

An investigation into the difficulties in developing and sustaining business eco-systems: borrowing from network theory to identify and reimagine value creation

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For the partial fulfilment of MSc Masters by Research, October 2023

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1. Introduction

I

First introduced by Arthur Tansley in 1935 to define an ecological unit comprised of the natural environment and the organisms inhabiting it, the term *ecosystem* was revisited by James F. Moore in 1993, to provide a framework for the systems by which business and organisational actors maintain relationships within a network: the birth of the phenomenon of business ecosystems.

As such it can be argued that business ecosystems represent a relatively novel concept (Galateanu and Avasilcai, 2013) that has and is now developing into a substantive new phenomenon- the growth of dynamic, multiorganisational systems as a method and process of organising economic activity between and across members (Fuller, Jacobides and Reeves, 2019). One sector example is that of their use in extensive supply chain management to drive competitive advantage (Sarafin, 2022). Business ecosystems have been increasingly found to be replacing traditional models of integrated organisations within hierarchical supply chains (Pidun, Reeves, and Schüssler, 2020). Renowned for their flexibility and agile nature, they hold significant value-creating mechanisms which offer organisations the opportunity to develop more efficient supply chains whilst adopting lower-risk strategies through the sharing of resources, knowledge, and services (Sarafin, 2022).

Through agile and fluent supply chains, business ecosystems have been argued to facilitate knowledge exchange, accelerated learning, and expertise development to ultimately drive business growth for those actors embedded within them (Gueler and Schneider, 2021). Furthermore, they provide organisations with access to shared resources that otherwise would not be attainable as a singular organisation (Pidun, Reeves, and Wesselink, 2021). Due to the modular structure business ecosystems adopt, organisations can experience much faster growth than if operating as a singular company, enabling scalability and flexibility, collaboration, and the option to add new members who can continue to add value to the ecosystem (Pidun, Reeves, and Schüssler, 2020).

This study recognises that research into the advantages that business ecosystems offer is substantial and provides justification and explanation for their surge in popularity and adoption over the past decade (Clauss and Ritala, 2023; Gueler and Schneider, 2021; Pidun, Reeves, and Schüssler, 2020). However, in the growing business ecosystem literature thus far, limited efforts have been made to review how theory can be used to understand and explain the difficulties that business ecosystems face in their development and in their ability to be sustainable over time. A particular feature of a number of ecosystems is in their development of linkages with other actors and organisations, which are devoid of the traditional bonds of value creation inherent in traditional network practice and theory (see for example, Gadde and Snehota, 2000; Ojansivu, Hermes and Laari-Salmela, 2020; Bankvall, Dubois, and Lind, 2017; Lindgreen, Hingley, Grant, and Morgan, 2012). This paper has a specific interest in how a successful ecosystem can be developed and sustained when there is no financial or supply chain interdependencies between actors and when there is a distinct lack of physical financial resource sharing to create traditional forms of shared value in business networks (Lingreen et al., 2012).

Therefore, the aim of this paper is to fill the gap in ecosystem literature, developing an understanding of what mechanisms may be implemented to firstly design, instigate and develop a successful business ecosystem, and how this may be sustained when there is no clear and agreed rationale across all actors as to how they can form interdependencies with one another and how they will gain sustainable forms of value from being a part of an ecosystem. In essence, the thesis seeks to identify the glue that is required to create ecosystems, and how this is then used to sustain them.

The case study used for the development of this paper was an electronics-technology 'electech' consortium based in the Northwest of England, named the Electech Innovation Cluster (ETIC). This theoretically developed thesis was based on a joint project between Lancaster University Management School, Lancaster University Faculty of Engineering, and the ETIC cluster which culminated in an 8-month design, development and delivery of an overarching marketing strategy designed to help the ETIC in overcoming some of the key challenges that it faced in developing and sustaining a strong business ecosystem. This thesis is therefore developed from the longitudinal work carried out by the author working as an action research consultant.

The ETIC is a group of 23 member organisations that all operate within the electronics technology (Electech) sector and are categorised through geographical proximity in the Northwest of England. This case study provided contextual relevance to this thesis as the ETIC does not conduct business on a dyadic or network effect in terms of transactional agreements involving the creation of value through traditional buyer and seller agreements to create and capture value in use (Leite and Bengtson, 2018). Actors within the ETIC do not have joint financial incentives, do not rely upon one another for success and very rarely exchange any form of physical or financial resources.

To create an overarching marketing strategy, a consultancy role was adopted to ascertain data that would be necessary for the development of an insightful and progressive strategy. Primary research was conducted through ethnographic techniques (Hammersley, 2006), in the form of semi-structured interviews and "being there" to try and ascertain how interdependencies between actors within the ETIC could be created in order for the business ecosystem to have value-creating synergies.

On commencing the project, the ETIC has been functioning as a loose group of firms for around 18 months, with two individual firm directors leading and cohering the activities on an ad hoc basis. The vision of this leadership team was clear, to create a fully coherent, organised value proposition for all members and for future technology members in the shape of a tech ecosystem. During this early phase of the consulting work, it was very difficult to ascertain where value stemmed from within the ETIC, as there was no coherent value proposition, no financial or production incentives, and no inherent value in efficiencies, effectiveness, or supply chains. As such, the ETIC was just a group of companies which operated within the Electech sector, were loosely geographically close and met through a variety of activities such as meetings and lunches on a bi-monthly basis. Therefore, the marketing strategy created for the development and sustainability of the ETIC as a business ecosystem was based on the key determinant of value creation and a resulting robust value proposition.

Initially, trends were determined in the data from the primary research conducted and linked with secondary research from a combination of academic and market lead data. Secondary data was taken from a series of sources including InnovateUK and the UK Department for Business, as well as consulting papers from Deloitte, Ernest Young, and McKinsey & Company. Findings concluded that for the ETIC to develop and sustain a successful business ecosystem, it would be prudent to cohere members around the concept of mutuality, specifically tackling some of the most pressing challenges that all ETIC members face.

In the process of finding mutuality between actors, a process of innovative spirit, collective thinking, and close collaboration was harboured, aiding in the development and sustainability of the ETIC. The

identification of collective challenges established the bond which committed actors within the ETIC and served as the organisational and social glue through which solutions to mutual challenges could be formulated, in correspondence with the ETICs value proposition.

The key findings from the research suggested that all members were adversely affected by the following core challenges:

1. The lack of a clear and unique value proposition.
2. An underrepresentation of the ETIC and the wider electech sector.
3. An electech skills shortage both regionally and nationally.

The findings enabled the development of a long-term vision for the ETIC and several strategic recommendations.

This paper seeks to theoretically add to and analyse the ETIC case study to provide an explanation as to how business ecosystems can overcome the challenges inherent in their development and be successfully sustained. Placing specific emphasis on the importance of mutual value creation and appropriation, a core element is in investigating how essential these mechanisms are in the successful development and sustainability of business ecosystems.

The paper begins by examining the origin of business ecosystems (Tansley 1935; Moore 1993 and Moore 1996) before moving onto the advantages that they pose as an explanation for their surge in popularity over the past decade (Gueler and Schneider, 2021; Li, 2009, Mason and Brown, 2013; Russell and Smorodinskaya, 2018; Pidun, Reeves, and Wesselink, 2021 and Zhang and Liang, 2011). Whilst it is recognised that business ecosystems certainly offer many advantages for a wide variety of organisations, a study from the Boston Consulting Group (2019) supported by a report from McKinsey & Company (2020), was used to suggest that business ecosystems are difficult to develop and sustain successfully, and for this to happen they must determine and understand their value creation agenda.

This focus on a value-creating agenda led the paper to analyse a broad selection of organisational network literature. Whilst this area has been extensively researched by the Industrial Marketing Purchasing (IMP) Group (Mouzas, Henneberg and Naudé, 2008; Håkansson, 1982; Araujo, 1999; Ford, 1986; Snehota, 1989), investigating relationships within and between organisations, this paper had a specific interest in how value (Matinheikki, Pesonen, Artto, and Peltokorpi, 2017) could be created within a business ecosystem. A particular model of organisational networks named the Actor-Resource-Activity (ARA) model was therefore investigated as it provides a basis for examining long-term industrial relationships within networks (Håkansson and Johansson 1992), whilst providing an insight into how business networks can be developed and sustained through value-creating synergies.

However, a key element within organisational network (including the ARA model) theories, is the concept that resources are exchanged between actors within a business network and that value is created through the development and need for interdependencies between actors. In the case of business ecosystems and the ETIC, resources were not as readily available nor exchanged between member organisations and unlike in traditional networks, ecosystems have fewer financial or supply chain ties that create strong relationships based on value creation (Hannah, Bremner and

Eisenhardt, 2016). Therefore, whilst the ARA model helped in understanding how value-creating mechanisms, such as relationships, between actors can help in developing and sustaining a business network, a gap is still apparent in business ecosystem literature when trying to understand how an ecosystem can be developed and sustained when there is a distinct lack of resource exchange, as well as a lack of commercial network ties and financial interdependence between actors.

Finally, the paper moves to boundary objects (Star and Griesemer, 1989), as the theoretical literature which potentially allows us to close this gap and provides an explanation as to how ecosystems can be successfully developed and sustained when there is little exchange of resource or interdependence between actors. By uncovering, identifying, and communicating to all actors a clear set of boundary objects (things which are “both adaptable to different viewpoints and robust enough to maintain identity across them” *ibid.* p.387), an ecosystem, and specifically the ETIC, can create value for all of its members by creating a bond whereby all members have a mutual connection and interest. In this case study, the boundary objects were the identification of shared issues that affected all members of the ETIC; the lack of a clear and unique value proposition, an underrepresentation of the ETIC and wider Electech sector, and a regional and national electech skills shortage.

Boundary objects are first defined and described before their pertinency is translated into the ETIC case study. It is then theorised that the common set of systemic problems that have been extracted from the data was vital in developing a marketing strategy that enabled the development of the ETIC, as they created the joint impetus, rationale, and value required for members to understand why being a part of the ETIC ecosystem is beneficial to them.

The use of case studies (see Eisenhardt 1989), such as the ETIC in this project, provides a method of developing theory by using insights of empirical experiences and their contexts (Dubois and Gadde, 2002). Research methodology often overlooks the advantages of interconnected research process enabled by case study analysis, often viewing case studies as a linear process (Dubois and Gadde, 2002). An integrated approach, based on abduction, which understands the consequences and characteristics of case studies, is required due to the difficulties that case studies face when handling the connected nature of aspects within research.

Therefore, this paper uses an abductive iterative matching technique between theory analysed and data collected, known as systematic combining. Systematic combining is a nonlinear, path determined process, with the objective of matching reality to theory (Dubois and Gadde, 2002). Eisenhardt (1989), suggests that a specific component of developing theory from case study research is the repeated overlapping of data collection and data analysis. Systematic combining was adopted throughout this research project due to the consistent nature of confronting theory with empirical evidence.

2. Literature Review

2.1 A Business Ecosystem Approach

The term ecosystem was first coined by Arthur Tansley in 1935, referring to a localised community of organisms interrelating with one another within their environment. In his definition, Tansley (1935) also noted that organisms had influence over and collaborated with one another, sharing resources,

and inevitably being exposed to external complications that affect, in some capacity, all organisms within that ecosystem (Tansley, 1939).

The concept of a 'business ecosystem' has been a topic of academic research since the 1990s and was first developed by business strategist James F. Moore, stemming from literature on biological ecosystems (Moore, 1993). Moore (1996, p.26) described a business ecosystem as "An economic community supported by a foundation of interacting organizations and individuals - the organisms of the business world. Member organisms can include suppliers, lead producers, competitors, and other stakeholders." Moore (1996) went on to suggest that over a period, organisations within an ecosystem tend to align with a leading or central organisation and that this leading organisation is valued by all ecosystem members as it enables progression towards shared visions.

Rather than abiding by a linear value creation process, business ecosystems tend to comprise a variety of organisations that collaborate to mutually produce a service or product (Iansiti and Levien, 2004). Consequently, the value chain does not consist of upstream and downstream actors but consists of organisations connected through horizontal ties, with ecosystem members creating value as an interrelated system of interconnected actors (Moore, 1996).

This collaboration within a business ecosystem leads to actors utilising their interdependencies to develop a competitive advantage over singular actors who are not part of any value network and internally complete all aspects of a value chain (Iansiti and Levien, 2004).

Originally, Moore's concept of a business ecosystem was embraced by the US technology sector- a sector that lent itself to transformative abilities of collaboration and connection (Deloitte, 2015). The impact that Moore's work has on the sector is still prevalent today; Google and Facebook place great emphasis on the development of their ecosystem (Miguel and Casado, 2016), and Apple considers its services and products as an ecosystem that delivers a seamless experience to its customers (DeAgonia, Gralla, and Raphael, 2013) while some analysts regard US technology competition now to be between business ecosystems comprised of loosely connected companies rather than singular firms (Deloitte, 2015).

2.1.1 The advantages of business ecosystem development

How businesses are organised is currently experiencing a paradigm shift (Cha, 2020). Business ecosystems are replacing traditional models of integrated organisations within hierarchical supply chains, creating networks that can help alleviate some of society's biggest challenges (Pidun, Reeves, and Schüssler, 2020). Examples of this can be found during the COVID-19 pandemic, where new business ecosystems were developed to create digital virus tracking apps, 3D printing capability, and the mass manufacturing of medical equipment (Boston Consulting Group, 2020).

Organisations globally are increasingly turning to business ecosystems for their ability to expand networks, generate revenues, and drive business growth (McKinsey, 2020). McKinsey (2020) suggested that world-leading organisations are progressively moving towards interconnected services in the form of business ecosystems and used the example of the Alibaba Group, which has developed an ecosystem that encompasses companies from e-commerce, financial services, media and entertainment, logistics, and cloud computing, all with interconnected links to one another. The integrated network economy has the potential to represent a revenue pool of \$60 trillion globally in 2025 (McKinsey, 2020).

Sarafin (2022) in a paper for Ernst & Young suggested that participation in a business ecosystem develops more value than could otherwise be created by a singular organisation and companies who

do not embrace business ecosystems risk missing opportunities within innovation, pace, and capital efficiency.

The benefits that are offered by business ecosystems justify the paradigm shift that businesses are currently undergoing. As discussed, a key element of a business ecosystem is that it enables capabilities that cannot be achieved by a singular actor, creating a mutual value that is higher than that which can be achieved individually (Ernst & Young, 2022). During a business ecosystems startup period, organisations can gain access to resources that could not be attainable as a singular firm, due to cost or lack of financial resources (Pidun, Reeves, and Wesselink, 2021). Once a business ecosystem has launched, it is argued that organisations within can experience much faster growth than if operating outside of an ecosystem, due to their modular structure which enables increased scalability and flexibility, reduced risk, enhanced collaboration, and the ability to efficiently add new members who could potentially add value to the ecosystem (Pidun, Reeves, and Schüssler, 2020). The success and longevity of a business ecosystem require collaboration (Clauss and Ritala, 2023), which was again initially emphasised by Moore (1996) suggesting that actors within business ecosystems must cooperate and co-evolve their capabilities and roles over time and in close conjunction with one another to ensure success.

Through agile and fluent collaboration channels, business ecosystems provide platforms that enable knowledge exchange, accelerated learning, and expertise development to ultimately drive business growth across an ecosystem (Gueler and Schneider, 2021). An additional strategic advantage of business ecosystems has been argued in that they do not subject actors to the same governance constraints between organisations that can be found in organisations outside of business ecosystems, such as in hierarchical structures (De Witt and Meyer, 2010). Hierarchical structures, such as a singular company or more formal contractual organisational networks, are usually dependent on processes, rules, and directives which form an authoritative delivery of procedures based on financial reward from product or service offerings (Grant, 1996). Business ecosystems do not follow the same formal organisation of processes. Alternatively, they can have very different and widespread governance structures which can be regarded as relational and mutually orientated constructs, that strive to offer value that could not be derived individually (Jones et al., 1997).

Academic literature surrounding the mechanisms by which geographically linked, clustered companies benefit from proximity to one another, and leading academic institutes has long been explored (Almeida and Kogut, 1999; Zucker and Darby, 2001; Van Looy et al., 2003; Saxenian, 2006). Research suggests that some of the key benefits of being in geographically linked, technological clusters include personnel availability, product mobility (Saxenian, 2006), the two-way multi-channel approach of knowledge exchange, collective learning, and value development between companies (Saxenian, 1996). Additionally, exterior economies of scale, which enable organisations to take advantage of shared resources, proximity between businesses within a sector, and leading academic institutes enable a faster speed of innovation diffusion, collective learning, and geographical development into an investment hub (Baptista and Swann, 1998 and Agrawal and Cockburn, 2002). As seen from this case, a key driver is this geographical proximity in conjunction with the unique formulations of electronic technology expertise.

The past decade has seen research into business ecosystems draw attention to those ecosystems that are developing in technology and innovation (Zhang and Liang, 2011; Li, 2009). Business ecosystems that are driven by innovation have developed into a foundation for a variety of international economic growth programmes such as the UK Industrial Strategy (2017) and the USA Comprehensive Economic Development Strategy (2022). The discussions surrounding business ecosystems in such political documents demonstrate that they play a crucial role in economic

growth, innovation, and business growth (Mason and Brown, 2013; Russell and Smorodinskaya, 2018). Recent research has further developed thinking on how value chains are developed within business ecosystems (Isckia, 2009), exploring how central entities can shape the governance, structure, and value creation within a business ecosystem whilst analysing the strategic roles, power dynamics and collaborative patterns within egocentric ecosystems (Rong et al., 2010).

2.1.2 The Problems Surrounding Business Ecosystems

Despite the plaudits outlined above to the unique positives of ecosystems, there is little within business ecosystem literature that explains the difficulties these entities can face in terms of getting traction and then sustaining this. For example, business ecosystem literature does not provide insight into how they can ensure businesses or people are attracted to become members of an ecosystem and what mechanisms are required to sustain their membership.

Research conducted by the Boston Consulting Group (2019) supported by Pidun, Reeves, and Zolotnik (2019), found fewer than 15% of business ecosystems that were sustainable long term. Furthermore, upon investigating value creation at over 50 businesses within ecosystems, no significant correlation between ecosystem participation and total shareholder return was found.

Further, it has been suggested that ecosystems are intricate, and choosing the best approach to ascertain maximum value creation and appropriation from an ecosystem is difficult (McKinsey & Co., 2020). This recent McKinsey & Co. study suggested that companies must determine their ecosystem by evaluating market characteristics and must understand their value creation agenda, for example, whether it be creating services or products, driving business growth, having shared commonalities amongst members, or enhancing operational efficiency. Despite this illuminative series of observations, it was also argued that this is a dynamic and difficult task as constellations of value uniquely change over time, and the identification of successful growth one quarter, may well change the next for many of the potential participants in the ecosystem (McKinsey and Co., 2020).

Despite the benefits that business ecosystems offer and the evolution of research from Moore's (1996) first definition, there is still little known about the structural determinants of what produces a successful business ecosystem, how people or organisations are motivated to join a business ecosystem and what ensures an ecosystem is successfully maintained and sustained across time to deliver value.

This project's case study suggests that commonality, geographical proximity, and mutual necessary connections are not enough to develop a strong and efficient business ecosystem. For this to develop there must be a mutual understanding between ecosystem members as to what value is being created and appropriated to them by the ecosystem (Hakanen and Rajala, 2018).

In the ETIC case study, it was essential to first develop a value proposition that was shared by all members of the ecosystem. The importance of a clear and shared value proposition in the success of a business ecosystem was highlighted by the Boston Consulting Group (2019), who suggested the initial development of an ecosystem should focus on a core, shared, value proposition and that a business ecosystem should be configured to deliver that value proposition. A value proposition was initially developed as part of an overarching marketing strategy, which was derived from a series of interviews from representatives from the ETICs member companies. The data collected from the interviews provided the basis for the value proposition and subsequently developed a channel, whereby mutual value was created for all ETIC member organisations through tackling mutual key challenges, specifically in talent shortage and underrepresentation across the UK and further afield.

As discussed in section 2.1.1, ecosystems have absolute positives, which builds the case that they are important entities that holds many benefits to organisations of varying sizes. However, very little research has investigated empirically the development, design, and implementation stages of these particular forms of business networks, along with how value can be created within ecosystems such as the ETIC where there is no financial or supply chain link between actors. Therefore, this paper aims to provide an investigation based on the empirical work in the creation of the strategic report for ETIC via an ethnographic, longitudinal action research study into the difficulties faced and the opportunities through which these problems can be overcome.

To explain how value could be created and appropriated within business ecosystems and what motives people and organisations must have to join an ecosystem to enable their development and sustainability, organisational network theories were turned to, incorporating literatures from the Industrial Marketing and Purchasing (IMP) Group and placing particular emphasis on value creation through the Actor Resource and Activities (ARA) model.

2.2 An Organisational Network Approach

Through questioning why companies develop interdependencies and what the advantages and drawbacks of businesses being dependent on one another are, the IMP Group have triggered a mass of studies (Mouzas, Henneberg and Naudé 2008; Håkansson, 1982; Araujo, 1999; Ford, 1986; Snehota, 1989) leading to scholars investigating relationships within organisations, between organisations and the wider network that surrounds organisations.

The IMP Group researchers see business relationships as interconnected, suggesting that actions within one business will affect relationships between other businesses that are related through a business network (Anderson, Håkansson, and Johanson, 1994). The IMP Group emphasises empirically based studies centred around how companies conduct business, and the effects had upon companies when interactions take place.

Through studies conducted within the IMP Group, the organisational network approach was developed. The study surrounding organisational relationships and networks concentrates on patterns, content, antecedents, and outcomes from connections between organisations, along with their bilateral links, whether horizontal or vertical (Ebers, 2001). Organisational network studies tend to focus on relationship patterns within large groups of organisations, for example, industry clusters (Ebers, 2001).

In its simplest form, an organisational network can be described as a network of companies that cooperate with each other to achieve common development objectives (Håkansson and Ford, 2003). This cooperation allows businesses to collaborate, creating relationships and sharing resources to drive innovation and become more competitive in markets domestically and internationally. Like business ecosystems, the development of an organisational network aims to create something which is greater than the sum of the individual businesses that constitute the network (Håkansson and Snehota, 1989). They can incorporate suppliers, customers, supporters, members, and distributors, with supporters often having a motive to remain active within a network (Word, 2009).

Håkansson and Ford (2002), describe organisational networks, as a structure whereby nodes (organisations or people) are linked to each other by specific threads. A complex business model addresses a broader, complex value proposition that combines multiple value propositions from a range of organisations, through one or more products or services (Håkansson and Ford, 2003). These business models can be regarded as a network, with the nodes being the businesses and the relationships between the businesses being the threads. Both elements of business networks, nodes,

and threads, were described by Håkansson (1997) as “heavy” with knowledge and resources as a result of complex interactions, investments, and relationship development between businesses over time.

The organisational network theory studies which concentrate on the border between the organisation and its environment have often concluded that individual organisations are often embedded within their environment, leading to constrained behaviours (Håkansson and Snehota, 1989). Propositions from the theory refer to environments surrounding organisations within a network that is often structured and complex, comprising interactive relationships between organisations that progressively develop (Håkansson and Snehota, 1989).

2.3 The ARA model

The ARA model (see Figure 1.) was initially created in 1992 and presented as a model of organisational networks, providing a framework for analysing long-term industrial relationships within networks (Håkansson and Johansson 1992). It aligns with traditional IMP research, emphasising the importance that organisational networks have as groups of related business relationships (Anderson, Håkansson, and Johansson 1994). The functions of these relationships within business networks are categorised into three linked elements: actors, resources, and activities (Håkansson and Snehota 1995). Therefore, the ARA model offers a perspective on business networks, where the studies’ attention is focused on a wider network analysis, rather than a single, dyadic relationship between a buyer and supplier (Easton, 1992; Axelsson, 2010). Although the ARA model has many similarities to business ecosystem models, it provides an insight into how a business network can be developed and sustained through the lens of value creation, a value creation based on the interplay between firms and resources.

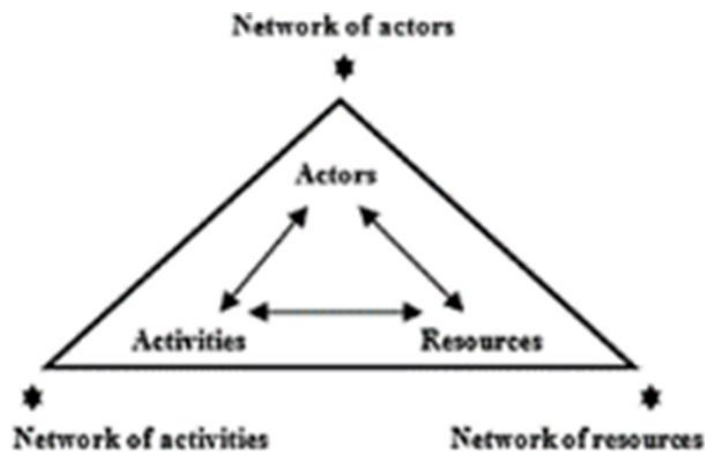


Figure 1. The ARA model created by Håkansson and Snehota (1992).

Within the ARA model, the role of actors and their desired goals are just one component that aims to explain interactions within business relationships. Alongside the acting layer are activities and resources, which “follow their own logic” and are separate from the characteristics of actors (Håkansson et al., 2009, p. 562). Therefore, the ARA model incorporates three layers of business relationships (actors, resources, and activities). Håkansson and Snehota (1995) then further developed the model, including the concept of interactions at analytical levels, in the form of relationships, networks, and companies, which is illustrated in Figure 2. (See below).

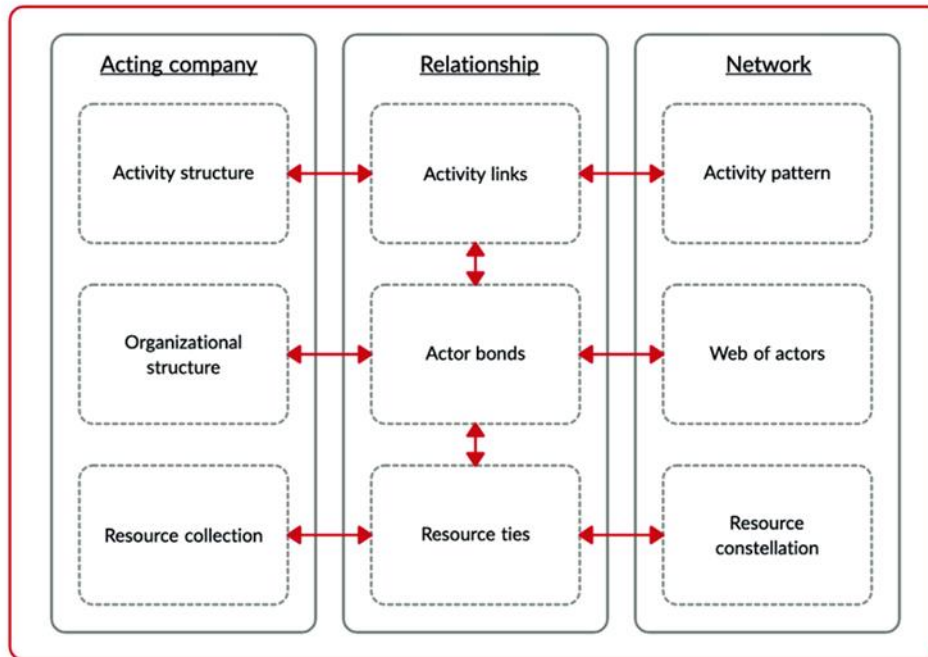


Figure 2. The further developed ARA model (Håkansson and Snehota, 1995).

The acting or actor layer of the ARA model was described by Håkansson and Johansson (1992, p.28) as “those who perform activities and control resources”, this could include individuals, departments, organisations, or groups of networks. The information and knowledge regarding resources, activities, and other actors in a network vary between each actor, leading to Håkansson and Snehota (1995) emphasising that with the support of the network, actors have a wide range of prospects. This confirms the significance of actors’ relationships and interconnectedness within the network through activity and resources. The connections that are developed between actors within a network are essential for mutual development, creating a meaningful position for all actors within the network.

At a singular business level, actors develop organisational structures to support activity structures within a business. On a relational platform, actors are connected through inter-organisational ties, which were described by Ford et al. (2008, p13) as “interpersonal links developed between individuals through interaction”. These ties can be formed through transactional or relational elements, for example, commitment or sharing experiences, which forge the essence of business relationships and consequent interactions (Ford et al., 2008).

The resources layer of the model refers to a combination of tangible assets, including technical, financial, and human as well as intangible assets such as skills and knowledge, which are required to carry out activities (Håkansson and Johanson, 1992). For actors to carry out activities, resources are required, however, very few organisations have all the resources they require to carry out activities and therefore must obtain what they require from their network. Resources are usually controlled by

a singular organisation or in conjunction with other organisations within a network and in these instances are described as direct. Håkansson and Johanson (1992, p.28) therefore described resources as “means used by actors whilst performing activities”.

The collaborative links that develop between actors within interconnected network structures have been analysed within the academic literature over the past decades (Lorenzoni and Baden-Fuller, 1995; Batt and Purchase, 2004; Le Rocca and Snehota, 2014). Resource sharing, specifically the sharing of knowledge and experiences, is considered by Ahuja (2000) to be a key factor that instigates collaboration between actors. Knowledge development and expertise development can increase an organisations capability to enhance innovation, drive business growth, and create competitive advantage (Lorenzoni and Baden-Fuller, 1995). The importance of inter-organisational knowledge exchange for the development of expertise within an industry is captured within business ecosystems, along with the reshaping of business models (Deloitte, 2015).

Within business relationships, some company resources are combined in another company’s resource pool. These resource connections establish structures known as ‘constellations’ and suggest the resources that an organisation supplies or uses are directly linked to those which an organisation has direct relationships with (Håkansson and Snehota, 1995). The value of a resource is determined by its use within a network.

At a business level, resources can be used as inputs, such as facilities, or outputs, such as education of company goods and development resource constellations to enhance competitive advantage (Hunt and Morgan, 1996). On a relational level, actors are connected via resource ties which involve discussions and mutual revision over long periods. On a wider network platform, actors could use resources to complete activities that require resources from actors across a wider network as opposed to the availability of resources in a singular business relationship (Koporci, 2017).

Activities are the final layer that comprise the ARA model. An activity is completed by an actor when resources are developed, used in conjunction with other resources, or exchanged (Håkansson and Johanson, 1992). It can therefore be determined that activities are dependent on activities performed by other actors within a network. Anderson et al. (1994) described activities as a collaboration between two or more organisations, whereby resources are used mutually for the benefit of each actor, enabling development, and learning through shared network insights. All layers of the ARA model are interconnected and mutually affect one another, as shown in Figure 1, and therefore the interaction between each layer can be viewed as a driving force for the progression of all relationships within a network (Håkansson and Snehota, 1995).

At a business level, activities associated with specific internal procedures, such as manufacturing products, create activity structures within a business. When businesses collaborate and form a relationship, activity structures become connected on a relationship level. This can then be integrated into a wider network level, as business relationships are embedded within the network that they operate within (Medlin, 2002).

The ARA model suggests that actors interact with activities and integrate resources to create value. Through actor bonds, activity links, and resource ties, business relationships form and grow within networks, due to the shared value that is created between businesses.

In terms of the implications for the current research, what is hoped to have been articulated in the prior review and sections was the clear identification of the complex interplay and interdependency of each of the components within the ARA model which are inherently connected to successfully bolster and deliver value across business networks. It is the potential paucity of resources in the

shape of those inherent in business network architectures which is of interest in the ability of ecosystems to develop and sustain their being over time.

In the development of some form of theoretical explanation into challenges faced in the creation and sustaining of ecosystems, we borrow notions of value creation and appropriation from the network literature and the ARA model, but as we have noted, ecosystems, unlike business networks, are not created and sustained through a joint sharing of resources such as those outlined in the ARA model.

It is to this discussion of value which we now turn, and in particular to the case in hand of the ETIC ecosystem.

2.3.1 The Importance of Value Creation and Appropriation in Business Networks

This paper has a particular interest in how organisational networks create and appropriate value and how that can then be translated into business ecosystem approaches to create a mutual understanding of value that a business ecosystem can provide. Although the organisational network approach would not be applicable in the ETIC case study due to its vertically integrated network system and reliance on one organisation (such as a supplier or manufacturer) for the success of another, how value is created and appropriated within organisational networks is of interest in this thesis.

Value creation refers to the process that converts services, products, or resources into something that offers value to others (McKinsey & Co. 2020). An example of this can be found in the automotive industry, which is exemplified by vertically integrated network systems that outsource most component manufacturing to independent suppliers, who adopt a hierarchical organisation structure (Sturgeon et al., 2008). This structure enables major automotive organisations to develop a network of suppliers and manufacturers that add value to their organisation. Value appropriation, on the other hand, alludes to activities that obtain the amount of value that has been created (Ritala and Tidström, 2014).

In this project's case study, all the firms in the ETIC are fundamentally part of, and embedded in, other organisational business networks – as providers, suppliers, manufacturers, and retailers of goods and services to the electronic industry. They are all also linked by geographical proximity and through mutual industry connections, two elements that are necessary conditions to be a member company of the ETIC. However, these commonalities alone were not enough to develop a strong business ecosystem. For this, the ETIC required its members to attempt to realise, understand and acknowledge the value that being a part of their business ecosystem offered. In the ETIC marketing strategy, this value was developed through the concept of mutual orientation to value via the identification of sector wide challenges (Håkansson and Snehota 1995), enabling members to collectively tackle the key challenges that they all faced, in underrepresentation and an industry-wide skills shortage.

Kothandaraman and Wilson (2001) suggested that there are a variety of different motivations that drive value creation in organisational networks, from communication channels to efficient supply chains, but the key factor to the success of a network is how these are utilised to discover value-creating synergies within the network, which consequently drives value creation to network members and their customers. This concept can be applied to the ETICs case study, whereby a series of interviews were held to discover what value-creating synergies could be utilised within the ETIC. This process of primary data collection and analysis then enabled value creation through successful identification of a mutual orientation of key challenges that could be collectively tackled.

Ford et al. (1986) suggested that the establishment of organisational relationships needs a 'mutual orientation' for the relationship to be successful and beneficial to both parties. This concept of 'mutual orientation' is extremely important in the development of an organisational network and was adopted in the development of a business ecosystem in this case study. The external strategic marketing strategy that was developed for the ETIC aims to cohere a mutual orientation to value creation for the members of the ETIC, which consequently aims to create a bond between members that will hold the business ecosystem that is the ETIC together. The importance of mutual orientation within an organisational network was emphasised by Easton (2016), who suggested that a precondition for the success and development of inter-organisational relationships is mutual orientation, as it indicates that organisations are prepared to collaborate to mutually create value.

Matinheikki et al. (2017) suggested that all organisational networks are formed of value-creating entities, comprising three or more actors. Value creation within business networks involves actors within the network to collaborate, share goals, and develop a process by which actors can interact (Provan et al., 2007). The governance of an organisational network needs principles that are mutually adopted between interacting actors, initiating productive communications and collaborations to drive value creation between interdependent actors (Hu et al., 2017). It is, therefore, necessary for an organisational network to create a mutual reason for the network's existence, centred around the shared goals of its actors (Winkler, 2006).

Winkler's (2006) concept (see also, Provan and Kenis, 2008 and Xie et al., 2016) can be slightly adapted and translated into value creation and appropriation within business ecosystems such as the ETIC. As discussed, business ecosystems do not have the same reliance on one another for one's success, for example, within the ETIC, no company is directly reliant on another in terms of manufacturing, or through a supply chain, therefore, unlike in the automobile industry there is no end goal in terms of production or financial targets. In the case of the ETIC value creation was developed through shared challenges. Creating an ecosystem that can drive change in the industry through actors collaborating and exchanging resources to create a strong collective voice within the electech sector that tackles its actors shared key challenges, creating mutual value.

2.3.2 The ARA models pertinency to this case study

Whilst the ARA model offers insights into how value creation and appropriation could be used to develop and sustain business networks, there is still a gap in the literature in the form of resources when applied to business ecosystems, specifically ecosystems with no specific financial or supply chain tie.

As such, one might then argue that organisational networks differ slightly from business ecosystems in that in ecosystems there is little lock-in or hierarchical structure, creating a free and flexible form of network. In cases where there is no locked-in dependency, such as the ETIC, the question is posed, what holds a business ecosystem together, and what motivates collaboration in the first place?

The business ecosystem literature suggests that elements that bind an ecosystem could be found within geographical proximity, mutual industry connections, or organisational structures (Letaifa and Rabeau, 2013). However, at the time of insertion into the ETIC group, although holding geographical proximity and mutual industry connections as necessary conditions to attain membership, and they had not yet succeeded in developing a successful business ecosystem, where all members had a clear sense of mutual purpose and mutual value creation. This suggests that to develop and sustain a business ecosystem, when traditional resource ties are lacking, other elements must be considered.

As discussed, the ARA model has its limitations when used in applications to develop value in a business ecosystem such as the ETIC. The model seems somewhat incompatible with ecosystem development as this is premised on the sharing and exchange of resources (Håkansson and Snehota, 1992). Within ecosystems, and particularly the ETIC, there are fewer resources being exchanged or developed to create value and allow actors to appropriate this in their exchanges or activities.

Furthermore, at the core of business clusters are companies that are driven by innovation and find mutual benefit from integrated support systems and dynamic business networks (Osarenkhoe and Fjellström, 2022). The ARA model is driven by companies that require a heterogeneous availability of designs and knowledge who collaborate towards an economic target. Within the ARA model, resources are vital, along with actors and activities that will then start co-aligning to develop goods and services.

However, the ETIC has a distinct lack of shared resources, with very little tangible or intangible goods being exchanged between member companies. To this end, this study sought to develop a new conceptualization of the original ARA model, which could lead to the ability for mutual value creation within an ecosystem without the presence of traditional supply chain resources (see 5.4).

In the case of the ETIC, member companies have been motivated to join a cluster that does not necessarily have an economic target, nor does it require heterogeneous availability of designs or knowledge. The ETIC therefore must develop its business ecosystem to demonstrate the differing formulation of value that it offers. Essentially, the marketing strategy has been created and developed to ensure the longevity of the ETIC, when other elements of the network approach seem not to lock in the members or the actors due to a lack of mutual orientation to value. As discussed, this mutual orientation to value was found in shared challenges between ETIC members.

As we have seen, the network literature suggests that for the development of a viable network, the success of one business depends on the success of another business. In the ETIC case study that is not the case, as there are no business exchanges taking place between member companies in a dyadic or network effect. Simply put, one business member could go bust, and this would not have a dramatic effect on the other firms as no buyer seller relationships were in place. As there are no financial targets set by the ETIC, and no inherent value creation in terms of production, efficiency, or supply chain enhancement, it makes ascertaining where value is created from within the ETIC when there is a lack of financial drive and resources very difficult. Therefore, a marketing strategy was developed for the ETIC which was based on the key determinant of value creation, in an environment where there was no coherent value proposition.

An element of business ecosystems that has received little research is in their early-stage design, development, and sustainability in terms of their feasibility over time. This seems of interest when as we have discussed, there is less emphasis on the physical resource or exchange of resource within the ecosystem to provide the reasoning and impetus for coming together in the first place. Within the ETIC case study, there are clear displays of actor bonds and activity links in terms of meeting to discuss industry trends, joint planning meetings across members on a bi-monthly basis, and opportunities for members to meet to discuss opportunities in the electronics market, but very little evidence of physical or intellectual resource ties or exchange. From this, one may posit that if the data were to have been analysed via the ARA model, the lack of resource exchange could be seen as contributing form of explanatory evidence as to why ecosystems have a reduced lack of success in their initial startup phase through the resulting lack of value creation from this resource exchange process (Håkansson et al., 2009).

What was identified in this case study was that the ecosystem was only able to be substantiated positively when a market lead strategy was developed that gave a clear understanding of how value is created within the ETIC. The particular value created was in lieu of resource exchange and availability but was developed in terms of the identification of common mutual challenges which faced all members yet were unclear before the market-led initiative was instigated. To this end, it is suggested that these alternative forms of mutuality were in many respects acting as boundary objects (Carlisle 2002), allowing a common understanding of the potential usefulness and value of the ecosystem, and thereby positively affecting its success.

2.4 Boundary Objects

As discussed in the previous sections, traditional networks as described by the ARA model are comprised of actors, activities, and resources, with actors interacting with activities and integrating resources to create value (Håkansson and Snehota 1995). This interaction between actor bonds, resource ties, and activity links enables business relationships to develop within networks, due to the shared value that is created (Håkansson and Snehota 1995).

Within the ETIC ecosystem, there are clear actors, its member companies and there are clear activities, in meet days, members lunches, and board member meetings. However, the ETIC has a distinct lack of resource exchange within its ecosystem, which therefore leads to an absence of what element 'ties' actors and activities together to create mutual value. Research from the case study suggests that actors within the ETIC struggled to explain where value is created and what the ETIC's emphasis, vision and strategy are. Numerous organisations spoken to in semi-structured interviews seem content with free membership of the ETIC without any real tangible evidence of how it can create value to benefit them.

With the empirical data from the case in mind, this paper therefore moved to boundary objects as the theoretical literature which closes the gap left by the ARA model and provides an explanation as to how ecosystems can be successfully developed and sustained through the concept of value creation and appropriation. In this case study, boundary objects are used to fill the gap in ARA model literature by uncovering, identifying, and communicating to all members of the ETIC, the mutual challenges that all members within the ecosystem faced. Developing an avenue whereby the ETIC as a whole ecosystem could move to being a networked entity which could still crucially create value in the absence of resources as depicted in the ARA model, and inherent within the business network intellectual field (Easton, 2009).

The concept of boundary objects was first developed by Griesemer and Star (1989) and has since developed into a multi-disciplinary theoretical tool (Stoytcheva, 2018). Boundary objects theory has been adopted from organisational literature and demonstrates how the interaction between objects allows disparate actors to make sense of common challenges, facilitating collaboration and enhancing interactions between network actors (Harrison et al., 2018). The objects referred to in this literature were described by Griesmer and Star (1989, pp. 393) as "...plastic enough to adapt to local needs and the constraints of several parties employing them, yet robust enough to maintain a common identity across sites".

An issue that is shared between organisational networks and business ecosystems is that of driving collaboration between a diverse group of actors who potentially have different individual purposes and interests (Tidström, 2015; Munksgaard, Johnsen, & Patterson, 2015). Boundary objects can help in resolving this by providing insight into how collaboration can be driven within a network through shared objectives and developed interactions (Harrison et al., 2018).

Boundary objects have the potential to enhance coordination, enable collaboration, and mediate change within business networks and across boundaries (Harrison et al., 2018). However, connecting actors within networks through boundary objects is not simple at a network level, as boundary objects must determine what elements of a network serve to drive collaboration, coordination, and change (Geurcini and Medlin, 2020). The needs of boundary objects will fluctuate between cases, networks, and organisations and can be found in a variety of forms that do not necessarily need to be material objects (Carlile, 2002). They can be found in visual representations or standardised reporting forms (Star and Griesemer, 1989), prototypes (Carlile, 2002), targets or timelines (Yakura, 2002), or even concepts such as 'resilience' or 'participation' (Brand and Jax, 2007).

2.4.1 Boundary objects applied to the ETIC

As boundary objects do not require physical, object material; ideas, concepts, and other intangible objects can be used to develop them. In this report's case study, the ARA model cannot be applied to the ETIC business ecosystem to ascertain value creation and appropriation, partially due to the absence of resources within the ETIC. Primary research conducted with ETIC member companies, suggests that a lack of understanding as to how value is created within the ETIC is a potential reason as to the stagnation of the ETIC. It was therefore identified that in this case study, the ecosystem was only able to be sustained positively when a market lead strategy was developed, providing a clear understanding of how the ETIC creates value for its members.

Therefore, it was through the empirical, longitudinal research conducted at the bequest of the two lead orchestrators of the ecosystem, and cemented by consequent strategy developed to identify opportunities for value creation that were not resources but instead through mutual challenges, that member companies of the ETIC were able to come together in the discovery of mutual value. The marketing strategy, based on the empirical research which concerned itself with the identification of common challenges for all members, became the vital tool connecting the ecosystem. The strategy document and the mutual value created through the identification of the challenges as boundary objects across the group became the missing resource; the boundary object which took the place of resources in terms of the ARA model to allow an ecosystem, not a buyer-seller network, to come together and find mutual value. It was this set of boundary objects, to include the document itself which could then be seen as the factor which propelled the membership and created the sentiment for sustaining the ecosystem.

The commonalities that held all the actors within this ecosystem together, besides geographical proximity and shared market sector, were pivotal determining the long-term capacities (Letaifa and Rabeau, 2013). These were identified as key common challenges, mainly; a sector-wide skills shortage, a local, national and international 'electech' underrepresentation in governing bodies and academic institutions and a requirement to increase knowledge exchange amongst member companies. These three elements became the boundary objects (Carlile, 2002) that created the value and opportunity for members in this ecosystem to enhance collaboration and coordination and drive change and growth within the Electech sector.

The boundary objects identified were the basis of the strategic marketing plan which linked all members together. The ultimate aim of this marketing strategy was to develop the ETIC into a successful ecosystem which could be sustained through the mutual understanding between its actors, that involvement within the ETIC was worthwhile and valuable as key challenges were being tackled collectively.

3. Methodology

As this study was to further our understanding of the challenges posed in the development of coherent and coordinated strategy for business ecosystems, and the network of members, the chosen methodology used a multiple case study research design consisting of fifteen member companies within the ETIC. This methodology ensured thorough data collection from industrial contexts which allowed a strategy to be developed that was grounded within that context (Yin, 2018). Fifteen case studies were considered a suitable amount as this is within the range of typical multi-case study approaches, which usually entail between fifteen to twenty-five participants (Griffin & Hauser, 1996; Zeithaml et al., 2020). Miles & Huberman (1994, p.30) reinforced this amount, suggesting more than 15 renders a study “unwieldy”.

3.1 Data Collection Methods

In addition to the interviews conducted, action research was carried out by the author in the capacity of a consultant, working closely with the ETIC member companies over a sustained period. Action research allowed for iterative learning through active participation in the development and testing of strategies within the ecosystem, which complemented the interview data with practical, real-time insights. This approach added value to the interview data by providing a continuous, reflective process, where findings from interviews could be applied in practice, before being observed, then refined. The action research method contributed to identifying and addressing the practical challenges that members faced, offering a longitudinal perspective that interview data alone could not capture. This dual approach ensured that the data collection was both reflective of participants' views and enhanced by the practical application of emerging strategies within the ecosystem.

Primary research was conducted in the form of semi-structured interviews while being supported by secondary research, using a mix of academic and market lead data, taken from a series of sources including Innovate UK, UK Research and Innovation, and the UK Department for Business, as well as consulting papers from McKinsey & Co., Deloitte, and Ernest Young. Qualitative research was considered the most suitable research method as it enabled an in-depth insight into the challenges that organisations within the ETIC face, the activities that are carried out over a period of time, and the relational exchanges between members, supporting organisations, and stakeholders within the ETIC (Rynes & Gephart, 2004).

In this case study approach, interviews were conducted with a variety of knowledgeable representatives from ETIC member companies, enabling crucial phenomena from the research to be viewed from diverse perspectives (Eisenhardt and Graebner, 2007). Case study research was conducted due to its capability to study phenomena such as inter-firm collaboration (Plakoyiannaki et al., 2008) and in the early stages of strategy development when exploring key challenges within an industry (Gibbert et al., 2008).

During a six-month period spanning from September 2022 to March 2023, a total of 15 semi-structured interviews with employees from management, marketing, and engineering departments from the ETIC's member companies were conducted, lasting between 19 and 65 minutes. Semi-structured interviews were selected as the flexibility they provide creates the opportunity for new concepts and theories from the data (Bryman, 2012). Furthermore, the reasoning behind interviewing employees from varying roles was to obtain information about each member company and the challenges that they face from differing perspectives. Yin (2018) describes interviewees of this nature as “informants”, who can offer detailed information about the challenges that the ETIC faces and are considered sources of corroboratory evidence.

An appreciative interview approach was adopted, allowing interviewees to reflect on past and present experiences that demonstrate the challenges that their organisation faces (Michael, 2005). The interviews began with preliminary questions about the interviewee's organisation that they were representing, specifically what they specialise in, their value proposition, their customer base, their product or solution range, and the current challenges they face. Probe questions starting with 'how' or 'what' were adopted to guarantee that answers came from the respondent and not because the questions asked created a "self-fulfilling prophecy" (Dick, 1990, p. 9). Questions then progressed to integrate the ETIC, specifically why the respondents' organisation was initially attracted to joining, where the ETIC holds value, how the ETIC can help in the challenges their organisation faces, the barriers to the ETIC helping in those challenges, and the ambitions their organisation had for the ETIC. Probe questions were a constant feature throughout the interview process and provided a dependable framework for data analysis across varying case studies (Perry, 1998).

3.2 Data Analysis

With the consent of all participants, interviews were recorded, transcribed, and analysed to confirm descriptive validity (Beverland & Lindgreen, 2010), with one primary investigator responsible for the data collection and analysis. The qualitative data from both the interviews and action research was analysed using a thematic coding approach, which has been described by Miles and Huberman (1994). The analysis involved identifying and categorising recurring themes that emerged across the data sets, allowing for patterns to be detected in the challenges and strategies employed by ETIC member companies. Coding was carried out through an inductive process, where the data was first openly coded to capture raw themes and then organised into more abstract categories related to the research questions. Furthermore, insights from the action research process were incorporated into the thematic coding, enhancing the data with longitudinal perspectives that were tested and observed in practice. Thematic coding enabled the comparison of data from both interviews and action research, offering a comprehensive view.

Once the data collection process was complete, similarities that emerged from each case study were compared to identify consistent patterns, comparing observations found to constructs, relationships, and models from network literature, related research techniques, and strategy development pieces. The Gioia methodology (Gioia et al., 2013) was also utilised to ensure rigour in the inductive research process. This approach helped to systematically build categories from the data and relate them to the theoretical constructs discussed in the literature review. As recommended by Gioia et al., the coding process involved a continuous interplay between data collection and analysis, allowing emergent themes to be refined iteratively. This method ensured that the final strategy was deeply rooted in both the empirical evidence collected, and the theoretical framework established.

Once this analysis was complete, secondary research was used in the form of academic literature and market lead data to determine which marketing methods were most applicable to create the most in-depth and applicable overarching marketing strategy for the ETIC.

4. Key Findings

Along with analysing how the ETIC, as a business ecosystem, could be developed and sustained through its value creation and appropriation capabilities, this project aimed to address the marketing activities of the ETIC through the development of a marketing strategy, creating a long-term market position to communicate the benefits of the ETIC to new members and existing members, driving growth, and sustaining activity.

To do this, research questions were devised and conducted in the form of semi-structured interviews with representatives from member companies within the ETIC. The information obtained provided an understanding of the challenges the SMEs face and how the ETIC could help in tackling these challenges. An overarching marketing strategy was developed, supported by reoccurring evidence from the data that was collected over a four-month period. It was determined that to cohere the ETIC together, the marketing strategy would seek to have at its core the ability to tackle mutual, key challenges within a geographical location that encompasses all of the ETICs member companies, driving innovation, creating value, and establishing a collective voice which expresses the positive and essential impact that the Electech sector has upon a mass of other sectors, including renewable energy, defence and healthcare. To accomplish this, it was deemed necessary that the ETIC develop and sustain a business ecosystem.

4.1 The ETIC's key challenges

The marketing strategy was created as part of a project that aims to tackle challenges within the ETIC and wider Electech sector. Three key themes were identified from the data collected; these were:

1. The need for a clear and unique value proposition to drive a sense of shared common interests through opportunities for the exchange of strategies, technologies, innovation, and knowledge, whilst also enhancing the ETICs 'collective voice' and showing why the services the ETIC offers are of value to its members, other sectors, and the wider UK economy.
2. Underrepresentation of the ETIC and wider Electech sector- the sector locally and nationally suffers from a lack of understanding and representation (Like Technologies, 2023). This consequently leads to a lack of awareness surrounding the opportunities and diversity within the industry.
3. An electech based skills shortage was apparent within the industry both regionally and nationally. A high number of member companies emphasised the general lack of electech talent available as well as the struggle to translate skills acquired from Universities or Colleges to industrial use, particularly in the local geographical region.

4.1.1 The Absence of a Clear Value Proposition

From the research conducted, it was concluded that ascertaining value within the ETIC proved to be difficult. In almost all interviews conducted the question 'What do you see the ETIC's value proposition as?' was asked. In some instances, the term value proposition was asked to be clarified. In these cases, the term value proposition was described as a reflection of the benefits the ETIC can provide to its member companies and how it differentiates itself by conveying what is distinct about its services.

Often, respondents not part of the ETIC board could not answer the question in any capacity. For example, representatives from the ETIC's member companies Gaist and Northern Hi-Tech responded with the answer:

"I'm not too sure what that would be" ... "To be honest I could not tell you", respectively.

Another ETIC member company representative answered the question by saying:

"If I'm honest, I think it's still finding it. You set these things [cluster groups] up and you might have a plan to go one way, and then you realize that you might need to recalibrate and probably go in a different direction".

Participants who did answer the question referred to the ETIC as a 'facilitation service', with some board member representatives placing an emphasis on the work the ETIC does to drive growth and innovation within the Electech sector locally. Others suggested that the ETICs value proposition was to help in tackling some of the challenges that local and national businesses within the electech sector faced. One board member placed importance on the online presence of business interactions within the ETIC, saying:

"The online presence is really important, as this is how businesses are transacting, this must be robust. The business is a global industry and in order to attract investment from outside the area you need to have that presence and a clear value proposition that also has to be reflected in wider engagement with companies. It [the value proposition] must engage resources from outside of the cluster that can help promote investment."

Generally, the board members of the ETIC had an idea of what they thought the ETICs value proposition should be, with some overlapping ideas between representatives, such as to help in tackling key challenges that local SMEs in the electech industry face. However, representatives from other businesses within the ETIC who were not part of the board tended to have no clear idea of what the value proposition of the ETIC was or should be.

4.1.2 Underrepresentation of the ETIC and Electech Sector

The second prominent theme noted from the data collected was the underrepresentation that the electech sector suffers from. One of the ETICs board members, when speaking about the representation of the sector said:

"... it must be made clear how important the electech sector is. What we have in the ETIC and the amount of electech SMEs in the local area is not something you find everywhere in the UK".

They went on to say that:

"... those in more central roles, who make the big decisions within; industry, universities, colleges, LEP committees, county councils and central government need to know that we [the ETIC] exist. At the moment they don't really know us".

They concluded speaking about the challenges that under-representation poses by saying:

"We recognise the importance of supporting the industry [electech industry] so that we have an industry to work in. There has been a lot of neglect over the past 20 years, and we need to rebuild it efficiently, which will be done better as a group".

One interviewee, when talking about the purposes of the ETIC, included increasing representation of the wider electech sector, saying that:

"The ETIC is in place to help companies solve cross-functional problems together. Through developing a collective voice, we can increase representation and facilitate ideas, conversations and bring people together". This was reinforced by a board member of the ETIC who when speaking on the issue of representation said, "Our job [the ETIC] is to be a collective voice and raise representation of electech [the sector] in the local area".

4.1.3 A Sector-Wide Skills Shortage

Early in the interview process, it became apparent that a reoccurring challenge that respondents faced was an electech-based skill shortage, making recruitment a difficult process. The first

interviewee was one of the ETIC's founding members and the first question was designed to explore the driving force and reasonings for the ETICs creation. The response stated that:

"Going all the way back to 2016, there have been issues with getting people with the right (Electech-based) skill sets into the local area. Lots of training and expenses have been spent on young talent who hadn't necessarily got a tech background. This got very frustrating, so we wanted to do something about it. We got five likeminded businesses together and found that they were experiencing the same problems."

He went on to say that the ETIC:

"wants to tackle the skills shortage in a big way" and emphasising "...skills training and innovation go hand in hand."

Later into the interview when speaking about how he felt the ETIC could help its member SME's, their response was:

"Getting young talent into the area, giving them the necessary skills to work in the industry and then crucially retaining them".

The skills shortage continued to be a theme throughout the various case studies conducted. One representative from an ETIC member company said:

"... the burning issue (for starting the ETIC) was the shortage of skills that SMEs struggle with".

While one interviewee noted that although the skills shortage is a pressing issue, it is essential to get:

"People with the right skills".

He went on to say that it is not necessarily the new, youthful talent that he needs but those:

"with the right experience and skills in the industry".

This point was further reinforced:

"We [the ETIC] need to work out what needs teaching and where the skills gaps are. Providing projects, equipment, placements and being responsive to create targeted programs through experiential learning." Finally, a board member, when speaking on the skills shortage challenge, stated that "the ETIC must aim to shape training and curriculum, making it applicable to industry".

4.1.4 Key Findings Applied to Theoretical Research

Due to the absence of clear value creating and appropriating mechanisms within the ETIC, a marketing strategy was developed for a business ecosystem that incorporates the key determinant of developing value. The ETIC had no inherent value in terms of increased production, effectiveness, upward or downward supply chains, business being conducted in a dyadic or network effect, or for financial gain. Therefore, this report analyses how elements of network literature and boundary object theories can be translated into the business ecosystem.

Although there are great number of research papers that discuss the advantages that business ecosystems offer (De Witt and Meyer, 2010; Gueler and Schneider, 2021; Pidun, Reeves, and Wesselink, 2021; Sarafin, 2022, Zhang and Liang, 2011), there is still a gap in ecosystem literature surrounding how business ecosystems are developed and sustained, specifically when there is no financial tie or supply chain. This study suggests that when there are no commercial ties that

naturally bring organisations together, as a network of actors with a common value-creating goal, then there must be another element that does this.

The ARA model helps in explaining how value can be created and appropriated within business ecosystems to aid in their development and sustainability through activity links, actor bonds and resource ties (see Figure 2.). Traditional networks typically have a resource, actor and activity capability that pulls relationships together (Ford et al., 2008), which is often driven by financial, collateral and material value, depending on one another for success. In traditional networks there are ample resource supplies that are regularly exchanged to produce mutual benefit. For example, all companies involved in the manufacturing process of a car have resources required for the car to be created and all rely upon one another to deliver these resources so that the car can be sold, and all actors can make a profit.

In this case study, as is prominent throughout business ecosystems, a distinct lack of resources is a prominent theme (Hannah, Bremner, and Eisenhardt, 2016). Activities and actors are still apparent within business ecosystems but with a significantly smaller amount of resource exchange. Therefore, it was much harder to understand what brought these organisations together to join the business ecosystem. Member companies of the ETIC have joined a business network that experiences very little exchange of tangible or intangible goods, and that has no economic target or requirement for heterogeneous availability of designs or knowledge.

As the resources section of the ARA model led to this model not being fully translatable into business ecosystem literature, other literature was analysed to help fill the gap that the ARA model left in developing interdependencies between actors within a business ecosystem where there is a distinct lack of resource. Data extracted from the primary research conducted suggested that prior to the marketing strategy intervention, the ETIC has little meaning, value, emphasis, or strategy. Organisations seemed happy for now to be a part of the ETIC without any real tangible evidence of what it can do for them.

To develop this meaning and value, boundary objects were adopted as a means through which interdependencies can be developed and mutuality of value could be created, developed, and appropriated. In the case of the ETIC, the boundary objects were founded through a consultancy project, whereby interviews with member companies within the ETIC were conducted to ascertain key challenges that all companies within the ETIC and Electech sector faced. This mutuality of key challenges was theorised as boundary objects and used instead of resources to develop relationships and interdependencies between actors. Through the discovery of these mutual challenges, the ETIC could re-align its strategy and value proposition to be centred around developing ways that can enable these challenges to be tackled collectively.

In the ETIC case study, the solution to filling the gap in business ecosystem literature regarding what is required for their development and sustenance, when there is no specific financial or supply chain tie, along with a lack of resource exchange, is the requirement to adapt the existing ARA model, replacing resources with boundary objects to enable the cohesion and progression of the ecosystem. The exchange of resources for boundary objects, within the ARA model, enables a common systemic set of challenges to be used to create the impetus and rationale for being part of an ecosystem, which subsequently has a significant impact on the success of a business ecosystem's development and sustainability. Perhaps one could entitle this current mode of thinking as the ABOA model.

4. Discussion/ Conclusion

The aim of this paper is to develop an understanding of how business ecosystems can be successfully developed and sustained, specifically in the absence of resource exchange and whereby actors do not have clear interdependencies upon one another in terms of supply chain, financial incentives or increased efficiency or effectiveness.

There is a gap in ecosystem literature, due to a lack of theoretical research, on what is required to develop and sustain a business ecosystem. Through an empirical investigation in one ecosystem (the ETIC), whereby primary and secondary research was tracked and traced over a year-long period, this paper seeks to determine what the inherent difficulties are in developing and sustaining an ecosystem, whilst attempting to explain some of the solutions that were imposed to engender success and progress within the ETIC.

Primary research was conducted in the form of semi-structured interviews with representatives from member companies of the ETIC. Part of this project was initially to develop an overarching marketing strategy for the ETIC which would enable them to develop and sustain their business ecosystem.

Upon first inspection, it was extremely difficult to ascertain where value stemmed from in the ETIC, as actors did not do business on a dyadic level. They had no interdependency on one another and had no joint financial incentive. Furthermore, there was very little to no exchange of resources between actors within the ETIC, making it difficult to understand what purpose actors had for being a member of this ecosystem and what value was being created by the ETIC for its member companies. Therefore, a marketing strategy was developed centred on the core determinant of value creation, seeking to establish a clear and unique value proposition that would create a mutual bond between ETIC members and develop value-creating synergies within the ETIC.

After all primary research was conducted, three core themes emerged from the data. The first theme was that ETIC members were unsure of what the ETICs value proposition was. When asked the question "How would you describe the ETICs value proposition?" some respondents from companies that were not part of the ETIC board replied by saying "I'm not too sure what that would be", "To be honest I could not tell you", and "If I'm honest, I think it's still finding it". Representatives from the ETICs board member companies offered a slightly more coherent value proposition, often stating that the ETIC was a 'facilitation service' which sought to drive innovation within the local electech community. This vague understanding from a minority of companies that formed the ETIC was not deemed a strong basis and proposition to enable the ETIC to be developed and sustained.

The second key theme extracted from the primary research was an underrepresentation of the electech industry. When speaking on the underrepresentation that the Electech sector suffers from, one respondent from the interview process stated that:

"... there has been a lot of neglect over the past 20 years [in the Electech sector], and we need to rebuild it efficiently, which will be done better as a group".

Other respondents reflected this sentiment suggesting that the Electech sector both regionally and nationally is poorly understood, especially in regard to its importance and relevance within other sectors and the opportunities that are available within the sector. This was summarised by one respondent who suggested that one key job of the ETIC should be to:

"Provide a collective voice and raise the representation of electech [the sector] in the local area".

The third key theme identified was that the Electech sector suffers from a regional and national skills shortage. Almost all interviewees indicated that an electech skills shortage was a key challenge in their business. Finding people who had the necessary skills, wanted to work in the industry, and wanted to work in the Northwest of England was a difficult task. Interviews with ETIC board members revealed that this challenge has been prevalent for almost a decade now in the local area and went on to state that:

“... there have been lots of issues getting people with the right skill set into the Electech sector” and “... lots of training had been spent on young talent who hadn’t necessarily got a tech background”.

This theme was apparent within board members and standard members of the ETIC. One respondent from a small ETIC member company said:

“... the burning issue (for starting the ETIC) was the shortage of skills that SMEs [Electech-based SMEs] struggle with”.

Equipped with this information, theories were examined to understand how value can be created by using these key mutual challenges to form interdependencies between actors within the ecosystem.

Initially, business ecosystem literature was assessed in order to understand how business ecosystems can be developed and sustained. Whilst this literature provided substantial research on the advantages that business ecosystems posed, they offered very little information on the difficulties that business ecosystems face in their development stage and what is required for their sustained success, specifically when there is less emphasis on resource exchange within the ecosystem. The Boston Consulting Group's study on business ecosystems (2019), supported by Pidun, Reeves, and Zoletnik (2019), found that less than 15% of business ecosystems were sustainable long term. Additionally, upon investigating value creation at over 50 businesses within ecosystems, no significant correlation between ecosystem participation and total shareholder return was found. This posed the question, with all the advantages that ecosystems pose, why are there not more that are successfully maintained long term?

Due to the gap in ecosystem literature, this paper turned to organisational network literature, with emphasis on the ARA model, to help understand how business ecosystems can create value for their members which would have a significant impact on the success of their development and sustainability. The ARA model was deemed a suitable model for analysis as it offers an insight into what is required to develop long-term industrial relationships through mutual value creation (Håkansson and Johansson 1992).

Similar to business ecosystem literature, organisational network literature only provides insight to a certain point. The ARA model provides a novel perspective on business networks, placing crucial emphasis on strong relationships between companies for the mutual development of the network as a whole. Characterised by three interrelated elements: actors, resources, and activities (Håkansson 1987, Anderson et al. 1994, Håkansson and Johansson 1992, Håkansson and Snehota 1995), the ARA model offers a complementary outlook on business networks, replacing research focused on single, dyadic relationships between buyers and suppliers with a broader network approach (Axelson, 2010).

A key element within the ARA model is the exchange of resources between organisations which subsequently creates financial, collateral and material value whilst developing strong relationships based on mutual value creation (Håkansson et al., 2009). Within business ecosystems, activities and actors are present but significantly less available, tangible resources (Hannah, Bremner, and Eisenhardt, 2016). This was evident in the ETIC case study. Along with the absence of resource within

ecosystems, there is also a diminished emphasis on financial and supply chain interdependencies, making it much more difficult to ascertain where value could be created to enable an ecosystem to successfully be developed and sustained. Therefore, although the organisational approach provided insight into how value creating interactions, such as relationships, can help to develop and sustain traditional business networks, the approach does not explain how a business ecosystem can be successfully developed and sustained in the absence of resource exchange.

The absence of resource exchange within business ecosystems led this paper to analyse boundary objects literature, seeking to find an explanation as to how business ecosystems can be successfully maintained and developed in the absence of resource exchange. By identifying a common systemic set of challenges that created the impetus and rationale for being a part of the ETIC, this paper theorised that these common challenges could be regarded as boundary objects, which led to value creation for all of the ETIC members by forming interdependencies between actors based on tackling mutual key challenges collectively.

In conclusion, for the successful development and sustenance of business ecosystems, they require tangible value-creating mechanisms which, like business networks, are mutually established and experienced by all members. To do this, unlike in business networks where there are financial value drivers in networks of supply chains, business ecosystems must look elsewhere, which in this case study, was the identification of boundary objects.

It has been identified that the ETIC was only able to be successfully developed and sustained when a market lead strategy was created that gave a clear understanding of how the business ecosystem could provide value for its members. Therefore, it is possible to re-think the ARA model, enabling business ecosystems to be successfully developed and sustained in the absence of resource and supply chain and financial interdependencies, by replacing the requirement of resource ties with boundary objects, which can be adapted to fit various business ecosystems.

4.1 Limitations of this case study

While this study provides valuable insights into the development and sustainability of business ecosystems, several limitations should be acknowledged. One significant limitation is the absence of a comparative case, which could have provided a richer context and allowed for cross-case analysis to further validate the findings. A comparative case could have highlighted differences or similarities in ecosystem development across different industries or geographies, adding depth to the analysis. Another limitation is methodological: although the study benefited from a longitudinal action research approach, it was constrained to a one-year period. A more extended longitudinal study could have captured the longer-term evolution of the ecosystem, providing a deeper understanding of how ecosystems change and adapt over time. Additionally, from a theoretical perspective, the study did not fully engage with the literature on the antecedents of ecosystem success or failure, which could have further informed the discussion on the factors influencing ecosystem sustainability. A more comprehensive engagement with this literature might have added valuable insights into the early-stage development challenges faced by ecosystems like the ETIC.

4.2 Further Research Directions

Building on the limitations identified, there are several directions for future research. Firstly, a comparative case study involving multiple ecosystems across different sectors or regions would offer a more robust framework for understanding the varied challenges ecosystems face in their development and sustainability. Comparative analysis could also reveal sector-specific dynamics that impact ecosystem success, further enhancing the generalisability of the findings. Secondly, future

research could benefit from adopting a more longitudinal approach, extending the timeframe beyond one year to examine how ecosystems evolve, especially in terms of actor interdependencies, value creation, and the emergence of boundary objects over time. Such studies would provide a more nuanced understanding of how ecosystems develop sustainable value-creation mechanisms over the long term. Finally, further research could focus on exploring the antecedents of ecosystem success and failure, particularly investigating how early-stage ecosystems overcome initial barriers to value creation and actor engagement. By engaging more deeply with this theoretical domain, future studies could contribute significantly to the understanding of what drives ecosystem longevity and success.

Through adapting the ARA model to become the 'ABA' model, the organisational network approach can be translated into business ecosystem approaches, to enable their development and sustenance when there is no tangible resource or value-creating mechanisms. Boundary objects can develop interdependencies through tangible and intangible elements of a business ecosystem such as artifacts, processes, concepts, and other entities that provide bridges across boundaries and act as shared references that are meaningful to actors within a business ecosystem (Fominykh et al., 2016).

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