Separating the birds and the bees – the co-evolution of network dynamics

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Abstract

The findings reported here are part of a wider research enquiry exploring processes of strategic alliance formation and determinants and measures of successful relationships. The research examines the application of the co-evolution literature to strategic alliance formation in SME's in the UK and Australia in two differing industries. Extending the framework developed by Das and Teng (2002), it engages with wider industry and environmental characteristics present in these two countries, specifically examining whether different theories are better suited to different stages of an industry life cycle. The issues discussed above are explored and developed through the use of a qualitative case study approach. Findings indicate strong resource-based drivers for alliance formation in both industries, with firms dependent on the co-evolution of their alliances and indeed selected by the results of their alliance participation. However, differences emerged in the strategic use of alliances in these two industries. The influence of the stage of the industry life cycle on this is discussed.

Key words: Co-evolution; industry life-cycle; case study

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Introduction

Extant literature on relationships and networks deals primarily with notions of motivations for relationship formation and the success of these relationships. There are a myriad of overlapping perspectives put forward. These range from purely focal-firm focused economic rationale such as transaction cost economics (Hennart 1988; Williamson 1985); to those which examine the focal firm's needs in terms of resource dependencies, the resource-based view (Barney 1991; Hagedoorn 1993; Pfeffer and Salancik 1978); to those which also take into account the wider network that firms are embedded in, i.e. social network theory (Granovetter 1985; Johannisson et al 2002).

The examination of how relationships develop over time is much more limited, (Das and Teng 2002; Koza and Lewin 1988; Supphellan, Haugland and Korneliussen, 2002). In reality, firms, relationships and networks are ever-changing (Das and Teng 2000) and the boundaries between firms, their environment and other firms are blurred. Recently, some work has examined the use of co-evolutionary theory to explain these characteristics and to better explain how change occurs. This work focuses on antecedents and stimuli for network formation, the co-evolution of the network with its environment; and the adaptation to this of network members (Bosch, Volberda and de Boer 1999; Das and Teng 2002; Rodrigues and Child 2003; Volberda and Lewin 2003).

Originally this literature addressed firm to firm and dyad and environmental change as a basis for co-evolution (Volberda and Lewin 2003). The main argument was that the external environment affects both the firm and the alliance and the firm and the alliance also affect the environment. Therefore any change that occurs can be said to be co-evolutionary (Das and Teng 2002). In this way Das and Teng (2002) defined co-evolution as the "simultaneous development of organisations, alliances and the environment independently and interactively". However, despite this theoretical development, nearly all empirical work has still been largely firm-based and the unit of selection, or survival has been the individual firm (Rodrigues and Child, 2003; Wilson and Hynes, 2009). However the focus of this, and nearly all previous research has been the basis of the focal firm's advantage brought about by simultaneously changing with the environment or interacting with other firms.

The aim of this paper is to extend the work of Wilson and Hynes (2009) which delineated the underlying constructs and assumptions of evolution and co-evolution applied to a business context and examine, using empirical evidence, whether different theories are better suited to different stages of an industry life cycle.

Background

Recent research shows that the alliance can be seen as a separate unit of structure which can co-evolve with the firm (Das and Teng, 2002). The use of co-evolution as an explanatory factor for this change stems from the observation that there is simultaneous change between the macro, micro and meso level environments and an organisation. Nearly all research has focused on the *process of change*. i.e. what was changing, and the focus has largely been on the firm/environment or the firm/alliance or the firm/ firm pairs which are said to co-evolve. If firms were to change cooperatively or concurrently this would effectively be co-evolution. The few empirical articles that examine co-evolutionary change have largely examined relationships in very similar ways to the existing alliance literature

(Wilson and Hynes, 2009). Although Das and Teng (2002) argue that in the future we should examine industry and environmental characteristics, this is currently lacking.

In addition, the implications for strategy setting are wide reaching since most managerial and strategy research stems from the idea of a lone firm monitoring and reacting to its environment and setting its competitive strategy as a result of the information available to it (Porter, 1985). The recent work on co-evolution challenges the underlying assumption of this work which states that firms survive because they set the best strategy, and the industry structure is defined by survival of the fittest. The growing importance of supply chains, the proliferation of strategic alliances in every industry and the increasing importance of platform technologies and technological interdependencies suggest that the idea of a lone firm setting and competing on its own might not explain much of today's industry structure. It would appear that collaborative actions of various sorts; joint ventures, strategic alliances or loose alignments in markets might better explain how firms compete.

The idea that firms co-evolve with other firms, or alliances and this might impact upon their success and survival is relatively new but may offer a better explanation for these new market structures. It could be that some firms survive or even thrive because they change together with other firms. This is of particular interest to firms at varying stages of their life cycle as Industry life cycle analysis suggests there are particular periods in the development of an industry which have greater selection processes. However the life cycle literature has focused solely on firms entering or exiting an industry (eg Klepper, 1996; Boyan and McDonald, 1994). These are clearly based on the assumption that firms enter the market alone, compete alone and are selected alone, once this assumption is questioned then the question of whether various stages of the industry life cycle are better explained by evolution or some other theory is important.

Williamson (1975) built on Schumpeter's (1924) early work which described the industry life cycle as several stages including the early or exploratory stage, an intermediate development stage and a mature stage. The early stage typically has a high degree of uncertainty; the intermediate stage is the time at which marketing and manufacturing techniques are sharpened and finally a mature industry is one where marketing manufacturing and management all reach a relatively advanced degree of refinement. Klepper (1992) then suggested that innovation is higher in the initial phase, followed by a period of "shakeout. This period of shakeout is often when many firms fail.

The preponderant theme of management theories has been derived from relatively mature manufacturing industries where firms largely competed on an individual basis, and were selected for on an individual basis (e.g. Porter, 1985) ie. on the presumptions of evolution and survival of the fittest. Wilson and Hynes (2009) discuss this in more depth and delineate the stages of importance. One issue is the unit of change and whether this is the firm, or the firm plus alliances, or firm plus alliance partner or even supply chain. This extends the work of Das and Teng (2002) who focus on the unit of change, but not the unit of section. This can easily be illustrated with common examples; the retail food industry in the UK is largely dominated by 4 supermarket chains; suppliers outside the supply chain to these 4 retailers are limited to a small and dispersed supply chain; those firms within the supply chain of the large 4 retailers were effectively co-selected for at the time the retailers became dominant. Software providers to mobile phones are selected for at two levels; as suppliers to the hardware manufacturers, and at the consumer level by consumers choosing a particular mobile phone; being a supplier to a phone manufacturer that goes out of fashion will lead to subsequent failure. In some industries therefore, the unit of selection may be dyadic, group or whole supply chains. This is shown in Table 1.

Table 1: Issues arising in the application of co-evolutionary theory to business

| Theory	Unit of change	Selective Unit	Means of selection
Evolution	Individual (firm)	Individual	Random genetic drift
Evolution	Individual (firm)	Individual	Survival of the fittest
Co-evolution	Pairs or more (dyads or chains)	Firm	Random genetic drift
Co-evolution	Pairs or more (dyads or chains)	Firm	Survival of the fittest
Co-evolution	Pairs or more (dyads or chains)	Dyad or Group / Chain	Random genetic drift
Co-evolution	Pairs or more (dyads or chains)	Dyad or Group / Chain	Survival of the fittest

(Wilson and Hynes, 2009)
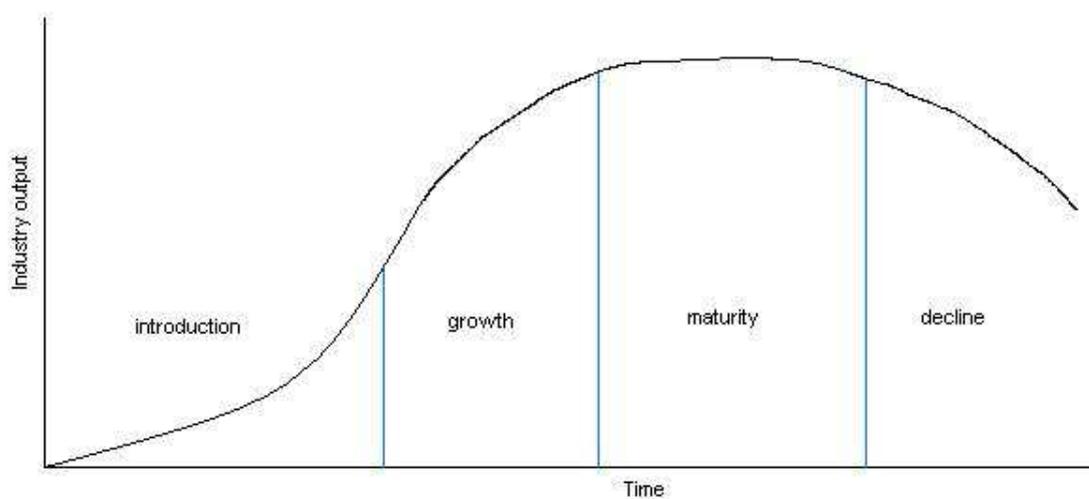
Figure 1 Industry Life cycle.

As discussed previously, much of the mainstream management and strategy literature has focused on existing firms; this literature has focused on firms which set strategy and compete individually, and are largely within the growth and mature stages of the industry life cycle. These theories are far harder to apply to the start up and decline stages of an industry.

Selecting a particular standard, technology or platform is an integral part of the evolution of an industry. Work on emerging industries tends to confirm the idea that there is a high number of small firms at the early stages of industry development, and that after some time of technological and market adjustment, the industry reaches some degree of legitimacy (Baum, 2005 Aldrich and Ruef, 2006). Streams of literature on emerging technologies tend to focus on the overall adoption of a technology rather than the growth and selection of firms but also suggest that the adoption of certain standards or norms will lead to the selection of firms which have adopted this standard (Hill, 1997). In fact "keeping a foot in the door" for new technologies has long been seen as a motivating factor for large encumbent technology firms to form many strategic alliances with small firms in emerging technologies because they believe that by retaining options in each of the new emerging technologies, they will effectively be co-selected for the winning technology (Hill, 1997; Meyer and Roberts, 1988).

Thus it would seem that at emerging stages of an industry, where many small players enter the field, along with a small number of larger firms co-evolution may a better explanation for change, and co-selection is a better explanatory variable than evolution and individual selections. Firms often work co-dependently at this stage often as a result of resource deficiency and the process of working together in a rapidly changing environment can result in concurrent change within the organizations. Likewise, the rapid change and high levels of uncertainty together with resource co-dependence mean that firms may be selected together for success of failure, therefore:

   P1. The success or failure of firms in the emerging period of an industry life cycle is best explained by co-evolution and co-selection.

Industries which are established are those which have largely been the focus of much strategy literature; these are firms which scan and interact with their environment, but can set their own strategy and are selected for on their own characteristics. Much of the mainstream strategy literature (Porter, 1985; Bowman and Faulkner, 1996, etc) focuses on firm strategy; monitoring the environment leading to strategic change and success or failure (Ansoff, 1957; Johnson and Scholes, 2006), therefore:

   P2. The success or failure of firms in the growth and maturity stages of an industry life cycle are best explained by the theory of evolution and survival of the fittest.

As discussed previously, this has been the basis of most management theory and is not addressed in this paper with empirical evidence. The aim of this paper is to examine other stages of the lifecycle to see which ones could be best explained with co-evolution and co-selection.

The third proposition relates to industries in decline where the number of firms is shrinking and demand is relatively static for a product. In this stage of the industry life cycle, for example, complete supply chains are selected for at once; companies supplying the wrong retailer are de-selected or fail, at the same time as the retailer fails. There is little chance for these companies to find other market requirements as the structures supporting the market are established and mature. Many small companies need to work together at this time to ensure that the group is selected for, rather than the individual firm; the overall market size does not increase, so the only strategy for growth is increasing market share (Klepper, 1992); often for firms the only way to remain competitive is to merge or work together through strategic alliances, therefore:

   P3. The success or failure of firms in declining markets stages are best explained by co-evolution and co-selection.

Methodology
The findings reported here are part of a wider research enquiry, exploring processes of strategic alliance formation and determinants and measures of successful relationships. The research examines the application of the co-evolution literature to strategic alliance

formation in SME's in the UK and Australia in two differing industries. Extending the framework developed by Das and Teng (2002), it engages with wider industry and environmental characteristics present in these two countries. The issues discussed above are explored and developed through the use of a qualitative case study approach, allowing an understanding of a 'complex, holistic picture' (Cresswell 1998).

Our research is interested in the use of co-evolution theory as an explanatory factor for organisational structure and change within industries. This is an area where little empirical research has been conducted. The use of in-depth interviews allows the researcher to gain an insight into these factors in a way that could not be achieved through a quantitative survey, building up a picture of inter-connection rather than a list of single key factors. The flexibility of semi-structured interviews allows for the possibility of unspecified factors to emerge in the interviews and their importance to be discussed in depth. The aim of this approach was therefore to give weight to proposed frameworks, rather than to discover generalisable issues.

The sensitivity of the area of the research also informed the methodology. Respondents were being asked in-depth questions about the purpose and scope of their strategic relationships with other companies; their selection criteria, operating procedures, goals and objectives; the costs and benefits of the alliances they were in, and how all this fitted into their current and future strategic operations. The information obtained from all respondents was only obtained after guarantees about the confidentiality of any disclosures. Data was collected from secondary sources; extensive semi-structured interviews with one or more members of the senior management team of the UK and Australian businesses on site; participant observation in meetings with overseas partners in three European countries; and the use of records and follow-ups with one or more senior members of each business over a period of eight months.

Each interview varied in length, lasting between one to three hours. The interviews were conducted at the respondent's place of work. Given the sensitive nature of the contents of the interview, most interviews were conducted in a private office with only the researcher and the interviewee present.
Immediately after the interview, the taped transcripts were checked and the interview notes were read to ensure there were no areas of ambiguity or uncertainty.

The samples for the UK and Australian interviews were chosen on a non-probability judgement basis. The UK data was stratified in terms of geographical area and produce type to obtain a spread of producers across the country and covering the main produce types. A range of firm size and ownership profiles was chosen. In total 33 UK producers were contacted and 20 interviewed. Changes in the UK retail food Industry over the last 20 years have had an important effect on the fresh produce sector in the UK. The main trend in the food-retailing sector has been the growing influence of the major food retailing chains to become the dominant force in food retailing. By 2005 these chains accounted for 84% of all fresh fruit and vegetables sold in the UK (Mintel, 2005). At the producer-end of the industry firms not adopting the dominant model, or those who cannot obtain access to the network of customers and suppliers on the dominant model, have come under significant competitive pressure and many have exited the industry. The outcome of this is that each product area is dominated by a few large companies despite the numerically dominant small-scale holdings.

The Australian sample was selected after inviting all listed Biotechnolgy firms within Queensland. Many declined to be interviewed, and the final sample included 13 organisations which all gave interviews. The Queensland Government is committed to

establishing the State as the centre of excellence in biotechnology in the Asia Pacific and will employ over 16,000 people and generate $4 billion in revenues to an industry worth $20 billion by 2025. Queensland's biotechnology industry currently comprises around 88 companies and 68 biotechnology-related research institutes. Combined, these organisations employed over 5,200 people and generated an estimated $690 million in revenues in 2004/05. (Innovation Dynamics- Queensland Biotechnology Report 2006). Data for the 2006/07 period will be available shortly. (www. http://www.industry.qld.gov.au). In addition, the "smart state" strategy encourages particular types of biotechnology industry; primarily those focused on human health, and several strategies have been put in place to encourage start-ups including cooperative networks, although the source of financing for most biotechnology companies in this region, remains commercial venture capitalists. However many start-ups are single product or service companies, and since the commercialisation of biotechnology products can be between 5 and 20 years after discovery, many small companies are found in these early development stages, the companies included in this study largely fell into this category.

Although these are relatively small samples, this is consistent with other qualitative research samples which are often very small even a single case (Sands 2000).   Indeed, Patton (2002) argues that "the validity, meaningfulness, and insights generated from qualitative inquiry have more to do with the information richness of the cases selected and the observational/analytical capabilities of the researcher than with sample size."

Findings
Evidence of Co-evolution in Emerging Industries

P1. The success or failure of firms in the emerging period of an industry life cycle is best explained by co-evolution and co-selection.

Most companies interviewed were small start ups with less than 10 employees; some were still incubator firms, but others had been around for longer, and many were developing technologies that they hoped would form the basis of future industries. These clearly fell within the scope of emerging industries. All had formed strategic alliances. These alliances ranged from R & D development projects, licensing in/out agreements, clinical trials at varying degrees, and upscaling to commercial production of new materials. Some alliances spanned marketing and finance as well, although these were less common.

A strong recurring themes in this emerging industry dataset was the motivation of most alliance formation which was clearly in the majority of cases, purely resource driven. These small biotechnology firms did not have enough resources and actively sought out a range of strategic alliances including suppliers, collaborators and large companies who could act as guarantees of reputation / quality that would then lead them to better outcomes in different ways; producing products, testing drugs; and raising venture capital.

These firms all confirmed that they could not survive on their own. An example of this is:

> *"In australia, they [other companies] don't have the resources to set up their own labs in general; they are one man operations or two at best so they have to out-source everything so therefore we are very good partners to work with"*

Another firm clearly expressed how relationships grew from other alliances and how this changed both firms over time; in fact this led to relationships with a third firm and changed all 3 companies:

> *Q: And do you think that relationship with X has led to other opportunities that you maybe would not have had without it?*
> *A: "Well it is interesting, they have actually brought some clients to [Firm A} and now that we are doing the bioanalyticals for {Firm A] we are actually now working more closely with [X] so we had an alliance with them, and another alliance with them, and now we have got the three-way thing happening and it is interesting, [Firm A] have a consultant who brings a lot of clients to them and now we are starting to work with their consultant as well, so it is interesting how things evolve. It starts off here but then it mushrooms"*

Every firm had multiple alliances and these had, by the nature of being involved in these alliances, changed the firms; in some instances they led to new alliance opportunities. Indeed all the firms in the study required strategic alliances to work; some showed evidence of changing with their partners, but others used alliances sparingly and for fixed portions of time to help with resource needs.
Yet other relationships meant that the firms could survive financially:

> *Q: So the alliance you are talking about is a commercial alliance to bring in money, is that right, to bring in money into your company?*
> *A: Right, it is a mechanism by which we can leverage our finance needs if you like and be able to roll over the grant into the next option period.*

For other firms, being part of the " right" strategic alliance gave credibility to the company and they believed this would lead to increased VC funding opportunities. A slightly surprising driving force behind the structure of the firms, and the way in which they worked together or co-evolved was the pressure from VCs to exit the industry:

> "*One of the other reasons for it is the venture capital industry here and they are very, very focused on exits, and they want exits within a five-year timeframe usually and at the very outside, somewhere between 5 and 10, and if you are doing pharmaceutical development then you are not going to get all that far in 5 years …..It does not create large companies…… It is just all about money, it is all about investment, it is really not about long-term economic development at all*"

And from another firm:
> " you are right, I think a lot of it has to do with the investors from the time that X started….we were very much a mum and dad type investment company and the management and board then had a quite different mentality, right now it is all about building up your assets and selling off the company and getting a big pay-off, but back in the 80's when it all started we just wanted to build things, make kits, sell them and make money"

And some alliances were formed because companies wanted to "hedge their bets" on new emerging technologies:

> "Because you cannot pick the winners on early stage stuff you are better off actually having a very large portfolio. So we have found that by working with them they don't want to invest in building a small team of their own because that is as much as their resource could be "

Other companies clearly wished to exit and indeed the VC capital market in Australia seemed to be expecting companies to exit once the product was commercialisable.

"The exit strategy for X is a trade sale and that will either happen in the next two years or X will disappear. It is a finite end to the whole thing and we have the technology. We have driven it about as far as it needs to go, we don't do much in the way of R&D we just try to sell the product and we either do or we don't. I mean if we don't then we will file the patent so to speak and keep it going for the moment but there is enough candles to keep the patents alive, because the technology may not be seen as desirable this year but it may be seen as desirable in a couple of years time"

This dependence on venture capital was significant, but perhaps more so, in this particular industry was the difficulty in scaling up from discovery to testing (clinical trials) and then scaling up once more before commercialisation. The sheer scale of sizing up appears to be the impetus for exiting the industry and selling off the intellectual property. Another company said:

"But I think, you know, there are lots and lots of small companies for whom $1 Million/$2 Million gets them a prototype and a proof of concept and another $5 Million gets them convincingly close to the market and then they suddenly realise, you know what, to get manufacturing going and things like that we need$20/$30/$80 Million where are we going to find that. Particularly in the last 6-9 months, and I suspect for the next 6 months, you would not turn to the public markets for raising that money. You really have to try to find a big company that is going, you know they are going to eat your lunch, but you know that is part of the deal you have gotta do."

This worked both for small biotechnology firms and the larger pharmas that they partnered with; however it was clear that the respondent felt that the two firms did not "need" each other anymore; perhaps implying that there were stages of development which clearly showed co-selection but that this period was now passed. In this case the product in question had been through clinical trials and was reaching the commercialisation stages.

"That is an interesting question. I suppose it has because we probably don't need them now as much as we did. I mean they still don't need us in the sense that they can survive without us, their product would stand on its own, it is not on the market yet but it probably will be in the not too distant future. Our product does not need theirs anymore either but we would still prefer to go with them. In other words of the options available now there are more than there were then but as it still happens that is the best plan for us, I suspect, to do it, not least because they are now with a really big pharma now, which suits us because that is eventually where we see our product as targeted"

In summary, all firms sought out alliances for mostly resource needs initially, although some subsequent alliances developed over time as a consequence of these initial alliances. Most alliances showed changes over a period of time between the firms, the firm and the alliance, and the environment, the firm and the alliance. Sometimes this extended to locating and entering new alliances. Selection appeared to be early at the firm level – could the firm raise venture capital to continue or not? However some firms hinted that the relationships they had formed through alliances, increased the likelihood of gaining funding, and this showed a level of co-selection. The Biotechnology Industry within Australia is determined very much by its environment; the ability to seek funding and local government initiatives, and these external factors played a large role in determining which alliances were entered. The fragmentation of the Biotechnology Industry, and the wide range of end markets mean that the industry life stage is hard, if not impossible to define.

The UK Fresh Produce Industry – A declining industry

P3. The success or failure of firms in the maturity and declining markets stages are best explained by co-evolution and co-selection.

The alliances included UK firms from all the main fresh product groups and geographical areas of production in the UK and a large proportion of these firms were major producers in their product area. UK multiple retailers were the main customer for all the UK firms. All had formed strategic alliances, but these were predominantly young and for all were the first alliance between the focal and partner firm. These alliances were all non-contractual. The alliances were all primarily for product marketing. They were predominantly informal but close, with UK firms involved in all areas of their partner's business.

The Fresh Produce producers interviewed were representing the relatively larger firms in the industry. In terms of the industry life cycle model, as argued above, this is an industry at a mature and arguably declining stage and these are the firms still left in the supply chain, the smaller firms having already exited the industry or having been forced to find alternative channels for their product. This has led to acute polarisation in the industry resulting in a large percentage of the industry excluded from the supply chain. Four multiple retailers dominate the supply chain, determining the structure of the supply chain and the functions of those members in it. The producers tended to be specialist in terms of product area and had been involved in that product since inception. In order to commercialise this product in their own market these established companies were forming strategic relationships with other producers from overseas. In all the alliances the over-riding drivers behind formation was for acquisition of resources. A large proportion of these relationships were with firms that they had already been involved with on a trading basis or known through third parties.

These alliances were again resource-driven, but a key differentiating factor in comparison to the bio-tech industry is that these Fresh produce firms were much more embedded in pre-existing supply chains. The needs of the other members of their supply chains, notably the resource needs of their multiple retail customers were the key catalyst for alliance formation. Securing supply of product out of UK season through alliance formation ensured continued trade with these key customers.

Firms formed alliances rather than traded openly in order to be able to have more control over the tight quality control specifications of their end customer. This carried a level of risk as the UK firm's whole relationship with their end customer was dependent on the success of the alliance. By bringing the partner firm into a relationship they made the partner firm also dependent to a greater extent on the success of the relationship. As one firm noted:

> "*The key buyers have the key customer base that they are reliant on. If you are in the inner circle and perform sufficiently, develop your business and are very positively debating commercial positions, but not destructive, this is critical to your commercial success.*"

Linking this explicitly to their strategic alliance activity, another company noted:

> "*Multiples now have 80% of the fresh produce sector. They are the most important driver for collaborative relationships. As they slim down their supply base the only way for firms like us to succeed is to be more successful than our competitors. This*

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> *means…..you have to never say no. If we are entrusted with a large share of a multiples business then it's up to us to service that business, because if we don't, there are plenty more people who would like to."*

In common with the biotech industry there are also issues of credibility being gained by being in the "right" strategic alliance. But this is not only in terms of conferred positive associations, but also in the risks not only to a firm's credibility if the alliance fails, but potentially to the business as a whole.

Secondary motivating factors were cost-focused, specifically spreading overheads and labour costs through increasing utilisation of facilities, however this was generally not seen to be a critical motivating factor, rather a bonus of the relationships. Thus one company argued:

> *"We initially looked at bthe business to cover costs and to make some contribution to overheads. We did not expect it to make a 'full' contribution in the same way that we would expect UK sourced product to do. I don't know if our Spanish system is necessarily cost effective."*

In common with the biotechnology industry, there is evidence of these alliances evolving out of other relationships and these alliances themselves evolving both in terms of structure and of scope over time, albeit in a more limited way. Most alliances started by trading in limited volumes and increasing these substantially to meet market demand. Other alliances developed from existing importing relationships where volumes traded had not changed significantly, but where the relationship between the two firms did. The focus of most alliances had been to develop sufficient volumes of product to meet market demand. Having achieved this, some alliances were looking at developing product ranges and also looking at other product areas.

What emerged strongly from the interviews was the importance of the strategic alliances to the overall operations of the firms. Many firms had more than one strategic alliance. These were not isolated, but were parts of total firm operations that had impacts on each other and were judged in terms of their contribution to the total strategic operations of the firm.

Most partner firms regarded their alliances as dynamic forms that needed to be flexible enough to change and adapt according to market conditions. This flexibility meant that there was also a strong consensus that the alliance form was seen as a distinct entity rather than a transitional structural form. Thus one organisation argued:

> *"I see our partnerships very much as an entity in their own right. They don't have to be set up with some other design in mind. They can be set up to accord mutual benefits in an on-going situation, not changing whatever the arrangement is."*

These relationships were co-evolving in terms of scope and operations and in some instances in terms of new emerging structures, quite separate from those of the two firms. In most cases there was a strong commitment to the strategic alliance with a sense that this was a structural form that could stay as such for an indefinite period. Where this was not the case was where this balance of resource needs had changed.

An interesting element of the biotech industry is that an exit-strategy was explicit in some of the alliances. The Fresh-produce alliances, by contrast, were in a sense much less strategically orientated in terms of development and change.

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Conclusions

Within the emerging industry of Biotechnology, the industry norms appear to have predefined life cycles for this industry sector: instead of building companies that commercialise one product, and then move onto the next, the structure seems to define that companies establish, form alliances, co-evolve for a period of time, leverage the alliances and then find an exit strategy; this in some ways contradicts the underpinnings of the industry life cycle which suggests there is a shakeout based on market effectiveness and efficiencies. It would appear that firms in fact are established only to exist through this emerging industry period. During this time they are dependent on the co-evolution of alliances; and are indeed selected by the results of their alliance participation. The need to use strategic alliances to survive the first emerging stage of product, market or company growth was clear. No single firm contacted could work alone. The companies worked closely with multiple alliance partners and this was clear evidence of co-evolution. The unit of selection is less clear; without the alliances the companies would have failed immediately as they lacked resources; yet it is unclear in this study whether the dependence on any one firm resulted in co-selection.

Biotechnology is a typical emerging industry; whilst there are few direct competitors in the start-up stage, until an industry has reached a level of legitimacy, this is common amongst all emerging industries (Aldrich and Fiol, 1994). This issue with legitimacy and establishing order in emerging industries is common (Rao, 1993, Aldrich and Fiol,1994).

The firm behaviour in the fresh produce industry supports ideas of co-evolution and co-selection. Firms were forming strategic alliances because they could not service the needs of their multiple retail customers alone. Thus they were forming alliances so that the group of firms was selected for, rather than the individual firm. The key strategy for growth was ensuring that through this behaviour they stayed within their pre-existing supply chain relationships as there were no other alternative routes to market. The UK fresh produce industry firms studied were not selected by results of their alliance participation, but rather on condition that through participation they would be able to service their existing customers.

The fresh produce forms were less overtly strategically orientated than the biotech firms. This again can be related to the stage of the industry life-cycle that they were in i.e. declining. They were operating within pre-existing supply chain structures over which they had very limited control and their strategy was oriented towards maintenance of their position in this supply chain.

Implications for strategic management emanating from our study are that in the emerging biotechnology industry alliances are used strategically to access resources, specifically to leverage funds by forming more viable organisational structures. A key finding from the study of this industry is that this organisational form is an enabler of firm growth, indeed survival, for a finite period of time. More fundamentally, obsolescence of this structural form is explicitly built in to strategic firm behaviour. In this way the evolution of this form is pre-determined at inception.

In the declining fresh produce industry resources are again a key driver. However the acquisition of resources are critical to the continuation of existing trading relationships with powerful gate-keepers in the supply chain. Without these relationships these firms have no viable route to market. In common with firms at the other end of the industry life-cycle there is a strategic decision to change organisational form, but once partner firms are engaged in strategic alliances their development and growth evolve in a far less overtly strategic way.

The two industries in this paper came from differing countries, and were both relatively small sample sizes. Further research should look at more industries to see if the patterns here were in large, determined by the environment that these firms operated in, or perhaps whether the life stage of the industry is in fact a significant factor in evolutionary and co-evolutionary behaviour.

References

Anderson, P. (2002), Co-evolution, Strategy and Adaptation, ERIM/NOFIA PhD Seminar on Coevolution of Strategy and New Organisational Form II, 9-11 October, Erasmus University Rotterdam

Ansoff, H (1957), Strategies for Diversification, Harvard Business Review

Barney, J. B. (1991): Firm Resources and Sustained Competitive Advantage, *Journal of Management*, 17(1), 99-120

Bowman C and Faulkner, D (1996) 'Competitive and Corporate Strategy, Irwin - 1996

Boyan J and MacDonald, G. M (1994), The life cycle of a competitive industry, *The Journal of Political Economy;* Apr 1994; 102, 2; p322

Cresswell, J. W. (1998), *Qualitative Inquiry and Research Design: Choosing Among Five Traditions*, Thousand Oaks, Calif.: Sage Publications,
Das, T., K. and Teng, B. S. (2000), A Resource-Based theory of Strategic Alliances, *Journal of Management*, 26(1), 31-61

Das, T. K., and Teng, B-S. (2002), The Dynamics of Alliance Conditions in the Alliance Development Process, *Journal Of Management Studies,* 39(5), 725-746

DEFRA (2008), *Farm Incomes in the UK*, Department for the Environment Food and Rural Affairs (DEFRA)

Easterby-Smith, M., R. Thorpe and A. Lowe (1991),. *Management Research: An Introduction*, London, Newbury Park: Sage,

Granovetter, M. S. (1985) '"Economic Action and Social Structure: The Problem of Embeddedness', *American Journal of Sociology*, November, 55-81.

Hagedoorn, J. (1993), Understanding the Rationale of Strategic Technology Partnering: Inter-organisational Modes of Co-operation and Sectoral Differences, *Strategic Management Journa*l, 14, 371-385

Hennart, J-F. (1998), A Transaction Costs Theory of Equity Joint Ventures, Strategic Management Journal, 9, 361-74

Hingley, M (2005), Power Imbalance in UK Agr-Food Supply Chains: Learning to Live with the Supermarkets? *Journal of Marketing Management*, 21, 63-88

Hingley, M, Sodano, V and Lindgreen, A (2008), Differentiation Strategies in Vertical Channels: A Case Study from the Market for Fresh Produce, British Food Journal, 110, 1, 42-61

Howard E. Aldrich,H. E and Fiol, C. M (1994), Fools Rush in? The Institutional Context of Industry Creation , *The Academy of Management Review*, Vol. 19, No. 4 (Oct., 1994), 645-670

Johannisson, B., Ramirez-Pasillas, M. and Karlsson, G. (2002), 'The institutional embeddedness of local inter-firm networks: a leverage for business creation', Entrepreneurship & Regional Development, Volume 14, Issue 4 October 2002 , pages 297 - 315

Johnson, G, and Scholes, K (2006), Exploring Corporate Strategy, Financial Times/ Prentice Hall; 7th Edition.

Klepper, Steven (1992), "Entry, Exit, and Innovation over the Product Life Cycle: The Dynamics of First Mover Advantages, Declining Product Innovation, and Market Failure." Mimeo, Carnegie Mellon University

Klepper, Steven and Graddy, Elizabeth (1990) "The Evolution of New Industries and the Determinants of Market Structure." Rand Journal of Economics, Vol. 86 No. 3 Spring, 21 (1), pp. 27-44.

Klepper, Steven and Simons, Kenneth L. (1993), Technological Change and Industry Shakeouts." *Mimeo*, Carnegie Mellon University,.

Koza, M. P., and Lewin, A.Y.(1988) The Co-evolution of Strategic Alliances, *Organization Science*, 9(3), (1988) 255-264

Londregan, J (1990), Entry and Exit Over the Industry Life Cycle, *The RAND Journal of Economics*, Vol. 21, No. 3 (Autumn, 1990), pp. 446-458

Meyer, M.H. and Roberts, E.B. (1988) 'Focusing product technology for corporate growth', *Sloan Management Review*, Vol. 29, pp.7–16.

Miles, M. B. and A. M. Huberman (1984), *Qualitative Data Analysis: A Sourcebook of New Methods*, Beverly Hills, London: Sage Publications

Mintel (2005), *Mintel Fresh Fruit and Vegetables – UK*, Mintel International Group, London.

Patton, M. Q. (2002), *Qualitative Research and Evaluation Methods*, Thousand Oaks, Calif.: Sage Publications

Pfeffer, J. and Salancik, G. (1978) *The external control of organizations: A resource dependence perspective,* New York: Harper & Row.

Porter, Michael E., "Competitive Advantage". 1985, Ch. 1, pp 11-15. The Free Press. New York.

Rodrigues, S. and Child, J. (2003), Co-Evolution in an Institutionalized Environment, *Journal of Management Studies*, 40(8), 2137-2162

Supphellen, M., Haugland, S.A., Korneliussen, T. (2002), SMEs in search of international strategic alliances: Perceived importance of personal information sources, *Journal of Business Research,* 55 (9), 785-795

Van den Bosch, F. A. J., Volberda, H. W., and de Boer, M. (1999), Co-Evolution of Firm Absorptive Capacity and Knowledge Environment: Organizational Firms and Combinative Capabilities, *Organization Science*, 10 (5), 551-568

Volberda and Lewin 2003 Volberda, H., W., and Lewin, A. Y. (2003), Co-Evolutionary Dynamics within and between Firms: from Evolution to Co-Evolution. *Journal of Management Studies*, 40 (8), 2111-2135

Williamson, O. E. (1985), *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting*, New York: Free Press

Wilson and Hynes (2009) Co-evolution of firms and strategic alliances: theory and empirical evidence, Journal *of Technological Forecasting and Social Change*, June