

4 Foreign direct investment

This chapter examines the potential for inward foreign direct investment (FDI) to stimulate SME participation in the advanced agriculture and biotechnology and food-for-the-future regional innovation cluster in Chiang Mai and Chiang Rai. FDI is likely to be attracted to the cluster in response to growth in its endogenous research, skills and entrepreneurship activity rather than act as the main stimulus for its development. However, there are policy actions that can be undertaken to build the value proposition to incoming FDI, strengthen regional FDI promotion, and develop FDI aftercare and embedding activities. The creation of a cluster management organisation for advanced agriculture and biotechnology and food-for-the-future in Chiang Mai and Chiang Rai could play an important role.

Introduction

Inward Foreign Direct Investment (FDI) activity can play an important role in SME development in regional innovation clusters through local purchasing and technology transfers. However, inward FDI in technology areas such as biotechnology is only attracted when there are strong local assets to exploit, e.g. in the form of capable suppliers, skilled labour, access to research and development (R&D) findings, and social capital. At present, Chiang Mai and Chiang Rai are not attracting substantial inward FDI, but this can change with continued development of the cluster from endogenous sources, particularly as driven by public R&D activities in the region, and with a strengthening of the regional policy arrangements for FDI attraction and embedding.

FDI subsidiaries act as key anchors in regional innovation clusters in many countries, alongside higher education institutions (HEIs) and public research institutions (PRIs). Each of these types of organisations often make contributions to inputting knowledge into SMEs in clusters and connecting cluster SMEs to international markets. Key conditions for contributions of this kind from FDI in the Chiang Mai and Chiang Rai regional innovation cluster are:

- An inward FDI presence in the region with knowledge content in relevant sectors.
- Supply chain and/or innovation collaboration linkages with local actors – including HEIs, research organisations, start-ups and scale-ups.
- Innovation absorption capabilities in start-ups, scale-ups and SMEs, i.e. the quality, efficiency and flexibility to work with FDI and participate in supply chains.

One of the key advantages of FDI for innovation clusters is that they tend to operate with international best practice technologies and this may spill over to SME innovation through a range of channels. The channels may include:

- Demonstration effects – enabling regional SMEs to observe the behaviours of FDI subsidiaries.
- Supply chain upgrading – for example FDI providing engineering support and specialised knowledge to SMEs in their regions.
- Regional labour mobility – whereby FDI managers, engineers and knowledge workers (experts) move between FDI and SMEs or start businesses using best practice methods

On the other hand, there may be also negative impacts from FDI presence in a regional innovation cluster through the accelerated transfer and leakage of useful knowledge and other resources from regional SMEs to the foreign subsidiaries of multinational enterprises (MNEs), rather than vice versa. This has been shown for example in a recent study of high-tech in Finland (Berghall, 2017). SMEs may therefore require advice and support in managing their relationships with inward FDI, particularly around intellectual asset management.

The Chiang Mai and Chiang Rai regions have yet to attract significant FDI in advanced agriculture and biotechnology and food-for-the-future or in other sectors. They are therefore not yet in a position to exploit inward FDI for SME development. The scarce existing FDI does have some local supply chain activities, which could potentially support technology transfer to regional SMEs. However, in general, the FDI operations have arm's length relationships with their local SME suppliers, for example, solely purchasing raw materials in vertical, rather than horizontal, agri-food markets. There are also few linkages between FDI and the universities, science parks, and public research laboratories in Chiang Mai and Chiang Rai and little, if any, research collaboration between inward FDI and domestic SMEs. This is to be expected in that few of the existing FDI operations in Chiang Mai and Chiang Rai are involved in research.

Further, there is an institutional void in Chiang Mai and Chiang Rai for an FDI policy that could attract more investment and integrate it into the regional cluster. There is no regional inward FDI promotion

office or economic development agency seeking to attract FDI in target sectors or seeking to build up the Unique Selling Proposition of the region for those target sectors. Nor is there an agency active in FDI aftercare, i.e. supporting existing investors in the region to overcome problems in the region and to reinvest, or in supporting FDI to create local supply and research linkages through matchmaking with regional SMEs and HEIs or reinforcing the capabilities of regional SMEs to supply FDI.

On the other hand, there are a few “green shoots” of FDI that signal the potential for future development in the regional innovation cluster, such as Enza Zaden, a Dutch MNE supporting technology transfer to local agricultural producers (Box 4.1).

Box 4.1. Case study of an FDI operation in Chiang Mai

In 2019, Enza Zaden, a company from the Netherlands, received a BOI promotion in Chiang Mai for its high-tech growing systems. It promotes hydroponics, greenhouses and open field agriculture for vegetables. The company uses technology to produce high-yield, stress- and disease-resistant crops using fewer fertilisers and pesticides. It aims to support local growers in Thailand.

Further information: www.enzazaden.com

The situation in advanced agriculture and biotechnology and food-for-the-future in Chiang Mai and Chiang Rai is therefore that the cluster needs to get established, and this will start to attract more inward FDI, which can then help support the development of supply chains and innovation networks locally.

This indeed is the typical scenario for FDI participation in regional biotechnology clusters. FDI tends to contribute to boosting SME innovation, collaborative network advantage and regional competitiveness in the mature growth stages of biotechnology cluster development, when the clusters are able to attract and embed FDI (Yehoue, 2005; Saha and Fikri, 2014), whereas in the early stages development is driven by research commercialisation from universities and public research through start-ups and scale-ups. For example, technology transfer from FDI was subsidiary to the process of technology generation from knowledge generation institutions in the early days of biotechnology cluster emergence in Silicon Valley (Blakely and Willoughby, 1990). Rather, it was local leading universities and research organisations that generated the relevant technological and organisational knowledge that diffused in innovative SMEs and large firms alike.

In world-leading regional clusters, like Silicon Valley, the pre-existing cluster provides a rich milieu for attracting talent, generating human and social capital, stimulating innovative SMEs with absorptive capacity, and facilitating key employee mobility, which facilitates innovation in emerging technologies and attracts a great deal of private investment, including inward FDI.

The key point for advanced agriculture and biotechnology and food-for-the-future development in Chiang Mai and Chiang Rai is that a policy strategy for technology transfer from FDI needs to be developed in tandem with a policy strategy to support cluster formation processes involving SMEs, rather than as a solution for kick-starting regional cluster development.

The relevance of this approach is supported by evidence from De Propriis and Driffield (2006), for example, who show that significant productivity spillovers from inward FDI only occur in mature clusters, and Thompson (2002), who finds that technology transfer from FDI in the garment industry in China has been stronger within clusters than outside of them.

There is also evidence of how FDI has supported SME innovation in established clusters in other middle-income countries. An early example is the Sinos Valley shoe cluster in the State of Rio Grande de Sul in Brazil from 1970 to 1992. The cluster involved 400 local shoe firms in its early stages of

development. In later stages these firms were surrounded by many more firms, both domestic and overseas, and the initial cluster was transformed to a dynamic cluster with a total of 1 821 firms in 1991 (Schmitz, 1995). MNEs from the USA and Europe entered the cluster in specialised operations spanning all kinds of value creation services, components and materials in the footwear industry. The FDI brought specialised knowledge flows to SMEs in local service rendering workshops, built the base of trained workers in tanning, leather and footwear machinery occupations, increased demand for specialised SMEs in the rubber industry, and gave SMEs access to international markets via an array of export and forwarding agents. The contribution of FDI was to upgrade and consolidate the design and production of shoes by SMEs in the area, although FDI was not there from the start.

The aim of this chapter is therefore to assess how policy can integrate FDI into the advanced agriculture and biotechnology and food-for-the-future cluster in Chiang Mai and Chiang Rai in the medium term and in this way further support SME innovation in parallel with the measures discussed elsewhere in the report. The chapter proposes two complementary policy solutions:

- *Solution 1: Strengthen FDI policy for advanced agriculture and biotechnology and food-for-the-future in Chiang Mai and Chiang Rai using existing policy structures.*

Existing agencies responsible for FDI and SME development in Thailand and in Chiang Mai and Chiang Rai may pursue activities to create stronger conditions to attract FDI in advanced agriculture and biotechnology and food-for-the-future. This may include developing more relevant R&D and training in HEIs and the Northern Science Park (NSP); marketing the region and its advantages in the sectors; emphasising the presence of relevant research, graduates and science parks; identifying SMEs with the potential to supply FDI and building their absorptive capacities so that they can participate in supply chains and benefit from knowledge spillovers; and aftercare work with attracted FDI to encourage research and training linkages with regional universities and science parks and supply linkages with regional SMEs.

- *Solution 2: Include FDI engagement activity in the roles of a new Cluster Management Organisation (CMO) for advanced agriculture and biotechnology and food-for-the-future in Chiang Mai and Chiang Rai.*

The CMO would increase visibility of the advanced agriculture and biotechnology and food-for-the-future innovation activities in Chiang Mai and Chiang Rai to potential inward FDI, create regional networks and trust necessary for collaboration among different stakeholders in the regions, and undertake purposeful brokerage between FDI, SMEs and universities, science parks and incubators in the regions as well as with national and international knowledge transfer intermediaries that can work with Chiang Mai and Chiang Rai enterprises, such as BIOTEC in Bangkok, and beyond in Singapore, Japan, India, etc.

These two policy solutions are complementary and should be pursued together.

Not all regional innovation clusters have a great deal of inward FDI, at least in the early stages of their development, and Chiang Mai and Chiang Rai are not different for the time being. The regional innovation cluster in advanced agriculture and biotechnology and food-for-the-future is in its embryonic stage of international development, in particular in terms of attracting FDI and using it to transfer knowledge to regional SMEs to support their innovation capabilities and access to markets. Both solutions can be adopted and implemented in parallel for building the future FDI role in the cluster.

The rest of this chapter discusses this agenda. Section two presents Thailand's FDI performance and FDI policy arrangements. Sections three and four respectively describe the two complementary policy solutions proposed to building the contribution of FDI to SME development in advanced agriculture and biotechnology and food-for-the-future in Chiang Mai and Chiang Rai. Section five provides summary conclusions and policy recommendations.

Foreign direct investment performance and policy arrangements

Thailand has experienced large fluctuations in the value of its inflows of FDI in the past two decades, but overall inward FDI to Thailand has been low compared with South East Asia as a whole (Table 4.1). The composition of this inward FDI includes significant inflows from Asia, led by investors from Japan, China and Singapore, and significant reinvestment by MNEs already present in the country.

Table 4.1. FDI inflows

	FDI inflows in USD millions					FDI inflows as % of gross domestic fixed capital formation			
	2005-07	2015	2016	2017	2018	2005-07	2016	2017	2018
Thailand	8 451	5 624	1 815	6 478	10 493	14.2	1.9	6.1	9.4
Malaysia	6 240	10 082	11 336	9 399	8 091	16.4	14.8	11.8	9.4
Indonesia	6 726	16 641	3 921	20 579	21 980	6.1	1.3	6.3	6.7
South East Asia	61 712	114 276	116 768	144 177	148 694	20.6	16.2	18.8	18.6
Asia & Oceania	291 439	516 028	474 458	493 782	513 420	10.7	6.1	5.9	5.7
Developing Economies	419 126	728 814	656 290	690 576	706 043	11.5	7.2	7.0	6.8
World (billions)	1 414	2 038	1 918	1 497	1 297	11.4	10.2	7.5	6.0

Source: World Investment Report 2019, UNCTAD

Data from Thailand's Board of Investments (BOI) shows approvals for BOI privileges available in certain geographic areas and industrial sectors in the country broken down by firm ownership (100% Thai, Foreign owned, or joint venture). Table 4.2 shows the breakdown of approvals from 2016-2018 for Northern Thailand as a whole. A substantial share of these projects are in Chiang Mai and Chiang Rai provinces (Table 4.3).

Table 4.2. Board of Investment (BOI) investment incentive approvals by investor origin, Northern Region, Thailand

Investor origin	2016		2017		2018	
	No. projects	Capital investment (THB million)	No. projects	Capital investment (THB million)	No. projects	Capital investment (THB million)
Thai investment	106	10 909	47	3 915	20	2 223
Foreign direct investment	33	6 351	36	8 743	32	4 548
Joint venture	11	755	5	259	12	248
Total	150	18 015	88	12 917	64	7 019

Note: BOI applications are made for the purposes of receiving BOI privileges in a certain geographic areas and certain industrial sectors.

Source: Board of Investment Thailand, https://chiangmai.boi.go.th/index.php/investment_file_download

Table 4.3. BOI investment incentive approvals in Chiang Mai and Chiang Rai

Province	2016		2017		2018	
	No. projects	Capital investment (THB million)	No. projects	Capital investment (THB million)	No. projects	Capital investment (THB million)
Chiang Mai	82	2 713	31	6 007	33	2 798
Chiang Rai	5	1 290	7	324	7	249
Total	87	4 003	38	6 331	40	3 047

Source: Board of Investment Thailand, https://chiangmai.boi.go.th/index.php/invesment_file_download

Table 4.4 shows the distribution of BOI incentive approvals by sector. Chiang Mai saw the largest investment, followed by Lamphun, Chiang Rai and Khamphaengphet. Overall, one-third of the approved investment projects were from FDI, ranging from 88% in Chiang Mai to 12% in Chiang Rai.

Table 4.4. BOI investment incentive approvals by industry in the Northern Region

Industry	2016		2017		2018	
	No. projects	Capital investment (THB million)	No. projects	Capital investment (THB million)	No. projects	Capital investment (THB million)
Agriculture and agricultural products	41	17 037	21	1 870	12	1 715
Mining, ceramics and basic metals	5	284	0	0	2	342
Light industry	8	4 573	6	214	5	705
Metal products, machinery and transport equipment	7	1 334	4	406	3	560
Electronic industry and electric appliances	24	2 261	45	3 231	6	491
Chemicals, paper and plastics	11	4 345	0	0	0	0
Services and public utilities	19	4 661	17	5 578	17	2 993
Total	115	34 495	93	11 299	45	6 806

Source: Board of Investment Thailand, https://chiangmai.boi.go.th/index.php/invesment_file_download

Overall, the long-term, inward FDI performance of Thailand is rather weak and needs to be strengthened with appropriate policy actions. In terms of regulations, Thailand ranks relatively well internationally, in 21st position in the World Bank's Ease of Doing Business Indicators 2020, although there should be improvements to the intellectual property system to encourage foreign companies to bring the latest technologies to Thailand.

However, some of the important FDI attraction and aftercare activities that would promote greater FDI inflows are missing or patchy in Thailand at the regional level. Straightforward actions like promoting financial incentives for Industry 4.0, information sharing webinars with government officials and business leaders including showcasing MNEs and SMEs, open access databases and the like are missing in the BOI case. The activities of the Malaysian Investment Development Authority (Malaysia's Investment Promotion Agency) offer a potential model for a more comprehensive system of financial incentives and information sharing activities.

The two sets of policy actions discussed below can help increase the role of inward FDI in promoting SME development in the advanced agriculture and biotechnology and food-for-the-future sectors in Chiang Mai and Chai Rai. Both of these actions can be pursued together. If a CMO is created it can

undertake some of the activities related to strengthening FDI policy in the regional innovation cluster, but others concern mainly different actors.

Strengthening foreign direct investment policy in the regional innovation cluster

The FDI policies of many countries include a strong focus on attracting FDI to regional clusters, where the country has the strongest value propositions for investors in particular sectors. This includes the FDI marketing activities of the Investment Promotion Agencies (IPAs), public investments in building sector-relevant infrastructures and skills as well as activities to build FDI supply chains in regional clusters. This is not currently a strong feature of FDI policy in Thailand.

An initial step would be for the BOI, as the Investment Promotion Agency, to include cluster promotion as one of the core elements of its mission. This would include more systematic FDI attraction, aftercare and embedding strategies for regional innovation clusters in Thailand in general, undertaken in co-operation with national research agencies, the OSMEP for the promotion of SMEs, and university science parks, such as the NSP. It would include an explicit focus on the advanced agriculture and biotechnology and food-for-the-future sectors in Chiang Mai and Chiang Rai.

The BOI could undertake the following specific activities for the regional clusters:

1. Sharing data about stocks and inflows of FDI, including information on BOI incentive applications and projects by sector, size and cluster. For the time being, relevant government FDI data is collected and kept across several departments without a single point of contact. This makes it difficult to organise support from related agencies for FDI attraction, aftercare and embedding initiatives in regional innovation clusters.
2. Marketing the strengths of the regional innovation clusters to potential inward FDI, including, for example, the top-10 reasons for FDI in specific sectors to choose a specific regional innovation cluster location within Thailand.
3. Carrying out FDI aftercare at the regional level, including through co-operation with other agencies in regional innovation clusters.
4. Co-operating with other agencies in regional innovation clusters to support the embedding of inward FDI. This should involve connections with the OSMEP, science parks, the Federation of Thai Industry and other regional bodies in order to broker connections between FDI and potential SME suppliers in clusters. It should include supplier development initiatives to support potential SMEs to reach necessary standards of quality, efficiency and price, and flexibility to be successful in gaining supply contracts with FDI.

The relative emphasis at the outset will be on increasing the international marketing of regional innovation clusters to potential inward FDI. As the stock of FDI in regional clusters grows, the scale of the FDI aftercare and FDI-SME linkage building activities will need to grow.

The advanced agriculture and biotechnology and food-for-the-future regional innovation cluster in Chiang Mai and Chiang Rai can serve as a pilot for reinforced FDI activities for other regional innovation clusters in Thailand. The following specific actions could form the basis of the regional pilot exercise:

1. Formation of an FDI-SME linkage strategy team in Chiang Mai and Chiang Rai with adequate skills and resources from BOI, the OSMEP and NSP. This team would develop and co-ordinate the actions with foreign investors.
2. Gathering and presenting data on the cluster with respect to attracting FDI and creating linkages with SMEs. This would require research, secondary data collection, and meetings with local stakeholders. The information should cover topics related to the attractiveness of the region to

FDI in the specific sectors, such as skills availability, research strengths and SME supply capabilities of the cluster. This should feed into marketing communications on the cluster to potential inward FDI. The information should also identify the potential of specific SMEs in Chiang Mai and Chiang Rai for supplying specific FDI operations and the finance and other support needs for these SMEs to reach the capability level required to supply FDI.

3. Developmental actions which keep up the impetus of the linkage strategy team, identifying future opportunities and maintaining the engagement of both FDI and SME sectors. The actions include formalising networking and contacts with FDI. In addition, actions may include development of a transparent system via the NSP and the OSMEP to give comprehensive support to potential SME suppliers including technology development, business development services and development finance, developing the research base, developing more flexible skills, and promoting entrepreneurship in the cluster.
4. A set of remedial actions relating to national regulatory barriers, such as in the area of regulations for operating FDI projects or developing land for FDI projects, which can be mitigated by local actions.
5. A small set of pilot actions designed to create some initial FDI-SME supply linkages or FDI participation in regional research or entrepreneurship development projects with one or more initial FDI ventures. The aim of the pilot actions is to create networking between FDI and SMEs and research organisations, demonstrate the requirements and engagement models of foreign investors to SMEs and research organisations, and give experience to the linkage strategy team.

The OSMEP has an important potential role to play in this agenda by supporting the identification of SMEs that are potential suppliers to FDI, introducing these SMEs to FDI, and strengthening their capabilities to act as suppliers to FDI ventures through business advice and financial support. However, the development of an FDI strategy for the regional innovation cluster, from FDI attraction, to aftercare, to embedding will require a partnership across a range of government departments with responsibilities in this field, including the BOI and the OSMEP, but also government departments such as the Department of Intellectual Property, the Department of Business Development, and the Department of International Trade Promotion.

In addition, the locations and sectors in which fiscal incentives for investment are offered should be reviewed with a view to increasing the attractiveness of regional innovation clusters to FDI. Fiscal incentives that are highly relevant for FDI attraction are currently available in Special Economic Zones (SEZs) and the Eastern Corridor, including incentives focused on the NSP. Consideration should be given to focusing incentives on the regions that dominate Thailand's priority sectors for driving future innovation-based growth, including advanced agriculture and biotechnology and food-for-the-future in Chiang Mai and Chiang Rai, on a similar model to the existing Eastern Corridor.

Foreign direct investment engagement by a new cluster management organisation

This section proposes the inclusion of FDI-SME linkage building activities in the remit of a cluster management organisation for advanced agriculture and biotechnology and food-for-the-future in Chiang Mai and Chiang Rai. If such a CMO is created and takes on FDI functions as part of its activities, it could be involved in some of the activities related to strengthening FDI policy in the regional innovation cluster mentioned above, namely sharing data about FDI in the cluster, carrying out FDI aftercare activity for the cluster, brokering connections between FDI and potential suppliers in clusters, and undertaking potential FDI-SME linkage building pilot actions for the cluster. The specific FDI engagement activities proposed for the CMO are set out further below.

Why a Cluster Management Organisation?

The Cluster Management Organisation (CMO) is a commonly-used innovation policy tool in OECD and other innovation-based economies. Their main function is to strengthen connectivity within the regional innovation clusters they serve. They do this through developing networks, collaborations, and shared visions in a range of key areas for cluster development including skills development, R&D projects, supplier development, and increasing the visibility and attractiveness of a cluster. Connectivity drives innovation performance and competitiveness, and this cannot be simply left to accident and serendipity.

An important distinction can be made between two types of knowledge production in innovation systems (Nowotny et al, 2003):

- **Mode 1:** Knowledge production motivated by “basic research” and disciplinary-based scientific inquiry that it is not primarily concerned by the applicability of its findings. Mode 1 is founded on a conceptualisation of science as separated into discrete academic disciplines, for example, a biologist carries out only biological research and not chemistry research.
- **Mode 2:** Knowledge production by multidisciplinary teams brought together for short periods of time to work on specific, real world problems in collaborative applied research projects. Mode 2 advances the knowledge of the cluster and builds up the innovation absorptive capacities of the SMEs and other stakeholders.

The CMO approach will contribute to Mode 2 knowledge production in the advanced agriculture and biotechnology and food-for-the-future cluster in Chiang Mai and Chiang Rai. This is particularly appropriate to the assets and challenges of the regions in exploiting knowledge generated and transferred by the region’s young universities and its science parks. It emphasises cross-fertilisation of knowledge and enabling the growth of start-ups, scale ups and innovative SMEs.

Mode 2 knowledge production can be promoted in the cluster through public sector part-funding of collaborative R&D projects via the CMO (in Minalogic – see Box 4.2 – the typical public sector contribution is 50% of project R&D costs covered by the state and 50% covered by private companies). Scientists in the regional public research organisations and university science parks can be funded as part of collaborative projects for upgrading advanced agriculture and biotechnology and food-for-the-future knowledge generation and transfer on the basis of five principles: knowledge produced in the context of application; transdisciplinarity; heterogeneity and organizational diversity; social accountability and reflexivity; and quality control.

Inward FDI can be involved in these processes as it is attracted to Chiang Mai and Chiang Rai, on condition of gradually building up a culture of collaborative research in Mode 2. Barriers that need to be addressed are that the MNEs in the regions are rare and have so far shown very little, if any interest, in collaborative research with SMEs and universities and science parks. Furthermore, when MNEs show an interest in SMEs, it would be as a prelude for an acquisition rather than fostering knowledge flows through collaborative projects. Furthermore, SME owners still tend to feel that they should be 100% funded by the government for undertaking research.

The CMO can address these issues by working to attract FDI and fostering collaboration and networking among MNEs, SMEs, science parks and government agencies in R&D, supplier development and skills development activities.

There are various examples internationally of public programmes supporting CMOs that promote FDI participation in cluster research, skills and supply networks. An example is the Danish Networking (Brokering) Programme, which was designed by the Danish Technological Institute, funded by the central government and implemented by the National Agency for Industry and Trade (NAIT). The NAIT was the trusted broker that strengthened co-operation and identified opportunities for regional SMEs to benefit from R&D collaboration with inward FDI. Over the 5-year implementation period of the

programme in Denmark as a whole, 5 000 firms collaborated and formed networks out of a target group of approximately 12 000 enterprises (Yehoue, 2005, 21).

Similarly, CMOs have been a key tool for innovation and entrepreneurship policy in France. Professional CMO managers and agents have been engaged to connect regional SMEs with large focal firms (both large domestic and foreign-owned firms) within clusters via collaborative projects supported by the French government through the ‘poles de competitivité’ programme. Lefebvre (2013) argues that these CMOs led to a shift from accidental to purposeful cluster brokerage in the clusters. An example is the micro-nano technologies cluster in Grenoble, France, where a CMO has created strong connectivity among large public research laboratories (similar to BIOTEC in Thailand) and universities, research-intensive large firms including FDI, and an array of SMEs (see Box 4.2).

Box 4.2. The Minalogic CMO, Grenoble, France

Description of the approach

Minalogic is a regional innovation cluster (“*pôle de competitivité*”) focused on digital technologies in micro-electronics and nano-technologies (including embedded software and services such as the cloud and 5G innovations). It is located in Grenoble in the Auvergne Rhone Alpes region of France. Minalogic operates through a CMO, which is hosted in MINATEC, part of the public research laboratory for miniaturisation technologies of the French atomic energy organisation (CEA LETI: <http://www.leti-cea.com/cea-tech/leti/english>). CEA LETI specialises in the emerging alternative forms of “green” energy and ICT Key Enabling Technologies (KETs).

Grenoble is considered as the Silicon Valley of Europe; ranked by Forbes magazine in 2013 as the 5th most innovative city in the world based on the number of patents per 10 000 citizens, and with a long history of cluster development and FDI attraction in micro-electronics and nano-technologies. The cluster includes an anchor firm, ST Micro-electronics, the largest European integrated semiconductor firm, founded by an international French-Italian-Swiss joint venture. It hosts the largest concentration of researchers and public research laboratories in France outside Paris. It includes unique large infrastructures at the European Union level, such as the European Synchrotron Radiation Facility and the European Molecular Biology Laboratory. It also hosts the European R&D headquarters of major USA-based MNEs such as Hewlett Packard and Xerox and industry associations such as SEMI (an association for semiconductors in Silicon Valley, California, and worldwide).

The CMO of Minalogic is a government agency in itself, supported by the local, regional and national governments with an annual budget of EUR 1-2 million. It is locally rooted (and globally connected) with about 20 permanent staff (experts from technical fields to business development and SME promotion) and currently maintains regional offices, not only in Grenoble, but also in Lyon and Saint Etienne, the other main cities of the Auvergne Rhone Alpes region.

The CMO plays a number of pivotal roles in the development of the regional innovation cluster and in supporting FDI-SME linkages:

- Steering public and private research spending towards producing innovations for application in new products and services in KETs in micro- and nano-electronics, photonics and embedded software technology, in application areas ranging from ICT and healthcare, to energy and construction, sport, and advanced manufacturing, including applications for the defence sector. It does this by feeding R&D collaboration proposals from regional actors to selection panels of technical experts and government representatives at different levels for potential funding, based on their commercialisation potential.

- Raising the profile of the cluster at national and international scales, for example, by connecting with the “Silicon Europe” project and the Dresden micro-electronics cluster led by large German MNEs, which helps in the attraction of FDI.
- Brokering R&D collaborations among regional actors, including making connections for innovative SMEs to FDI and research organisations, through putting together and funding large research projects.

Minalogic is supported by generous public research funding for collaborative R&D projects (a total of EUR 881 million from French government research programmes since its establishment from 2005-2019). It nurtures hundreds of public-private collaborative research projects on a competitive basis, funded 50:50 by industry and government. As of 2019, 586 projects had been funded through Minalogic, involving more than 350 small and large companies, plus universities and public research labs in the city-region.

The French government has also created a dedicated inward FDI agency (AEPI – *Agence des études pour la promotion de l’Isère*) to promote inward FDI to the Minalogic cluster and more broadly to attract and embed FDI to the region. In the last decade or so, it has attracted leading FDI projects including from ARM, UK (now in Japanese ownership), GE Healthcare (with respect to med-tech operations), and Rolls Royce (with respect to cleantech). Each has opened offices near Minalogic so that they are in a good physical location to join in with applications for collaborative R&D projects with regional SMEs and research organisations (CEA-LETI and others).

The activities of the CMO have had positive results in stimulating knowledge flows, commercialisation of new products and services, attracting internationally mobile highly skilled labour particularly the “new Argonaut” returnees from world-leading clusters (e.g. Silicon Valley, United States and clusters in Israel), facilitating inward FDI and enabling public-private partnerships.

Factors of success

The Minalogic CMO has the benefit of being located in a very dense and sophisticated regional innovation system with substantial R&D activity, skills generation, and business activity. It therefore builds on a high level of pre-existing high-tech cluster activities and a very supportive innovative milieu and institutional environment in Grenoble (Assimakopoulos et al 2021 forthcoming).

In this context, the CMO has played a critical role in building R&D connections among the regional cluster actors and linking FDI and SMEs. It puts a premium on frequent individual meetings with regional cluster actors to discuss project opportunities and potential connections with other firms and organisations.

Having an active team and management that mixes skills and profiles from the private and research sectors has been important to the credibility of the CMO with local actors and hence its effectiveness. As an independent actor, it has been able to foster trust among the local actors.

The potential access to R&D project funding has incentivised participation by all the actors in the joint activities, which has helped build new areas of collaboration. The competitive nature of the R&D grants has been a tool to steer the collaborations towards promising new areas of exploitation.

A further key to success has been opening up the long standing research and infrastructure of the public research laboratories, like CEA LETI, and capitalising on the knowledge and infrastructure of the European Synchrotron Radiation Facility, the European Molecular Biology Laboratory and the University Grenoble Alpes to collaboration with industry through government funding to collaborative research projects.

Obstacles and responses

In the early stages of the activities of the CMO there was relatively little involvement of SMEs (Potter, 2009). The key players in designing the cluster vision and in R&D collaborations were the large firms and the research institutions. However, a shift was made in the 2010s to give an explicit priority to the CMO on involving innovative SMEs as CMO members and to give an advantage in R&D project bidding to projects involving innovative SMEs. An example is the involvement of Presto Engineering, founded by a returnee from Silicon Valley (Assimakopoulos et al 2016).

Relevance to Chiang Mai and Chiang Rai

Creation of a CMO would help to fill the institutional void in Chiang Mai and Chiang Rai for an overall region-level player brokering connections across all the actors – FDI, SMEs, science parks, research organisations, universities, government departments and agencies.

It illustrates a way of steering research funding to universities and research organisations towards potential commercial outcomes by making funding competitive and conditional on collaborations with firms. It also shows the importance of a team of people who meet with FDI ventures, local SMEs and research organisations to promote research.

Whereas the key research actors and infrastructures of Minalogic are within the region, a CMO for advanced agriculture and biotechnology and food-for-the-future in Chiang Mai and Chiang Rai would also involve collaborations with the BIOTEC national research laboratory in the Bangkok area. Also, whereas the CMO in Grenoble is hosted in a major public research laboratory, the management and team could be hosted in the NSP or the FTI regional office in Chiang Mai and Chiang Rai.

It is also important that a CMO in Chiang Mai and Chiang Rai includes a dedicated FDI team, including support from the BOI, to foster FDI attraction. This work is done in Grenoble by AEPI working in collaboration with the CMO.

Clearly, whereas the focus of FDI attraction in Grenoble has been electronics investments from the United States, Germany and the UK in particular, the focus for FDI attraction for Chiang Mai and Chiang Rai will be in advanced agriculture and biotechnology and food-for-the-future. It would seek incoming FDI activities with knowledge and research content and potential linkages with regional SMEs and research organisations, and target countries such as Singapore and Japan, and to a lesser extent China and India, among others.

Sources of further information: <https://www.minalogic.com/en/home>. Assimakopoulos, D., M. Tsouri, D. Mavridis, and A. Moore (2016), "Don't lose sight of the forest for the trees: Minalogic and Presto Engineering as a 'New Argonaut' in a French ICT ecosystem", in Wang, H. and Y. Liu (eds), *Entrepreneur and Talent Management from a Global Perspective: Global Returnees*, Edward Elgar, Cheltenham: 251-272. Assimakopoulos, D., H. Lawton Smith, N. Baines, M. Tsouri, and S. Romeo (forthcoming), "Oxford and Grenoble: knowledge organisations in local development revisited", *Regional Studies*, October 1 2021.

Potter, J. (2009), "The micro-nanotechnology cluster of Grenoble, France", in J. Potter and G. Miranda (eds), *Clusters, Innovation and Entrepreneurship*, OECD Publications, Paris.

The activities that CMOs play in leading OECD country clusters for FDI attraction and embedding, as well as generating other connections, are clearly missing in the case of advanced agriculture and biotechnology and food-for-the-future in Chiang Mai and Chiang Rai.

Broad domains of foreign direct investment policy activity for a CMO

A CMO for advanced agriculture and biotechnology and food-for-the-future in Chiang Mai and Chiang Rai can play important roles in a number of broad domains of FDI activity:

- Increasing the visibility of the regions to potential incoming FDI by helping prepare information on their strengths for marketing materials (highlighting in particular the research and skills outputs of the regional universities – e.g. the medical school, pharmacology department, and department for cosmetic science and biodiversity protection – and the NSP) and making contacts on the ground for potential inward investors.
- Helping identify research collaboration opportunities for FDI with universities, science parks and research organisations in the cluster.
- Helping integrate FDI into supportive supply chains with SMEs.
- Involving FDI in supporting entrepreneurship, for example encouraging FDI operations to work with business angel networks and venture capitalists in improving access to financing and linking FDI with business incubators to provide mentoring and financing and other support.
- Helping steer national-level skills development towards the needs of incoming FDI, including steering the content of continuous education programmes and specialised professional Masters programmes (e.g. MBAs and Masters in a variety of disciplines from engineering to pharmacology to management, finance, marketing and accounting).

Foreign direct investment engagement actions of the cluster management organisation in the cluster

The CMO would undertake the following main actions with respect to FDI engagement activity aimed at SME development within the cluster:

1. Identifying FDI projects already hosted in Chiang Mai and Chiang Rai with cluster-related activities and establishing regular contacts with them. As part of this relationship building, support FDI to overcome any operational problems locally, for example with regulations, and promote reinvestment and contributions to regional cluster development.
2. Identifying the critical mass of SMEs with capabilities in advanced agriculture and biotechnology and food-for-the-future, including a complete directory and a mapping exercise. This could be co-ordinated by the CMO and undertaken by the NSP in conjunction with the Federation of Thai Industries. The output could be used to help build the marketing of the cluster to FDI.
3. Selecting the most capable SMEs from the mapping exercise for support with a view to connect them with inward FDI in supplier chain initiatives. This could be facilitated by one-stop shop consultants working for the OSMEP. The support could involve an integrated package of consultancy, finance, training and innovation support to develop technical and management skills in high potential SMEs in order to build their capabilities for engagement with FDI.
4. Brokering and nurturing SME supply chains with FDI operations. Arrangements can be brokered, for example, whereby an FDI takes equity in an SME in exchange for making investment in new product development in the SME.
5. Encouraging collaborative R&D projects between FDI, SMEs, universities, science parks including NSP, NSTDA and BIOTEC and others. This could involve financial incentives to participate in collaborative R&D projects as an incentive to get involved in applied research and its commercialisation and to build a culture of trust and collaboration amongst the players.
6. Encouraging the role of FDI in corporate entrepreneurship and promoting serial entrepreneurs in the regions, addressing the lack of existing resources in terms of knowledge and finance (private innovation support mechanisms have to be combined with public support mechanisms).

Making links with foreign direct investment in other clusters internationally

There is also potential for the CMO to connect SMEs to MNEs in related clusters outside of Thailand to promote international supply opportunities, for example on product testing. This could be achieved by

the CMO in Chiang Mai and Chiang Rai making links with other advanced agriculture and biotechnology and food-for-the-future clusters internationally. These co-operations among related CMOs would aim to broker cross-national FDI-SME linkages and could also extend to other collaborations such as research collaboration. An example of a related CMO with which linkages could be made is given in Box 4.3.

Box 4.3. The Cosmetic Valley CMO, France

The CMO of Cosmetic Valley is based in the city of Chartres, France (about 100 km west of Paris). Cluster policy in France differentiates between “national” and “global” competitiveness clusters. As a national cluster, the Cosmetic Valley CMO receives a much smaller government budget and employs about half of the staff of the Minalogic cluster in Grenoble (Box 4.2), which is in the category of global clusters. Furthermore, Cosmetic Valley covers all the French regions (but with a main focus in the North of the country). Hence, it is not a geographically-agglomerated cluster like Minalogic but a distributed cluster organisation.

As well as maintaining connections with national players and FDI hosted in France, the CMO maintains links with other cosmetic clusters internationally, particularly in Italy and the European Union, but also further afield. Specialised service providers participate in the regional linkage strategy and provide connectivity for SMEs in the Cosmetic Valley cluster with partners internationally. For example, the SpinControl Group (<https://spincontrolgroup.com/spincontrol-around-world/thailand>) specialises in the scientific substantiation of aesthetical and well-being claims for cosmetics, food supplements, and medical devices. For this purpose it carries out new product testing in global locations, and maintains linkages with Thailand through its Asian office in Bangkok.

The opportunity for Chiang Mai and Chiang Rai is to connect with CMOs in other countries, such as Cosmetic Valley in France. The CMO could propose capable SMEs in Chiang Mai and Chiang Rai to carry out testing in Thailand for firms in other countries. It could also propose to CMOs abroad to carry out testing of new Thai products for their markets. In this case, Cosmetic Valley firms in France could carry out product testing of Thai products for the European market.

Other connections could also be made, for example between the Cosmetic Science Department in Chiang Rai University and the Cosmetic Valley cluster to learn from their activities and launch collaborative projects such as virtual seminars to build joint communities of practice.

Sources of further information: <https://www.cosmetic-valley.com/>

Arrangements for developing a cluster management organisation

It is recommended that the CMO become a member type organisation, as per the Minalogic global competitiveness cluster in Grenoble, France (see Box 4.2). Members could include SMEs, FDI, research organisations, skills development organisations as well as Government departments and agencies, including the OSMEP. As well as offering the benefits of networking, one of the incentives for participation offered by Minalogic is a label given to members. This is recognised by government departments and agencies and gives members the possibility to apply for publicly-subsidised collaborative R&D projects.

A CMO in Chiang Mai and Chiang Rai could be driven by a secretariat based in one of the regional knowledge organisations, such as the NSP. As the driver of the CMO, the NSP could work with the BOI in the attraction and aftercare of FDI, with the OSMEP brokering linkages between FDI and SMEs. It could also partner with other government agencies in brokering linkages with regional and national level universities and research organisations (including for example links with the BIOTEC national research laboratory).

The CMO could have a geographical boundary around the Chiang Mai and Chiang Rai provinces and target selected innovative start-ups and scale-ups in the advanced agriculture and biotechnology and food-for-the-future sectors as members. Only MNEs with regional direct investment presence could participate in the membership organisation.

The Federation of Thai Industries (FTI) plays an important role in promoting the agri-food cluster in Chiang Mai, with some 200 members in the food sector, following the model of the Food Valley ecosystem in the Netherlands. Thus the FTI is also a potential host for a CMO, and would in any case be a key player in the activities of any newly-created CMO.

Conclusions and policy recommendations

FDI activity is currently limited in advanced agriculture and biotechnology and food-for-the-future in Chiang Mai and Chiang Rai. This shows up in both the small scale of inward FDI and the limited linkages between FDI and SMEs and other cluster actors. Therefore FDI cannot be seen as a key anchor for knowledge generation and access to international markets for regional SMEs at the current juncture in the development of the cluster. However, the experience of biotechnology clusters internationally is that FDI can be expected to grow in parallel with the growth of the cluster. In other words, as the skills, research and SME capabilities in a biotechnology cluster grow, its attractiveness to FDI grows. Therefore FDI could become an important asset for the regional innovation cluster in the medium and long-term.

In order to stimulate such a positive development, policy needs to address the current lack of institutional arrangements in Chiang Mai and Chiang Rai for attracting and embedding FDI and for purposeful brokerage of FDI-SME linkages. Policies need to be introduced that can:

- build regional conditions that will attract FDI to Chiang Mai and Chiang Rai, including relevant research, training and capable SME suppliers;
- market the region to FDI, recognising the need to direct biotechnology-oriented FDI considering Thailand to Chiang Mai and Chiang Rai;
- create contacts with the FDI that has been attracted in terms of aftercare and connections to SMEs, universities, science parks, incubators and research organisations; and
- identify and support selected SMEs capable of working with FDI with upgrading their processes and management practices to the standards required by FDI and broker linkages between FDI and these SMEs.

This can be supported by the two policy approaches proposed above, namely:

1. Strengthening FDI policy for the advanced agriculture and biotechnology and food-for-the-future cluster in Chiang Mai and Chiang Rai through existing policy infrastructures.
2. Introducing FDI engagement activity in the activities of a CMO created for the Chiang Mai and Chiang Rai advanced agriculture and biotechnology and food-for-the-future cluster.

The key specific recommendations are put forward below.

Box 4.4. Recommendations on foreign direct investment

Strengthening FDI policy through existing policy infrastructures

- Develop a set of supporting conditions to attract FDI in advanced agriculture and biotechnology and food-for-the-future to Chiang Mai and Chiang Rai including by strengthening regional skills and research capabilities in this sector.
- Produce an on-line leaflet with the top-10 reasons why an inward FDI project in advanced agriculture and biotechnology and food-for-the-future will choose to locate in Chiang Mai and Chiang Rai and promote this with relevant FDI prospects.
- Steer advanced agriculture and biotechnology and food-for-the-future FDI projects exploring a location in Thailand to Chiang Mai and Chiang Rai, based on regional cluster mapping, and promoting the unique selling proposition of the regions for hosting FDI in these sectors.
- Reinforce BOI's linkages with other government departments and agencies and with regional organisations including the universities, science parks and cluster organisations players in promoting Chiang Mai and Chiang Rai to FDI.
- Increase the availability of incentives for FDI in advanced agriculture and biotechnology and food-for-the-future in Chiang Mai and Chiang Rai, for example by creating a Northern Corridor SEZ on the lines of the existing Eastern Corridor.
- Include promotion of FDI in regional innovation clusters as one of the core elements of the mission of the BOI working in collaboration with other agencies, including the OSMEP. This would involve:
 - Sharing data about stocks and flows of FDI in regional innovation clusters.
 - Marketing the strengths of regional innovation clusters to potential inward FDI.
 - Carrying out FDI aftercare at regional level.
 - Brokering connections between FDI and potential SME suppliers in regional innovation clusters.
 - Undertaking a regional pilot exercise in Chiang Mai and Chiang Rai involving (i) formation of an FDI-SME linkage strategy team, (ii) gathering and presenting data on the cluster, (iii) undertaking developmental actions including formalising networks and contacts with FDI, (iv) undertaking remedial actions to help FDI work through any regulatory barriers they face, (v) undertaking pilot actions to create some initial FDI-SME supply linkages with one or more inward investors.

FDI engagement through a new Cluster Management Organisation

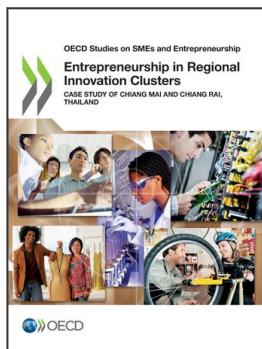
- Create a CMO with a team of dedicated staff at the level of the advanced agriculture and biotechnology and food-for-the-future regional innovation cluster in Chiang Mai and Chiang Rai as a whole, with firms, universities, science parks and other organisations participating as CMO members.
- Include FDI attraction, aftercare and brokering linkages between FDI and SMEs and research organisations as part of the responsibilities of the CMO.
- Identify FDI operations hosted in the region with relevance to the cluster and develop FDI aftercare relationships with them. This includes establishing regular contacts between the public sector and FDI investments that would support FDI to overcome any operational problems locally, for example with regulations, and to promote reinvestment and contributions to regional cluster development.

- Create an easily accessible and usable, public and continuously updated web-based database of capable potential SME suppliers to FDI in advanced agriculture and biotechnology and food-for-the-future in Chiang Mai and Chiang Rai, including a range of company details such as locations, size and products and services.
- Co-ordinate an integrated package of consultancy, finance, training and innovation support to high potential SMEs with the capabilities to supply FDI in advanced agriculture and biotechnology and food-for-the-future in Chiang Mai and Chiang Rai to upgrade their capacities to supply FDI, together with support in winning supply contracts.
- Co-ordinate the offer of financial incentives to CMO members for participation in collaborative R&D projects as an incentive to FDI, SMEs, universities, science parks and others to get involved in applied research and its commercialisation and to build a culture of trust and collaboration amongst the players.
- Encourage the role of FDI in supporting corporate entrepreneurship and supporting incubators and other entrepreneurship support programmes in the cluster.
- Make links for cluster SMEs with FDI in related biotechnology clusters internationally

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