

# Mining and sustainable economic growth

Employers' Association of Greenland (GA)  
11 October 2012

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## **Foreword**

In April 2012, the Employers' Association of Greenland (GA) approached Copenhagen Economics with the desire to clarify what the country can do to ensure that the coming investments in the mining industry will be translated into sustainable development, in the form of permanent economic growth and prosperity in Greenland.

Copenhagen Economics has subsequently analysed the strengths and potentials in the Greenlandic society and matched these with the possibilities of the mining companies to contribute to them, as illustrated by London Mining and the Isua Mine. We have also examined experiences with mining investments in northern Canada, which is in many ways similar to Greenland and can therefore provide a qualified input to the discussion.

## Summary

‘One should stick to one's own class’, says a proverb. If that is true, Greenland will be facing a relationship companion out of its class when the global mining companies arrive. London Mining, for example, expects to invest an amount in the construction of the Isua Mine equal in size to Greenland’s entire GDP.

But, as we all know, challenges also reveals new opportunities. In this study, we have found that there are significant differences in the size of the potential benefits that could accrue to the Greenlandic society, depending on how we approach the relationship.

The most important thing is perhaps to recognise that coercion is necessary. The Impact and Benefit Agreement (IBA), which is the contract between the Government of Greenland and the mining company that sets out goals and requirements in connection with the use of local labour and local companies, must ensure that first priority is given to local people. This is not an area in which market forces can be given free rein, in the sense that the supplier who offers the lowest price wins the subcontract. The whole idea is for the local business community to be able to use the mining projects as leverage to develop better quality and to grow. This will require skills that many lack today, but which they could acquire through the mining activities. The IBA should make this quite clear, laying down targets for the number of local employees and the extent of outsourcing, without the possibility of sidestepping these. These targets must apply right from the construction phase. The synergies for the coming mining projects and the operational phase mean that local skills enhancement should begin during the construction phase.

The binding targets and close ties created through the IBA will increase the incentive of the mining company to do what it can to enhance the professionalism, capacity and quality of the local employees. We find that the IBA should promote what we call ‘proactive outsourcing’. This refers to a close collaboration between the subcontractors and the mining company with the purpose of increasing the productivity and quality of the subcontractors through the mining company’s provision of tools, processes and skills.

We find that proactive outsourcing will be the key to sustainable economic growth. At the same time, the management of subcontractors and the transfer of skills are one of the key competencies of the mining company, and since the mining company must make use of subcontractors in any case, it will be no great burden for the company to provide an extra effort in this area. The companies can thus do a great deal to professionalise and support the local business community, which will not impose any significant costs on the company, but will be of tremendous importance to achieving sustainable economic growth in Greenland.

Conversely, the Government of Greenland should not pressure the mining companies to carry out activities that have no connection to their core competency, namely the extraction of raw materials. Such activities might for example involve contributing to the support of primary education. This would stimulate sustainable economic growth in Greenland, but it would also impose a significant burden on the mining company, as it would not thereby reap any direct benefit. For such purposes, the Government should utilise the proceeds of the corporate taxation paid by the mining company.

Finally, maximum economic benefit implies the implementation of reforms by the Government of Greenland to increase the supply and mobility of labour, strengthen incentives to work, improve the possibility of matching job seekers with jobs right across the country, and ensure that foreign knowledge, labour and capital can easily acquire access to and be anchored in the business community and the population. Such measures will also reduce the risk of overheating in the economy.

## Chapter 1

# Mining as a basis for economic growth

Our subsoil contains many valuable raw materials, including iron, rare earths, precious stones and oil. These make our country attractive for foreign companies to invest in – to invest heavily in. The most current and promising project, the iron mine at Isukasia to be constructed and operated by London Mining, involves a total capital investment of DKK 11 billion. This will increase employment in Greenland, and thereby the level of prosperity in our society.

In this study, we find that there are significant differences in the size of the potential benefits that could accrue to the Greenlandic society, depending on whether we allow the possibilities to play out 'by chance' or consciously exploit them. The difference lies in concrete decisions – to a large extent those of the Government of Greenland. We can use the mining projects as a lever to create permanently higher economic growth and prosperity in our country – but success will depend on the concrete choices.

### 1.1 Two channels to economic growth

The mining companies can contribute to economic growth in the community through two main channels.

*The first channel* goes via taxation.<sup>1</sup> Tax revenues must be used to strengthen the areas of our economy that have the greatest potential to create economic growth in the long run – areas to which the mining companies do not contribute simply by virtue of their presence. These might include the strengthening of preschools and primary schooling, infrastructural investments, or areas in which we are already strong, such as the fishing industry. However, there is no need to select areas to which the mining companies already contribute through their mere presence. Here, the use of more funds is likely to give a lower return to society. Neither is there any reason to force the mining companies into contributing directly to, for example, the expansion of primary schooling, as this would be considered an additional tax on the companies.

*The second channel* goes via the company's specifically mining-related activities, such as the recruitment of local people to work in mines like that at Isukasia, or the provision of scholarships to local people to study mining-related subjects at domestic or foreign educational institutions. Both of these possibilities are rooted in the mining company's core activity, and it is therefore also relatively inexpensive for the company to contribute more to the local community in these areas, as part of the gain will accrue to the company itself, for example in the form of locally-available workers with greater skills. One might say that the company has comparative advantages in these areas. London Mining might for example train and educate local employees, which will benefit the company itself, but this will also equip employees with skills that can be applied to other mining projects or in other professions, and which thereby increase the employee's market value.

We have illustrated this idea about how mining companies can contribute most to the country's economy in Figure 1, which shows the marginal (i.e. extra) costs involved for the mining company if the Government of Greenland presses them to provide something extra in the individual areas. The lowest costs for the mining company lie towards the left. The costs associated with, for example, 'direct

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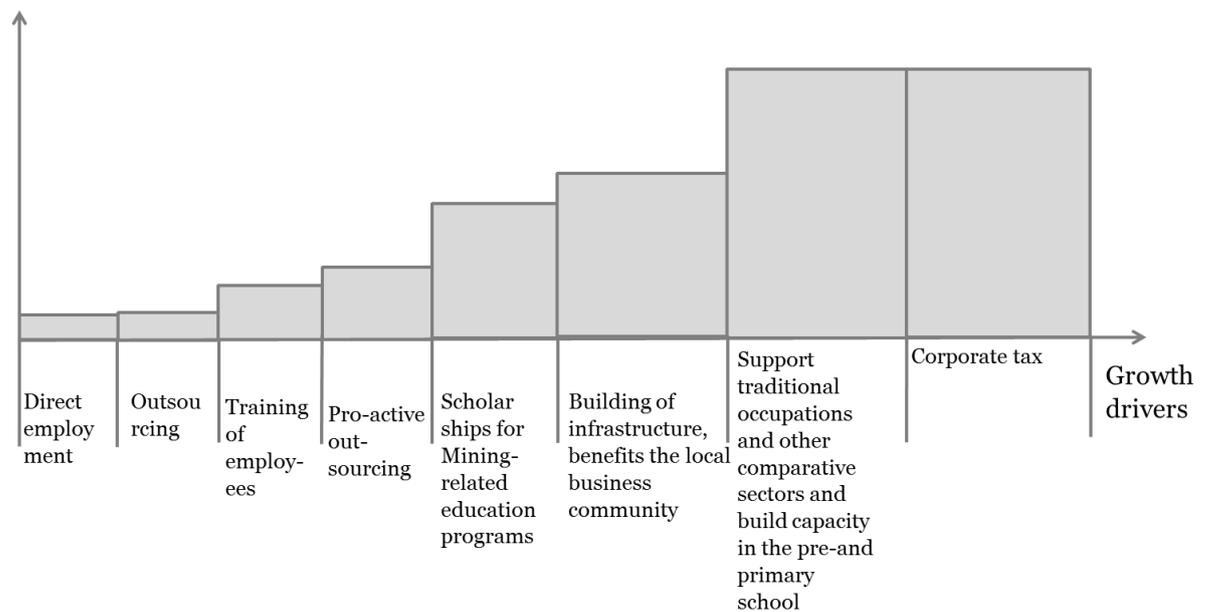
<sup>1</sup> And royalties, etc., if applicable.

employment' are very low. This reflects the fact that the mining company will have to hire employees anyway, and so the demand to use a proportion of local people fits in with its plans. The more we move towards the right, the less the mining company stands to gain from the initiative, which is therefore more expensive, seen from its point of view. On the far right lies the gross payment of corporation taxes, which are a pure cost and do not provide any benefit to the company.

This conceptual framework can thereby be used as a guideline for the government in its negotiations with London Mining on the content of the so-called IBA agreements. The government can get London Mining to go a long way in training and outsourcing, and thereby obtain an economic gain for something that does not inflict massive extra costs on London Mining. If, on the other hand, the government demands that the mining company must improve the quality of primary schooling, the company will regard this as equivalent to a tax.

**Figure 1 'Marginal costs' as an indicator of the division of labour between the mining company and the government**

'Marginal costs' for the mining company



Note: Purely for illustrative purposes – not based on actual figures for costs, etc.

Source: The authors

We will now elaborate on the two channels.

**Where the potential is greatest**

*The first channel* goes via those areas which contribute significantly to economic growth, but in which the mining companies do *not* directly affect our economy through their activities. Here, the government should *not* require involvement from the mining company's side in order to enhance the area, but should instead make use of corporate tax revenues from mining companies. The amounts that the government will have at its disposal are potentially significant. London Mining itself estimates that the iron mine will generate corporate taxes of up to DKK 30 billion over fifteen years. Corporate taxation is thus by far the

greatest contribution the mine will make to the country's economy. The government should therefore ensure that the principles embodied in the legislation for the payment of corporate tax are enforced in full.

One obvious area for investment is in the preschool area and primary schools. Here, the country has a significant potential for improvement, while at the same time strengthening the area will lay the foundation for sustainable, i.e. long-term, permanent economic growth. The current situation is inadequate. In 2009, approximately 30 percent of Greenlandic primary school pupils had a failing grade in Danish and English. At the same time, 58 percent of the pupils who left school in 2010 were rated as academically poor (48 percent) or very weak (10 percent).<sup>2</sup>

Without stating the extent of the precise efforts, the government assesses that the benefits of early intervention at preschool age could permanently boost value creation in society (GDP) by 10 per cent.<sup>3</sup> In the preschool period, important building blocks are laid for future learning. This says something about the importance of education for economic growth in a society, but also about the significant gap that we have to make up in the preschool and primary school area.

Another obvious area in which to utilise corporate taxes is in infrastructure investment. Once again, the area is ideal, because better infrastructure will support economic growth that mining investments do not 'automatically' ensure, due to the asymmetry between the needs of the mining companies and the needs of society for specific investments. If we compare three of the Transport Commission's top wishes for infrastructural projects, the immediate assessment is that none of these projects will be 'automatically' boosted by the mining companies, cf. Table 1.

**Table 1 Three growth-enhancing infrastructure projects**

Infrastructure project recommended by the Transport Commission	Possibility via mining project?	Comment
New Atlantic airport in Nuuk	No	London Mining is establishing the Isukasia Mine outside Nuuk, but does not mention the construction of a new airport in Nuuk in its Social Impact Assessment (SIA)
Airport in Qaqortoq	Probably no	Rimbal Pty Ltd. Greenland Minerals & Energy A/S (probably a heliport)
Container harbour in Nuuk	Probably no	London Mining is establishing the Isukasia Mine outside Nuuk and a harbour for ships to transport the extracted material away. The company's SIA suggests that no-one else will be able to use the harbour, partly for safety reasons.

Note: The summary contains three of the most likely projects, which can be completed with an economic viability analysis and a specific recommendation from the Commission on whether to proceed with or terminate the project work on the existing basis.

Sources: Transportation Commission(2011) and London Mining (2012)

However, there is the possibility of a certain overlap between what a given future mining project may need in terms of infrastructure and what the Transport Commission assesses would be beneficial for the country. If this is the case, it would be an ideal negotiating parameter for the government in the IBA negotiations. If the mining company must build the infrastructure in any case, while society would benefit

<sup>2</sup> Tax and Welfare Commission (2010)

<sup>3</sup> Ministry of Education and Research (2012)

from being able to use the same infrastructure, possibly in a modified form, the potential exists for a win-win situation. These kinds of possibilities may be present in the Isua Mine project. As Table 1 shows, the country would benefit from a container harbour in Nuuk, while London Mining will need a harbour in Nuuk to transport the extracted material to the market. This would appear to indicate an overlap.

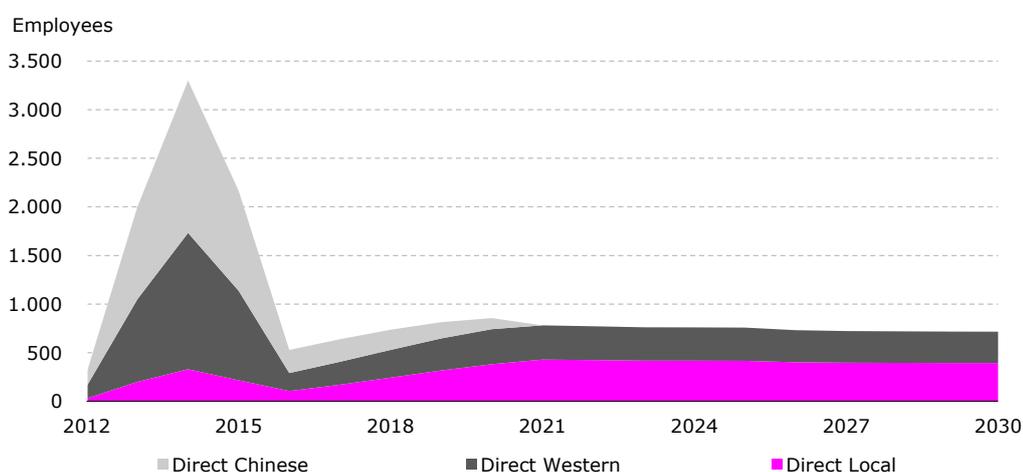
The fact that the opportunities to create win-win situations in the infrastructure area depend on the concrete situation is the reason why we indicated several possible sizes for the infrastructure column in Figure 1.

### Where the opportunities arise

*The second channel* goes via the areas that contribute to economic growth, and over which the mining companies exert an 'automatic' influence through their immediate presence – i.e. through their core activity, the extraction of raw materials. These areas are local employment, skills enhancement and outsourcing to local companies.

Immediately London Mining expects to employ up to 300 local people at the mine during the construction and operational phases, cf. Figure 2. During the construction phase this will be a very small share of total employment, while the proportion will increase as the project goes into operation.

**Figure 2 Direct employment, construction and operational phases**



Note: The figures are London Mining's estimates for employment, in accordance with figures from their SIA of July 2012 (London Mining 2012). See appendix A.2 for further details regarding assumptions, etc.

Source: London Mining (2012) and the authors' own calculations

In order to maximise the economic benefit, we find that it is very important that the mining companies take a proactive approach to outsourcing to local subcontractors. They must recruit staff to exclusively identify the outsourcing opportunities within the mining company, and then arrange contact and opportunities for local businesses, see Box 1. The proactive aspect also implies helping local companies to develop new business models, quality assurance procedures and management tools. This will enhance the quality and productivity of the business community and provide a basis for expansion, higher earnings

and socio-economic prosperity. (See also box.) In this area, the mining companies possess a comparative advantage in relation to the government.

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### **Box 1 Outsourcing at the Diavik Mine and the Hebron Project**

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In order to increase the likelihood that the Diavik Mine would meet its IBA target level of outsourcing to local companies, Rio Tinto, the group behind the Diavik Mine, chose an 'out of the box' approach. The company chose to hire a Business Development Manager – not a position which is normally required at a mining company. His job was to formalise Diavik's business policy, and then help the company to identify contract opportunities, after which he would help the northern/local businesses to make use of these opportunities.

Diavik also chose to use an innovative outsourcing approach which would help to build up the capacity of local enterprises. Instead of performing work on the mine using Diavik's own workforce, as usual, local contractors provided their own staff. The aim was to support local and native businesses.

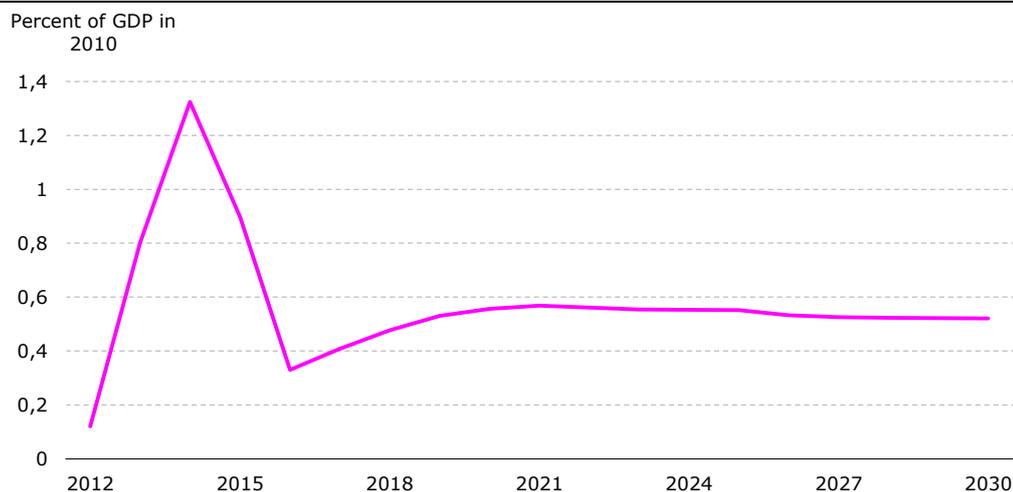
Another example is the Hebron oil extraction project, in which the company actively helped local subcontractor companies to optimise their business procedures, such as by implementing accounting systems, reporting systems, new processes and quality assurance systems. This kind of business development can make it possible for local companies to create a more profitable business, and to expand and develop the quality of their services.

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Source: Tom Hoefer (2004) and interviews with Hebron representative

It would be of great socio-economic importance if the mining companies could boost the productivity of their subcontractors through targeted, proactive involvement. On the basis of the information about the Isua Mine contained in the associated Social Impact Assessment (SIA), we have calculated the impact on the economy if London Mining could increase the productivity of its subcontractors by 10 percent through targeted professionalization and capacity building. This would increase earnings significantly for these companies and their employees during the operational phase, equivalent to just over 1/2 percent of GDP, cf. Figure 3.

**Figure 3 Effect on GDP of a productivity increase of 10 percent by local subcontractors**



Note: The productivity increase has been calculated as a rise of ten percent in the subcontractors' gross value added for the same consumption of inputs, labour and capital. See appendix A.2 for further details of assumptions. The subcontractors operate in the fields of construction, transport and business services, cf. the results presented in Copenhagen Economics (2011).

Source: Authors' calculations

We also find that the potential for local subcontractors to deliver in the construction phase is significant, with up to 1,000 employees. This is not a potential that can be harvested in the construction phase at the Isua Mine today, as the capacity is not present. London Mining itself estimates that there will be approximately 210-430 jobs for subcontractors.<sup>4</sup> This illustrates, however, that the potential of local involvement in the construction phase is considerable – and that the building-up of the professionalism and capacity of local companies should proceed with all possible speed, and should be proactively supported by London Mining, which has comparative advantages in this area.

The Isua project may also have important consequences for the opportunities of employees to exploit a larger part of the job potential in other future mining projects. This is one of the reasons why the proactive inclusion of local people and businesses must take place right from the construction phase. Skills built up during the construction phase at one mining project can be reused in the construction phase of the next mining project. There is thus synergy between mining projects. The development of local expertise, larger companies and increased earnings can be generated over time, and over several mining projects. Experience from mining projects in Northern Canada shows that some local companies can even develop such a strong expertise that it can be exported to mining projects elsewhere in the world. Proactive outsourcing can thus lay the foundation for a future export business.

We also find a strong correlation between the sought-after skills in the construction and operational phases; skills developed during the construction phase put local people and companies in a stronger position during the operational phase, cf. Table 2.

<sup>4</sup> London Mining (2012)

**Table 2 Comparison of job functions expected to be occupied by local people in the construction and operational phases, Isua Mine**

Operational phase	Construction phase
Medical staff	x
Kitchen staff	x
Laboratory technicians	
Secretaries	x
IT assistants	x
Training co-ordinators	
HR	x
Environmental technicians	
Professional health workers	x
Professional security staff	x
Drivers	x
Operators of excavators, trucks and bulldozers	x
Harbour tasks	x
Navigation support	

Note: The London Mining SIA specifies a range of job functions during the operational phase that are expected to be occupied by local employees. During the construction phase the focus is on outsourcing in contract packages, which is why the SIA does not have a similarly detailed description of job functions for this phase. In the table we have placed a cross if we assess that a given job function in the operational phase will also be present in the construction phase. For example, during the operational phase there is a need for the job function 'kitchen staff' (as stated explicitly in the SIA), while in the contract package for the construction phase there is a need for 'catering staff', cf. the SIA. We have therefore given the job function 'kitchen staff' a cross, as we consider that the contract package's need for catering staff also covers the job function 'kitchen staff'.

Source: London Mining (2012)

## 1.2 A good start with Impact and Benefit Agreements (IBAs)

The so-called Impact and Benefit Agreements (IBAs) are the key to getting off to a good start. An IBA is a contractual agreement between the authorities and the mining company. It contains concrete targets and actions for the mining company, with the aim of realising the boost in the country's economic prosperity that is enabled by the company's presence.

IBAs are designed to ensure that local people are the first choice for jobs and sub-contracting, and that outsourcing is proactive. The IBA that the owners behind the Hebron oil extraction project in Newfoundland and Labrador signed in 2008<sup>5</sup> states that external labour can be used in the construction phase only after the local workforce has been given an opportunity to bid for it.

This also means that local employees and subcontractors do not necessarily have to be 'competitive' with foreign suppliers in the traditional sense. Mining projects create an opportunity to *develop* the local business community. From a purely economic point of view, lower wages may be permitted for foreign workers as long as the mining company has first 'filled up' with local workers and local businesses at local wages. All of this must be included in the IBA.

<sup>5</sup> See <http://hebronproject.com/the-project/project-benefits.aspx>

Once the IBA has been adopted it must be followed up, and an authority should be able to assess whether the objectives of the IBA have been achieved, and how to deal with emerging opportunities and challenges. On the North Canadian model this could be done in various forums, with the government, the mining company, and relevant interest groups. Within the oil extraction field, a regulatory body (C-NLOPB)<sup>6</sup> has been set up in Canada to monitor and enforce the IBA and environmental and safety obligations. If there is a breach of agreements or obligations, the C-NLOPB can respond with actions, production halts, or, in the worst cases, even the cancellation of the agreement.<sup>7</sup> Something similar could be done in Greenland. Given the huge corporate tax potential from the Isua Mine, in excess of DKK 30 billion over 15 years, cf. London Mining (2012), it seems obvious that it must be possible to enforce the principles that affect the amount of tax payments in Greenland.

For us as a country to negotiate the best IBA agreements requires consensus on the objectives, and the ability to stand together and speak with one voice. The objectives are to secure the actions that the mining company can undertake to enhance the economic growth of our country as much as possible. This, amongst other things, is the focus of this report. The ability to stand together and speak with one voice is the process that leads to the government's negotiations with the mining companies. All else being equal, this ability will be strengthened if the government involves stakeholders to the greatest possible extent in the preparations for the negotiations.

### **1.3 The chicken and the egg**

The targeted inclusion of local people and businesses from the start involves a risk that mining companies may draw off employees and local businesses that are already in employment, with the result that overall unemployment does not fall, and net employment and value creation in the economy fail to increase. Moreover, increased demand for local labour and local services could lead to rising wages and prices throughout the country. This would increase the level of costs for all companies and erode the economic gains from the mining projects.

Accordingly, maximum economic benefit to society implies that the government must undertake reforms to increase the supply and mobility of labour in the country, for example through the restructuring of traditional industries, strengthen incentives to work, improve the possibility of matching job seekers with jobs right across the country, and ensure that foreign knowledge, labour and capital can easily access and be anchored in the country's business community and population. There is a need for many of the recommendations that the Government of Greenland presents in its recently-published 2025 plan.

There is thus a need for reforms to achieve maximum economic benefit, which should be the answer to the challenge of overheating, because all external demand of this magnitude, which is a prerequisite for being able to create a boost in the economy, will always lead to a risk of overheating. It is a chicken and egg situation: the local business community cannot absorb the increased demand, because it is not large or professional enough. But it is precisely in these areas that a mining company can strengthen the business community. The answer should thus never be to postpone exploiting the opportunities.

However, it is fortunately not the case that without reforms, there can be no gains. We assess that the country can reduce its structural unemployment through the increased demand for labour from mining companies. This would not normally be an expectation, but we believe it is possible in Greenland due to the current lack of employment opportunities. The fragmented labour market and poor employment

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<sup>6</sup> Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB).

<sup>7</sup> Bureau of Minerals and Petroleum (2012), p. 40.

opportunities in remote areas create high structural unemployment, as do the (relatively high) minimum wage levels, which make it less attractive for companies to move to a local community. This leads to an unnaturally high level of unemployment, and instances of more or less subsidised jobs. The lack of infrastructure amplifies the problem, as it limits the ability of people to seek work outside the local community.<sup>8</sup> In the end, with the prospect of rising unemployment and long periods of unemployment, people lose the will to seek jobs. This can cause unemployed people to lose their abilities and job-preparedness, with the result that they completely fall out of the labour force.<sup>9</sup> In this area the mining activities will bring new jobs, which will increase the work supply.

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<sup>8</sup> See Gibbons and Machin (2006) for a description of the importance of infrastructure to the labour market.

<sup>9</sup> This is called the 'discouraged worker' effect – see for example Ham Mulder Hooimeijer (2000).

## Chapter 2

# The potential of Isukasia

Mining projects affect the community around them and have implications for Greenlandic society as a whole. They can lead to economic, social, educational and cultural changes. The largest projects must therefore compile a Social Impact Assessment, or SIA. The SIA is the company's statement that the mining project is socially sustainable, and that it will contribute to Greenlandic society.<sup>10</sup>

In mid-August, London Mining Greenland A/S (London Mining) submitted an application for an exploitation licence for an iron mining project in the Isukasia area north of Nuuk Fjord (the Isua Project, or the Isua Mine) together with an SIA. In this chapter, we describe London Mining's assessment of the project's economic impact on the country, as described in the SIA. For this purpose, we make use of calculations which show the economic benefits that society can derive from a well-defined IBA agreement that utilises London Mining's comparative advantages in upgrading the skills of the local business community.

### 2.1 Direct employment

The Isua Mine can potentially increase the level of employment in Greenland (local employment) via three channels:

- Direct employment: Local employees at the mine
- Indirect employment: Additional employees at local subcontractors to whom the mine outsources, and at companies from whom these subcontractors therefore demand more goods and services
- Induced employment: The employment that arises in local companies that experience increased demand for their goods and services when direct and indirect employees spend their earnings in Greenland

Non-direct employment (both indirect and induced) is explained in Section 2.2 below, but we will first describe London Mining's expectations towards direct employment on the basis of the SIA.

#### Direct employment at the Isua Mine

London Mining expects that in the construction phase, the Isua Mine will require up to 3,000 workers in all construction disciplines, such as building, technical installations, erection of steel structures, electrical installations, concrete work, etc. Such a workforce, with the necessary qualifications, professional skills and experience, does not currently exist in Greenland. Local contractors will however be offered small service and construction packages at competitive prices, which will mean a local employment share of 7-10 percent during the construction phase.

In the operational phase (year 6-15), the total annual staffing is estimated at 680 people in the first five years, rising to 810 people during the remaining lifetime of the mine. London Mining estimates that the small population and the lack of local workers with experience in large-scale mining will mean that

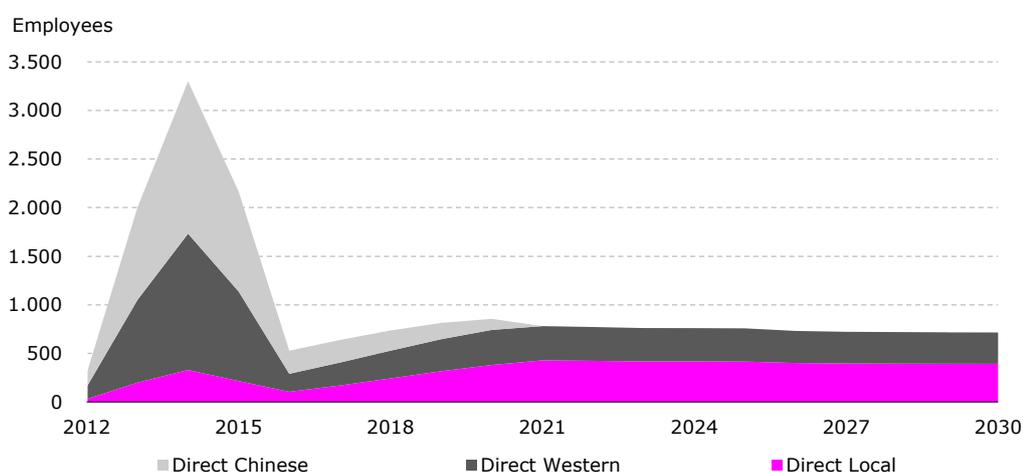
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<sup>10</sup> The assessment of social sustainability forms the background to and is followed up by an IBA Agreement (Impact and Benefit Agreement), which is a tripartite agreement between the Government of Greenland, the municipalities affected, and the company. The IBA agreement specifies how the positive and negative impacts of the project must be handled, and includes targets for the use of Greenlandic labour and the involvement of Greenlandic businesses (purchases of services and use of local technical operators and suppliers).

staffing in the first five years will consist of a combination of local people (20 per cent) and North American, European and Chinese (45 percent Chinese) employees.<sup>11</sup> Subsequently, the ongoing upgrading of the skills of the local workforce will mean that Greenlanders can constitute up to 55 percent of employees, while the remaining 45 percent will be drawn from Western countries (no specific year is mentioned for this distribution).

On the basis of this information from the SIA (London Mining (2012)), we have estimated the development and distribution of labour, as shown in Figure 4.<sup>12</sup>

**Figure 4 Direct employment, construction and operational phases**



Note: The figure is based on the following assumptions: Total employment in the construction phase (2012-2015) is as indicated in Table 9 in appendix A.1, of which 10 percent is Greenlandic labour, 42.5 percent Western, and 47.5 percent Chinese. In the operational phase, the number of employees accords with the London Mining employment estimates that we received in September 2011, but which are in line with the figures from the SIA of July 2012. In the first year of the operational phase, the share of local, Western and Chinese labour, respectively, is 20 percent, 35 percent, and 45 percent. Up to the sixth year of operations, these proportions develop linearly to 55 percent, 45 percent and 0 per cent, respectively, which is the distribution for the remainder of the mine's lifetime.

Source: London Mining (2012) and the authors' own calculations

A declared goal of both London Mining and the Government of Greenland is that the employees should be residents of Greenland, so that the employment and income growth generated by the project can accrue to the Greenlandic population. Box 2 summarises the initiatives that London Mining mentions in the SIA to ensure the use of as high a proportion of local labour as possible.

<sup>11</sup> All foreign and local employees will stay in permanent camps during their stay at the site. This accommodation, together with meals, safety gear, laundry and transportation to and from the workers' homes will be made available free of charge to the workers, who will work in shifts.

<sup>12</sup> It has not been possible for us to gain access to the Banking Feasibility Study which underlies the results for London Mining (2012).

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## Box 2 London Mining's active efforts to maximize the proportion of local labour

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London Mining will gradually replace Chinese operators, workers and supervisors with local staff. To achieve this, applications will be made for help from the government and the public employment centres in identifying and attracting the best candidates. The principal goal is to employ as many qualified local candidates as possible who have at least completed a specified educational requirement, and who have demonstrated the ability to learn and meet other specific selection criteria.

London Mining will make use of the following initiatives to maximize the proportion of local workers:

- Early implementation of an HR department (when planning permission is granted), which will be dedicated to implementing recruitment campaigns and facilitating contact with candidates in Greenland. This may initially be supported by a locally-based headhunting or human resources company.
- Development of a recruitment campaign aimed at Greenlanders who currently live in Denmark. Although Greenlanders in Denmark read Greenlandic newspapers, use the Internet and are informed concerning job opportunities, it may be advantageous to provide additional information or conduct interviews in Denmark.
- Preparation of a detailed job description for each position and the requirements it involves.
- Proactive and early communication with trade unions, professional organisations and local job centres concerning the basic requirements to be met by applicants for jobs at Isua, so that they can enhance the qualifications of employees and clients interested in working there.
- Discussion of the possibility of adapting basic courses and extended courses in the curriculum of the Greenland School of Minerals and Petroleum and ARTEK, so that their courses will match the Isua project and the needs of other highly-mechanised mining operations, and thereby improve the employability of graduates.
- In order to retain the local labour force, it is recommended that Greenlandic-speaking HR staff are employed, who will also have a role in advising the workers on developing personal and group-based strategies to resolve conflicts and overcome difficulties in adapting to the conditions of working life.

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Source: London Mining (2012)

### Reactions on the labour market

Even if it proves possible to secure the local workforce up to half of the positions available during the operational phase, corresponding to almost 450 jobs, it does not necessarily mean that revenues equal to 450 extra jobs will be created. This would be the case if some of the jobs are filled by people who were previously employed, and whose previous positions would thereby fall vacant.

The specialized and highly productive local jobs at the mine will probably be filled by persons who are already in employment. In this context, what happens to the previous jobs of these people is crucial. If, for example, an engineer is employed at the mine, and his former position is filled by another engineer who was also previously in employment, it is also relevant to consider whether the latter's former position will also be refilled, etc. The crucial factor in this chain of job changes is whether there will eventually be one more person in employment elsewhere in the economy when one more person is employed at the Isua Mine. In this case, overall employment will be increased by one person.

If the engineer's position is not refilled, the total number of jobs will remain unchanged, but there may still be an effect on the overall economy – namely to the extent that the job at the Isua Mine delivers higher productivity and is thus better paid than the previous job.

It is thus difficult, especially in the short term, to assess whether employment will increase, and if so where the labour will come from. It depends, amongst other things, on the response of the population to the project and on the labour market policy practised. In the longer term the supply of employment is more flexible, as it can be affected by upgrading, activation, etc. Increased employment may in the long run also especially be realised by a reduction in the number of people on public benefits as a result of the Isua Project and the opportunities that thereby arise. If it proves hard to get people who are for example on anticipatory pensions into jobs, the focus must be on encouraging the young – who otherwise risk becoming recipients of early retirement benefits, public assistance, etc. – to instead take up employment. Consequently, the application of an appropriate labour market policy, including skills enhancement, is already vital today if the country is to obtain maximum benefit from the project.

## 2.2 Indirect and induced employment

In addition to direct employment, the Isua Project will also create indirect and induced activity and employment in the economy.

### Indirect employment

Indirect employment will arise to the extent that the project demands subcontractors from the local business community, thereby creating new jobs. This outsourcing of tasks to local businesses will give rise to additional indirect employment at their subcontractors (not to be confused with the induced effect).

London Mining itself identifies a number of tasks in the Isua Project, during both the construction and operational phases, which could be outsourced and thereby create opportunities for local businesses:

- Drilling, logistical support, on-site monitoring, geological surveys and helicopter support during the construction phase
- Construction of permanent camps, camp services and pre-stripping
- Waste management
- Air transport in the construction and operational phases
- Boat transport of workers during the construction phase. Boat and/or air transport of mining employees during the operational phase
- Helicopter support
- Demand for food and other goods, especially local meat and fish products
- Camp logistics and support functions: catering, leisure services, laundry, cleaning, translation, legal services, building maintenance, etc.
- Residences and accommodation services for temporary and permanent staff in Nuuk, incl. taxis, restaurants, etc.

In the SIA, London Mining proposes a number of initiatives to maximize local business opportunities, cf. Box 3, but the company stresses that the final impact on the local economy will be determined by the ability of local companies to respond to the opportunities and provide timely services and products in the desired quality and at competitive prices.

Finally, indirect employment also encompasses jobs created in the public administration through research and analytical work prior to the project, and supervision during the project. As there have not previously been projects in Greenland on the same scale, this employment will comprise a large share of the total indirect employment.

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**Box 3 London Mining's initiatives to maximize local business opportunities**

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London Mining will maximize local business opportunities through a series of initiatives, but only on condition that these measures are economically sustainable and do not negatively affect the company's overall contractual costs. London Mining will:

- maintain a close dialogue and secure continuous updates with the municipal and national authorities on the progress and plans of the project, and as accurately as possible define the project's requirements and timing during construction
- keep GA regularly informed about upcoming opportunities and discuss solutions and alternatives to the potential challenges of local companies in gaining access to business opportunities in the construction and operational phases
- develop a strategy for corporate social responsibility and an implementation plan for the project, in order to increase the proportion of local content
- monitor indicators of business volume and type, and incorporate these into the company's annual report. It is also recommended that the reporting procedures of the Global Compact or special guidelines for the mining industry be followed
- ensure that the opportunities to purchase local goods and services for mining camp operations, including in communications, logistics and support functions, are exercised when these are competitive
- inform the Tourist Board and the municipality regarding the anticipated annual requirements for hotels and temporary housing
- ensure opportunities and flexibility for catering suppliers in the supply of local food
- enter into arrangements with the professional hunters in Kapisillit and Nuuk for the supply of Greenlandic food for the canteen and camp in general.

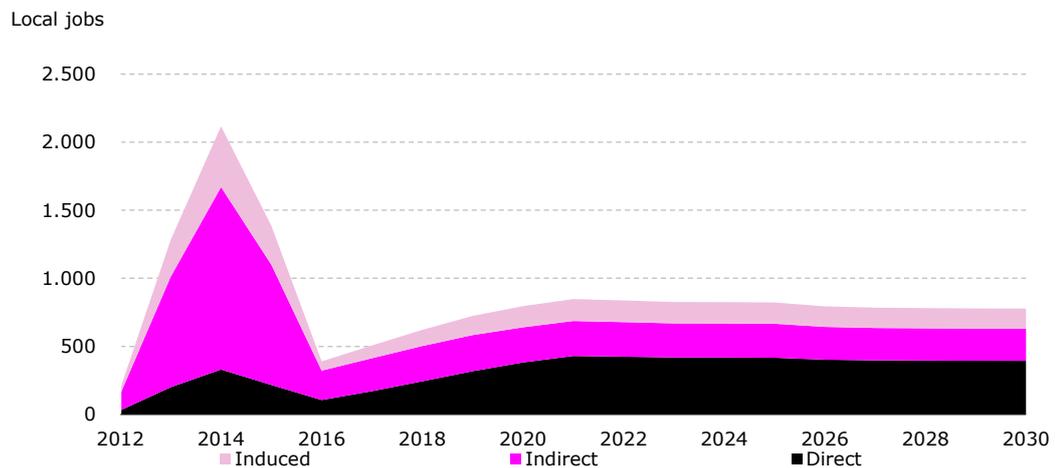
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Source: London Mining (2012)

If London Mining manages to increase production capacity among local businesses through active efforts towards the business community combined with aggressive outsourcing, then the local employment opportunities are significant. We have calculated the potential for indirect employment – i.e. the employment generated among subcontractors and their own subcontractors – at up to 1,300 jobs during construction and 250 during operations. See Figure 5.

**Induced employment**

In addition to the indirect employment effect, there is also an induced effect, in as much as the directly and indirectly affected consumers spend their earnings in Greenland. This creates jobs, and eventually revenue to the Treasury. We find that the potential for induced jobs in the economy is somewhat less than the potential for indirectly engendered jobs – up to 430 during construction and 150 during operations. See Figure 5.

**Figure 5 Potential for local employment**

Note: See appendix A.2 for a description of the calculations.

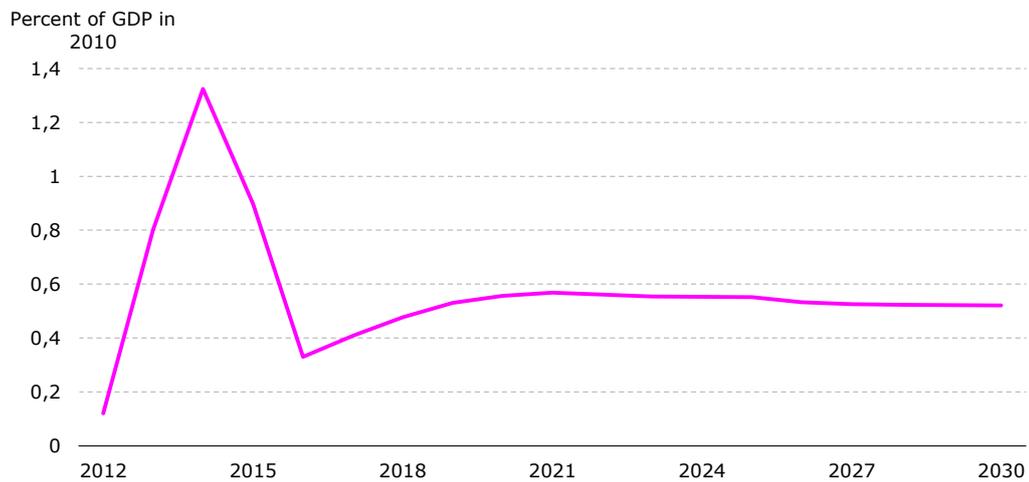
Source: Authors' calculations

It is currently unrealistic to expect there would be sufficient capacity in the local business community to fill up to 2,000 jobs during the construction phase. The point is not to estimate a 'realistic' number of jobs, but merely to demonstrate that the potential of the construction phase is significant, and that the building-up of the professionalism and capacity of local companies should proceed with all possible speed, and should be proactively supported by London Mining, which has comparative advantages in this area. The potential also shows that the Isua Project may have important consequences for the opportunities of the company to exploit a larger part of this job potential in other future mining projects.

At the same time that proactive outsourcing can provide a basis for local companies to grow their businesses, it will also have a positive effect on their productivity. A boost in the productivity of the local business community will have a considerable positive effect on the national economy. An increase of 10 percent in productivity in those businesses which we assess will play the largest role as subcontractors<sup>13</sup> would increase GDP by more than 1/2 percent in the long term (during the operational lifetime of the Isua Mine). See Figure 6.

<sup>13</sup> These are: building and construction, transportation and business services. The results are presented in Copenhagen Economics (2011) for the Government of Greenland.

**Figure 6 Effect on GDP of a productivity increase of 10 percent among local subcontractors**

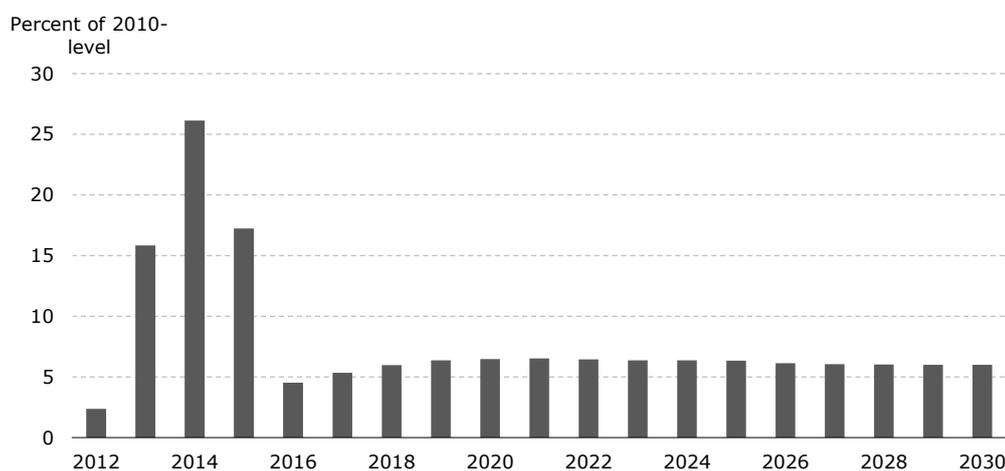


Note: The productivity increase has been calculated as a rise of ten percent in the subcontractors' gross value added for the same consumption of inputs, labour and capital. See appendix for further details of assumptions, etc. The subcontractors operate in the fields of construction, transport and business services, cf. the results presented in Copenhagen Economics (2011).

Source: Authors' calculations

### 2.3 Effect on GDP and public finances

The increase in employment will lead to increased value creation (GDP) in the economy. On the basis of the above potentials for overall direct, indirect and induced employment, the mine can be expected to increase national GDP by about six percent over time. In the short term, during the construction phase, the contribution of the investments in the mine will result in a very high GDP.

**Figure 7 Effect of the Isua Mine on GDP**

Note: On the expenditure side, GDP consists of private sector consumption, public sector consumption and investment, minus net exports. See appendix A.2 for further details of assumptions.

Source: Authors' calculations

### Public sector spending

The Isua Project will place great demands on public sector investments, including in infrastructure and housing. At the same time, initiatives in educational policy and labour policy will in the short term be costly. In addition, there will be increased costs in building up the government's capacity to manage the project, and there may be costs associated with supervision of the mining company and other expenses for official processing. According to Greenland's Economic Council (2012), the immediate impact on the expenditure side will necessarily be greater than the corresponding improvement in revenue. This would also be the case without direct government involvement in the large-scale projects. Public finances will therefore be strained in the short term, which will demand tight control of expenditure.

### Public sector revenue

Public finances could potentially be improved by the Isua Mine. In addition to inducing higher income tax revenues and lower public spending on transfers, the project will affect public revenue through corporate taxes and charges.

Direct revenue to the Treasury derives from corporate taxation and personal income taxes, of which corporate taxation is by far the source with the greatest potential. See Table 3.

**Table 3 The contribution of the Isua Project to the Treasury (DKK bn)**

Corporate taxes and charges	28.5
Income tax of staff	3.8
<b>Total</b>	<b>32.3</b>

Note: The table shows London Mining's own estimates of direct revenue to the Treasury, calculated on the basis of the current 15-year lifetime assessment of the Isua Mine. The mine life may be extended by a further 15 years, up to 30 years, if additional reserves are found in the mine. This further prospecting will be carried out during the construction phase and the operation of the mine.

Source: London Mining (2012)

London Mining reports the expected contribution to the Treasury from corporate taxation and charges on the basis of SNC-Lavalin's Banking Feasibility Study of March 2012. Here, the total revenue is calculated at DKK 28.5 billion over a lifetime of 15 years. It has not been possible to obtain documentation of this estimate, but it may be added that it is generally very difficult to calculate both the magnitude and the chronological profile of corporate taxes, as the mine's taxable income depends on many uncertain parameters, including future iron prices, dollar exchange rates and construction costs.

London Mining estimates the project's total personal income tax base to be DKK 12.34 billion  $\pm$  10 per cent. The income tax rate is 42 percent in Sermersooq Municipality and 37 percent in areas outside the municipal classification. The personal allowance is DKK 58,000. People employed in the mining industry who have not been liable to pay taxes in Greenland for six months prior to their appointment are taxed at 35 percent on any income relating to the project, with the exception of contributions to approved Greenlandic and Danish pension funds.

On the basis of this data, London Mining estimates that the total contribution to the economy from income taxes will amount to around DKK 3.8 billion throughout the lifetime of the project, broken down as in Table 4.

**Table 4 Revenue from income taxes, DKK mill.**

Construction phase (2012-2015)	278
Operational phase (2015-2030)	
Local labour	1,595
Foreign labour	1,876
<b>Total</b>	<b>3,778</b>

Note: See the appendix for a further breakdown of income tax revenues.

Source: London Mining (2012)

As a final benefit to the public sector, an improvement in public finances today would also provide an additional contribution to the Treasury in the future, in the form of a drop in interest expenditure.

## Chapter 3

# Strengths and opportunities

The mining companies can also contribute to the country's economic wealth in ways other than through employment, outsourcing and tax payments, which we examined in the last chapter.

This will be the case if companies can contribute in other respects to those areas of the economy which are important for creating wealth. These include the economy's comparative advantages, potential growth industries and areas that are important for economic growth, and in which the country is lagging behind. If the mining companies can help to strengthen these areas, it will significantly increase the country's economic wealth.

In this chapter, we will analyse the economy's comparative advantages and two potential growth industries, namely fishing and tourism. We will moreover identify the areas in which the country is lagging behind, and which are also important areas for economic growth. We find these to be infrastructure and education. In this chapter, we will thus examine whether, through their activities, the mining companies can play a role in enhancing the economic growth of the country by strengthening:

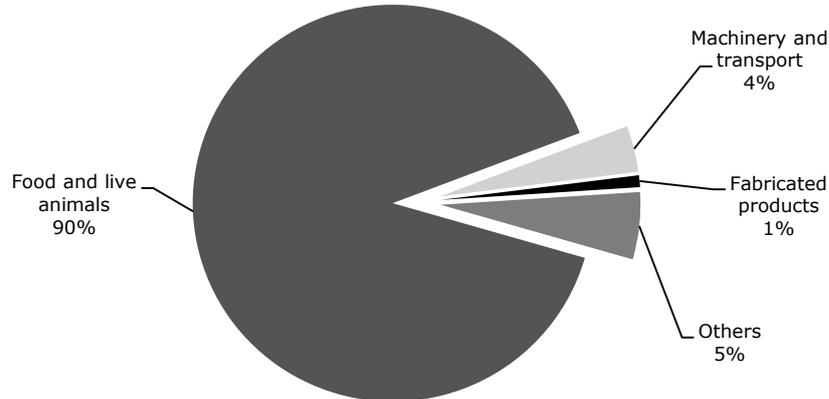
- Fishing
- Tourism
- Infrastructure
- Education

### 3.1 Fishing

Fishing is Greenland's most important industry in terms of foreign earnings, and in 2010 fish and food products accounted for 90 percent of the value of the country's total exports.<sup>14</sup>

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<sup>14</sup> Statistics Greenland

**Figure 8 Composition of the value of exports in 2010**

Source: Statistics database, Statistics Greenland

The fishing industry is of great importance to Greenland's economy, and employed 1,237 people in 2010, 68% of whom were unskilled.

There will be a need for structural adjustments if sustainable economic development is to be secured in the future. The challenges to fishing include the fact that a large part of the coastal prawn fleet can no longer generate a profit due to high unit costs and high maintenance costs. Current conditions are not favourable for the coastal prawn fishing fleet to reinvest in new vessels.<sup>15</sup> In addition, the coastal fishing fleet is in general too large and lacking in coherence, with increasing overcapacity in some on-shore plants, while there are shortages elsewhere. Overall, there are thus structural problems that must be solved in the fishing industry if the industry's growth potential is to be fully exploited in the future.

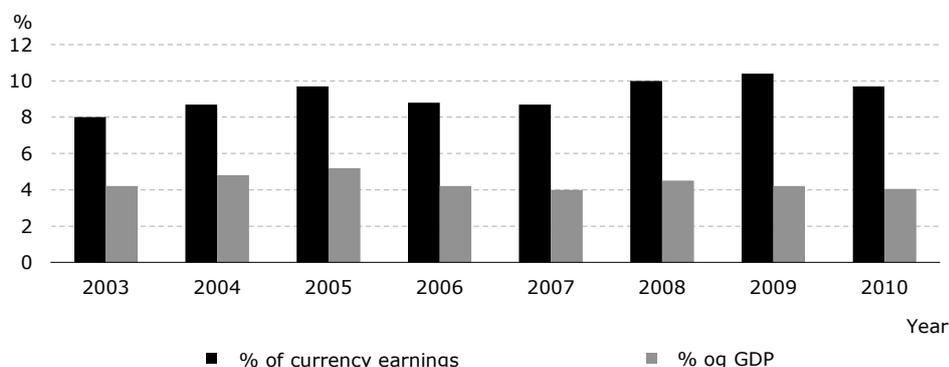
We do not believe that the mining companies, through their activities, are likely to contribute to any structural adjustments in the fishing industry.

### 3.2 Tourism

The tourism/experience industry has been identified as a significant growth area in Greenland in the coming years. Progress has been particularly significant in cruise tourism, trophy hunting and business tourism. In 2010, tourism represented about 10% of the country's total foreign exchange earnings, and around 4% of its GDP – see figure below.<sup>16</sup>

<sup>15</sup> Tax and Welfare Commission (2010)

<sup>16</sup> Ministry for Industry and Mineral Resources (2012)

**Figure 9 Assessment of the national economic importance of tourism**

Source: Ministry for Industry and Mineral Resources (2012)

Greenland has also had a stable balance of payments surplus in tourism of DKK 100 million annually.<sup>17</sup> It would be attractive and financially advantageous to secure the further development of this growth industry. The objective of the Government of Greenland is also to secure economically, socially and environmentally sustainable growth in the tourism and experience industry. The goal is that by 2020, this area will constitute a significant part of Greenland's export earnings. The government has also set out strategic objectives for the sector which, over the next five years, should lead to growth of 5 per cent, including a 5 per cent rise in employment in the industry.

Continued growth depends on the creation of skills enhancement possibilities that support the industry's objectives; otherwise, the jobs will go to unskilled workers from outside Greenland. According to Visit Greenland, employment in tourism is especially associated with large, well-established and professional players in the hotel, restaurant and transport industries, who can exploit and extend the season while increasing their earnings on individual products. Close co-operation with the well-established companies will therefore be important when attempts are made to increase employment in tourism.

Service jobs in tourism often do not require any formal education or training, but make significant demands on personal skills. Consequently, Visit Greenland proposes that training should be combined with practical work experience at the companies.

However, the tourism industry still faces significant challenges, including transport possibilities and the large seasonal fluctuations in activity. There are only four places in the country that enjoy a significant level of tourist activity throughout the year: naturally enough the country's capital Nuuk, and in Ilulissat, the main transportation gateway Kangerlussuaq, and East Greenland.<sup>18</sup> Infrastructure has in this connection considerable significance for the length of the industry's season.

### Summary

Tourism has been selected as a potential growth industry. We do not, however, assess that mining activities as such will have an impact on the tourism and experience industry. However, the mining companies can benefit tourism through the establishment of new infrastructure. The mining companies will often need to construct new infrastructure, and if this can be used by stakeholders in the tourism

<sup>17</sup> Ministry for Industry and Mineral Resources (2012)

<sup>18</sup> Tax and Welfare Commission (2010)

industry in a way that benefits their service, the mining companies' activities will have a beneficial effect on growth in the tourism sector.

### **3.3 Infrastructure**

A well-functioning infrastructure is important for all; residents, visitors, students, mobile labour, and so on. All business is dependent on the country's infrastructure being coherent and efficient, to avoid wasting time that could be put to better use.

A well-functioning infrastructure and good accessibility also contribute to the development of prosperity by increasing the size of markets for companies, reducing transportation costs and improving the regularity of deliveries and transport. By creating flexibility for the individual and for the labour market in general, a good infrastructure also strengthens the competitiveness of businesses. There is therefore a mutual dependency between business development and the traffic infrastructure. Businesses demand transport services, both in relation to supplies of raw materials, etc., and in connection with the sale of their production.

In general, a coherent and effective infrastructure is crucial to the growth and attractiveness of society, see Box 4.

## Box 4 Infrastructure is important for economic growth

Empirical studies show that investments in infrastructure can bring about a long-term positive effect on a country's production, productivity and rate of economic growth. This applies in particular to infrastructure such as roads, energy and telecommunications, which have a significant positive impact on a country's economic development. Studies show, for example, that African countries, on average, could increase their economic growth by 2.2 % a year if they achieved the same level and quality of infrastructure as Africa's leading country in this area, Mauritius (the leading developing country). Moreover, some African countries have missed out on significant growth opportunities due to a poor level of infrastructure. One example is the African developing country of Mali, which in the period 1996-2000 could have achieved a growth rate 1.79 percentage points higher per capita than was actually the case if it had had the same level of infrastructure as South Korea during the same period, see table below.

**Table 5 Anticipated contribution to economic growth, selected developing countries**

Country	Actual growth per capita (1996-2000)	Percentage rise in potential growth rate per capita	Potential growth rate for same period (1996-2000)
Botswana	5.32%	0.6	5.92%
Burkina Faso	0.59%	1.59	2.18%
Mali	-0.03 %	1.79	1.76%
Rwanda	-0.12 %	1.23	1.11%
Uganda	1.29%	1.16	2.45%
<b>Average for 21 African countries</b>	<b>0.07%</b>	<b>1.04</b>	<b>1.11%</b>

Note: The table illustrates the potential economic growth opportunities that selected African countries would have had if their starting-point had been the same quantity and quality of infrastructure as South Korea possessed during the same period (1996-2000).

Source: UN-HABITAT (2011)

Investment in infrastructure thus leads to more and better economic growth, which in turn leads to more investment in infrastructure. In this way, economic growth and the level of investment in infrastructure exert a mutually positive effect. UN-HABITAT has identified the following main channels by which investment in infrastructure can bring about sustainable economic growth for a developing country:

- Reduction of transaction costs, facilitating trade within and across national borders and between small autonomous communities.
- Individuals, businesses and the public sector become better at responding to new forms of demand, both geographically and, for example, technologically.
- Input factor costs are reduced, making it easier to enter the market as a new entrepreneur, and in the same way, existing businesses become more profitable.
- In the actual start-up phase in the development of infrastructure, jobs are mainly created in the construction sector and related industries. Some long-term jobs are also created, as investment in infrastructure require maintenance.
- Improved access to schools and hospitals promotes human capital in both health and education terms.
- Improved environmental conditions and living conditions.

The positive correlation between economic growth and the quantity and quality of infrastructure is strongest in roads, energy and telecommunications.

Source: UN-HABITAT (2011), International Finance Cooperation (2002)

Besides traffic infrastructure, IT and communication technologies also have a positive impact on a country's economic growth. Improvements in information and communication technologies in Arctic countries can exert an influence on many areas, including health and education.<sup>19</sup>

- **Telehealth:** Satellite communications have been a determining factor in the growth of telemedicine – i.e. the delivery of medical services to remote communities, e.g. the transmission of health information over both short and long distances. This may be something as simple as a phone call between health professionals, or the more advanced use of satellite technology in surgery.
- **Education:** Investment in information and communication technology opens up a wide range of possibilities in education (and, as assessed, education in Greenland is an area in need of many improvements). Video conferencing makes it possible for specialists in other countries to teach the local population. In "The University of the Arctic", for example, a network of universities in the northern Arctic makes use of telecommunications technology to teach students in the Arctic Circle area. The Internet also enables general knowledge-sharing.
- **Company activities:** Improved possibilities for communication with business contacts.

Greenland is already well positioned to create value through modern communications technology. South and West Greenland are linked to the outside world via the modern fibre optic undersea cable "Greenland Connect" cable, which extends from Nuuk and Qaqortoq to Canada and Iceland, and from there to the rest of the world: in all, a 4,598 km long fibre optic link. With a response time of just 23 milliseconds, it is one of the fastest communications routes across the Atlantic.

Traffic infrastructure is also an area of importance to Greenlandic society and its development. The Greenlandic market is generally characterised by many small local markets centred around towns and villages, as transport between these areas can only be undertaken by aircraft or helicopter, or by sea. There are thus no road traffic links between the towns. This special structure of the country's infrastructure limits economic development and the length of the tourist season, and is in this context an important parameter in relation to securing sustainable growth. The low level of infrastructure has in its simplicity an impact on the potential for future economic growth.<sup>20</sup>

The mining companies will need to implement infrastructural investments. The table below provides a summary of the options for mining activities where a licence has either been issued, or there is a high probability that one will shortly be applied for.

**Table 6 Potential mining activities in Greenland and infrastructure**

Activity	Operator and licence type	Need for own harbour	Need for own airport	Population centre in the vicinity	Anticipated construction phase and labour needs	Anticipated operational phase and labour needs	Camp
Lead and zinc, Maarmorilik, expires 2037	Black Angel Mining A/S, EL	Yes	Yes	Qaarsut (airport) Uummannaq (harbour)	2012, 30-50	2012, approx. 110	Yes
Molybdenum, Malmbjerget, expires 2038	Malmbjerget Molybdenum A/S, EL	Yes	Yes	Illoqqortoormiut	Construction phase expected from 2014	Expected 2017, approx. 400	Yes
Rare earths,	Hudson	Not yet	Not yet	Kangerlussuaq	Awaiting	Possibly (400-	Camp

<sup>19</sup> Infoseries, "The Arctic: Transportation, infrastructure and communications"

<sup>20</sup> Transport Commission (2011)

Kangerlussuaq	Resources Inc., EP	decided	decided	(West Greenland)	political decision due to ban	500)	expected
Zirconium and eudialyte, Kringlerne	Rimbal Pty Ltd., EP	Yes	Not yet decided	Narsaq Qaqortoq	Application in 2011	Possibly 2015, approx. 80	Not yet decided
Rare earths, Kvanefjeldet	Greenland Minerals & Energy A/S, EP	Yes, under the current plan	Probably heliport	Narsaq Qaqortoq	Awaiting political decision due to ban	Possibly 400-600	Camp expected
Lead and zinc, Citronenfjorden	Ironbark Zinc Limited, EP	Yes	Yes	Station Nord	24-35 needed in 2010, more if operations begin	Approx. 200-300	Camp established
Rubies and sapphires, Fiskensæsset	True North Gems Inc., EP	Yes	Possibly	Qeqertarsuatsiaat	2011, 30-50	2012-2013, approx. 30	Yes
Gold and palladium, Skærgårds-intrusion	Platina Resources Ltd., EP	Yes	Yes	500 km to Tasiilaq and Illoqqortoormiit (East Greenland)	Poss. 2014-2016, 500-1000	2016, 400-500	Yes
Iron, Isukasia (Isua)	London Mining Greenland A/S, EP	Yes	Not yet determined	Kapisillit, Nuuk	Expected EL, late 2011	Approx. 500 from 2015	Yes
Gold, Nalunaq, expires 2033	Angel Mining A/S EL	Yes	No	Nanortalik	In progress	In progress, approx. 60 persons	Yes

Note: EL = Exploitation Licence, EP = Exploration Permit

Source: Transport Commission (2011)

Future mining activity may bring about massive investments in infrastructure, cf. the above table. These investments, however, will not necessarily support the needs of society. Table 7 compares the deliberations of the Transport Commission on profitable infrastructure investments with potential mining projects. The table provides a picture of opportunities, as many mining activities imply the need for appropriate infrastructure.

**Table 7 Infrastructure considerations of the Transport Commission, compared with possible mining projects**

Project	Transport Commission's assessment of the project	Anticipated mining activity in nearby area	Mining company and specific infrastructure needs that match the Transport Commission's recommended projects
Atlantic airport in Kangerlussuaq or Nuuk: - Kangerlussuaq with 1,199 m in Nuuk Nuuk, - 2,200 m with shut-down of Kangerlussuaq	A decision on the relocation of the country's central airport from Kangerlussuaq should be postponed, pending the results of the recommended turbulence study.	Kapisillit, Nuuk Qeqertarsuatsiaat	London Mining. No
Airport in Qaqortoq	For 1,199 m runway, it is recommended that the airport be moved from Narsarsuaq	Narsaq, Qaqortoq	Rimbal Pty Ltd. (need for airport not yet decided) Greenland Minerals & Energy A/S (probably a heliport)
Container harbour in Nuuk	The present value and internal rate of return are probably underestimated. The benefits of more efficient shipping logistics could be as high as DKK 67 million. It is recommended that a new harbour be constructed.	Kapisillit, Nuuk	London Mining A/S has the use of the harbour under construction. Not however intended for immediate use by others, inter alia for safety reasons.
Airport extension in Iluliassat	With a 1,199 m runway	Quaarsut	Black Angel Mining A/S (own airport and heliport at mine)
Airport in Qaqortoq	A relocation of the airport from Kulusuk to Tasiilaq would be socio-economically worthwhile	500 km to Tasiilaq and Illoqqortoormiut	Platina Resources Ltd. (own airport)
Airport in Ittoqqortoormiit	The basis exists to build a new airport in Ittoqqortoormiit and close the current airport in Nerlerit Innat.	Illoqqortoormiut	Malmbjerget Molybdenum A/S (own airport)
Closure of the airport in Qaanaaq	It is recommended that the airport in Qaanaaq be closed as soon as possible.		
Road between Sisimiut and Kangerlussuaq	From a socio-economic perspective, it is not realistic to build the considered road (with or without the preservation of Sisimiut Airport)	Kangerlussuaq	Hudson Resources Inc. (Need not yet determined)
Road links in South Greenland	It is not realistic from a socio-economic perspective to build a road link between the airport at Narsuaq and Qaqortoq, and this cannot provide an alternative to relocating the airport from Narsuaq to Qaqortoq.		
Internal passenger transport in South Greenland	Service in South Greenland, unless boat services in the period with no field ice/firm ice are associated with socio-economic benefits, rather than a helicopter-based system throughout the year. The safety issues have however not been evaluated.	Nanortalik	Angel Mining A/S (own harbour)
Combined road and boat connection link between Qaqortoq and Narsaq	It is recommended that if the airport is moved from Narsuaq to Qaqortoq, the combined road and boat link between these two towns should also be established, regardless of where the airport at Qaqortoq may be located.		
Combined road and boat link between Qaqortoq and Uummannaq	Boats should be placed in service to replace helicopter passenger transport during the summer.	Quaarsut, Uummannaq	Black Angel Mining A/S (own harbour)

Note: The summary includes only the most likely projects, which can be completed with an economic viability analysis and a specific recommendation from the Commission on whether to proceed with or terminate the project work on the existing basis. The stated figures for NPV and IRR include tourism effects.

Source: Transport Commission (2011)

At the present moment, the concrete possibilities are however uncertain. In practice, many details in connection with a mining company's infrastructure investments will have to match local needs if they are to benefit the local community. The Transport Commission describes the challenge as follows:

*"If the economic exploitation of mineral deposits, etc., which lie at a considerable distance from current centres of population requires the construction of new airports and/or harbours, it is generally unlikely that such mining activities will have a decisive influence on the decisions on infrastructure investments that must otherwise be taken. Unless, for example, it proves optimal to establish a link to the mine from the nearest airport, it is not decisive where this air link is established – probably from the country's main airport, wherever this is located... "*

Transport Commission (2011)

### Summary

The financing of infrastructure need not necessarily be a public task. Greenland has an opportunity to take advantage of private initiatives from the mining companies in relation to specific transportation investments. If the mining companies establish an infrastructure that can be used by other companies, and which it is profitable for these companies to use, then the mining companies can contribute to economic growth through this infrastructure channel. Investments which support the recommendations of the Transport Commission are likely to create the greatest socio-economic growth. If we look specifically at the London Mining's plans to invest in infrastructure, we do not immediately expect that these will significantly support the growth of local industry.

## 3.4 Education

A well-educated workforce is a prerequisite for prosperity and growth. Education is however an area that contains a variety of issues which will need to be improved and resolved if our society is to secure sustainable development in the future.<sup>21</sup> These issues are particularly applicable in the preschool, primary and vocational education areas.

In Greenland today, the preschool area is dominated by an excessive proportion of workers in kindergartens who lack the correct training or the educational qualifications required to ensure that all children can be given the necessary opportunities for development and learning. As a result, the current staffing in the preschool area cannot meet the minimum requirements for development and learning.<sup>22</sup> The supply of trained kindergarten staff is simply too low.

The shortage of trained kindergarten staff inhibits the possibility of enhancing children's development at an early and crucial stage. Educational tools are considered to be very important in terms of stimulating children's language and learning, and early intervention in the preschool period will also help to alleviate later behavioural problems such as crime, addiction, etc.<sup>23</sup> This will increase the welfare of society as a whole, as well as being directly beneficial to the individual. The benefits of early intervention in the preschool areas are therefore estimated to be in the region of 10 per cent of GDP per year. It is thus extremely worthwhile to invest in the preschool area.

To achieve the greatest possible gains throughout the entire education system and secure a solid improvement in educational qualifications among the population, the investments should begin right from the preschool stage.

<sup>21</sup> Department of the Prime Minister (2011)

<sup>22</sup> Parliamentary Regulation no. 22 on staffing, and Opinion & the Government of Greenland (2012)

<sup>23</sup> Ministry of Education and Research (2012)

One of the principal areas of Greenland's regional development strategy is "*Focused efforts in primary schools*", as primary schooling is a crucial foundation for further educational efforts, and ultimately, for the overall development of society.<sup>24</sup> In 2003 the primary schools were reformed, and the first pupils who attended classes in the "good school" from first grade will not leave school until 2013.<sup>25</sup> For this reason, the overall effect is not yet known.

The current situation is inadequate. In 2009, approximately 30 per cent of Greenlandic primary school pupils had a failing grade in Danish and English. The leaving examinations clearly show that many students have problems in the language subjects. At the same time, 58 per cent of the pupils who left primary school in 2010 were rated as academically poor (48 per cent) or very weak (10 per cent). There is also a strong positive correlation between pupil-teacher ratios and the average grade achieved by the students (80% correlation). The vast majority of trained teachers work in the urban schools, which results in insufficient skills among pupils in village schools, relative to urban schools.<sup>26</sup>

On the basis of the current situation, it is clear that there are major problems in connection with language learning, which is also an important parameter in relation to the optimum utilisation of the resources and opportunities that the business community, including the mining sector, has to offer. Poor language skills are thus a major problem in relation to further studies in the educational system and the exploitation of the activities of the large-scale projects in Greenland.

It is not only at primary school level that there is a need for educational improvements; this also applies at higher levels in the education system, where the lack of a skilled workforce affects several industrial sectors in Greenland, particularly construction and mining.<sup>27</sup> The building and construction sector covers three industries: construction workers, electrical and plumbing, and building contractors. In 2008, it was estimated that there was a shortage of 520 skilled workers in these industries, which employ a total of around 3,500 people. The lack of skilled manpower in this sector will only be exacerbated in the case of increased activity by foreign mining companies.

As a result of the lack of skilled labour in the construction industry, a mismatch may arise between the labour supply in the Greenlandic labour and the labour demand produced by mining activities. This mismatch is due to a lack of education and skills in the workforce, despite the fact that the basic requirements for work in the mining sector are very similar to the requirements found in other industries: good primary education, good social skills and a good work culture in terms of punctuality, professionalism, stability and the like.<sup>28</sup>

It is furthermore essential for knowledge-sharing that all employees master English, as the special training programmes in this sector will be drawn from abroad. As a result of the lack of skilled labour, and a basic level of education that is lower than the requirements, it will be difficult to find sufficient local workers with the professional training that the mining sector needs.

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<sup>24</sup> Department of the Prime Minister (2011)

<sup>25</sup> Tax and Welfare Commission (2010)

<sup>26</sup> Department of the Prime Minister (2011)

<sup>27</sup> Employers' Association of Greenland (2008)

<sup>28</sup> Bureau of Minerals and Petroleum (2007)

### Summary

By comparison with other countries, Greenland devotes many public resources to education. In 2008, total public expenditure on education amounted to around 15 % of GDP. By comparison, public expenditure on education in Denmark, with the highest level among the OECD countries, is around 8 % of GDP.<sup>29</sup> Greenland is thus right at the top by comparison with other countries in terms of the consumption of resources for education. Unfortunately, the results do not match up to the large social investments in the area. Only about 15 % of the pupils in a primary school year go directly to a course of further education, which means that Greenland loses out on major benefits. If students, for example, enter the labour market two years earlier than otherwise, society can expect an increase of 5 percentage points in GDP.<sup>30</sup>

A coherent educational system is essential in order to enable the local business community to seize the opportunities that the large-scale projects may offer in the future and translate them into economic gain. This means that each level of the education system must be interlinked, cf. Figure 10.

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### Figure 10 A coherent educational programme

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Source: Copenhagen Economics

The activities of the mining companies are relevant to phase 3 (Better vocational and secondary education) and phase 4 (More internships in interplay with foreign companies). We assess that the mining companies can help to enhance the educational phases. At the same time, we assess that this will not be a major extra burden on the companies, as they can be expected to have an incentive to help to enhance this area.

Conversely, we assess that the mining companies do not have a great incentive to invest in better pre-schooling or the primary school area, as there is no natural link between the activities and interests of the mining companies and these precise areas. Accordingly, any requirement for the mining companies to invest in, for example, better primary schooling, will be regarded as a tax. The government would therefore be better advised to use the tax revenues from the mining companies for this kind of investment.

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<sup>29</sup> Tax and Welfare Commission (2010)

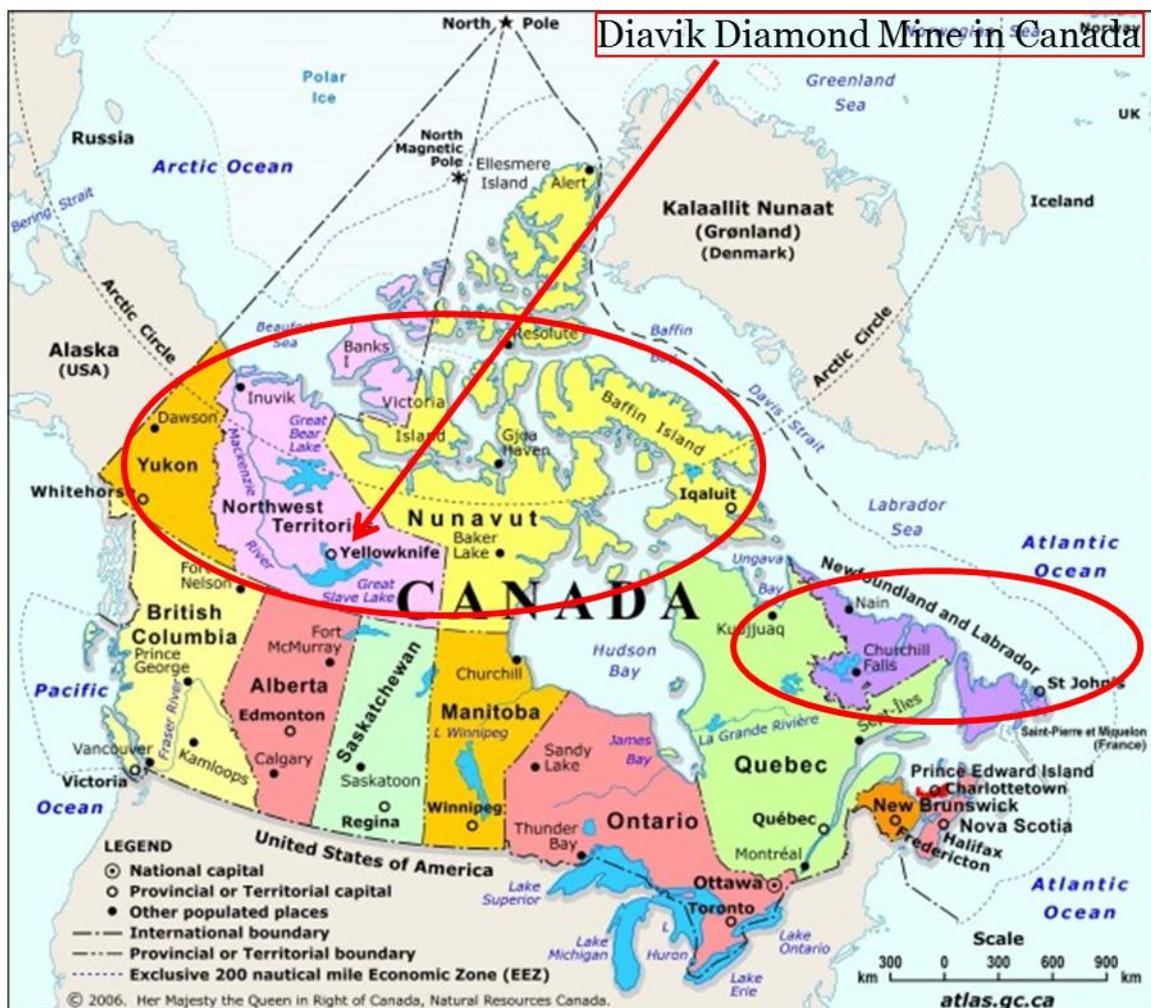
<sup>30</sup> Ministry of Education and Research (2012)

Chapter 4

# The lessons from Northern Canada

Northern Canada is a major location for mines and oil wells. The north Canadian territories of Yukon, The Northwest Territories, Nunavut and, in part, Newfoundland and Labrador, have many similarities with Greenland. The climate is predominantly Arctic, with a large part of the indigenous population living in settlements and small towns separated by large distances, and with limited infrastructure, cf. Figure 11.

**Figure 11 Canada's northern territories**



Source: Google Maps and information on the Diavik mine.

Yukon has a population of around 30,000 people, around 25 per cent of whom are of aboriginal<sup>31</sup> origin. Yukon has a population of around 41,000 people, around 50 per cent of whom are of aboriginal origin. In

<sup>31</sup> The term 'aboriginal' covers Indians, Métis and Inuit.

the capital, Yellowknife, live just fewer than 19,000 people. Yukon has a population of around 29,000 people, around 85 per cent of whom are of aboriginal origin.<sup>32</sup>

Yukon, The Northwest Territories and Nunavut are home to six mines, including the Diavik diamond mine, which we will refer to several times in this chapter. In 2012, the production value of the six mines exceeded CAD 2.6 billion.

Newfoundland and Labrador, which is a somewhat larger province with a population of more than half a million, just under five per cent of whom are of aboriginal origin, and in which English is the dominant language, is home to oil exploration projects such as the Hibernia, White Rose and Hebron projects, which we will also refer to.<sup>33</sup>

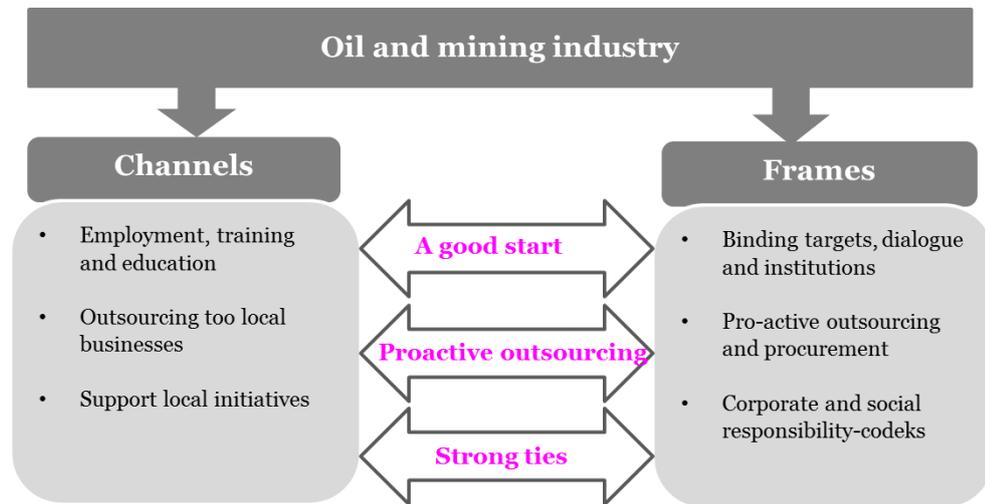
We emphasise three channels for the transfer of economic wealth from mining companies' activities to the local Canadian communities and territories in and around which the companies operate. These are, firstly, direct employment in the mines, etc., and the related education and training of the workforce; secondly, subcontractor contracts with the local business community; and thirdly, general initiatives in the community, such as providing scholarships for higher education programmes of relevance to mining. These channels must however be supported by policies and framework conditions, and we therefore assess that maximum utilisation of the channels requires a good framework.

The above can ensure that the mining project gets off to a good start and creates local jobs (a good start), that the local business community is involved, develops skills and grows (proactive outsourcing), and that, over time, strong and trusting bonds will develop between the mining company and the local community (strong ties). We have illustrated these factors in Figure 12.

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<sup>32</sup> See: <http://www12.statcan.gc.ca/census-recensement/index-eng.cfm>

<sup>33</sup> See Bureau of Minerals and Petroleum (2012), p. 6.

**Figure 12 Best practice experiences**

Source: Author's analysis

#### 4.1 A good start

The fundamental legislative framework must be in place from the start; we highlight three key means of regulation.

First of all, there must be agreements. An example is the Canadian Land Claims Agreement, which defines who has the right to issue licences for the mining companies' use of resources, and how mining companies are to be taxed and pay royalties to the local community and the federal Canadian government. It corresponds to a certain extent to the Mineral Resources Act in Greenland. There are also Impact and Benefit Agreements (IBAs), which describe the positive impact the project is to have on the area, beyond revenues to the public purse. In specific terms, the benefits plan must include strict targets for, inter alia, the extent of employment of local people, apprenticeships, skills enhancement courses, education funding, research and development and the use of subcontractors. The IBA should basically ensure that local people have first priority. If a local job-seeker meets the qualifications for a position, he should be hired before non-local job-seekers who are also qualified.

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## Box 5 White Rose and Hibernia: benefits plans for the use of local labour

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"The White Rose oil field is operated by Husky Energy, and consists of undersea drilling systems with floating production, storage and offloading facilities (FPSO). The oil field currently has a capacity of 0.14 million barrels per day, and production began in 2005. In the benefits plan which formed part of the company's development application in 2001, the needs of the project were estimated in working hours for both the construction and operational phases. Calculated against the background of a project lifecycle of 12 years, White Rose was expected to require 12 million working hours, with 57 per cent attributable to construction and 43 per cent to operations. The figures for the use of local labour are correspondingly high for the Hibernia project, where 59 per cent of 26,000 man-years in the construction phase went to local people, and 83 per cent of the employees in the first year of the operations phase were from the locality. For White Rose, broad participation by local labour in most elements of the system was expected, while working hours during the operational phase were to be covered exclusively by local people. The plan also sets out the supply of job categories in the local market. The conclusion is that it will in general be possible to meet the project's demand within Newfoundland."

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Source: Bureau of Minerals and Petroleum (2012), p. 38.

Secondly, there must be following up. This includes following-up on, for example, the IBA goals, and on-going dialogue with relevant stakeholders about the various challenges that arise and new initiatives that are underway. This is quite complex in Canada, where stakeholders include the aboriginal groups, trade unions, employers' associations, etc., at the very local level (often it is the aboriginal groups that own the resources that the mining company wishes to use, cf. the Land Claims Agreement), at the territory government level, and at the federal government level.

Thirdly, there must be a well-functioning system of enforcement. This ensures that disagreements in anything from the economic area to cultural and environmental issues can be quickly and efficiently resolved. In the oil extraction area, a regulator has been set up in Canada (C-NLOPB<sup>34</sup>) to monitor and enforce agreements, including IBAs and environmental and safety obligations. The C-NLOPB acts as a link between the federal government and the provincial government.<sup>35</sup> If there is a breach of agreements or obligations, the C-NLOPB can respond with actions, production halts, or, in the worst cases, even the cancellation of the agreement.<sup>36</sup>

Once per quarter, the oil companies must report on the extent to which they have succeeded in living up to their obligations. If they have not lived up to their obligations, they must explain how they intend to correct this. If the oil industry fails to meet the requirements, the C-NLOPB has the power to impose fines or, alternatively, completely stop the oil company's oil production. Halting the oil companies' production, either by not extending the licence to extract oil or by temporarily stopping production, is an incredibly powerful tool, as in the oil industry, huge costs are associated with downtime and production halts. According to the Bureau of Minerals and Petroleum report from 2012, *Erfaringerne med udviklingen af olieindustrien i Newfoundland og Labrador* ('Experience with the Development of the Oil Industry in Newfoundland and Labrador'), the C-NLOPB has imposed production halts five times. Most of these involved stops of a few days, in the case of minor oil spills; however, one of the stops had a longer duration of 2-3 months, and was imposed due to poor maintenance in response to the largest spill, which involved approximately 1,000 barrels of oil.

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<sup>34</sup> Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB).

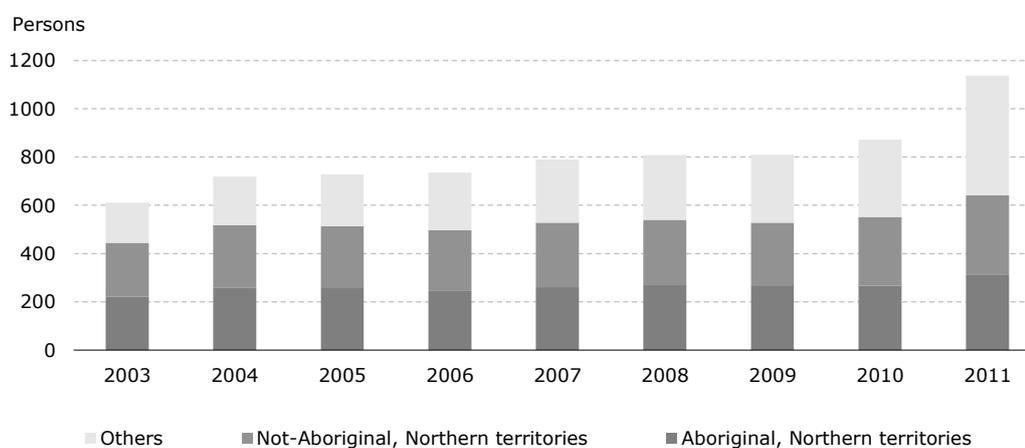
<sup>35</sup> Bureau of Minerals and Petroleum (2012), p. 46.

<sup>36</sup> Bureau of Minerals and Petroleum (2012), p. 40.

On the basis of such a structure, the content of the IBA is crucial to getting off to a good start. In this area, the Canadian experience indicates that two factors largely control how successful the community will be in its negotiations with the mining company: agreement on the goals, and the ability to stand together and speak with one voice.

The many Canadian mining projects have brought about a significant level of employment among the local population. The Diavik mine in the Northwest Territories, which became operational in 2003, employs around 600 people from all over the territory, cf. Figure 13.

**Figure 13 Number of employees in the Diavik mine, operational phase**



Source: Diavik Diamond Mine (2011)

Local people were however employed right from the construction phase, in which the skills acquired by the workforce made them more attractive as labour during the operational phase, as well as during the construction phase for the next mining project. Employment in the construction phase thus increases the utility of labour during the operational phase. Several mining projects at once – or consecutively – create synergies that strengthen the acquisition and maintenance of local skills, both for the individual employee employed by the mining company, but also for the local business community, who gain the opportunity to refine and develop their services from project to project.

It is important for sustainable economic growth that local people receive skills enhancement and training via the mining projects. This gives them skills that they can use in other industries, or in other mining projects, in other parts of northern Canada or abroad. See also the description in Box 6.

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## **Box 6 Skills enhancement for the local workforce creates economic value for the individual and society**

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The training and experience that people in Alaska (and especially local people) build up by working in the mining industry makes it easier for them to obtain work in other projects in the state, such as in the oil and construction industries, in environmental monitoring industries, and in a wide range of other sectors of the economy. The skills they learn on the job or through mine training/education make local people better able to occupy positions that may be available in their community (in jobs that might otherwise be occupied by non-local employees), or other, more distant jobs that can allow them to continue to live locally while working rotating shifts (e.g. one week on, one week off). Moreover, the skills that workers acquire are in many cases in demand all over the world, and these abilities thus greatly enhance personal opportunities.

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Source: Alaska Miners Association (2012)

Some of the oil companies in Canada have assumed responsibility for training the workforce in order to be able to obtain people with the right qualifications. One example of this is Husky Energy's so-called 'co-op students' programme, in which Husky Energy pays for a student's education at the local university in return for the student spending part of his or her study time as an intern at the oil company. This arrangement also results in a large proportion of these students choosing to stay on with the company after graduation, which is also a gain for the company. Husky Energy's programme is further described in Box 7, below.

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## **Box 7 Husky Energy's Co-op Students**

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"For Husky Energy, one of the best measures it has implemented to recruit skilled labour is the so-called co-op students scheme. Under this scheme, the company pays for a student's education at the local Memorial University in return for the student spending part of his or her studies as an intern at the oil company. Husky finds that many of their co-op students remain with them after graduation, which is why in St. John's they spend CAD 1 million per year to finance the co-op students. Husky has succeeded in steadily increasing its proportion of local employees since it began recruiting, such that it now has a workforce which is 85 per cent local. This figure must of course be seen in light of the fact that outsiders become locals in the statistics as soon as they have settled in the province and changed jobs. Part of this 85 per cent will thus have come from elsewhere to work in the oil industry, but are now counted as locals after a local job change. Special training programmes have been instituted for fishermen who wish to obtain employment in the oil industry which build on the fishermen's existing skills. There is overcapacity in the fishing industry, so there is still potential for this transfer, but people are often tied to the fishing industry through their investments. There is also the structural problem of fishermen residing far from St. John's, where there is no demand for their labour."

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Source: Bureau of Minerals and Petroleum (2012), p. 62.

In Canada it is, as far as we are aware, rare for Asian labour to be employed, at lower wages, during the construction phase. However, labour from the rest of Canada is often used, but this happens only after the local labour resources have been exhausted. The IBA that the owners behind the Hebron oil extraction project in Newfoundland and Labrador signed in 2008<sup>37</sup> states that external labour can be used in the

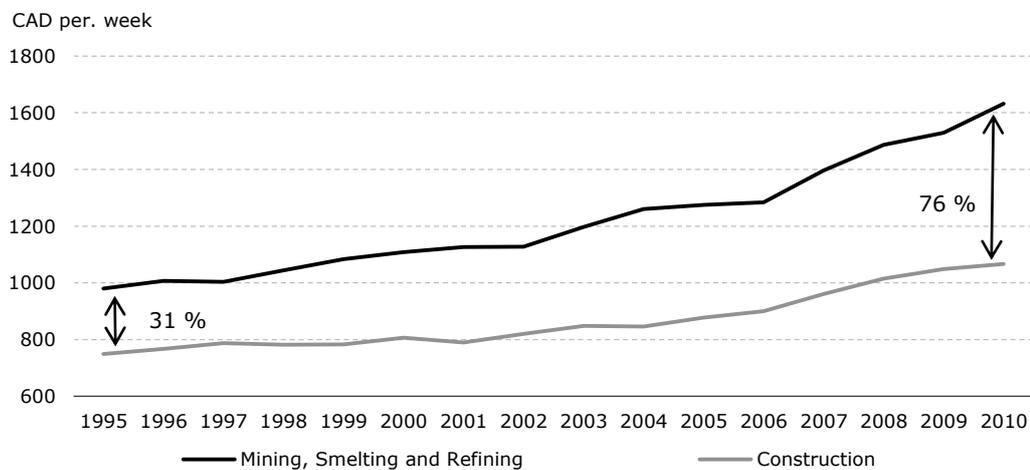
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<sup>37</sup> See <http://hebronproject.com/the-project/project-benefits.aspx>

construction phase, but only when no further organised (priority 1) or unorganised (priority 2) local workers are available.

Wages in the mining sector are also generally high. In Canada as a whole, wages in the mining industry are significantly higher than wages in, for example, the building and construction sector, and the gap has been steadily increasing over the past 15 years, cf. Figure 14.

**Figure 14 Pay trends, weekly wages in Canadian dollars**



Note: NAICS (North American Industry Classification System) code 212 and 3314

Source: Mining Association of Canada (2011)

## 4.2 Proactive outsourcing

The IBA must also specify the extent of outsourcing from the mining company to the local business community. It was thus a requirement for the Diavik mine that 38 per cent of its subcontractor needs during the construction phase, and 70 per cent during the operational phase, were to be met by companies from The Northwest Territories.

But for outsourcing to result in a permanent strengthening and qualifications improvement of the business community requires a more proactive outsourcing strategy on the part of the mining companies. One example of such an approach comes from the Diavik mine. The company took a proactive approach to outsourcing, which ensured a high level of outsourcing, and also helped local businesses to spot subcontractor possibilities, cf. Box 8.

## Box 8 The Diavik mine's 'out of the box' approach

In order to support local businesses, Diavik set itself the target that at least 38% of its construction should be undertaken by northern businesses, while the same is true for 70% of Diavik's operating expenses.

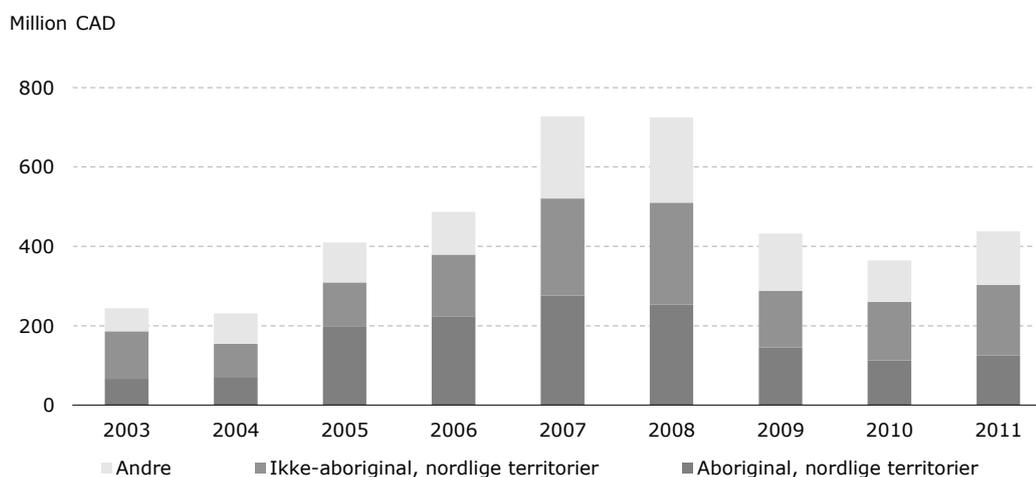
In order to secure the success of this policy, Diavik took an 'out of the box' approach. The company chose to hire a Business Development Manager – not a position which is normally required at a mining company. His job was to formalise Diavik's business policy, and then help the company to identify contract opportunities, after which he would help the northern/local businesses to make use of these opportunities.

Diavik also chose to use an innovative outsourcing approach which would help to build up the capacity of local enterprises. Instead of performing work on the mine using Diavik's own workforce, as usual, local contractors provided their own staff. The aim was to support local and native businesses.

Source: Tom Hoefer (2004)

Today, the Diavik mine outsources for more than CAD 300 million to companies from The Northwest Territories, see Figure 15.

### Figure 15 Outsourcing from the Diavik mine, operational phase



Source: Diavik Diamond Mine (2011)

Another example is the Hebron oil extraction project, in which the company actively helped local subcontractor companies to optimise their business procedures, such as by implementing accounting systems, reporting systems, new processes and quality assurance systems. This kind of business development can enable local companies to create a more profitable business, and expand and develop the quality of their services.

For oil companies in Newfoundland and Labrador, an important element in their benefits plans is that the companies must ensure that local companies win subcontracts. The companies must give local companies

an opportunity to win contracts through so-called 'full and fair opportunities', which means that the companies must choose local suppliers/companies rather than outside companies.

Moreover, if no local companies bid for a task, the oil companies are obliged to seek out possible local companies before they can choose a supplier from outside. Potential local suppliers are organised in the NOIA organisation, which can help to facilitate contacts and inform the oil companies if they have overlooked a local business. In addition, a number of important initiatives have been undertaken to strengthen the possibilities of local companies<sup>38</sup>: amongst other things, the oil companies' subcontractor tenders come with deadlines long enough to allow local businesses to develop the required services, and thereby be in a position to bid for the contract. The box below shows one of the most specific initiatives that have helped to strengthen local businesses.

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### **Box 9 Travel fund in connection with White Rose**

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"In the White Rose project, in order to secure the access of local businesses to the necessary knowledge and international cooperation, Husky Energy has been required to set up a travel fund for local companies, for journeys associated with business development. Similar requirements have been imposed in connection with the upcoming Hebron project. The White Rose travel fund is utilised only to a very limited extent, although travel activity among local companies is increasing rapidly. This may be because companies find it inappropriate to ask for money to make such journeys. In any case, there are many local suppliers who travel in order to learn from the industry elsewhere. In the early 1980s, for example, 5-7 Newfoundland businesspeople attended the world's largest annual offshore oil fair in Texas; last year, this number had increased to approximately 150 local people. According to ExxonMobil, it is essential for local subcontractors to be placed in contact with relevant foreign partners. In this context, it is less important to cover the travel expenses to visit them."

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Source: Bureau of Minerals and Petroleum (2012), p. 52.

### **Export business**

Outsourcing can even lead to companies exporting their services beyond the country's borders, as they improve their skills and become more ambitious. This may thereby open up the possibility of a new export industry.

The considerable expertise acquired by local companies, combined with the managerial and organisational skills they build up, can enable them to export their services. Contacts created by the oil companies have greatly contributed to supporting local businesses in both national and international oil projects. According to an analysis by the Bureau of Minerals and Petroleum in 2012, a review of 65 subcontractors to the oil industry in northern Canada revealed that 25% of these had also sold goods and services outside the province, and that figure is even larger today.<sup>39</sup>

This has also been part of the story for the two originally local businesses Rutter and Stratos Global from Newfoundland and Labrador, who provide services based on high technology and communications to the oil industry and others.

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<sup>38</sup> See Bureau of Minerals and Petroleum (2012)

<sup>39</sup> See Bureau of Minerals and Petroleum (2012), p. 31.

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## Box 10 Rutter Inc. and Stratos Global

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Rutter has evolved into a company selling fully-integrated, radar-based systems for oil and gas exploration and production, as well as safety and security equipment. In addition to this, as a production company, it also supplies a comprehensive range of cabinets and electronic/electromechanical components to two of the world's largest defence system providers. Rutter can supply multi-disciplinary engineering services to suit projects of any size.

Stratos Global was originally founded to provide communications between Hibernia's plant facilities and its headquarters in St. John's. Subsequently, the company won an order to supply onshore-offshore communication equipment for the Hibernia and Terra Nova fields. The company has since undergone rapid development, and today is estimated to be the world's third-largest supplier of Inmarsat (the world's leading satellite system) services, with customers in the fields of offshore oil, oil pipelines and defence and coastguard activities. The company's headquarters is in St. John's, where it employs 150 people.

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Source: Extracts from Rutter's website <http://www.rutter.ca/> and the Bureau of Minerals and Petroleum (2012) p. 50

### 4.3 Strong ties

Mining companies typically operate in local communities for several decades. This long-term presence can serve to strengthen ties between the mining company and the community.

To this end, tangible and measurable corporate and social responsibility (CSR) goals can prove a good tool. In 2004, the Mining Association of Canada (MAC) launched six 'TSM' (Towards Sustainable Mining) principles that reflect the behaviour of the mining companies in the area, cf. Box 11. Mining companies must issue annual reports on their performance in TSM, which must be verified by an external party. The six areas are:

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**Box 11 Towards Sustainable Mining (TSM)**


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<b>TSM Performance Element</b>	<b>Measures a Company's Management Systems for...</b>
Tailings management	Dealing with tailings, the material left over after valuable minerals and metals have been separated from ore
Energy use and greenhouse gas emissions Management	Using less energy and release less greenhouse gas
Aboriginal and community outreach (formerly external outreach)	Maintaining dialogue with communities affected by the company's operation
Crisis management planning	Being prepared for all potential crisis
Biodiversity conservation management	Conserving wildlife in and around the facility
Safety and health	Protecting the safety and health of the company's workers, contractors and visitors

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Source: Mining Association of Canada (2011); F & F 2011, website of the MAC

Over the years, mining companies in Canada have also contributed to the community by supporting initiatives in such areas as health, education and the environment. As an example, in March 2011 the Diavik Diamond Mine Inc. began the construction of the first wind farm in the Northwest Territories, which is expected to be completed by the end of 2012. The aim of this project is to minimise dependence on diesel fuel for energy needs. It is also envisaged that the experience garnered from this wind turbine project and its use can be shared with other stakeholders in the northern areas.<sup>40</sup>

In the oil industry it has proved possible, through the joint organisation One Ocean, to achieve a positive development in relation to the fishing industry. One Ocean aims to secure dialogue, mutual understanding and co-ordination between the fishing and oil industries. Its board consists of senior people from the oil companies and fishing industry organisations, and the board's decisions are based on consensus. Through One Ocean, the oil industry has achieved a number of positive effects and agreements with the fishing industry cf. Box 12.

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<sup>40</sup> Diavik Diamond Mine (2012)

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## Box 12 Ocean One

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The board of One Ocean consists of senior staff from the oil companies and fishing industry organisations, and the board's decisions are based on consensus. The overriding concern of the fishermen is to be able to continue to reside and work in the area, which is why fishermen have a great need for knowledge about what is happening in the oceans, and to be consulted for advice in all offshore-related issues. The oil industry, on the other hand, prioritises knowing and responding to the concerns of fishermen. The One Ocean co-operation has resulted in many successful activities, including:

- Highly comprehensive studies of the effects of seismic surveys, in which fishermen were to a great extent involved in collecting samples.
- 500 fishermen and others have been trained to report and respond to oil spills, so that the surveillance and response capacity has attained a far greater extent than the authorities themselves would have been able to provide.
- Several fishermen have also been on trips with the oil industry to the Gulf of Mexico to learn about oil spills from the extensive offshore oil industry there.
- Fishermen are consulted when major oil-related activities, such as seismic surveying or construction projects, are initiated. This has meant that oil activities can be planned outside of the periods of the fishermen's varying seasonal fishing, and fishermen are aware of what is happening and respect the activities of the oil industry.
- Fishermen have an opportunity to anonymously communicate their concerns and negative experiences in the oil industry, for example in environmental studies, which has made them more secure about contributing to the process.

A significant lesson from this co-operation is that fishermen and oil people speak very different languages – not only in their way of speaking, but also in very specific terms. The two industries use, for example, different terms for sea areas, which initially made it impossible to specify which location you were talking about. Accordingly, the oil people now always use a map with the fishermen's names for the various areas when they need to talk to fishermen about activities and other conditions at sea. In addition, the oil industry has a tendency to talk in very technical terms, which they have had to reduce in order to conduct a dialogue with the fishermen, and in the beginning they also discarded their suits in favour of sweaters and other casual attire. All of this has been highlighted as very important factors in building confidence and co-operation.

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Source Bureau of Minerals and Petroleum (2012), p.73

In Labrador, where much of the population has a Native American background, there has even been a strengthening of the local culture as a result of the oil industry. This is due to the fact that there is now more money in circulation in the community, which has increased the demand for local culture. With the increase in spending power, folk music is for example enjoying a strong revival.<sup>41</sup>

### Infrastructure

Canadian mining companies are active in many countries around the world, where they make a large contribution to local communities, both through tax payments, job creation and partnerships with local businesses. The massive focus on CSR means that these companies contribute to helping to pay for

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<sup>41</sup> Bureau of Minerals and Petroleum (2012)

schools, roads, hospitals, clinics, etc. Table 4.1 provides an overview of the indirect investments that selected mines have implemented, which have resulted in a positive impact on, in particular, the local infrastructure in the communities in which they operate. As an example, the Northern Saskatchewan mine in Canada has contributed to the community through the massive expansion of roads, installation of power lines, construction of facilities for leisure centres and health care, and development of water and wastewater systems – all initiatives which are not directly related to mining or to other activities by the company in the area.

**Table 8 The contribution of mining companies to infrastructure**

Country	Mine	Roadways and harbours	Energy	Hospitals, schools, etc.
Canada	Inti Raymi	Minor roads	Power station for the mine	Local schools and health centres
Canada	Northern Saskatchewan	Massive extension of roads	High-voltage cables	Facilities for leisure interests and health care, water and wastewater systems
Chile	Candelaria	Harbour in Punta Padrones (for company use), 22 km road	-	Sports centre, establishment of primary and secondary school
Chile	Escondida	Harbour in Coloso (for company use only), local roads in harbour area and road to the mine	-	International school, water tanks
Peru	Yanacocha	Building, upgrading and maintenance of local roads	-	Schools, water and sanitation projects

Source: Copenhagen Economics and World Bank & International Finance Corporation (2002)

## Bibliography

- Copenhagen Economics (2011): *"GAP analyse af to storskalaprojekter"*
- Ministry of Education and Research (2012): *"Uddannelse for fremtiden – Uddannelse for alle"*
- Diavik Diamond Mine (2012) *"2011 Socio-economic Monitoring Agreement"*
- Epinion & Government of Greenland (2012): *"Kortlægning af førskoleområdet"*
- Department of the Prime Minister (2011): *"Redegørelse om Regional Udviklingsstrategi"*
- Gibbons & Machin (2006): *"Transport and Labour Market Linkages: Empirical Evidence, Implications for Policy and Scope for Further UK Research"*
- Greenland Development (2010): *"Beskæftigelseeffekten ved en aluminiumssmelter"*, PowerPoint præsentation
- Employers' Association of Greenland (2008), *"Grønlands Arbejdsgiverforenings undersøgelse af manglen på arbejdskraft"*
- Economic Council of Greenland (2012): *"Økonomisk Råds Rapport 2012 - naturressourcer som vækststrategi"*
- Ham, Mulder & Hooimeijer (2000): *"Local Underemployment and the Discouraged Worker Effect"*
- International Finance Cooperation (2002): *"Large mines and local communities: forging partnerships, building sustainability"*
- London Mining (2011): *"London Mining PLC Isua 15 Mtpa Scoping Study Report"*
- London Mining (2012): *"Vurdering af samfundsmæssig bæredygtighed for ISUA-jernmalmprojektet for London Mining Greenland A/S"*

- Ministry for Industry and Mineral Resources (2012): *“National Turismstrategi 2012-2015”*
- Niras (2010): *“Aluminiumsprojektets økonomiske betydning”*
- Bureau of Minerals and Petroleum (2007): *“Arbejdsbetingelse og jobmuligheder i råstofsektoren”*
- Bureau of Minerals and Petroleum (2012), *‘Erfaringerne med udviklingen af olieindustrien i Newfoundland og Labrador’*
- Tax and Welfare Commission (2010): *“Hvordan sikres vækst og velfærd i Grønland – baggrundsrapport”*
- Tom Hoefer (2004): *“Diavik – The art of the possible”*, Northern Mines Ministers’ Conference, Ottawa.
- Transport Commission (2011): *“Transportkommissionen – betænkning”*
- UN-HABITAT (2011): *“Infrastructure for Economic Development and Poverty Reduction in Africa”*
- Watkinson (2009): *“Nalunaq Gold Mine – social impact assessment”*
- World Bank & International Finance Corporation (2002) *“Large Mines and Local Communities: Forging Partnerships, Building Sustainability”*

## Appendix A

### A.1 Employees and income taxes in the construction and operational phases

**Table 9 Employees and income taxes in the construction phase**

Year	2012	2013	2014	2015	Total
Number of construction workers	300	2,000	3,300	2,000	
Annual income tax (DKK mill.)	11	73	121	73	278

Source: London Mining (2012)

**Table 10 Employees and income taxes in the operational phase**

	year 1-5	year 6-15	total
Greenlandic employees			
Average number of employees	136	445	
Annual payroll expenses (DKK mill.)	97	331	4,129
Annual income tax (DKK mill.)	38	128	1,595
Chinese employees			
Average number of employees	306	0	
Annual payroll expenses (DKK mill.)	101	0	504
Annual income tax (DKK mill.)	26	0	176
Foreign Western employees			
Average number of employees	232	383	
Annual payroll expenses (DKK mill.)	259	369	4,854
Annual income tax (DKK mill.)	65	129	1,700
<b>Annual income tax, total (DKK mill.)</b>	<b>129</b>	<b>257</b>	<b>3,470</b>

Note: Calculations based on estimates from SNC LAVALIN (2012) and Grontmij

Source: London Mining (2012) and the authors' own calculations

### A.2 Calculation of indirect and induced employment, and the effect on GDP

#### Calculations based on input-output tables

The derivative activity in the economy, which arises to the extent that production at the mine requires input from other companies and sectors, can be calculated on the basis of the number of employees, a number of simplifying assumptions, and an input-output table for the Greenlandic economy.

The fundamental idea is that any production at the mine requires input in the form of labour and raw materials from either foreign or other domestic industries. The latter creates a demand for the goods and services of local subcontractors, which places increased demands on their production, employment and imports. This results in a

multiplier effect, in as much as these subcontractors themselves demand higher inputs for their production from other companies and industries. These multipliers can be calculated with a few assumptions<sup>42</sup> using an input-output table for Greenland compiled by Statistics Greenland with data from 2005 and earlier. In order to take account of fluctuations in the individual years, we have based our calculations on an average of the input-output tables from 2003-2005. However, the fact that the structure of the economy may have changed since 2005 implies in itself a large degree of uncertainty in the calculations.

Other qualifications must also be borne in mind for the results in Figure 5 and Figure 7. It can in general be said that input-output models are not suitable for calculating the impact of major changes in the externally-defined variables – in this case employment. Multipliers, as applied below, should primarily be used to assess the impact of, for example, minor fiscal measures, rather than major changes in the economy like the Isua Project. This is due to the simplified assumptions about production functions and the link from the income side to the consumption side (see footnotes 42 and 46).

Due to the sparse information about the project, including uncertainty regarding wage levels<sup>43</sup>, the calculations are based on a situation (a baseline scenario), in which direct employment within the relevant industries rises without changing the structure of existing industries in terms of production requirements for input from other domestic industries, imports and payments to labour and capital (gross profit). This applies to all the affected industries except mining and extraction, see below.

### **Increase in the work supply**

The project's impact on the economy depends largely on how much the total work supply increases, cf. the description of reactions in the job market in section 2.1. The breakdown of local and foreign workers is assumed to be as shown in Figure 4. The low local employment share in the construction phase, in particular, reduces the sensitivity of the calculations towards the assumption of an increase in the work supply. In the operational phase, the rise in the work supply is of greater significance to the results.

On the basis of the table shown below from Niras (2010), which analyses the impact of an aluminium smelter in Maniitsoq, we assume in the calculations that the effective work supply will be increased by 10 per cent in local jobs generated during construction and 50 per cent during the operational phase – corresponding to the proportion of partially-employed persons, fishermen employed in coastal fishing, recipients of anticipatory pensions and recipients of public assistance. These assumptions cover both the effect of chains of job changes in the labour market and the degree of upgrading of the local workforce.

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<sup>42</sup> The impact assessments in an input-output model require that the relationship between the industries' input requirements is constant and that the production function is linear, i.e. that there are no economies of scale or disadvantages.

<sup>43</sup> On the basis of the total payroll expenses, cf. Table 10, the average gross annual wage can be calculated at DKK 714,000, DKK 1,089,000 and DKK 329,000 for local, Western and Chinese workers, respectively. The wage level is however still subject to discussion between the government and the companies.

**Table 11 Distribution of the recruited workers**

Pct.	Construction phase	Operational phase
Already employed, primarily from the construction industry	90	0
Employed in the middle-income group	0	20
Employed in the low-income group	0	30
Partly employed	2.5	20
Hunters, or fishermen in coastal fishing	2.5	20
Recipients of anticipatory pensions	2.5	5
Recipients of public assistance	2.5	5
<b>Total</b>	<b>100</b>	<b>100</b>

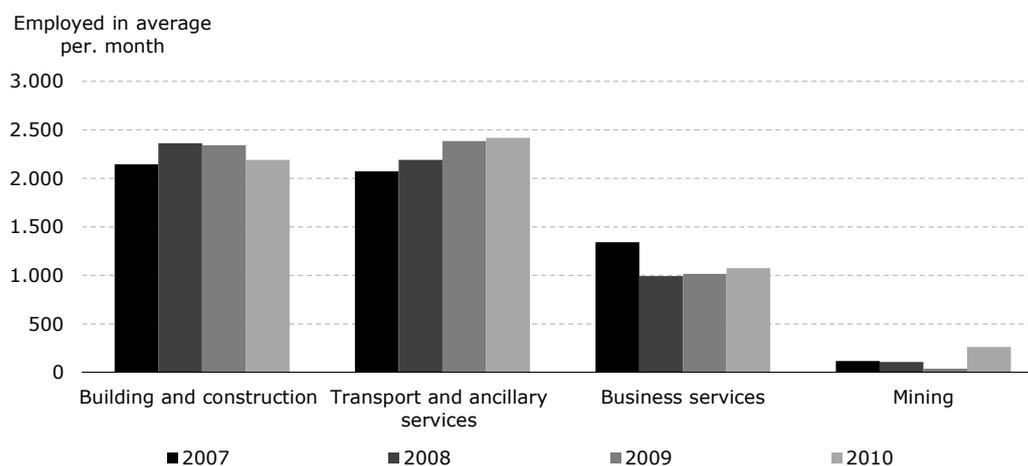
Source: Niras (2010)

### The affected industries

The industry distribution in the construction phase is assumed to be as calculated in Copenhagen Economics (2011). Here we found that the need for services for large-scale projects will primarily be directed at three industries: Construction, Transport and Ancillary Services, and Business Services. On the basis of the key expenditure figures in Bureau of Minerals and Petroleum (2009), we estimate the gross distribution of the services required by the large-scale projects at 40 per cent of the needs of large-scale projects to be covered by construction, 40 per cent by transport and ancillary services, and 20 per cent by business services. In the operational phase, 90 per cent of the employees are assumed to be employed in the mining industry, and 10 per cent in business services. These industry distributions are in good agreement with London Mining's descriptions of the jobs, in their SIA.

Figure 16 shows the latest developments in employment in the relevant industries, and the size of these. In itself the figure says nothing about the free capacity in these industries, but shows that no sector has experienced a significant fall in employment within the past few years. The relative sectorial distribution of the businesses during the construction phase (40, 40 and 20 per cent) is in good agreement with the relative size of the sectors in 2010.<sup>44</sup>

<sup>44</sup>See Copenhagen Economics (2011) for a calculation of the gap between project demand and the supply from Greenlandic industry.

**Figure 16 Employment in the affected industries**

Source: Statistics database, Statistics Greenland

Table 12 shows the multipliers for these industries, as an average from 2003-2005. Box 13 describes the special factors we have considered in this connection concerning the mining sector. The multipliers can be explained as follows: If, for example, a company in the construction sector increases its sales by one million kroner, this brings about a direct requirement for employment expansion by 1.36 full-time positions, plus an indirect requirement for almost half a full-time position in other industries.<sup>45</sup> At the same time, it will also require a direct increase in imports of almost DKK 400,000, and an indirect increase in imports by other indirectly-affected businesses of DKK 150,000.

<sup>45</sup> In calculations of the employment multipliers, all employees with annual wages of at least DKK 40,000 have been included.

**Table 12 Multipliers used in the calculations**

		Building/ construction	Transport and ancillary services	Business services	Mining
Persons per DKK million					
Employment	Direct	1.36	0.83	1.69	0.73
	Indirect	0.46	0.42	0.83	0.33
Percentage of production value					
Domestic production	Direct	0.22	0.32	0.33	0.21
	Indirect	0.21	0.17	0.15	0.35
Imports	Direct	0.39	0.25	0.19	0.29
	Indirect	0.14	0.11	0.10	0.22
Wages	Direct	0.37	0.25	0.46	0.13
	Indirect	0.27	0.21	0.20	0.44
Profits	Direct	0.02	0.18	0.02	0.37
	Indirect	0.12	0.10	0.09	0.20

Note: <sup>1</sup> The multipliers for transport and ancillary services have been calculated as a weighted average of the multipliers in the industries of land transport, pipeline transport, shipping, air transportation and ancillary services for transportation and travel agencies, according to the contribution of these industries to the final use from 2003-2005.

Source: Authors' calculations, based on input-output tables from Statistics Greenland for 2003-2005.

### Calculation of the induced effect

The link from income to consumption demand is not immediately apparent from the input-output model.<sup>46</sup> This complicates the calculation of the induced effect. Simplified, it is assumed that the local share of the workforce spend a proportion of their gross wages on private consumption which is equal to the average for the whole economy in 2003-2005, i.e. 75 per cent. The foreign workers are assumed to spend 10 per cent of their gross wages in Greenland. The induced employment can then be calculated on the basis of the input-output table, i.e. the amount by which total employment rises as a result of the increase in private consumption – approximately 1.2 persons per DKK million. This means that if the foreign workers spend, for example, one million kroner on purchases of food in Greenland, this will create a total indirect employment impact of 1.2 people in the shops in which these goods are bought, and in the companies that produce the goods demanded, in the transport companies that transport the goods, in the electricity generation that provides power to these processes, and so on.

<sup>46</sup> An input-output table establishes the link between the demand side and the production side, divided into domestic and foreign production (through imports). The transition from income to consumption and investment demand is very complicated. This transition is usually modelled in behavioural equations for consumption and investment in the so-called macroeconomic models – in Denmark, for example, in the ADAM and DREAM models. There is as yet no operational macroeconomic model of Greenland's economy, as a result of which it has been necessary to use simpler assumptions to establish the relationship between income growth and increases in consumption and investment.

### Box 13 The structure of the coming mining sector

The distribution of inputs in production in the coming mining sector will have a major impact on both employment and income growth, so these assumptions require special attention. As can be seen from the very small mining and extraction sector in Figure 16, there have not previously been mining projects on the same order in Greenland, so the mining sector has hitherto primarily consisted of exploration work. This in itself produces a challenge when calculating the indirect and induced effects, as the figures in the Input-Output table are not accurate for the mining sector. For example, exploration work in 2003-2005 gave a loss of 13 kroner for each 100 kroner spent, as shown in the table below, but when the project arrives at the operational phase it can be expected to yield a very high profit margin. Consequently, in the mining sector we have made use of direct multipliers corresponding to an average for the exploration sector in Greenland in 2005 and the oil and gas extraction sector in Denmark in 2008.

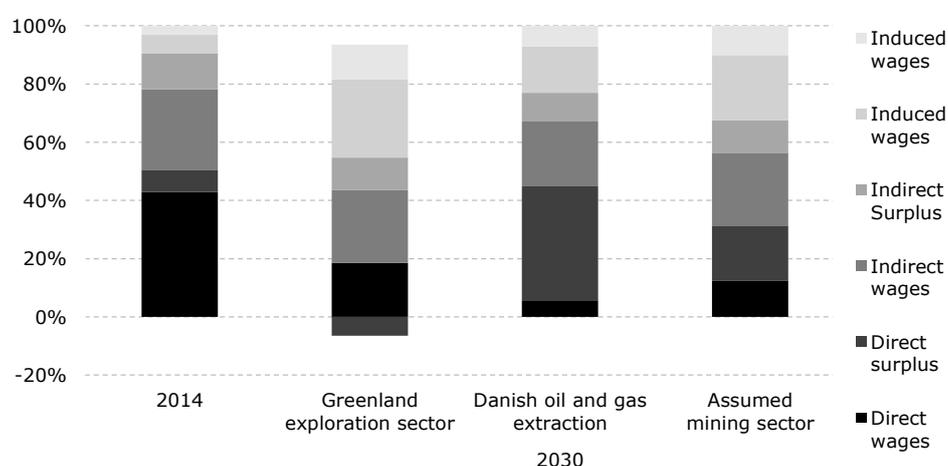
**Table 13 Direct multipliers in the mining sector**

	Greenlandic exploration sector	Danish oil and gas extraction	Assumed mining sector
Domestic production	0.33	0.09	0.21
Imports	0.55	0.03	0.29
Wages	0.25	0.01	0.13
Profits	-0.13	0.86	0.37

Note: The multipliers used for the Greenland exploration sector are from 2003-2005, while those for the Danish oil and gas extraction sector are from 2008. The assumed multiplier for the mining sector is calculated as the average of the two.

Figure 17 shows the distribution of the gross value added, calculated from all the previously-mentioned assumptions for 2014 and 2030 – the year with maximum activity in the construction phase, and the final year of the mine's assumed lifecycle. The assumptions for the mining sector do not affect the construction phase, which is assumed to exclusively involve the construction, transport and business services sectors. In these industries, wages for the workforce comprise the majority of the added value, as shown in the first column:

**Figure 17 Distribution of gross value added with various assumptions about the mining sector**



In the operational phase, a different picture emerges of the distribution of the value creation process, depending on the assumptions of the direct multipliers. It has not proved possible to calculate the importance of the proposed structure of the mining sector for the indirect multipliers, which are therefore assumed to be unchanged. Consequently, the total size of the gross value added, besides the direct effect, is affected only through the induced effect, which in turn depends on the share of wages relative to profits (higher wages means greater consumption, and thus greater employment). In sum, the correction of the mining sector relative to the 2003-2005 IO tables therefore results in an increase in gross value added of DKK 86 million in 2030.

Source: Authors' calculations

## Results

On the basis of all these assumptions, we calculated the indirect and induced employment as shown in Figure 5. The indirect and induced employment multipliers are as shown in Table 14:

**Table 14 Employment multipliers**

	2012	2030
Indirect	1.39	1.33
Induced	1.13	1.16
<b>Total</b>	<b>1.52</b>	<b>1.49</b>

Source: Authors' calculations

In connection with socio-economic assessments of the aluminium smelter at Maniitsoq in 2010, the indirect employment multiplier was assumed to be between 1.2 (Niras, 2010) and 1.4 (Greenland Development, 2010). In 2009, the corresponding employment multiplier for the gold mine at Nalunaq was assessed at 1.276, cf. Watkinson (2009). In connection with the gold mine at Nalunaq, Watkinson (2009) calculates the induced employment multiplier to be between 1.358 and 1.395. Studies from Canada and Alaska indicate overall employment multipliers of 1.6 to 1.8 in large-scale mining projects. Finally, London Mining (in its SIA) expects a multiplier of 1.3 for the Isua Project during the operational phase, due to the high proportion of imports from Denmark, the relatively small manufacturing sector in Greenland, and the project's geographical remoteness.<sup>47</sup>

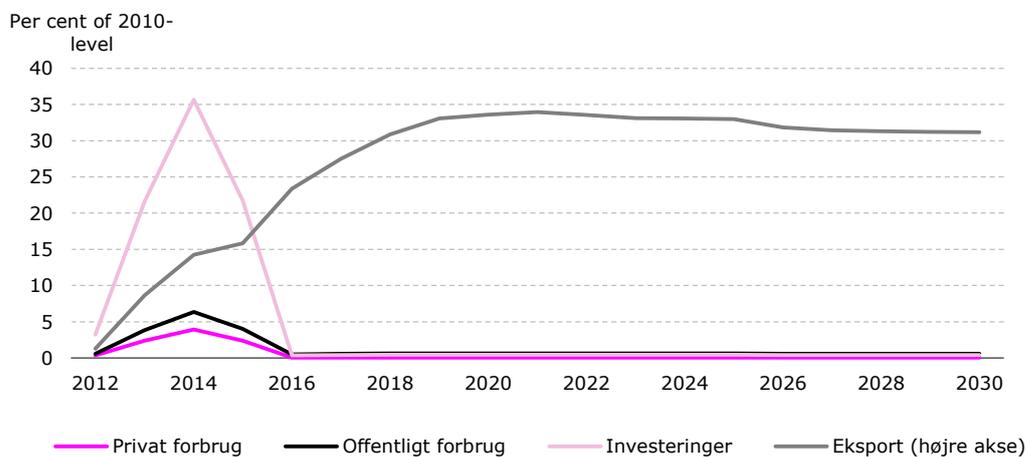
Figure 7 in section 2.3 shows the overall effect on GDP. The apparently large effect should be seen in the context of the implicit assumption that the work supply will increase corresponding to the entire indirect and induced employment shown in Figure 5.

Figure 18, below, shows the trends in usage categories (private consumption, public sector consumption, investment and exports). The figure is based on the assumption that private consumption, public sector consumption, investment and exports for the

<sup>47</sup> However, London Mining indicate a major effect on the construction sector as demand increases for homes and apartments in Nuuk in the first year of the project.

respective industries will in the future comprise the same constant proportion of total output as in the input-output tables for 2003-2005.<sup>48</sup> Calculated in this way, a rise in income in the transport industry will lead to higher private consumption, while 85 per cent of the production of the mining and extraction industry (here assumed to be equal to the Greenlandic exploration industry) is exported. The latter means that the greatest contribution of the Isua Mine to the Greenlandic economy will occur via increased exports during the operational phase, cf. Figure 7, while the former implies a very small overall effect on private consumption.

### Figure 18 Impact of the Isua Mine (direct, indirect and induced ) on the usage categories



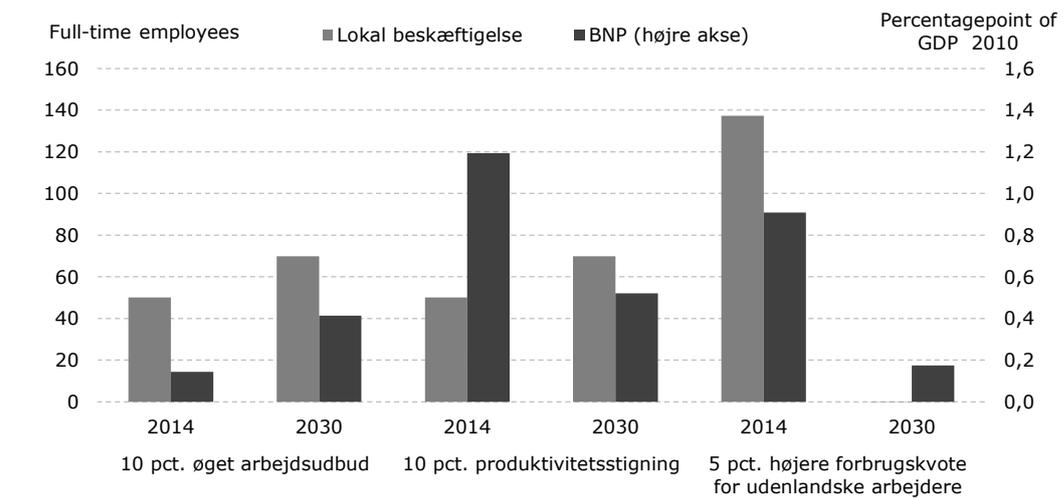
Source: Authors' calculations

### Sensitivity analysis

Figure 19, below, shows three sensitivity analyses, i.e. the additional effect on GDP and employment of changed assumptions in the calculations. This shows that the assumption about the level of consumption by foreign workers in Greenland is very important, especially for induced employment during the construction phase. A relatively modest increase in the consumption ratio from 10 to 15 per cent would increase the induced employment by 137 persons. This is due to the large number of foreign workers employed in the construction phase.

<sup>48</sup> In the input-output tables, total output is equal to total input. The inputs in production are derived from other domestic production, imports, labour and capital, which we can calculate for each industry using the multipliers in Table 14, once we know the development in employment.

**Figure 19 Effect on GDP and employment of changed assumptions**



Note: The *increased work supply* is calculated as an increase in the Greenlandic work supply of 0.1 man-years per local workplace to 0.2 during the construction phase and 0.6 in the operational phase. This gives rise to an increase in employment, which is the basis for all other calculations. The *productivity rise* is calculated as an increase in the indirect wages and profits multipliers (i.e. the multiplier for the gross value added of the derived business) by 10 per cent.

Source: Authors' calculations