ONE PERSON’S TRASH IS ANOTHER’S TREASURE –
THE CONCEPT OF SYMBIOTIC INNOVATION CLUSTERS FOR REGIONAL
DEVELOPMENT

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ABSTRACT

The conceptual gap that this paper seeks to address centres on perceiving clusters, formed for the purpose of stimulating innovation, within an entirely different theoretical framework, identified here by the authors as the Symbiotic Innovation Cluster. The authors propose a typology within a new conceptual framework that explains the development of the Symbiotic Innovation Cluster. The authors have identified four different types of symbiotic innovation relationship that involves clusters; the first two cluster types focus on a collaborative approach to innovation (Mutual and Commensal), while the third and fourth symbiotic cluster typologies (Parasitic and Amensal) both constrain and encourage innovation through environmental exploitation and organisational failure respectively. The existence of Symbiotic Innovation Clusters present a challenge with regard to preconceived notion that, clusters need to develop around industry specific interests. It is argued here that, rather than seeking cluster partnerships based on similarities, managers should seek to develop relationships based on resource maximisation through Symbiotic Innovation Clusters.

KEYWORDS: Symbiotic, Innovation, Clusters, Mutual, Commensal, Parasitic, Amensal
INTRODUCTION

The nature of the global marketing environment combined with new inter-relationships between firms, is forcing the need to use multidisciplinary approaches to better understand, analyse and improve business performance.

The purpose of this paper is to consider new and innovative approaches that derive from collaborative relationships, which draw on cluster and innovation theory in order to gain new insights for business strategy, which can facilitate sustainable growth within different geographical and economic regions. The conceptual gap that this paper seeks to address centres on perceiving clusters, formed for the purpose of stimulating innovation, within a different theoretical framework, identified here by the authors as the Symbiotic Innovation Cluster. This immediately raises questions concerning why a new typology might be required within the discipline. It is argued by the authors that, the new typology allows for a clearer and more functional classification of cluster types than is currently available, which may also assist managers in focusing on how relationships should be developed within specific types of cluster arrangements. In addition, that there is need to recognise that cluster development is neither homogenous, nor does it need to be focused towards the traditionally held view of enhancing of synergistic relationships in order to achieve greater innovation potential (Mackintosh, 1992; Grabher, 1993, Montresor & Mazetti, 2007). To this end, the question that this paper therefore seeks to address is, “How might the different innovation clusters types be classified?”

Historically, much of the literature has tended to focus on the relationships that are developed through common industry and sector requirements and overlaps (Brenner, 2005; Moreno, Paci & Usai, 2005; Lavie, 2006; Maskell & Kebir, 2006; Montresor & Mazetti, 2007). The authors argue that, while some benefits might accrue through industry specific cluster assimilation, evidence suggests that innovation processes are all too often undermined by each organisations tendency towards excessive compromise and/or competitive tendencies (Simme, 2006). The authors propose a typology within a new framework, the Symbiotic Innovation Cluster. Consisting of four relationship types - Mutual, Commensal, Parasitic and Amensal, and provide examples supporting the existence of each. In addition, from the discussion on
typology a conceptual framework of Symbiotic Innovation Clusters has been developed, which explains the dynamics that underpin two specific types of Symbiotic Innovation Cluster; the Mutual and Commensal. The Parasitic and Amensal clusters are evaluated as part of the discussion surrounding typology development, but are not the primary focus of this paper

The paper begins with a critical review of the literature surrounding cluster development, and examining in particular, the challenge that cluster development poses to the resource—based view of the firm, and the importance of relationship development; personal association, alliances, networks, as well as the traditional role of compatible, common and complimentary synergies. The paper goes on to briefly define the characteristics of innovation and links the two theoretical bases via the concept of a symbiotic cluster, where the Symbiotic Cluster Typology is introduced. A conceptual framework is presented, which explains how Symbiotic Clusters might form, and the dynamics that underpin their development. The paper then concludes by examining the implications for management of the Symbiotic Innovation Cluster, and opportunities for further research are suggested.

**CLUSTER DEVELOPMENT AND INNOVATION**

In a discussion of the concept of a cluster, the theoretical proposition outlined by Porter (1990) extends this notion and the relative national, state and local competitiveness of the firm, into a global context. More importantly, the adoption of a cluster view of competitive advantage demands a greater acceptance of the concept of *causal ambiguity*, which is introduced by the resource-based-view (RBV) literature (Dierickx & Cool, 1989; Wilcox & Zeithaml, 2001). This is because the notion of a cluster is based on linkages between a number of entities that are *indeterminate, intangible* and often *personal*. The RBV suggests that it is an organisation’s access to superior resources that drives its competitive advantage (Lavie, 2006). The challenge posed to RBV by the formation of traditional clusters is that, it may require that organisations dismantle the protective mechanisms that prevent the diffusion of their resources, and ultimately their competitive advantage, to other organisations within the cluster (Lavie, 2006). This may

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1 The terms used in this paper; Mutual, Commensal, Parasitic and Amensal, have been adapted from the Industrial Ecology literature and used to explain Symbiotic Innovation Cluster formation (Desrochers, 2001; Jacobsen, 2006; Chertow, 2007).
provide one explanation why many companies are often reluctant to engage in cluster-type relationship development.

Alternative approaches have tended towards concentrating on market drivers, as opposed to resource sharing. A key finding from the literature has been that “…much of competitive advantage lies outside a given company or even outside its industry, residing instead in the locations of its business units” (Porter, 1998:198). In terms of value as a unit of analysis, clusters, as opposed to more familiar enterprise categorisations, “…capture important linkages, complementarities, and spillovers in terms of technology, skills, information, marketing, and customer needs that cut across firms and industries” (Porter 2000:18). That is, the intangible assets and capabilities are shared and all participating firms benefit.

A cluster as defined and discussed by Porter (2000:17) is “a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities”. Porter acknowledged that the geographic reach of clusters is variable, in that clusters may range from single industrial parks, cities to clusters between neighbouring countries. The reach of a cluster can reflect the extent to which the efficiencies gained can be effectively managed, in terms of the transactions between firms (Porter, 2000). It is important to note that here that, clusters are functionally different from alliance type networks (Lavie, 2006), and presented as being much more concentrated and tend towards emphasising the development of more deeply embedded cooperative and synergistic relationships (Mackintosh, 1992; Grabher, 1993). The authors argue that, while Porter’s definition provide a useful starting point for understanding the generic aspects of cluster formation, it does not go far enough because it assumes that cluster characteristics will always operate in manner that is beneficial to both parties. Evidence is presented later in the paper that challenges this conceptualisation, where the authors suggest that there are in fact four different types of cluster, and as a consequence, a more focused definition is therefore required.

Porter (2000: 17) further described the cluster as “…a system of interconnected firms and institutions whose whole is more than the sum of its parts” which he proposed can affect competition in three ways:
a) Increasing the current (static) productivity of constituent firms or industries

b) Increasing the capacity of cluster participants for innovation and productivity growth and

c) Stimulating new business formation that supports innovation and expands the cluster. “Many cluster advantages rest on external economies or spillovers across firms, industries, and institutions” (Porter 2000:17).

Central to the concept is that the relationships in the clusters are generally personal and rely on the combined networks of the individual cluster members (Gisling, 2005; Lavie, 2006; Nooteboom, 2006). Furthermore, clusters are not naturally occurring phenomena, and require the development of formal structures and organisational processes to operate effectively (Malmberg & Power, 2006).

Porter (2000: 21-23) linked the concepts of clusters and innovation suggesting that “…cluster participation offers many potential advantages in innovation and upgrading (& some risks)” compared to a firm operating in an isolated location. For example, shared insights from other firms in the cluster, potential co-ordination of contractual arrangements and constant benchmarking against other cluster members.

A possible disadvantage of cluster development is a sort of groupthink, which may override innovative ideas and create inflexibility that can inhibit the development of superior performance.

The work of McDonald and Vertova (2001), assists to differentiate the cluster (a geographical concentration of firms from a sectoral area of specialisation) from other types of geographical concentrations of firms. Their discussion of the concept of industrial districts as being “…a cluster of firms in a particular industry that have constructed local networks with firms in supporting industries and also with the local community”, focuses much more on the development of networks, rather than geographical attributes (McDonald & Vertova, 2001: 159). This is an important distinction, as they further suggest that there are essentially two types of industry districts (types I and II); in that type I industry districts build from clusters of firms in the same industry and develop business networks, and
that type II districts build from clusters of firms in the same industry and develop socio-economic networks.

Over the past decade, there have been a number of studies of clusters that inform the literature by exploring evolutionary processes. Industrial districts in the Emilia-Romagna region in Italy, have developed on the basis of flexible specialisation, which has led to the province being identified as the Emilia Model of economic organisation (Moreno et al., 2005). McDonald and Vertova (2001: 159) report that in this region, the “…Firms in the ceramic tile industry are clustered in the city of Sassuolo and networks, both business and socio-economic, have been constructed around this cluster. Sassuolo has developed into an industrial district type II”. They go on to suggest that the export data, used as a proxy for international competitiveness, indicates that the province of Modena possesses a degree of international competitive advantage within the EU in the ceramic tile industry, and that this has increased in a period when markets became more integrated (McDonald & Vertova, 2001).

In their study of the Basque region in Spain, Arbonies and Moso (2002), describe the knowledge cluster as a co-operation structure that includes all actors in the innovation system operating in a region or a country. They describe its success as being a process of contamination and “…an engine of adaptation on a regional basis” (Arbonies & Moso, 2002: 354) concluding that it provides a forum for collective learning, but also warn that new organisational models with greater flexibility are needed.

Britton (2004) undertook a study of manufacturing firms from the electronics cluster in Toronto. He found that high-export firms had significantly stronger levels of input connections especially with consultants and alliance partners (Britton, 2004). More importantly, Britton establishes that higher export-orientation companies generate greater degrees of in-house knowledge, receive more innovative input from external sources and have distinctive network geographies (Britton, 2004). Britton also cautions that, firms have a greater capability to link with collaborators further a field, than is often acknowledged, and that locally defined clusters may not be fully leveraging this capability. This position is supported by a study of Turkish industrial clusters (Eraydin & Armatli-Koroglu, 2005) where there is evidence linking
the intensity of local networking and related levels of innovativeness, as well as greater degrees of innovation in firms linked into global networks. Additional evidence from de Martino, Reid & Zygliopoulos (2006) concludes that as firms internationalise, their close-networked relationships become less significant and that firms develop new capabilities that lead them to reorient their levels of interaction locally to a greater focus on extra-regional interaction.

In a more recent study examining the Timber industry cluster in New Zealand, (Perry, 2007) concludes that the attributes of the more successful clusters are related to:

1. Enterprise characteristics and extent of reciprocal business relations;
2. The motives for participation; and
3. The relative appeal of cluster participation versus membership of a national industry group.

The study also finds that if clusters become unbalanced the distribution of advantage is likely to be reflected in the quality of the underlying business relationships, in that some of the participants may see the cluster as operating to their disadvantage (Perry, 2007:21).

What is evident from the literature on clusters is the notion of the cluster existing as a geographical framework or network, which focuses on innovation occurring through sectoral interests (Ketelhohn, 2002; Steinle & Schiele, 2002). Over the past decade, the business unit known as the *region*, has seen a resurgence of interest in studies of regional economies. Storper (1995:191) coined this “*the region as a nexus of untraded interdependencies*”, which Saxenian (1998: 29) supports by claiming that it is “…*the region and its relationships, rather than the firm, that defines opportunities for individual and collective advance (in Silicon Valley)*”. In addition, Raagmaa (2002: 73) also stresses that strong *regional identity* facilitates greater “*collective and personal work motivation, induces learning and civic activities*” and secures greater public participation in planning. He warns that despite globalization, “*places and regions still matter*” and that planners should note the importance of *community* as a significant component in economic, social and cultural activities.
There is also considerable debate within the literature as to what does, as well as what does not constitute innovation (Utterback, 1971; Roberts 1988; Amabile, 1996; Cooper, 1998; Knox, 2002; McFadzean O’Loughlin & Shaw, 2005; Bessant & Tidd, 2007). Discussion surrounding what should be included in any definition range from incremental product and process identifiers (Covin & Slevin, 1991), through to the complex multidimensional, and often peripheral descriptors (Lumpkin & Dess, 1996), which have tendency to expand the boundaries of innovation and dilute the focus of the definitional usefulness.

McFadzean et al., (2005: 355) attempt to give the discussion a coherent focus by defining innovation as “a process that provides added value and a degree of novelty to the organisation and its suppliers and customers through the development of new procedures, solutions, products and services as well as new methods of commercialisation.” Their discussion concentrates on the potential evolution of a Fifth Generation Model that fits within Rothwell’s (1992) taxonomy. While the focus of McFadzean et al.’s, (2005) and Shaw, O’Loughlin and McFadzean (2005) studies are the exploration of the dynamic labelled intrapreneurship, it is argued here that, this definition provides a suitable foundation for the exploration of innovation clusters, but more specifically, a particular type of cluster; the Symbiotic Innovation Cluster, of which intrapreneurial activity forms an intrinsic part.

The following section now seeks to address the issues raised here by presenting a new conceptualisation - the Symbiotic Innovation Cluster.

**SYMBIOTIC CLUSTERS AND INNOVATION: THEORETICAL UNDERPINNINGS**

Symbiotic innovation occurs where a relationship develops between two dissimilar functions or organisations, which possess a high level of constancy and intimacy (Daida, Ross & Hannan, 1995). Such notions remain true to de Bary’s original discourse on the subject, where he notes that symbiosis provides the mechanism through which rapid and reliable innovation occurs (Daida et al., 1995). In addition, Symbiosis is a term that is used within the innovation literature to explain the coming together of two functions within a single company, or between two organisations (Harding, 2000; Ehrenfeld & Gertler, 2006). The authors have identified four different types of symbiotic innovation relationship that involves
clusters; the first two cluster types focus on a collaborative approach to innovation (Mutual and Commensal), while the third and fourth symbiotic cluster typologies (Parasitic and Amensal) both constrain and encourage innovation through environmental exploitation and organisational failure respectively:

- **Mutual Innovation Clusters**: The conditions for mutual innovation clusters to occur include, for example - that the organisations may or may not be related, the exchange is of relative but equal value, and the input is also proportionally equal. For example, Aviation and Aerospace Victoria (AAV) is an Australian Incorporated Association, which has been formed by the Victorian State Government in order to assist the domestic aviation industry commercialise business opportunities and stimulate innovation ([http://www.aviationvictoria.com.au](http://www.aviationvictoria.com.au), 2007). The programme was established to support small and medium sized independently operated aerospace companies located in the Gippsland region of Victoria, but has now been widened to include all Victorian aerospace companies. The cluster operates as a functional platform and business conduit, which draws the aerospace companies together and assists in the “investigation of [commercial] opportunities on their behalf” and “presentation of commercially viable [and innovative] opportunities to members” ([http://www.aviationvictoria.com.au](http://www.aviationvictoria.com.au), 2007). The cluster has been formed around the cluster type characteristics of; mutual cooperation, synergy, complimentary skills and compatibility, where the members are held to benefit through greater integration and the diffusion of resources and competencies, which in turn stimulates innovation (Mackintosh, 1992; Grabher, 1993; Porter, 2000; Lai, Chiu & Leu, 2005; Otsuka, 2006; Smith and West, 2007).

- **Commensal Innovation Clusters**: The conditions giving rise the commensal innovation clusters include, for example; that the organisations are unrelated, only one of the organisations may gain from the relationship, and therefore the exchange may be considered unequal and the resource input varied. Contributions to the relationship might centre on, for example, one organisation providing some kind of protection or shelter/accommodation for another. The power stations located in Eastern Victoria, Australia have developed a relationship with a number of small
farmers, where the land and cooling ponds are used for small-scale agricultural production, such as, growing roses and beef cattle grazing (Minerals Council of Australia, nd). While these farm businesses are able to profit significantly from being able to access the mining and power generators primary resource base, large tracts of land and water in what are officially classed as drought affected areas, interestingly, the power generators do not appear to gain any significant value from the relationship, but neither are they affected by the farmers’ presence. Commensal clusters raise some important questions about the degree to which traditional conceptualisations of cooperation, synergy, complimentary skills and organisational compatibility are crucial for cluster formation and innovation, and more importantly, whether the relational benefits must always be positively geared towards the maintenance of some kind of mutual reward equilibrium, where all of the cluster participants benefit from the innovation processes of one of the cluster partners (Smith and West, 2007). The example presented here suggests that other drivers, such as, some form of organisational philanthropy, or a simple willingness to share indirect resources (grass and water in this case) may have a more important role to play in Commensal type cluster formation.

The following cluster arrangements are an important part of the symbiotic innovation cluster framework, and are mentioned here as the negative elements of the conceptualisation. It is important to note that, these two typologies have a tendency towards largely inhibiting, while also, and perhaps paradoxically, stimulating external innovation processes. In addition, they do not entirely fit with the criteria specified above in terms of collaborative organisations.

- **Parasitic Innovation Clusters**: The conditions that give rise to parasitic innovation clusters are, for example; that the organisations are generally unrelated, one of the organisations is significantly disadvantaged, the relationship occurs over a prolonged period, usually while the parasitic organisation is present in that particular market place. For example, in Jamaica during the 1970s the bauxite-alumina industry was clustered around a number of large and vertically integrated multinational corporations (MNC) (Girvan, 1976, Payne, 1988). The bauxite industry
offered considerable potential as the foundation for heavy industrialisation and diversification, but it was precisely because the innovation and technology transfer and partnering processes were managed and controlled by various MNCs that Jamaican industry failed to capitalise on the bauxite-alumina clusters presence (Girling, 1978; Davies, Davis & Morrison, 1984; Prahalad & Lieberthal, 2007).

- **Amensal Innovation Clusters**: These occur where one organisation is disadvantaged, while the other gains little or no benefit from the association. For example, during the late 1990s and early 2000 the British defence conglomerate GEC (later named Marconi Corporation), embarked on a consolidation, and also a diversification programme involving the acquisition of a large number of telecom companies (Owen, 2003). The diversification process was a major contributor in the eventual collapse of Marconi, whose senior management had failed to understand the importance of technological change and market fluctuations (Owen, 2003). Importantly, the cluster that had developed around Marconi’s telecom interests involved a number of large organisations, such as, Siemens, Alcatel and GE. The collapse of Marconi provided little or no benefit to the other organisations that were involved in the cluster, but deeply impacted Marconi’s ability to operate independently in the telecom market (Owen, 2003). In 2006 Marconi Corporation was sold to Ericsson, thereby ending the technology cluster that had been developed under Lord Weinstock (Aris, 1998, Ericsson Media Relations, 2005).

**DEVELOPING A CONCEPTUAL FRAMEWORK EXPLAINING THE DEVELOPMENT OF MUTUAL AND COMMENSAL SYMBIOTIC INNOVATION CLUSTERS**

Having explained the different types of Symbiotic Innovation Clusters, the following sections detail the development of a conceptual framework that is used to explain the operational components of symbiotic clusters. This section concentrates on the dynamics that underpin Mutual and Commensal symbiotic clusters.

**A conceptual framework of mutual and commensal symbiotic innovation cluster development**
Figure 1 presents a framework, which explains how symbiotic clusters develop. The example cited here utilises the overlap between a power station or mining cluster and agricultural producers or market gardeners. The power station/mining company owns large tracts of land, which is an unutilised resource, while the agricultural producer/market gardener possesses the requisite skills and infrastructure to manage the land and develop programmes to exploit the resource. The forces here are identified as centripetal, in that the resource, process and infrastructure are pushed together to form a small cluster symbiotic cluster within the overlap (Baptista, 1996).

In addition, the overlap is identified as the area where the greatest level of cooperation is likely to occur between clusters (Montresor & Mazetti, 2007). It is important to note that temporal issues may govern the relationship, such as, when the open cut mine expands, as well as infrastructure constraints, where the symbiotic innovation cluster begins to expand.

**Figure 1: A Conceptual Framework Explaining Mutual and Commensal Innovation Cluster Development**

[Insert Figure 1 here]

**Symbiotic Innovation Cluster Group Overlays**

In extending the theme developed in Figure 1, Figure 2 is used to illustrate the overlap between various symbiotic cluster groups. It is likely that cluster groups will possess more than one overlap with other cluster groups (Oerlemans, Meeus & Boekma, 2001; Tracey & Clark, 2003). For example, a power station might have various clusters contained within a single operation, each overlapping with other symbiotic cluster formations; for example, market gardening, fish rearing in the cooling ponds, fertilizer manufacture, environmental experiments, educational and community programmes.

**Figure 2: A Conceptual Framework Explaining the Development of Multiple Overlapping Symbiotic Clusters**

[Insert Figure 2 here]
It is important to note that, in certain circumstances, the symbiotic progeny may actually outgrow the parents. This may occur over time, for example, as the mine’s resources start to deplete beyond useful economic levels, or the life-cycle of the power station reaches the maturity and decommissioning phase.

SYMBIOTIC INNOVATION CLUSTERS AND THE IMPLICATIONS FOR MANAGEMENT

The notion of Symbiotic Innovation Clusters and the related conceptual frameworks present a number of important implications for management.

Firstly, Symbiotic Innovation Clusters present a challenge with regard to the conceived notion that clusters need to develop around industry specific interests. Symbiotic Clusters raise questions about maximising the opportunity costs and operational attributes of resource use and allocation. Rather than seeking partnerships based on similarities, Symbiotic Clusters suggest that managers should seek to develop relationships focused towards resource maximisation. As a consequence, and in recognising the typology, managers need to understand that in order for organisations to achieve their innovation objectives, it may not always be necessary to cluster with businesses that have similar synergies, interests, capabilities, or are from the same industrial sector. Indeed, it may be of greater benefit for managers to engage with cluster types that avoid resource diffusion, and the potential erosion of any competitive advantage, such as, Commensal cluster types. Resource maximisation occurs when a particular resource is able to be exploited by one of the cluster partners, without that organisation presenting itself as a challenger or potential threat to the other partners.

Importantly, many established clusters have been developed as a defence mechanism, simple associations/partnerships, or as closed networks for specific industry sectors (Earl-Slater, 1996; Johnston, 2003; Gilbert, 2004). As a consequence, the partnering process that is supposed to act as stimuli for innovation, more often than not acts as a structural impediment (Garrett-Jones, 2004). Symbiotic Innovation Clusters do not possess the same defensive dynamic as traditional cluster types, as the relationships are based on a desire exploit underutilised resources and to innovate, rather than being negatively geared towards defensive and protective action. Symbiotic clusters are focused very much
towards partnership enhancement, where growth, innovation and development are the key determinants, rather than intra-cluster competition and resource diffusion. This is important for managers as it raises questions about how managers might maintain an organisation’s competitive advantage, as well as with whom to cluster.

The identification of four Symbiotic Innovation Cluster types allows managers to develop different management tools to manage the relationships and partnerships that develop within each typology. For example, Mutual Innovation Clusters may see a high degree of activity from all of the partner organisations, whereas, Commensal Clusters possess an altogether different set of drivers and management requirements. Indeed, given the imbalance in inputs they may in fact be called upon to more proactively manage relationship development than other cluster partners. As a consequence, the typology allows managers to identify which tools and techniques should be used, as well as the likely issues, problems and benefits that may arise through their engagement with the cluster. For example, within mutual clusters the partners may be required to manage multiple interactions based on the maintenance of synergistic capabilities and resource transfers, while in commensal clusters engagement may be solely focused towards the exploitation of unused or underutilised resources. Understanding which typology the organisation sits within should assist managers in avoiding confusion concerning the type and intensity of any relationship.

**OPPORTUNITIES FOR FURTHER RESEARCH**

There are a number of areas where further research needs to be undertaken. The first centres on confirming the existence of the four different types of symbiotic cluster. While historical examples support the presence of the four types, research needs to focus on whether industry recognises, and might usefully categorise its relationships in this manner. In addition, the dynamics of Parasitic and Amensal clusters clearly differ from those of the Mutual and Commensal type clusters, and there is need to develop frameworks that explain the differences in operational factors. Furthermore, behaviour within each cluster type needs to be clarified. For example, questions pertaining to why organisations might engage with a commensal cluster, when on the face of it there appears to be nothing significant to be gained from the
interaction needs to be explored in more detail, as does why would organisations allow parasitic, or the self-destructive amensal relationship to develop?

Further research also needs to be undertaken on the extent to which the formation of symbiotic clusters stimulates innovation, as well as how innovation might stimulate cluster development. There is also a requirement for longitudinal studies to confirm the life-cycle of the symbiotic clusters, and how their stages of growth might impact on the innovation process. For example, do they possess similar dynamics to other types of clusters in relation to organisational formation, growth, maturity and decommissioning, or do they possess an altogether different dynamic and time scale?

The examples cited here have used primary resource-dependent clusters, overlapping with smaller clusters types whose members are willing and able to utilise/exploit part of the primary resource. What is not clear is the extent to which one cluster’s technological development, or alternatively, waste products might encourage the formation of a symbiotic cluster. For example, aerospace companies often regard their core competency as aerospace engineering and assembly. However, the finished product often needs painting, or a specialist finish of some kind. Rather than building a new section of the business, and trying to develop a new set of competencies, it might be possible to develop the business to a specific level of expertise, and then invite a specialist paint company to takeover and manage the task for a variety of aerospace companies.

Finally, research needs also to be conducted into the various tools, techniques and training that managers might need in order to administer, manage and construct Symbiotic Innovation Clusters.

SUMMARY AND CONCLUSIONS

This paper has argued that rather than perpetuating Porter’s outdated and somewhat simplistic view of cluster development, there is a need to understand regional cluster formation not simply as organisations from the same industrial sector coming together in order to exploit the diffusion of resources and competencies (Lai, Chiu & Leu, 2005; Otsuka, 2006; Smith and West, 2007), but as being comprised of
collaborative but dissimilar, superior-performing organisations, which are able to share intangible assets and capabilities for problem solving, information sharing, innovative development, superior performance and competitive advantage. Such simplistic views of cluster development may be a contributing factor to, as well as explain why many clusters often fail to achieve their full potential. As a consequence, the discipline needs to move beyond the simple notion that cluster formation is largely generic in context, and that greater emphasis should be placed on understanding innovation clusters within a wider and more detailed typological/classification framework, such as the Symbiotic Innovation Cluster Typology presented here.

The primary purpose of this paper has been to answer the question “How might the different innovation clusters types be classified?” To this end a new cluster typology has been identified; Symbiotic Innovation Cluster, of which there are four specific types - Mutual and Commensal, where the organisations seek superior performance through focused collaborative arrangements, and Parasitic and Amensal clusters, where there is less reciprocity in the relationship and a tendency towards exploitation. Examples supporting each type of cluster have been presented, and in order to explain the dynamics that underpin Symbiotic Innovation Clusters, and a conceptual framework, which focuses on the Mutual and Commensal cluster types has been developed.

In conclusion, the principal utility of the typology and related frameworks is that it highlights the need for managers to understand regional innovation cluster development from an altogether different perspective; one that involves building relationships across different multifunctional and resource boundaries, rather than seeking to coalesce as an industry specific group.
Figure 1

Symbiotic relationship recognises greatest area of resource overlap and cooperation between two or multiple clusters differing clusters. The overlap occurs because cluster interests have a common resource orientation, but different operational focus and requirements. The relationship is governed by temporal and infrastructure constraints.

Centripetal innovation forces comprise, for example, market and industry knowledge, infrastructure support, capital and project champions. Strength of centripetal forces depend on type of cluster being formed.
Clusters work partly in cooperation with each other, and partly independent of other clusters. Overlaps develop through recognition of symbiotic relationship and strategic benefits that are likely to accrue.

Multiple symbiotic innovation clusters may develop between different clustering and overlapping groups.

Symbiotic Cluster may eventually outgrow parents and establish new industrial cluster by extracting support and infrastructure sections from the parent clusters.

Clusters may be surrounded by overlapping clusters, or may possess only one or two areas where symbiosis and innovation can occur.
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