

# Networking and Innovation in the Malaysian Palm Oil Industry: Past, Present and Future

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## ABSTRACT

*This article encourages leaders in the oil palm and palm oil industry to think deeply about networking, and to form both informal and formal networking groups so that more innovation can be achieved. It introduces ideas from a range of leading strategic management theorists about the links between three main kinds of networking and three corresponding stages of the process of innovation. Different kinds of networking groups are helpful at different stages of the innovation process. Open and informal social networking within 'creative networks' and 'transformation networks' supports the development of radically new technologies and new ways of thinking about how to apply them to counter the challenges faced by businesses in a fast-changing global economy. In contrast, once firms reach the final stage of creating new products and markets based on groundbreaking technologies, it makes sense to share ideas less freely. More secretive and closed 'process networks', in which the partners are bound by formal contracts, tend to be useful at this stage.*

*The argument is supported by practical examples from the Malaysian palm oil industry which has a long and successful record of both networking and innovation. The article concludes with recommendations for applying these ideas to a range of challenges currently faced by the industry. Different challenges require different approaches, so managers will need to engage in both co-operative and competitive behaviour at the same time. This can create uncomfortable tension between the need to share technical information to solve problems, and the need to keep commercial secrets. Such tension can be managed more easily when it is clearly understood which kind of networking is needed for each of the various challenges to be dealt with.*

## INTRODUCTION

Throughout the growth of Malaysia's palm oil industry, the people who were involved in driving it have been remarkable – both for the wide range of professions and cultures from which they come, and for their

enthusiasm. Plant breeders, field managers, engineers and marketing experts have been united in their passion for innovation. They have encouraged and inspired each other through regular meetings – on the golf course, at lunches and dinners, concerts and dances, and

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at industry seminars. Networking and innovation have always gone hand in hand.

This article draws upon cutting-edge strategic management theory to explain why networking and innovation are so closely related, and how the networking process can be managed to deliver maximum benefits at minimum risk.

The article will cover ideas from a range of leading theorists who argue that networking is essential to the process of knowledge creation, especially when radically new technologies are being applied commercially in a turbulent and uncertain business environment. It will also draw on findings from research on the business history of United Plantations Berhad (Martin, 2004) to provide practical examples of successful networking linked to innovation in the Malaysian palm oil industry since the 1950s.

It is very unusual to find case studies drawn from Asian agriculture rather than European or American industry in literature on management studies. The leading theorists on networking and innovation developed their ideas by studying cases like the Italian shoe industry, the United Kingdom car industry and the North American aerospace, Internet search and entertainment industries (Hamel *et al.*, 1989; Brandenburger and Nalebuff, 1996; Porter, 1998b). There are a number of theorists who discussed networking in Asia (Yeung and Tung, 1996; Zhou *et al.*, 2007) but they did not link it to the processes of innovation and economic development. Instead, they looked at *guanxi* relationships in Chinese culture, seen as a way of getting contracts or raising finance, rather than as a way of generating new ideas, which is our focus here. So in its own way, this article too is cutting-edge. It will apply the theories in a

manner that the original thinkers did not expect (or intend), and it will lead to conclusions that may also be unexpected for those of us still involved in networking and innovation in Malaysia's palm oil industry today.

#### THE DEVELOPMENT OF STRATEGIC MANAGEMENT THEORY ON NETWORKING AND INNOVATION

Strategic management theorists have not always taken much interest in social networking and other co-operative relationships between managers working for different organizations. The founder of the discipline, Professor Michael Porter of Harvard Business School, is still most famous for the 'Five Forces' model which he developed 30 years ago (Porter, 1979). This is a model in which strategy is seen as a war game. Mainstream industry players (in the case of Malaysia's palm oil industry, these would be organizations like Sime Darby, IOI, Kuala Lumpur Kepong, FELDA and United Plantations) need to look outside of their own organizations to ask the following questions: how powerful are their competitive rivals? How powerful are their suppliers? (In our case, these are the equipment manufacturers or perhaps the suppliers of transport services linking Malaysian operations with foreign subsidiaries). Also, how powerful are their customers? (In our case, they refer not just to the end-users of products like soap or cooking oil from their own refineries, but also to the independent manufacturers of products using palm oil such as oleochemicals, biofuels and processed food). In other words, how hard will their own organizations have to fight in order to get the best price deals and the highest market share, and to make the most profit within the

industry? Once these questions are answered, what new threats will they face from players outside the industry?

Abnormally high profits tend to attract fresh competition, both from new entrants to the same industry (which could include oil palm growers in non-traditional locations like India or Brazil) and from substitutes (which could include soyabean oil and olive oil). The development of Malaysia's own oleochemical and biofuel industries has turned palm oil itself into an effective substitute for crude petroleum, so that the price trends for these two commodities have begun to move together (Fry, 2008).

Porter's framework still has a central place in strategic management thinking, so much so that many students are unwilling to move beyond it. Yet professional writers have moved on. Cutting-edge authors like Kim and Mauborgne in their book, *Blue Ocean Strategy* (2005) use quite different language. Instead of talking about threats, power and abnormal profits gained from winning a zero-sum game, they talk about creating value through innovation. Instead of focusing on what goes on within the boundaries of an existing industry, they talk about how radical 'value innovation' can move those boundaries and change the competitive landscape. Instead of focusing only on price negotiations when dealing with customers, they suggest firms ask their customers for new ideas. They also argue that new entrants and substitutes can be seen as valuable sources of ideas, not just perceived as a competitive threat. Finally, they use the idea of *complementors*, *i.e.* the producers of goods that help the sales of a firm's own products because they go so well together. Two examples in the Malaysian palm oil industry are: petroleum-based diesel when

it is blended with palm oil-based biodiesel, and potatoes when they are sliced and fried in palm oil to make chips and crisps.

The idea of complementors was first developed by Brandenburger and Nalebuff (1996) in their book *Co-opetition* which made such a strong impact on the discipline of strategic management that many textbooks now talk of a Six rather than Five Forces analysis, with the sixth force being complementors. Complementors can include organizations from other industries, working with technologies that can help solve problems in your own industry. For example, engineers working in the medical equipment, aerospace and automotive industries may well help the palm oil industry in finding new equipment for harvesting and other forms of mechanization. Professional associations and government 'think tanks' are two of the main ways by which co-operation can be encouraged between possible complementors, or, as explained below, firms may see the gains and start up the talks by themselves.

Strategy theorists now believe that most organizations choose to co-operate even when the government does not tell them to do so. Co-operation takes various forms ranging from formal alliances to social networking. It is always linked to innovation and the creation of new forms of customer value – 'Blue Oceans' – where the old forces of competition are left behind. As new forces of competition emerge, the art of strategy becomes the art of managing the paradoxical tensions within the group of firms which are innovating together. Leaders will try to balance the interests of the various groups rather than to win outright battles. As the influential textbook authors de Wit and Meyer (2005) put it, competition between suppliers and their buyers can

destroy customer value, whereas co-operation can create customer value, so that extra profits are made for both sides to share. Even firms engaged in head-on competition can gain from some co-operation. For example, the work of the Oil Palm Genetics Laboratory from 1965-1973 was jointly supported by Guthries, Unilever, Harrisons & Crosfield and Dunlop although all four firms remained independent of each other. The quarrels that could have arisen over who was to get the biggest share of any profits from a major breakthrough were forestalled by the transfer of the laboratory to MARDI in 1973.

Porter himself acknowledged the importance of co-operation when he developed his Diamond framework for analysing the national competitive advantage (Porter, 1998a). Instead of talking about the bargaining power of customers and suppliers, he asked whether demand and factor conditions were favourable to the industry; and instead of talking about the threats from suppliers and new entrants, he allowed a positive role for complementors (related industries) and suppliers (supporting industries).

Porter's new framework also includes an element of chance, *i.e.* accepting uncertainty. This makes it more realistic for markets like that of crude palm oil, where prices can double and then halve again in the space of 18 months. With uncertainty comes the need to change, and the role of co-operation is not just between firms and their customers as well as related and supporting industries, but also between privately-owned businesses and governments like in Malaysia where both these entities are keen to promote the national development process. Porter went on to publish a trail-blazing article (1998b) in which he explained the emergence of regional clusters of competitive success, mainly

in terms of the development of collaborative alliances across industry boundaries, supported by government agencies and public-private sector partnerships (like the Malaysian Palm Oil Board), and linked to the development of new technologies and the creation of new kinds of customer value. In the rest of this article, we will look at some practical examples of networking and innovation within Malaysia's palm oil cluster, using some more recent ideas from strategic management theory to explore alternative ways of managing these processes in the future.

#### NETWORKING AND INNOVATION WITHIN MALAYSIA'S PALM OIL CLUSTER

For 45 years, Malaysia has been the world's leading exporter of palm oil. **Exports grew from 0.2 to 12 million tonnes per annum** between the periods 1962-1969 and 2002-2007 (Martin, 2004; MPOB, 2008). In 2007, Malaysian exports of palm oil and palm oil-based products earned RM 45 609 million, accounting for 8% of Malaysia's total export income and 7% of GDP (Department of Statistics Malaysia, 2009).

This success story springs from a long series of innovations in plant breeding, field cultivation, harvesting and transport methods, in specific items of the processing machinery, in the arrangement of workflows within palm oil mills and refineries, in marketing to new locations, and in the integrated management of the whole chain of operations from the production of seedlings to shipment of the end-products. Some ideas were locally developed, for example the harvesting poles which were introduced to the palm oil industry in the 1960s by United Plantations whose managers had earlier used

them successfully for harvesting coconuts. These poles saved the harvesters from the risk of injury (including breaking their backs) in falls from the tops of tall palms, especially when startled by snakes which sometimes slither up there in search of rats that eat the oil palm fruit. Other ideas flowed into Malaysia from Indonesia and the Congo (Zaire). One example is the pollinating weevil which Leslie Davidson first saw in Unilever's estates in Cameroon, and brought into Malaysia with the help of a leading entomologist from Pakistan, Datuk Dr Rahman Syed (Mahbob, 2003; Martin, 2004). Techniques in plant breeding, oil processing and refining were also introduced from Europe and America, and from India and Japan. This process of bringing in new ideas was helped by transnational institutions like the International Society for Oil Palm Breeders (ISOPB) as well as by informal social contacts within multinational firms like Harrisons & Crosfield and Socfin – and now Sime Darby – together with many others. Local associations like the Incorporated Society of Planters and the Malaysian Palm Oil Council helped the ideas to spread within Malaysia once they were established and proven.

Yet it is not enough to say that networking has happened; it is more important that the process of innovation continues to go from strength to strength. Malaysia's ability to sustain the success of its palm oil cluster since the 1960s stands in stark contrast to the fate of British clusters like Lancashire textiles and West Midlands car manufacturing, both of which have sunk into decline despite the presence of long-established social and commercial networks and vigorous government efforts at support (Thoms and Donnelly, 2000; Wilson and Popp, 2003). Unlike these collapsing clusters, Malaysia's vigorous palm oil cluster

is well-placed to benefit from the current trends in globalization and from the new technologies which are breaking down previous industry boundaries through convergence (Ohmae, 1989). Biotechnology, chip technology and advanced materials technology can now be applied across previous industry boundaries, creating new hybrid industries like biofuels and oleochemicals. The genetic selection of planting materials offers opportunities, as MPOB's own Advanced Biotechnology and Breeding Centre has shown, to improve the nutritional value of palm oil, to improve the resistance of palms to diseases like *Ganoderma*, and to cut the costs of field operations by reducing the height of palms, lengthening the bunch stalks and making it easier to identify ripe fruit bunches (Anon., 2007).

The heavy overhead cost of the investments needed to convert these potential gains into real ones will certainly push industry players not only into mergers and acquisitions (as in the recent case of Sime Darby) but also into looser strategic alliances and informal social networking activities, which can speed up the sense-making process through which effective applications of ground-breaking ideas become possible. As Professor Denis Murphy (2007) and others (Baskett *et al.*, 2008) have shown, the development of improved planting materials is only the starting point of the process of innovation; many more experiments will be needed and possibly failures will be encountered to ensure the adaptation of current management practices and technologies elsewhere in the supply chain, before the full commercial potential of the new materials is realized. Beyond this, there are the challenges in developing new applications, such as nutraceuticals, and seeking

out new markets, for example in Africa.

Malaysia's experience of a previous wave of innovation – the adoption of the *Tenera* palm and the screw press, followed by the search for new markets and new end-uses for palm oil from the 1950s to the 1980s (Martin, 2004) – shows that social networking is much more important than formal strategic alliances, mergers and acquisitions in helping firms meet such radical challenges. In the next section of this article, this point will be explored in more detail. The key questions tackled will be: First, out of all the different kinds of networks and networking that are possible, which ones are most useful for the kinds of innovation that will need to be developed now? Second, how can the networking process be managed so that the tension between competition and co-operation becomes a source of creative energy, rather than a destructive force that slows down progress?

### THREE DIFFERENT KINDS OF NETWORKS

Since Porter published his article on clusters (1998b), there has been an explosion of interest in networks within the strategic management field, and the result is that we now have a clear idea of three main types of networks. The first two are social networks: informal systems linking people belonging to different work organizations through their families, religious or other social ties including golf club memberships. A large body of research now confirms the idea first voiced by Granovetter (1973) that such 'weak-tie' networks are exceptionally well-suited to the generation of surprising ideas. In the process of innovation, social networks can take two main

forms:

- a) creativity networks which link people doing fundamental scientific research that can lead to major technical breakthroughs;
- b) transformation networks which link managers trying to make sense of ground-breaking ideas in order to develop commercial applications. A third type of network has also been identified, which is more formal in structure, typically existing within a single work organization or within a group of firms linked by a contractual alliance. This is a 'strong-tie' or embedded network, and in the process of innovation, it takes the form of; and
- c) process networks which exploit well understood ideas to bring commercially viable products to the market-place. Typically these networks are closed and secretive, unwilling to share their ideas with outsiders (Van Wijk *et al.*, 2008). They are usually dominated by one, or possibly two, big firms who want to learn from the other members of the network, but not teach them new ideas (Hamel *et al.*, 1989; Markides and Geroski, 2005), although a 'hub' firm of this kind may choose to share a few, carefully selected ideas with their suppliers. For example, they will share some relevant ideas if they want to improve the quality of the inputs they get from these allies (Capaldo, 2007).

#### MALAYSIAN PALM OIL INDUSTRY EXAMPLES

Social networking has a long tradition within Malaysia's palm

oil industry, going back to the 1920s when planters from many different national backgrounds got together for curry tiffins, tennis tournaments, and golf and flying club events. The successive shocks of the Japanese Occupation, the Emergency and Merdeka disrupted these networks, but did not destroy them – quite the opposite. The original network members were bound even more closely together by their experience of danger and hardship, and the networks were revitalized as new members joined, still mainly Europeans, in the 1950s and 1960s (for example, Eric Rosenquist of Guthries, and Jack Maycock of Unilever), but then a wider range of people from Asian cultures joined in too. This was especially important in bringing new ideas about products and trading contacts outside the traditional colonial markets.

Linking these trends to the process of innovation within the palm oil industry at that time, it is possible to connect different kinds of networks with the different kinds of innovation. For example, the breeding process for the *Tenera* hybrid palm was developed in the Belgian Congo (1922-1941) through a creativity network very similar to that which Professor Murphy described for the USA in its late 19<sup>th</sup> century Land Grant system, linking public and private sector researchers. The news of this technical breakthrough spread to Malaysia through the wider creativity network linking agricultural department researchers in the two continents. The next stage of the innovation process involved private sector planters, linked to the enthusiastic agricultural department staff both through personal friendships and through a shared desire to try out the new planting materials. Through this transformation network, practical experiments were carried out and the potential for increased yields

was proven. For example, in Ulu Bernam Estate in Lower Perak, it was shown that yields could rise from 17 to 24 t of FFB per hectare per annum using the *Tenera* hybrid (Martin, 2004).

The main problem with using the *Tenera* fruit commercially was that it was too pulpy for the previously standard hydraulic presses, a problem that was quickly realized in the Belgian Congo and subsequently solved. New technical ideas were generated within the existing creativity network linking professional scientists in Europe and Africa, and quickly tested in a new transformation network linking these scientists with Unilever's private sector mill managers. The results, written up in the *Mongana Report* (CONGOPALM, 1955), quickly became known in Malaysia because Unilever began shifting investment (and people) here following the 'Congo crisis' of 1959-1965. The *Mongana Report* was shared among friends in a new transformation network, and they worked together to improve on the ideas on how best to manage a palm oil mill based on the new technology. This was a semi-secret process which possibly would not have been approved by Unilever's Board of Directors back in Europe, although it is equally possible that the Board chose to ignore the information leakage because Unilever used much more palm oil in its soap and food processing operations than it could produce itself. The spread of 'best practice' engineering within Malaysia helped to expand the supply of 'best-quality' palm oil for Unilever's European refineries. It is therefore possible to see Unilever taking on the role of the 'hub' firm within our third kind of network – the process network – linking firms through contractual ties, in contrast to the two kinds of social networks linking individual

managers through less formal ties. The process network is closely linked to the challenge of bringing commercially viable products to market, rather than to the earlier phases of innovation which are designed to make new ideas workable in operational terms.

Once the new production technologies were well established and Malaysia's palm oil output was growing fast, from the early 1970s onwards, the challenge of developing new commercially viable products and selling them to new customers became the key problems facing planters. Business historians have found this phase of the industry's development very hard to research. This difficulty clearly indicates the presence of process networks – secretive communities of practice, internal to each firm, engaged in the development of 'Blue Ocean' strategies. Kim and Mauborgne (2005) in their detailed guide on how to develop such strategies, also clearly described a process network in which customers and complementors are used as sources of ideas – but the firm's own staff is tasked with creating the new products or services based on these ideas, and the firm then tries to delay the entry of competitors to its new 'ocean' by keeping their findings secret.

The United Plantations (UP) example confirms the view that the commercialization stage involved a break with the older patterns of social networking in Malaysia. When UP established its Unitata refinery (1971-1974), it used technical information supplied from outside the existing social networks. A new recruit, S. Krishnan, made a tour of India, which ultimately led to a formal alliance with the Tata Group, and a further ally was found in Europe, when Borge Bek-Nielsen established contact with Florent Tirtiaux in his Belgian farmhouse.

New trading partners were found in India and in order to begin dealing with them, UP chose to break up the old colonial Malayan Palm Oil Pool, which had been dominated by Guthries' Agency House. Finally, another important strategic alliance was formed with the Danish firm of Aarhus Olie, leading to the development of a new range of specialty fats for the European market.

#### RECOMMENDATIONS FOR THE FUTURE

Since the mid-1970s, the Malaysian palm oil industry has maintained a fairly stable level of productivity, with average annual yields of just under 4 t of palm oil per hectare (Baskett *et al.*, 2008). The focus of the producers' efforts has been on developing fresh commercial applications and new markets. For this purpose, current strategic management theory suggests that it is entirely appropriate for industry players to concentrate on developing process networks involving close collaboration between colleagues within each organization.

Recent purchases of European refineries and investments elsewhere in Asia by large Malaysian industry players like IOI and Sime Darby have enabled them to build international process networks internally. However, when process networks are confined to just one organization, they can become limited in their way of thinking. A more creative, if challenging, way of innovation is to form strategic alliances with a carefully chosen set of outside partners. This is the strategy chosen by Procter and Gamble to develop their new product technologies (Huston and Sakkab, 2006). It is beyond the scope of this article to identify potential business partners for Malaysian firms, but it is possible to show how firms can use the

theorists' ideas to evaluate such partners and manage the alliances well.

Probably the best summary of the theoretical writings on strategic alliances is by Bartlett, Ghoshal and Beamish (2008) who gave a useful checklist of things to look for in a business partner. Partners should have complementary (rather than overlapping) knowledge, skills, activities, technologies and products. They should trust each other and share key goals, making it easy to develop closely linked strategies and management methods; but they should also respect each other's culture, accepting any differences. Beyond this, a partner should be able to deliver on its promises. Successful alliances often involve a pilot phase during which the partners test each other out against these criteria. They engage in small joint projects, making sure these do not go out of control.

Following a successful pilot phase, the theorists suggest the following golden rules for managing a major alliance. A contract with clear and simple rules about ownership will make management easier. This should allow for an easy exit by both partners, given that alliances (unlike mergers) are not meant to last forever. It should also set clear limits on the scope of shared activities and the range of functions or countries involved in the co-operation. Once the contract has been made, both partners should use trusted individuals, or 'gatekeepers' to control the flows of information between the main organization and the project group. Going back to the literature on paradoxical tensions, theorists advise that the gatekeepers will need mentoring and support in order to hold the balance between sharing some information and building trust, while keeping other things secret. I think that many readers will

recognize this situation. Alliances are not easy to manage and mergers can seem safer – yet the research conducted so far for this article suggests that alliances are well worth the effort in terms of the innovations they produce.

If alliances are risky and hard to manage, how much harder it must be for organizations to manage the results of social networking. Social networking is by definition unbounded, informal and free. It takes place between managers in their private time, often with family and friends outside the organization. Employers in all nations understandably find it threatening and seek to limit it through confidentiality clauses, rather than to encourage it. Nevertheless, the free flow of certain kinds of information within an industry can be of great benefit to all players. When PORIM was first established in 1979, one of its main roles was to communicate ideas freely so as to renew creativity in the search for new planting materials and processing technologies, and to spread ‘best practices’ throughout the nation’s palm oil industry at a time when there was a trend within the private sector towards secrecy.

Strategic management theorists argue that social networking within creativity and transformation networks can be especially vital to the health of a cluster once its core industry has matured. This is most obviously true in cases where the trading environment is becoming increasingly unstable and the possibility of new technical breakthroughs exists. MPOB and the Malaysian palm oil producers linked to it are facing just such conditions now, and when planning how to manage the response, strategy theory suggests it will be useful to consider each type of innovation separately, asking in each case the following questions: which kind of networking is most

appropriate? **How soon is this likely to change?** Who could, or should, manage the transition – and how?

Three examples of current issues will now be used to illustrate this approach, and to conclude this article. Firstly, the issue of sustainability, for which the key challenge facing Malaysian producers is to make sense of a radical social/cultural shift within USA and EU. Consumers are now worried about the environment and NGOs have found a powerful symbol in the orang utan. The process network strategy of creating a formal alliance, the Roundtable on Sustainable Palm Oil (RSPO), linking producers with a limited number of NGOs like WWF and the Rainforest Alliance, does not seem to have affected the ability of other NGOs, including Greenpeace, to command press attention (Leake, 2008). In order to make sense of the social and media trends involved, and to develop a fresh creative response, it could be helpful to engage more freely in social networking, and to develop more open and direct communications with the most hostile NGOs. Greenpeace and Friends of the Earth are two examples of NGOs whose views should be better understood – and which should be informed – through social networking. This could start by inviting them to speak at palm oil conferences, and to develop the networking through less formal conversations over dinner and other social activities.

Secondly, the challenge of developing markets for biofuels and nutraceuticals is a classic example of a process network problem. It is an especially difficult challenge given the onset of world recession, which has come very soon after the expansion of capacity, especially for biofuel production. It is not difficult to identify potential business partners, for example, in

the case of nutraceuticals, firms such as Procter and Gamble, Johnson & Johnson, Unilever, Novartis and Monsanto. MPOB’s Technical Advisory Service is also well-used to assist Malaysian firms in finding contacts. It is more difficult to judge which of a range of possible partners is likely to be best matched to a given Malaysian organization, and how best to safeguard each side’s valuable technical secrets. The research on strategic alliances surveyed above may help with this problem.

A third and final challenge is that of deciding how much information to share, and on what terms, for example with MPOB’s strategic allies in the process of genomic resource development. MPOB has a unique and valuable collection of oil palm germplasm and through its Advanced Biotechnology and Breeding Centre (ABBC)’s collaboration with Orion Genomics of USA, it has made substantial progress in sequencing the genes in these materials (Anon., 2007). Yet the strategic management of this innovation process has followed the style (less of the open creativity network appropriate to fundamental scientific ‘breakthrough’ research than) of the closed process network appropriate for taking viable products to market. The possibility of forming a creativity network is still open to MPOB although it would mean a fundamental shift in policy away from the current emphasis in forming contractual alliances and ensuring protection through patenting of ABBC’s intellectual property rights on certain proteins and molecular markers. Nevertheless, MPOB has a long tradition of encouraging the publication of new ideas, and the practice of social networking through the biennial Palm Oil International Palm Oil Congress (PIPOC) and other events, so it would not mean a fundamental change in culture.

## CONCLUSION

This article encourages leaders in the oil palm and palm oil industry to think deeply about networking, and to form both informal and formal networking groups so that more innovation can be achieved. It introduces ideas from a range of leading strategic management theorists about the links between three main kinds of networking and three corresponding stages in the process of innovation.

Different kinds of networking groups are helpful at different stages of the innovation process. Open and informal social networking within 'creative networks' and 'transformation networks' supports the development of radically new

technologies and new ways of thinking about how to apply them to the challenges faced by businesses in a fast-changing global economy. When scientists and practitioners share information freely across institutional boundaries, they increase the probability that someone will find a new way of making sense of the information. In contrast, once firms reach the final stage of commercializing new products, it makes sense to share ideas less freely. More secretive and closed 'process networks' in which the partners are bound by formal contracts, tend to be useful at this stage.

Within a successful cluster such as the Malaysian palm oil industry, creativity and

commercialization must co-exist, creating uncomfortable tension for individuals as they try to balance the need to share technical information while tackling complex new problems and the need to keep commercial secrets. Such tensions can be managed more easily when it is clearly understood what kind of networking is needed to counter each of the various challenges to be dealt with.

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