build with their stakeholders may also help to reduce the resource dependency on contractor firms.

2.4 *Contribution of the paper*

This research aims to uncover how resource pressures and stakeholders' power dynamics influence the actions of local authorities in the design of public procurement exercises and related supply chains. Specifically, the research will aim at identifying distinctive supply chain archetypes related to public procurement-driven projects, along with specific interactions and power relations among stakeholders which characterise each of the archetypes. Tensions between different objectives to be pursued by Local Authorities will be highlighted, along with the different types of roles played by LAs, and the prevalence of different models based on different levels of public-private partnership or active planning and intervention. The next section of the paper details the methodological foundations of the paper.

3. Methodology

This research is an exploratory investigation into the procurement practices and subsequent management of supply chains following a critical realist approach. The research aims to uncover understandings of institutional patterns and accounts of how resource pressures and power dynamics influence the actions of local authorities in the configuration of supply chains. These observations can be the results of the underlying laws and mechanisms from unobservable, institutional networks and pressures which require multiple steps of qualitative analysis in order to explore issues presented by multiple stakeholders along the entire public procurement supply chain. The need to investigate the perspective of multiple actors in the same supply chain required the use of a multi-method iterative approach where new rounds of activity were informed by results that arise in the previous round, as illustrated in the following (Killip, 2013).

3.1 The Unit of Analysis

The United Kingdom presents a suitable case to explore, given the desire of successive UK Governments to introduce market-based approaches into public sector procurement projects. Within this context, public authorities are requested to develop innovative supply chain

management systems that maximise the benefit from public funds (DECC, 2010; Killip, 2013; Morris et al., 2017).

One area which presents some challenges of this type is represented by Housing Improvements and Energy Efficiency Retrofit Services (in the following, EERS) for the management of the dwelling stock of LAs. Such area recently saw a shift in funding from taxation-backed schemes towards public-private partnerships, with LAs (and their housing partners) being placed at the forefront of projects delivery despite the recent cuts in public expenditure due to austerity measures (Morris et al., 2017). As such, this represents a typical example of an area of public-private projects (Killip, 2013). In these projects, the LA takes on a prominent role as the project planner and manager of stakeholder demands. EERS schemes are sufficiently large enough to have the potential to benefit from largescale public funding (Genovese et al., 2013) and can constitute significant source of regional development focus due to their capability to mobilise wide supply chains from multiple industries (i.e., construction and residential energy services).

Within the UK, this study focuses on the Yorkshire and Humber Region, a region which according to the latest census, the region has a population of 5,142,000 and a rural-urban division which mirrors England as a whole (Genovese et al. 2013). The size and characteristics of the region also makes it comparable to many other regions within Europe. Genovese et al. (2013) reveal that the housing profile of the region (in terms of type and age of dwellings) is not significantly different from that of England as a whole and has the second largest quota of publicly managed dwellings in the whole of England. Within the region, several publicly funded EERS schemes have been performed in recent years (Genovese et al., 2013). This makes the region an interesting case for understanding supply chain implications of public procurement projects.

Within the region, 10 LAs were studied, following an approach which follows previous research by Patrucco et al. (2016). Here the public procurement role of LAs is studied using a triangulation approach with actors from across the different phases of project delivery (see Table 1) to reconcile views from stakeholders which fall on the demand and supply sides of such projects (Hueskes et al., 2017; Rodríguez et al., 2016). To uncover the network of institutional practices and processes, this research takes an exploratory inductive approach to combine multiple phases of investigation which considers the power relationships evidenced between key stakeholders, and the contexts in which these are developed. These phases included:

- An investigation of the Supply Side (involving a web-based questionnaire and telephone interviews with companies providing EERS solutions);
- An investigation of the Demand Side (involving interviews with Local Authorities and a Focus Group).

Similar to the work conducted by Behera et al. (2016), supply chain archetypes were then developed after ensuring that an adequate mapping of the supply chain stakeholders is provided (capturing perspectives from both principals and agents) through the use of an iterative approach where new rounds of activity to be informed by results that arise in the previous round (Killip, 2013). The entire research lasted 18 months; details of the specific dates in which the different data collection steps took place are reported in Table 1.

Data Collection Step	Purpose	Details	Analysis	Months
Web-based questionnaire	Investigating stakeholders in the supply side (regional companies, their propensity to take part in public procurement exercises, existing barriers); identifying companies to be invited for interviews	493 companies targeted; 153 responses 31.2% response rate.	Descriptive statistics	1-3
Phone Interviews to Regional Businesses	Confirming findings from the web-based questionnaire and elaborating on supply side issues in public procurement	20 companies targeted (selected among participants to the questionnaire who have had previous experience of involvement in publicly funded projects)	Qualitative analysis	4
Interviews with LAs	Understanding the demand side of the supply chain (namely, procurement mechanisms adopted by LA)	Representatives from 10 LAs were repeatedly interviewed (3 times across a 18-month period)	Qualitative analysis	5-18
Focus Group with LAs	Confirming findings arising from interviews	Representatives from 10 LAs participated in 3 focus groups across a 18-month period.	Qualitative analysis	14

Table 1: Details of the Employed method

3.2 Investigating the Supply Side

The investigation of the supply side took place over two months and consisted of surveying local EERS firms to identify the key stakeholders involved in procurement processes and in supply chains related to project delivery. 493 companies in the region were identified from trade directories and chamber of commerce listings utilising the key words of "energy efficiency", "housing improvements" and "building retrofitting". 153 companies responded to the survey (giving a response rate of 31.2%). According to a 5-point Likert-scale, companies were asked to rate the importance of customer categories (identified in Genovese et al., 2013) for their contribution to company turnover and barriers (emerging from Genovese et al., 2013) they face when engaging in EERS projects promoted by LAs. Survey data was analysed through descriptive statistics and all respondents were given the option to participate in further telephone interviews.

In order to develop a greater understanding the supply of firms potentially participating in the supply chain, 72 firms agreed to be interviewed (47% of the respondents) and 20 were selected. Companies were evenly spread across five different turnover brackets, with the condition that they had previously participated, at least as sub-contractors, in EERS projects led by LAs. This ensured that the study had an adequate *dyadic* perspective, with contractors being connected with selected LAs and, hence, an adequate match between the supply and demand phases. Each of the 20 companies were interviewed once (with an average interview duration of 20 minutes). Interview respondents had responsibility for preparing submissions for tendering exercises, although the variations in size and scope of companies meant the exact job roles varied across each company. Interviews were partially transcribed and analysed using thematic content analysis to achieve clarification and consolidation of responses provided to the questionnaire[1]. This help understand stakeholders involved in public procurement projects, and potential barriers that exclude their collaboration.

[1] All the rounds of coding were performed independently by all the authors; a kappa-type measure was employed in order to keep track of disagreements. The few cases of disagreements were dealt with through a collective discussion for reaching consensus.

3.3 Investigating the Demand Side

The next round of analysis aimed to build a picture of the supply chain designs employed in ten Yorkshire and Humber LAs. To do this, face-to-face semi-structured interviews were held with procurement officers (or staff with responsibility for procurement) from ten LAs, along with representatives from housing providers employed in similar positions to examine the demand side of the supply chain.

Tables 2 and 3 detail the surveyed LAs, the rural and urban classifications from the Office of National Statistics (ONS 2009), the prevailing political alignment of the council (Local Government Association 2015) and the housing stock composition in each LA. Three rounds of interviews were conducted with the ten participants in the study across an 18-month period, enabling the generation of rapport with representatives, access to documentation, and a longitudinal analysis to develop the required understanding the experiences of the procurement process and subsequent supply chain management of projects (Table 3). These engagements focused on the relationships between stakeholders with specific themes of i) procurement strategies; ii) resultant supply chains, including involved stakeholders, their relationship and the *power fulcrum* (intended as the set of key stakeholders controlling resources in the supply chain); iii) understanding benefits deriving from alternative supply chain designs; and; iv) barriers to switching to alternative strategies. Interviews lasted approximately 1 hour and were partially transcribed and coded using a thematic approach with the aim of identifying different supply chain archetypes. Consideration was also given to the ideological influences on supply chain management strategies. Two confirmation focus groups were held over the 18-month period (month 15 and 18) which followed the same analytical process but allowed for examining the interactions between each of the authorities. A summary of the surveyed LAs is reported in Table 2 and 3.

LA	Political Alignment	Dwellings					
		Type of Authority	Local Authority	Private Registered Provider	Other public sector	Private sector	Total
LA1	Conservative	Rural	0.01%	13.84%	0.00%	86.15%	100.00%
LA2	Labour	Other Urban	17.24%	3.41%	0.00%	79.35%	100.00%
LA3	Labour	Major Urban	16.57%	4.89%	0.00%	78.53%	100.00%
LA4	Labour	Other Urban	0.02%	15.04%	0.08%	84.86%	100.00%
LA5	No Overall Control	Other Urban	12.39%	3.10%	0.00%	84.51%	100.00%
LA6	Labour	Other Urban	15.23%	2.77%	0.00%	82.00%	100.00%
LA7	Labour	Major Urban	16.59%	7.28%	0.03%	76.10%	100.00%
LA8	Labour	Other Urban	18.00%	3.99%	0.28%	77.73%	100.00%
LA9	Conservative	Other Urban	5.44%	3.92%	0.91%	89.72%	100.00%
LA10	No Overall Control	Other Urban	8.79%	5.59%	0.41%	85.21%	100.00%

Table 2: Surveyed LAs and housing stock composition

LA	Organisations	Interviewees	Interview Duration
LA1	Housing Partner	Housing Partner Procurement Manager	3 interviews (months 6; 10; 14); 90 minutes each
LA2	LA Procurement Department Arms-Length Management Organisation	LA Procurement Manager ALMO Programme Manager	3 interviews (months 7; 11; 15); 90 minutes each
LA3	LA Procurement Department Arms-Length Management Organisation	LA Procurement Manager ALMO Programme Manager	3 interviews (months 6; 10; 14); 90 minutes each
LA4	Housing Partner	Housing Partner Procurement Manager	3 interviews (months 6; 10; 14); 90 minutes each
LA5	LA Procurement Department Arms-Length Management Organisation	LA Procurement Manager ALMO Programme Manager	3 interviews (months 6; 10; 14); 90 minutes each
LA6	LA Procurement Department Arms-Length Management Organisation	LA Procurement Manager ALMO Programme Manager	3 interviews (months 8; 12; 15); 90 minutes each
LA7	LA Procurement Department Arms-Length Management Organisation	LA Procurement Manager ALMO Programme Manager	3 interviews (months 6; 11; 14); 90 minutes each
LA8	LA Procurement Department Arms-Length Management Organisation	LA Procurement Manager ALMO Programme Manager	3 interviews (months 6; 10; 14); 90 minutes each
LA9	LA Procurement Department Arms-Length Management Organisation	LA Procurement Manager ALMO Programme Manager	3 interviews (months 6; 12; 16); 90 minutes each
LA10	LA Procurement Department Arms-Length Management Organisation	LA Procurement Manager ALMO Programme Manager	3 interviews (months 7; 11; 14); 90 minutes each

Table 3: Surveyed LAs

4. Results and Analysis

4.1 Identifying the Supply Side

The survey analysis revealed a strong representation of micro-businesses (Table 4) employing a limited number of people and reporting relatively low turnovers; fourteen firms reported an annual turnover of £5m or higher; and the majority (8) of these employ more than 250 people, and three of these companies employ between 100 and 249 people, indicating an interrelation between the number of employees and company turnover.

Turnover	Employees					%	Count
	1-9	10-49	50-99	100-249	250+		
£0 - £250k	74	0	0	0	0	48.4%	74
£250k - £500k	17	4	0	0	0	13.7%	21
£500k - £1m	12	6	0	0	0	11.8%	18
£1m - £5m	1	23	2	0	0	17.0%	26
£5m+	0	1	2	3	8	9.2%	14

Table 4: Businesses classification based on annual turnover and number of employees

According to the employed 5-point Likert-scale rating (with 1 meaning *not important at all* and 5 meaning *very important*), Table 5 reveals that on average the most important customer grouping is private owner-occupiers (scoring on average 3.72). Social Housing Associations (1.87) and LAs (1.97) do not feature as important customer categories. This might indicate that local businesses experience difficulties in directly engaging in publicly funded EERS projects. This is supported by breaking down companies by number of employees, which shows that larger companies are more likely to place importance on LAs and Social Housing customers (Table 5). LA importance to firms of greater than 50 employees is 3, compared to just 1.70 for micro-businesses, suggesting a barrier to entry of smaller firms for public projects.

According to the employed 5-point Likert-scale rating (with 1 meaning *not important at all* and 5 meaning *very important*), barriers such as a lack of advertising of opportunities (scoring on average 3.2) seem to represent the most pressing issues for companies of all sizes. Barriers related to the complexity of the bidding process (cost of bidding opportunities, skills required by the bidding process) are more relevant to smaller firms (see Table 6).

Customer Categories	Average Rating	1 – 9	10 - 49	50 – 99	100+
Private Owners-Occupiers	3.72	3.97	3.33	3.00	2.00
Private Landlords	2.64	2.86	2.13	1.67	2.25
Contractors	2.44	2.32	2.58	3.00	3.25
Developers/Architects	2.29	2.12	2.71	2.67	2.50
Commercial Builders	2.27	2.09	2.75	3.00	2.00
Self-Build Projects	2.11	2.14	2.13	2.33	1.50
LAs	1.97	1.70	2.50	3.00	3.00
Social Housing Associations	1.87	1.69	2.17	3.00	2.50
Energy Efficiency measures installation businesses	1.82	1.77	2.00	1.33	2.00

Table 5: Relevance of Customer Categories.

Barriers	Average Rating	1 – 9	10 – 49	50 – 99	100+
Opportunities advertising is insufficient	3.20	3.40	2.85	2.80	2.80
Lack of Support/Assistance	2.85	2.96	2.70	2.33	2.20
Costs of bidding opportunities are too high	2.72	2.83	2.48	2.33	2.20
Not trained or skilled in bid production	2.69	2.85	2.30	2.00	2.20
Financial appraisals when bidding are too rigorous	2.69	2.85	2.33	2.00	2.00
Corporate Social Responsibility Issues	2.13	2.19	1.89	3.00	1.80
Politics/Historical difficulties with clients in this area	2.02	2.00	2.04	3.00	1.80
Health and safety record issues	1.79	1.90	1.41	2.00	1.80

Table 6: Barriers in bidding for publicly-funded EERS projects.

Table 7 confirms that the involvement of local SMEs in the supply chain enacted by the procurement process related to the promotion of EERS projects is quite limited. Most of the regional firms are mainly involved in small scale projects whilst first-level contractor positions are generally filled by larger firms.

Project Value	Employees					%	Count
	1-9	10-49	50-99	100-249	250+		
£0-£5k	50	6	1	1	0	43.0%	58
£5k-£10k	17	3	0	1	1	16.3%	22
£10k-£50k	22	16	1	1	2	31.1%	42
£50k-£150k	3	4	1	0	0	5.9%	8
£150k+	2	1	0	0	2	3.7%	5

Table 7: Typical size of undertaken projects

To validate the findings frm the questionnaire survey, a round of telephone interviews with 20 companies was performed. Firms were evenly selected across different turnover brackets, under the condition that they had previously participated in EERS projects led by LAs (at least as sub-contractors). Interviewed firms recognised that larger firms are awarded most of the opportunities as demonstrated by the following quotes:

"*Most of the work seems to go to large contractors coming from other regions*" (Owner, Insulation Micro-Business).

"*Large businesses have their own sub-contractor list that rarely includes local businesses*" (Managing Director, EERS Firm)

"*Very often, main national contractors winning large projects act as 'middle men': this adds costs and squeezes profit margins for sub-contractors*" (Managing Director, EERS Firm).

"*Publicly funded projects tend to be quite large; local businesses lack the capacity to get involved at a main contractor level*" (Owner, Heating Interventions Micro-Business)

"*Sub-contracts tend to be awarded to the companies that they have the best informal relationships with, or those who are the cheapest, rather than those capable of offering the best overall service*" (Managing Director, EERS firm)

4.2 Identifying the Demand Side: Emerging supply chain archetypes

Face-to-face interviews with ten LAs shed further light on the mechanisms employed by Local Authorities to deliver public procurement-driven projects, while adhering to regulations and trying to maximise the benefits for local communities. Specifically, as explained in Section 3.2, the following dimensions were evaluated and served as a coding scheme for the material collected at the single LA level (as reported in Table 8):

- *Involvement of stakeholder groups*: including the different actors playing a role in the supply chain.
- *Involvement of stakeholder types*: classifying the stakeholder groups into public and private sector.
- *Project type*: namely large public initiatives, individual initiatives, public incentive schemes

- *Project scale*: describing the economic value of the project (in the case of EERS projects, for instance, this may range from single dwelling projects to projects in which hundreds of dwellings are treated);
- *Power Fulcrum:* referring to the identification of the key stakeholders (controlling most of the resources) within the supply chain.
- *Role of the Procurement Department*: understanding the extent to which this organisational unit is able to shape the supply chain dynamics deriving from the projects.

Also, LAs were asked to mention the critical dimensions across which they evaluate the performance of supply chains resulting from public procurement projects. The discussion started by classical criteria mentioned in the public procurement and PPI literature, such as: quality of finished project, construction cost (including economies of scale and unit costs), construction time, occupational health and safety, labour dependency, contractor's project management, quality of coordination by the construction team, contractor's manpower capacity, construction flexibility, environment friendliness, level of technology (see, for instance, Regan et al., 2011; Liu et al., 2014 and 2018). The main dimensions which were mentioned by the LAs in individual interviews (and confirmed at the mentioned focus group) were:

- *Degree of Public-Private Partnership*: the extent to which LAs are able to exert control over the whole supply chain.
- *Standardisation Level*: the homogeneity of installed materials and components and therefore the ease for which maintenance can be carried out.
- *Economies of Scale and unit costs*: the extent to which the adopted supply chain archetype allows for savings due to the possibility of purchasing bulk quantities of materials and components.
- *SME Involvement*: the level of involvement of small businesses at every tier in the supply chain.
- *Planning and Management Requirement for LAs*: the level of direct involvement of LAs in order to manage the supply chain and ensure project deliverables are met.

Given the high level of commonality, supply chain designs identified at each Local Authority can be aggregated into four archetypes or *ideal types* (Doty and Glick, 1994) described by the dimensions introduced above in the following Table 9: the Baseline, Global Service,

Framework and Active Planning archetypes. The following sub-sections describe, in detail, each of the archetypes.

LA	Stakeholders' Groups	Stakeholders Type	Project Type	Project Scale	Power Fulcrum	Procurement Department Role
LA1	LAs; ALMOs; Procurement Consultancy Firms; Main Contractors; Qualified Sub-Contractors; Suppliers.	Public and Private	Complete outsourcing of all the activities	Large	First-Level Contractor	Appointment of the first-level contractor; management of the relationship with the first-level contractor
LA2	LAs; ALMOs; Procurement Consultancy Firms; Main Contractors; Qualified Sub-Contractors; Suppliers.	Public and Private	One-Off projects	Average	LAs; ALMOs; Procurement Consultancy Firms; Main Contractors	Appointment of first-level contractors for one-off projects; management of the relationship with the first-level contractor, sub-contracting monitoring
LA3	LAs; ALMOs; Procurement Consultancy Firms; Main Contractors; Qualified Sub-Contractors; Suppliers.	Public and Private	Complete outsourcing of all the activities	Very Large	First-Level Contractor	Appointment of the first-level contractor; management of the relationship with the first-level contractor
LA4	LAs; ALMOs; Procurement Consultancy Firms; Main Contractors; Qualified Sub-Contractors; Suppliers.	Mainly public	Long-term projects and schemes	Average	LAs; ALMOs; Procurement Consultancy Firms.	Appointment of first-level contractors for one-off projects; management of the relationship with the first-level contractor, sub-contracting monitoring
LA5	LAs; ALMOs; Procurement Consultancy Firms; Main Contractors; Qualified Sub-Contractors; Suppliers	Public and private	Long-term projects and schemes (divided lots of work)	Large (divided in smaller lots)	LAs; ALMOs; Procurement Consultancy Firms	Appointment of a set of first-level contractors for projects in the same area to be run across a longer period of time; repeated tender exercise for shortlisted contractors; management of the relationship with the first-level contractors, sub-contracting monitoring

LA6	LAs; ALMOs; Materials' suppliers; Distributors; Sub-contractors	Mainly public	Long-term projects and schemes; standard maintenance (divided lots of work)	Variable	LAs; ALMOs.	Active project management and supply chain orchestration. Monitoring of materials flows and inventory levels
LA7	LAs; ALMOs; Procurement Consultancy Firms; Main Contractors; Qualified Sub-Contractors; Suppliers.	Public and Private	Complete outsourcing of all the activities	Very Large	First-Level Contractor	Management of the relationship with the first-level contractor
LA8	LAs; ALMOs; Procurement Consultancy Firms; Main Contractors; Qualified Sub-Contractors; Suppliers.	Public and Private	Complete outsourcing of all the activities	Average	First-Level Contractor	Management of the relationship with the first-level contractor
LA9	LAs; ALMOs; Procurement Consultancy Firms; Main Contractors; Qualified Sub-Contractors; Suppliers.	Public and Private	Complete outsourcing of all the activities	Average	First-Level Contractor	Management of the relationship with the first-level contractor
LA10	LAs; ALMOs; Procurement Consultancy Firms; Main Contractors; Qualified Sub-Contractors; Suppliers.	Public and Private	One-Off projects	Average	LAs; ALMOs; Procurement Consultancy Firms; Main Contractors	Appointment of first-level contractors for one-off projects; management of the relationship with the first-level contractor, sub-contracting monitoring

Table 8: Characteristics of the Public Procurement supply chains at the individual Local Authority level

Archetype	Stakeholders Groups	Stakeholders Type	Project Type	Project Scale	Power Fulcrum	Procurement Department Role
Baseline	LAs; ALMOs; Procurement Consultancy Firms; Main Contractors; Qualified Sub-Contractors; Suppliers.	Public and Private	One-Off projects	Average	LAs; ALMOs; Procurement Consultancy Firms; Main Contractors.	Appointment of first-level contractors for one-off projects; management of the relationship with the first-level contractor, sub-contracting monitoring
Global service		Public and Private	Complete outsourcing of all EERS activities	Very large	First-Level Contractor	Appointment of the first-level contractor; management of the relationship with the first-level contractor
Framework		Public and Private	Long-term projects and schemes (divided lots of work)	Large	LAs; ALMOs; Procurement Consultancy Firms.	Appointment of a set of first-level contractors for projects in the same area to be run across a longer period of time; repeated tender exercise for shortlisted contractors; management of the relationship with the first-level contractors, sub-contracting monitoring
Active Planning		Mainly public	Long-term projects and schemes (divided lots of work)	Variable	LAs; ALMOs; Procurement Consultancy Firms.	Active project management and supply chain orchestration. Monitoring of materials flows and inventory levels

Table 9: Public Procurement supply chains archetypes

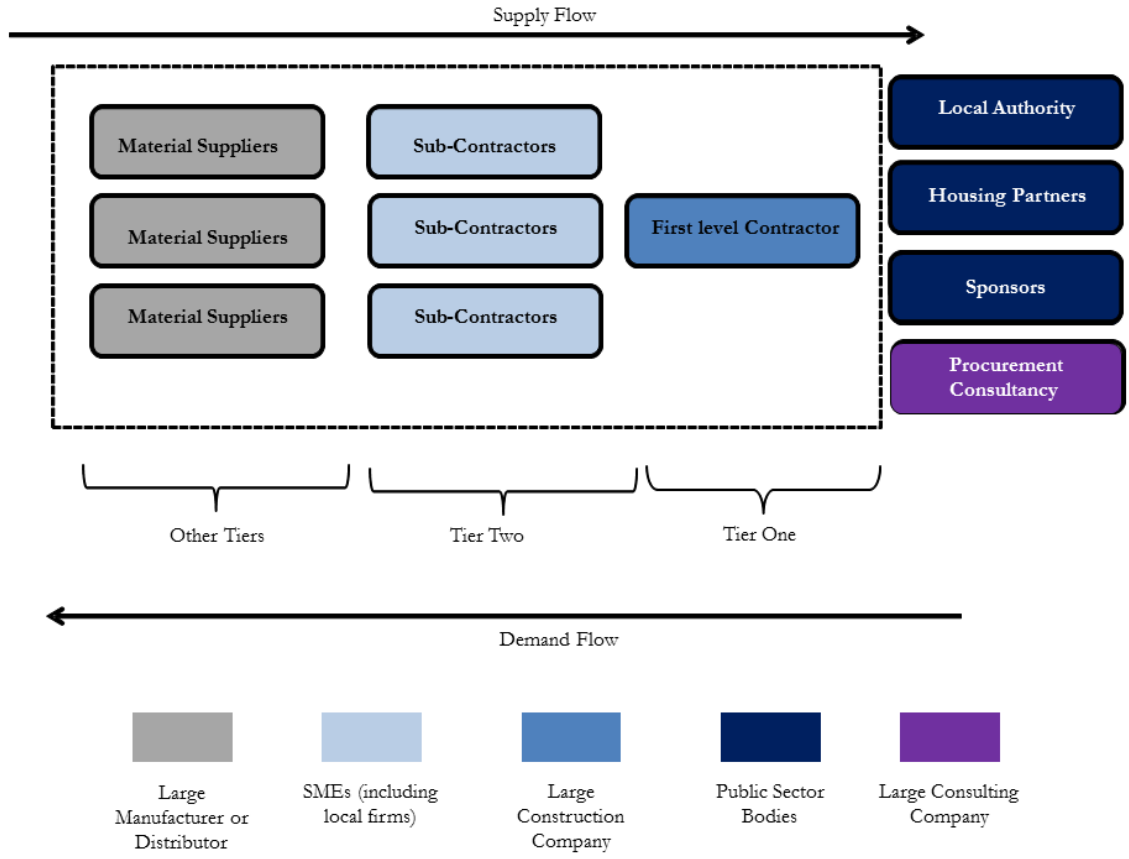
4.2.1 The baseline supply chain archetype

The *baseline* supply chain emerged from discussions with LA2, LA4 and LA10. The key stakeholders in this archetype include the LAs, Arms-Length Management Organisations (ALMOs) (or, in some cases, Registered Social Landlords, RSLs), procurement consultancy firms, tier-one contractors, and smaller tier two sub-contractors. Data from interviews suggest that in this archetype an effective working partnership between 'public' and 'private' actors is crucial. Tier two sub-contractors (usually SMEs) often do not have any power and are frequently discriminated against winning contracts as projects are typically awarded on a one-to-one basis. Competitive tendering is employed with the appointed contractor responsible for a single lot of work including sourcing raw materials, sub-contracting and managing lower-tier suppliers. This First Tier Contractor is critical in verifying that all specifications and deliverables along the supply chain are met, and supply chain communication and trust can be improved, and risk reduced by forging long term horizontal Principal-Agent relationships with Sub-Contractors operating within the private sector and increase supply chain functionality and effectiveness (Chen and Paulraj, 2004). Long term relationships are dependent on the ability to control conflicts between principal and agent goals (Jones, 1995).

For the organisation of new projects in the same area of interest there is a separate tendering process and the First Level Contractor with existing relations with the LA has no preferential route in bidding for additional projects as per UK public procurement regulations. "*This is a hindrance for LAs to organise their key stakeholders to maximise local economic objectives from the implementation of public projects; also, this need to repeat procurement exercises might mean that we end up with less standardisation in the materials installed and in the work we undertake. This can increase maintenance costs in the long run*", said one of the procurement officers. "*One-off contractors might come with their supply chain and their preferred sub-contractors. They have no incentive in engaging with the local guys*", added another officer.

Due to the limited powers of LAs, there may become a dependency on first tier contractors for running the project and managing supply chains. Attempts to re-balance the dependency relationship with contractor firms has occasionally seen procurement contracts insisting that upstream tendering involves local SMEs (Edler and Gheorghiou, 2007). However, achieving this becomes more complex if power, skills and expertise are distributed among a number of additional organizations including Housing Providers, Sponsors and Procurement Consultants.

In this scenario the LA becomes increasingly dependent on the managerial capabilities of the first level contractors and on their own supply chains and is one of the most common approaches used by LAs. However, this shift of power is limited by the one-off nature of projects being undertaken and leads to the type of supply chain archetype as illustrated in Figure 1 (top). This *baseline* supply chain archetype can be seen to exhibit two levels of a Principal-Agent relationship. The first level is a *vertical Principal-Agent* relationship, as LAs are the Principal, while First Tier Contractors are the Agents. In addition, from the perspective of LAs, *horizontal* Principal-Agent relationship also exists in the supply chain archetype, where the First Tier Contractor serves as the Principal, and the sub-contracting firms are the agents. There is a weak, or non-existent relationship between the main sponsor and the sub-contractor.



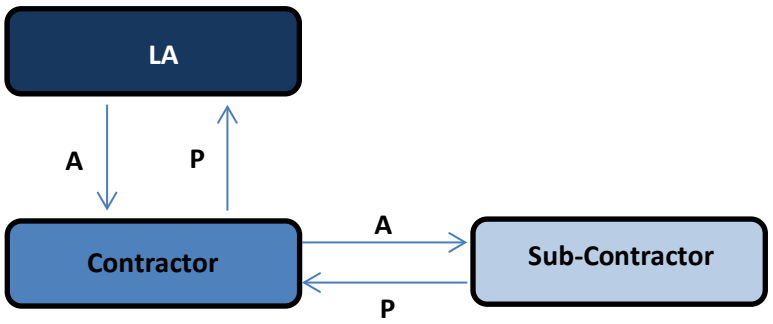


Figure 1: The Baseline Supply Chain archetype (top) and its relationship between stakeholders (bottom). A signifies the action of the Agent, P signifies the power of the Principal.

4.2.2 The global service supply chain archetype

The *global service* supply chain is a variant of the *baseline archetype* arising from consultation with LA1, LA3, LA7, LA8 and LA9. In this scenario, LAs outsource the whole set of works and activities related to the project to a First Level Contractor for a given amount of time (typically 3 to 5 years), including future works related to the initial project. This has the advantage of reducing the need for new procurement processes. First Level Contractors therefore may become close partners of the LA and may, over a period of time provide additional services (e.g. planning and management); this makes the supply chain archetype *permanent*, as opposed to the temporary nature of the baseline archetype. This type of supply chain archetype became popular in the 1980s as councils attempted to negate the impacts of severe funding cuts by outsourcing administrative activities and day-to-day maintenance, whilst exploiting well established services identified in the global supply chain. Experiences from the LAs that adopted similar approaches reveal that the effectiveness of this archetype is contested. A Procurement Officer at a surveyed ALMO stated:

> "*Benefits are becoming less apparent. The main contractor is also responsible for sourcing components. We end up paying more than we could pay sourcing them autonomously. Frequently the main contractor does not perform installation works; sub-contractors come in, and the council, obviously, has to pay for their profit. We may reconsider this model, which was introduced to outsource not only the EERS and repairs function, but also the project management and planning phases*".

According to a RDT perspective, this illustrates how public control in projects is weakened as power is concentrated with the First-Tier contractor, particularly regarding sub-contracting and

labour sourcing decisions, reducing the potential for producing local economic benefits. While there may be a desire to shift from this arrangement, another Procurement Officer indicated that, due to staff cuts, *"the procurement team is basically made up of a single person. Adopting this model is probably the only way to get administrative support"*. This supply chain archetype is illustrated in Figure 2.

The *global service* supply chain archetype assumes the same Principal-Agent relationship structure as the *baseline* supply chain archetype (as shown in the bottom of Figure 1) but differs in the levels of exposure to risks from conflicts in project goals, as well as the risk in outcomes due to the outsourcing of administrative tasks to first tier contractors and to the medium-term nature of such arrangements. Such an archetype is a typical example of a setting in which *multiple stakeholders with conflicting stakes* (Elias, 2016) are operating; a situation in which conflicts might arise.

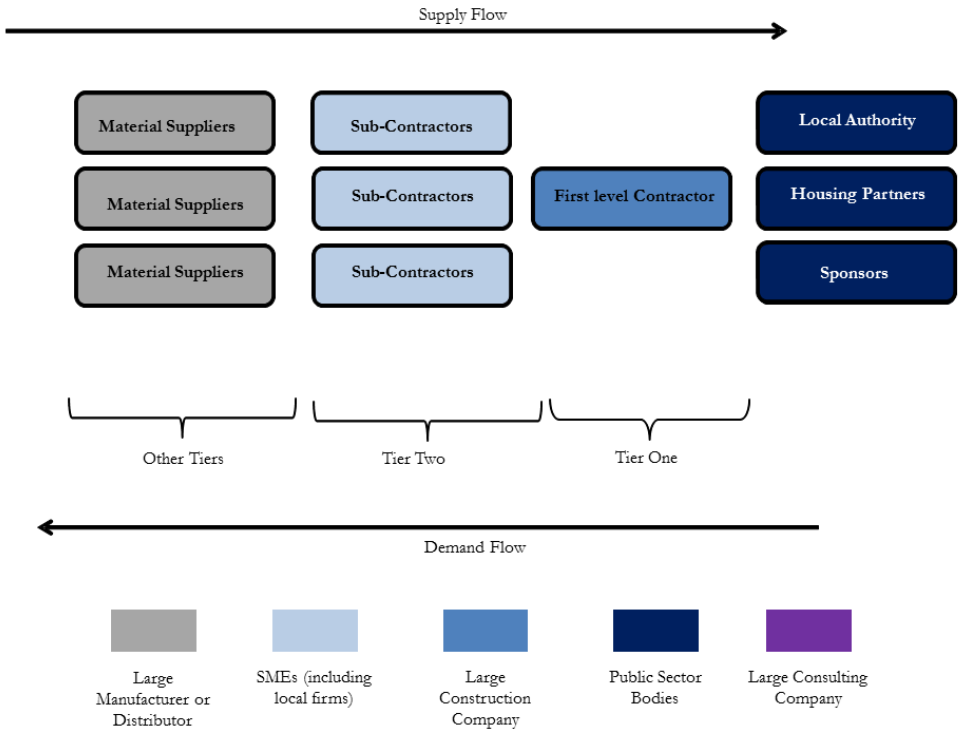


Figure 2: The *Global Service* supply chain archetype

4.2.3 The Supply Chain framework archetype

The type of archetype employed by LA5 was shaped by the use of framework contracts; a portion of required work can be awarded to any one of shortlisted first tier contractors (derived from an initial screening process) over a number of years (typically 3-5 years) and specific work can be awarded to any of the short-listed sub-contractors based on a quicker selection process. This is termed as the *framework archetype.* The first-tier contractors can still source raw materials and involve subcontractors and is illustrated in Figure 3.

A Procurement Officer indicated that *"this model is a good compromise solution. Indeed, we get a fair amount of competition among big contractors, as, once the shortlisting process is concluded, they still have to bid for the specific portion of the works to be conducted. We can still take advantages of their size and scale, without completely outsourcing the control of the whole supply chain".* Another officer added: *"We can place higher demands on them in terms of standardisation of the work, which can result in lower maintenance costs. We can try to impose tighter requirements on standardisation and on local sourcing and involvement of sub-contractors, with respect to one-off exercises. Of course, this can result in higher coordination costs and on ourselves playing a much more active role in shaping the supply chain; but the LA is happy to do so also to stimulate the local economy*". This highlights that the difference between the framework archetype and the previous two archetypes is that each first-tier contractor chosen within the supply chain framework archetype would have a unique Principal-Agent relationship with the LA (as shown in Figure 3), along with their own sub-contractors which might affect the nature of the behaviour of the actors, risk and capacity management, and communication and trust. Chosen agents within the framework archetype are direct competitors with other potential agents and the ability for LAs to change contractors can (directly or indirectly) alter relationship dynamics and agent behaviour in supply chains, through reinforcement actions (Harrison et al., 2010); as also postulated by Lacoste (2014), framework contracts can reinforce cooperative relationships among buyers and suppliers. Therefore, this type of archetype can significantly reduce the dependency of LAs on first tier contractors.

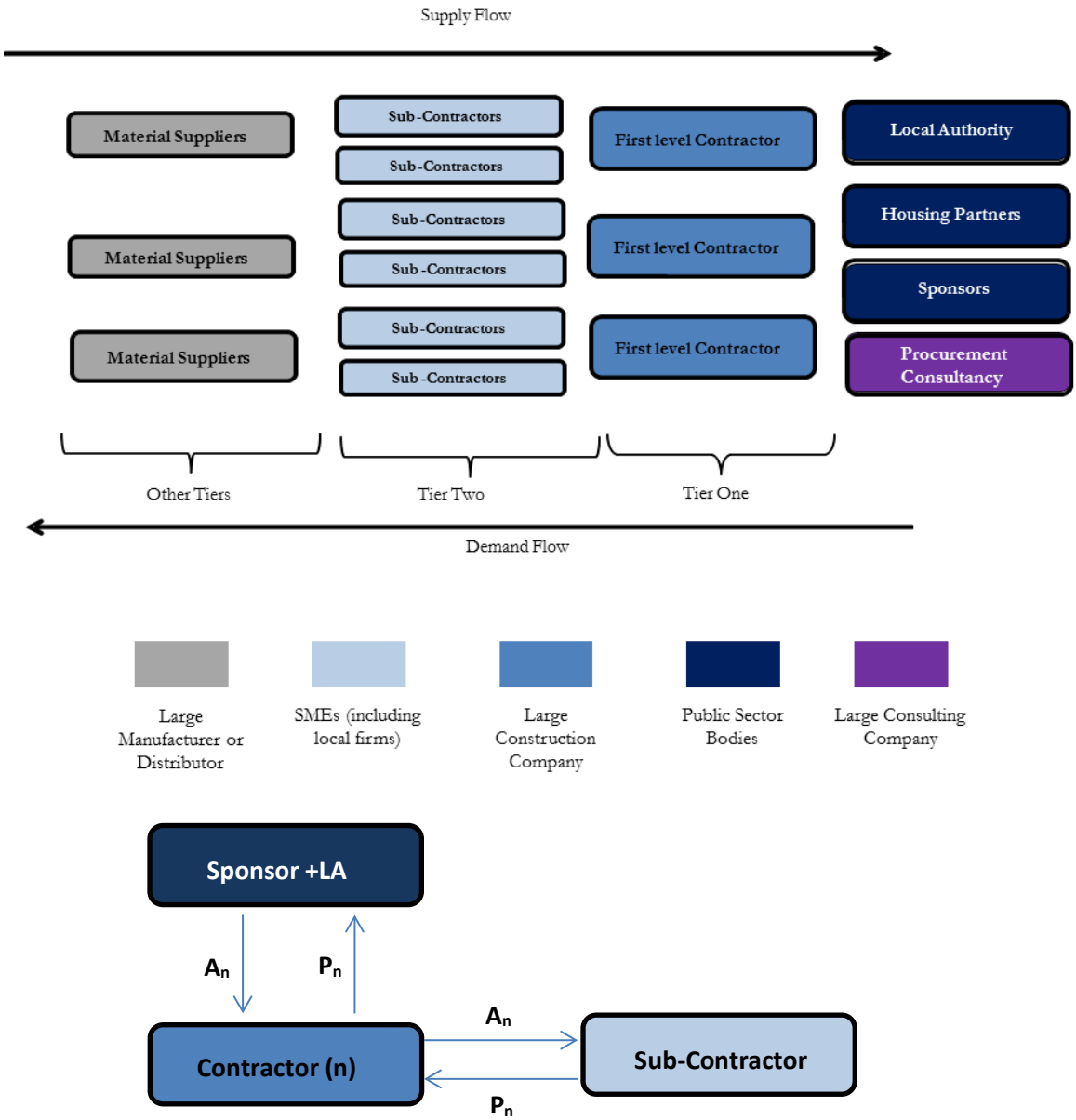


Figure 3: The supply chain framework archetype (top) and its relationships between stakeholders (bottom)

4.2.4 Active Planning Supply Chain Archetype

The *Active Planning archetype* is a variant of the supply chain framework archetype. This archetype is mainly adopted by LA6 and is characterised by greater LA input and activity which enables greater SME engagement within the supply chain. LAs (through their housing partners and procurement consultants where appropriate) directly acquire the materials to be installed from suppliers (via distributors) and use their role as planners to regulate demand and supply, only tendering the installation of the acquired materials and required measures.

"*We have recently shifted to this model. We try to buy large quantities of materials, taking advantage of discounts. We develop forecasts on repairs and on installation of energy efficiency measures. We have a dedicated team for this. It's fun: it's like we have taken back control!*", said the procurement manager at LA6.

Within this archetypes, SMEs can be empowered as the requirements for capital investment from contractors is lower (largely only responsible for labour resources). A Procurement Officer at one of the surveyed LAs highlighted that this archetype would be beneficial for involving local SMEs, but that there are many obstacles in the procurement process that restricts the ability of LAs to configure their project supply chains in this manner. The Officer explained:

"This model would allow more SMEs to bid. Indeed, they should not be worried about capital costs required to buy materials to be installed. Furthermore, this process would also be beneficial from a standardisation point of view: everybody would be installing the same materials and components that would reduce maintenance costs. However, there are some obstacles. Indeed, this process will require lot of labour for supply chain planning and warehousing capacity for storing materials. At the moment, the council is not prepared to face this"

A practical example of model adoption was seen at the ALMOs for LA6, which completely revised its supply chain through use of a warehouse which stored the major components and materials required for EERS. The Procurement Manager at the ALMOs stated:

"We are used to have many different types of fans in our properties! With this new approach, that we implemented for a scheme that was aimed at retrofitting 1,000 hard-to-treat dwellings, we just have one that goes into all properties. Costs are kept at minimum, as we can buy bulk quantities of spare parts, while standardisation is maximised. Also, we are able to consolidate deliveries and shipments, reducing CO_2 emissions. We have regained control of our supply chain!"

A variant of this archetype exists in which acquired materials are not directly stored at LAs (or ALMOs) premises but instead through implementing a form of Vendor Managed Inventory which removes the requirement for capital expenditure for warehouses. Figure 4 (top) shows the *Active Planning* supply chain, emphasising the prominent LA role. The Principal-Agent relationship within the *Active Planning* supply chain archetype is more strongly related to a

vertical Principal-Agent relationship (as shown in Figure 4, bottom). The sponsor or LA concurrently acts as the main contractor who tenders the installation works mainly to sub-contractors. Because of the direct Principal-Agent relationship existing within this archetype, there is more direct form of communication between the Principal and the Agent, overcoming problems of supply chain communication and trust. The power in the relationship lies with the LA who is the main contractor and who has the power to control and mitigate any conflict and risk that may occur. Given this balance of power, the dependency of LAs on resources of sub-contractors is extremely low.

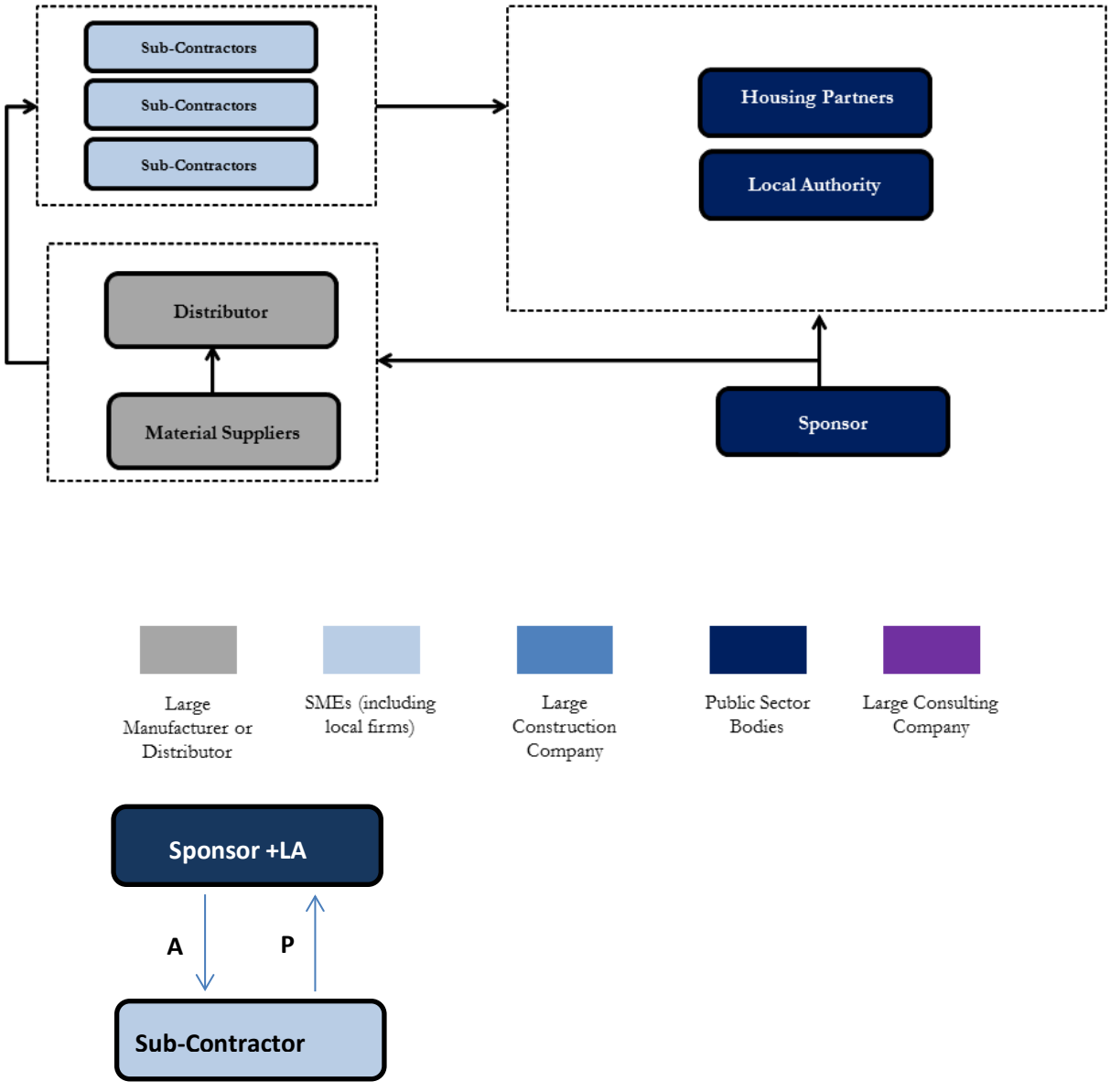


Figure 4: *Active Planning* supply chain archetype (top) and its relationship between stakeholders (bottom).

4.3 Comparative analysis of supply chain archetypes

The supply chain archetypes can be linked to expected performance, considering the above-mentioned measures.

The *global service supply chain archetype* implies a high level of partnership between public and private stakeholders, with first level contractors controlling the entire supply chain. The economies of scale from contracting a large organisation will see the purchasing and installation of standardised materials and components (favouring easy maintenance and post-sales activities). Power is concentrated at the first-tier contractor which enables prioritisation of their objectives (e.g. profit maximisation) over LA desires to benefit local economies (particularly if first-tier contractor preferred sub-contractors are used). At the other extreme, the Active Planning supply chain archetype allows for a much higher level of public control, allowing LAs to manage both large projects (such as schemes aiming at upgrading large sections of the housing stock) and occasional interventions (for which short term hiring of contractors might be required) thanks to the fact that they can outsource the installation service. The LAs play a mediatory role by coordinating purchasing and orchestrating the whole supply chain. With strong management, it is possible to achieve standardisation and high levels of economies of scale.

Table 10 illustrates a summary of the expected performances for each archetype; these were identified from the feedback from LA representatives from individual interviews and from focus group where the supply chain archetypes were presented for deliberation. Table 11 illustrates the advantages and disadvantages for each archetype; this list was compiled thanks to feedback from LA representatives from individual interviews (also based on quotes from the previous sub-sections) and consolidated in the mentioned focus group.

Supply chain archetype typology	**Public-Private Partnership Degree**	**Standardisation Level**	**Economies of Scale Optimisation**	**Local SMEs Involvement**	**Planning and Management Requirement for LAs**
Baseline	Average	Low	Average	Low	Average
Global service	Very High	High	Variable	Low	Low
Framework	Average	Average	Average	Average	High

Active Planning	Very Low	High	High	High	Very High

Table 10: Perceived performances of the supply chain archetypes

Supply chain archetype	Advantages	Disadvantages
Baseline	• Allows tailor-made solutions resulting from one-off tendering exercise • Appropriate for specialist work • Good for low value contractors	• Value for money may not be achieved due to the one-off nature of the engagement. • Labour intensive • Potential for delays • No relationship with suppliers • No innovation • Excludes SMEs • Adds to administrative and management costs on short term projects • Limited number of firms involved
Global service	• Existing relations can be developed to work through issues • Fixed budget once implemented • Minimisation of Overheads thanks to outsourcing • Offers value for money and fits in with current assessment criteria • Low input from LAs	• Loss of LA control to contracted firm – can be a reputational risk to the LA • Standards can't be challenged • Lack of competition
Framework	• Competition between firms drives down costs • Rules and regulations established before the start of the project can reduce administrative burden when selecting shortlisted contractors • Possible to contract different installers with different expertise to carry out different tasks • Potential for SME engagement • Inclusion of wider social factors in tendering contracts (e.g. local employment)	• Quality can be compromised if contractors outbid each other on price (i.e. low cost, low quality) • Difficulty in keeping firms not employed engaged for further projects
Active Planning	• Direct control of labour and inventory • LAs can keep the whole supply chain local • Potential boost to SME involvement as capital restrictions can be overcome • Potential to develop relationship with suppliers Economies of scale on labour and materials	• Big capital outlay required to set up storage and warehouse • Money tied up in inventory could lead to cash flow problems • Skills are required for LAs

Table 11: Empirical results on procurement and supply chain archetypes

From focus group discussions it is clear that there is no single supply chain archetype which fits the specific conditions of each LA. Specifically, the adoption of a given archetype seems to be linked to *contingent* factors (Stonebraker and Afifi, 2004), including internal (such as the

capability of LAs to leverage on internal resources in order to coordinate complex supply chain mechanisms) and external ones (such as pre-existing relationships with big contractors).

The *baseline supply chain archetype* is highlighted as the most cost effective and the best for specialist projects, enabling contractors to provide services on specific schemes. However, the nature of the archetype often leads to labour intensive processes and extra administrative and management costs to LAs which reduces value for money and limits the number of potential engaged firms in the project. Promising attributes were found in the global service supply chain archetype, for example fixed budgets and reduced the administrative input, important factors given the current economic and financial climate of austerity and local government funding cuts. However, the lack of control and potential tensions between contractor aims and LA desires were seen as a major disadvantage. Potential reputational risk to the LAs involved from these arrangements highlight how dependence on first-tier contractors is a major challenge for LA supply chain management. The supply chain framework archetype appeared to offer a balance between LA control and value for money due to the establishment of rules and regulations and the vetting of suppliers prior to the start of the project, as well as the increased competition between contractors. There are a number of disadvantages associated with this archetype, most notably the concern of firms becoming 'frozen out' as chosen suppliers form a closed group. Long-term agreements with LAs can lead to complacency whilst excessive price competition can impact on effective project delivery as quality is neglected. In considering the resource dependence between LAs and their contractor firms in EERS schemes we consider how the adoption of specific supply chain archetypes is not related to the political alignment of the council (see Table 2). Despite the localism agenda, it is the prevailing national ideology of neo-liberalism which has largely shaped the LA procurement policy across the entire political spectrum as highlighted by LA3 and LA4 (Labour-led) adopting the Global Service archetype (that leverages highly on privatisation and public-private partnerships). However, we can see that there are characteristics of the four emerging groups of supply chain archetypes that are influenced by the political ideologies of the elected bodies of the LAs.

The *Active Planning* supply chain provoked the most discussion between the LA representatives as a archetype that would enable LAs to maintain control over materials and labour and reduce the barriers to involving SMEs. However, potential future cash flow problems were cited, for example if finance becomes tied up in inventory such as large capital outlays required to secure warehouse facilities. A potential solution is for LAs to develop relationships with approved suppliers and shift to an 'on demand' system for obtaining

materials, requiring a shift in the prevailing ideology toward public procurement. Nevertheless, it provides an example of how public-private partnerships can be configured to reduce dependencies and principal-agent conflicts between stakeholders.

5. Discussion

Resource dependency theory sheds light on the relationship between the main actors shaping emerging supply chain archetypes and how characteristics such as the behaviour of actors, risk and capacity management, and communication and trust influence the ultimate supply chains archetype in public procurement projects. Effective and efficient procurement practice has become integral to contemporary value creation within organisations because procurement services have been recognised as an important source of organisational savings and improvement in the operational efficiency particularly in public sector institutions such as LAs. Public procurement can be an effective tool to address local and regional issues such as promoting growth of SMEs and green businesses through local government procurement but the reality of the situation in Yorkshire and Humber is that LAs are more likely to engage in *off-the-shelf* procurement rather than developing tailored procurement specifications that afford LAs greater control of supply chains in public projects to ensure growth of firms that can generate wider benefits for the economy, society and community. The empirical analysis conducted in the ten LAs involved in large scale EERS projects revealed four models of supply chain archetypes, each with profound implications for LAs to pursue their own local economic development strategies through the involvement of SMEs.

From a theoretical standpoint, a Resource Dependency Theory perspective highlights the importance of the procurement process, particularly regarding the drawing up of contracts and project specifications to empower LAs in managing principal-agent relationships with contractors, community groups, government agencies which cannot be explained by stakeholder theory alone. The varied power relations arising in the identified supply chain archetypes impact the interactions between actors in the procurement process and delivery of local government contractors and the ability for LAs to ensure and exert their influence. For example, LA1 (conservative-led) adopts the global service (inspired by public-private partnership and free-market principles) and LA6 (labour-led) adopt the Active Planning (inspired by planning principles) with diverging levels of economic planning and privatisation

ideologies. Given these power relations and the ideological drive of each Local Authority, we present the following set of inter-related key findings:

***KF1*:** An LA with a governance ideology based on principles of privatisation are likely to adopt the baseline and global service archetypes in the way they approach procurement practices and supply chain management to deliver large scale projects. These supply chain archetypes may limit involvement for local SMEs because the power is more strongly concentrated at the contractor level. Therefore, we would expect the degree of SME involvement in these archetypes to be low.

***KF2*:** LAs which are able to manage power-relations and dependencies in their supply chains are better able to facilitate *Active Planning* supply chain archetypes. This is likely to emerge if procurement practices are shaped by an active engagement in the planning process. This archetype consists of LAs controlling sub-contractors drawn mostly from local regions in a *vertical* Principal-Agent relationship. Our feedback from LAs employing such a set-up suggest this archetype could support efforts to stimulate regional economic growth through greater involvement of local SMEs stemming from the procurement process.

KF3: The overall influence and *cultural hegemony* (Gramsci, 1994) of neo-liberal ideologies (emphasising a concept of *minimal* state intervention in economic issues) has shaped economic and regional development policy across the whole political spectrum, reducing the overall effect of historical political alignments of local economies. As a result, competitive mechanisms such as competitive tendering and the usage of *off-the-shelf* procurement contracts are evident even in councils run by left-leaning political parties more sympathetic to active economic planning strategies. As a result, the overall political climate can be seen to be contributing towards the imbalance in power relationships between LAs and their contractors.

5.1 Practical Implications and Future Research

In terms of practical implications, the research carried out in this paper has the potential to inform practice, policy and research in aiding LAs and other public organisations in the design of public projects before the procurement stage. This research has indeed shown that the design of procurement contracts has implications for subsequent supply change designs and could

yield different outcomes as a result of controlled stakeholder power. It is only through the LAs promoting their agenda at all levels of the supply chain that can ensure social and economic benefits arising from public projects are maximised. Our findings can help to inform practice, policy and research in aiding public organisations such as LAs in the design of public projects before the procurement stage also taking into account issues related to administrative and management costs to LAs.

Future research should be aimed at addressing the main limitations of this study, primarily focussing on validating the findings from this research through the surveying of LAs in other areas in the United Kingdom; and in other policy arenas. This would aid in understanding the extent to which greater investment in procurement functions can aid in developing schemes that maximise the economic and social benefit for local communities. Given the value of public sector projects, the efficient use of funding sources has the potential to greatly improve the economic and social standards of local communities, but further research is required to link procurement investment, local government ideologies, and public project deliveries. The research could be extended to an international context, by conducting a cross-national comparative analysis of supply chain archetypes deriving from public procurement projects, and their potential links to underlying ideologies. Further theoretical lenses (such as Resource Orchestration Theory and Contingency Theory) could be employed in order to analyse the power relationships within the identified supply chain archetypes and the responses adopted by Local Authorities. This is particularly crucial in countries with additional tiers of Governance structures, for example countries with regional levels of Government. This would also aid in identifying the most appropriate scales for the delivery of public projects.

A further future direction may focus on replication studies to identify the drivers for new trends related to the in-sourcing of public services have been reported in the media (Brady, 2019). Rigorous investigations are needed to understand the rationale for these decisions and, potentially, the identification of related new supply chain archetypes.

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Appendix A – Interview Questions for Local Authorities

1) Could you provide us with a detailed description of the currently employed procurement processes for Energy Efficiency and Housing Repair projects? In particular:

    a. Who is responsible for issuing and managing competitive tenders?
    b. How proposals are evaluated and scored? Do you use any particular methodology? What are the "dimensions" on which the evaluation is conducted?

2) We would like to review the most recent projects your LAs and ALMOs have launched in the EE retrofitting field. In particular, for each project we would like to understand:

    a. Size of the project (in terms of treated dwellings)
    b. Involved measures
    c. Winning firms (acting as main contractors)
    d. Involvement of regional suppliers

3) How do you describe the role of your procurement department? How active are you in shaping the supply chain? How has your role changed in the last decades? How could your role change in the future?

4) Who are the most powerful actors in the supply chain resulting from your procurement exercises?
   Do you see the risk of becoming dependent on any of the actors involved in the execution of your projects?

5) In your opinion, what is preventing local SMEs from being involved in large scale energy efficiency projects you are performing?

    a. Lack of information about opportunities
    b. Lack of competencies about the bidding process
    c. Cost of bidding opportunities are too high
    d. Lack of support/assistance
    e. Financial appraisals when bidding are too rigorous
    f. Health and safety issues
    g. CSR issues
    h. Lack of capacity

6) What are the crucial aspects you employ in order to determine the performance of a project, from multiple perspectives (economic, environmental, social)?

7) Which aspect of your procurement approaches could be revised for delivering local growth and local jobs creation? Have you thought about bringing back in-house some functions?

8) Are you aware of organizations like Yorkshire Purchasing Organization and YORBuild, which provide collaborative purchasing schemes? What has been your interaction with them? What do you think could be their impact on the growth of the regional supply chain? Do you think they can provide benefits to local firms in terms of aggregation of purchasing power?