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MEGAPROJECTS IN THE CIRCUMPOLAR NORTH

Broadening the horizon, gaining insight, empowering local stakeholders - Social impacts: The case of the Kárahnjúkar power plant and Alcoa Fjarðaál plant in Iceland

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1. MAIN FINDINGS

Impacts of the two megaprojects were observed to be confined to primarily two municipalities where the projects are located. Sample surveys indicated positive attitude towards impacts on economic conditions in the area and increased diversity of jobs.

Participation of foreign workers was much more than anticipated in the environmental impact assessments. Globalization, size of the projects many other projects in other locations in the country and the high value of the ISK are among mains reasons for this development. The Icelandic system of governance was not prepared for this great influx of foreign workers.

The structure of the local economy changed during the construction period and beginning of the operation period. There was especially decrease of jobs in fisheries and fish processing. This cannot be directly related to the advent of the aluminium plant but more likely that this is due to continued rationalization and automation in these fields.

The relative size of the aluminium plant compared to the local labour market makes it important for the social rhythm. Issues such as work shift schedules may become more pronounced due to this fact and in the case of this plant a system of 12 hours shifts appears to be less suitable, e.g. for parents of young children. Another indicator of its impact on the local labour market is the fact that participation of women has been unusually high. It was 32% soon after the plant began operating on 2007 but had dropped to 26% in the end of 2009. However it was much higher than in the other two aluminium plants in Iceland.

This is the policy area where the most obvious mistakes were made during the construction period, the most striking of which being the excessive building of residential housing. This applied especially to apartment buildings but single family houses have traditionally been the most important building type in the area.

Infrastructure was considerably strengthened as a result of the projects. This applies especially to a new export harbour at the site of the aluminium plant and a number of new roads.

Income of municipalities rose considerably but their economic condition did not change similarly. For the municipality where the plant is located income continues to be high. However there has been huge investment in infrastructure and services.

This is in one result of the competition between the two main municipalities for new inhabitants and companies.

Planning of new building areas should have been carried out more carefully and increased cooperation between municipalities on planning issues desirable.

Sample survey among companies indicated inter alia that tourism companies experienced considerable positive effects from the projects.

During the construction phase Icelandic society was in an unusual state of turmoil. There was much expansion in the economy of the country with rising housing prices and a credit bubble which burst in October 2008. Also there were cuts in fishing quotas and other negative changes in the traditional economy. Taking this into account cause and effect due to the megaprojects becomes even more blurred.

It can be said with certainty, that the burden of the construction work has not proved to be too much for the communities in East Iceland to shoulder, and therefore the area seems to have survived this phase satisfactorily. On the other hand, the various social institutions, both municipal and state, do not appear to have been sufficiently prepared to bear the weight of the strain placed on them during the construction period.

It seems to be the case that Alcoa Fjarðaál has succeeded in working well with the inhabitants of the area during the short time the plant has been operational. The effect on society was all in all good. The inhabitants are in general pleased with the decision to go ahead with the project, are happy with their remuneration and the population has increased. Optimism rose in the area when construction began.

Concerning the regional development, it appears that the construction has strengthened Egilsstaðir as its service centre. The gap between the largest and second largest towns in East Iceland has widened. The interests of the different communities of the central impact area appear to converge to a significant extent, and therefore it is possible that these communities will either continue to work closely, or even merge to form larger units.

2. INTRODUCTION

This report is one of deliverables of the project "Megaprojects in the Circumpolar North", focusing on the social and economic impacts of megaprojects on local communities. The report includes recommendations on how to improve the planning procedure and maximise positive effects while minimizing the negative.

Available research findings on socio-economic impacts of Kárahnjúkar hydro project and Alcoa Fjarðaál aluminium plant in East Iceland are compiled here. A research on the impacts on these small communities in East Iceland was carried out during the period 2004-2009. Until now, nearly all of the findings of the research have however only been available in Icelandic language and therefore not accessible for the international community. This report uses information from this study and thus the timeframe is limited to the same period.

This research has relevance to the objectives of the Arctic Co-operation Programme 2009-2011 as a similar project is planned in Maniitsoq Greenland and also other locations in the Arctic can benefit from the project are conditions in these locations may be similar in many ways.

The objective is that this report should be available e.g. on the Arctic Portal http://www.arcticportal.org/ and other relevant web pages dealing with arctic issues and planning of large scale projects.

This report is to a large degree a summary of the final report in the research project on socio-economic impacts of the megaprojects in East Iceland 2003-2008 (Hjalti Jóhannesson, ed, 2010) and has been prepared mainly by Hjalti Jóhannesson, researcher at University of Akureyri Research Centre.

3. THE SCOPE OF MEGAPROJECTS IN EAST ICELAND

15th March 2003 contracts were signed on the single largest construction project in Iceland's history. The project consisted of a large hydropower project, Kárahnjúkar and the Alcoa Fjarðaál aluminium plant in East Iceland. Estimated resources were 6,300 man years during the construction period and cost of 2.5 billion USD.

Figure 1. Location of Kárahnjúkar hydro power project and Alcoa Fjarðaál plant in Iceland.

For several decades, there had been plans to use the energy supplies of the glacial rivers in East Iceland to build large industry and create jobs. Therefore, there were very high hopes for the project and its impacts on the surrounding area. The region's population and economy had been in a relative decline for decades with limited diversity of jobs and dependency on the primary sector which has been rationalized and thus needing ever less manpower. The age and sex distribution of the area shows signs of lengthy out-migration, resulting in relatively fewer young adults and women who historically tend to migrate to the capital area, its vicinity or other regional centres. Therefore, the plans to build large industry in the area can to a large degree be looked upon as regional development initiative on behalf of the Icelandic authorities.

3.1. Kárahnjúkar hydro project

In 2003 building of the Kárahnjúkar hydropower plant commenced in the east part of the central highland, an area mostly untouched by human activities. During the construction period there were many protests against the project, probably more than in any construction project in Iceland to date.

Kárahnjúkar power station was formally opened November 30 2008 but was connected to the electricity grid to deliver energy to the Alcoa Fjarðaál plant already in April 2007. In December 2008 all six dams and 54 km of waterway tunnels of the

project were finished. In addition there are access tunnels and similar so in total there were 73 km of tunnels in the project.

The main contractors were foreign firms and the single largest was the Italian firm Impregilo. Similarly, the majority of workers in the project were foreign. Cultural and economic relations probably had much impact regarding which nationalities came to work on the project. Prior to 2003 no one was of Portuguese nationality in the region but a year after the project commenced, they were the most numerous among foreign nationals followed by Italians. In the Environmental Impact Assessment of the Kárahnjúkar project (2001) it was anticipated that some 20-25% of the workers would come from East Iceland. This prediction did not materialize as 9 out of 10 workers were foreign in the summer of 2007 at the peak of the project. When the number of workers decreased, the share of Icelanders became higher and at the end of 2008 they were around half of only 22 workers remaining. The staff needed to run this largest power station in Iceland is very small or 13, there of only one female.

3.2. Alcoa Fjarðaál aluminium plant

Smelting of aluminium began in April 2007 and in 2008 the aluminium plant had reached full capacity. Kárahnjúkar power station provides Alcoa Fjarðaál with 690 MW / 4,600 Gwh of electricity to produce 346,000 tons of aluminium annually.

Figure 2. The Alcoa Fjarðaál plant in Reyðarfjörður Iceland.

The aluminium plant was built in the town Reyðarfjörður in East Iceland, a town of just over 600 persons when the project commenced in 2003. The labour market of the plant within 45 minutes driving distance however consists of some 8,000 inhabitants. During the construction period the region in central East Iceland witnessed huge changes. Foreign citizens became the majority of the workforce and

huge investment also took place in the housing sector and infrastructure construction.

It took some 2,100 man-years to build the aluminium plant and at the height of the project Icelanders were 17% of the workers but the Polish were most numerous or 70%. There were around 1.700 workers on site at the height of the project. During building of the plant there were protests along with protests towards the Kárahnjúkar project. The picture below shows a display put up by protesters close to the project site during the summer of 2007.

Figure 3. Display by protesters by Alcoa Fjarðaál plant in the summer of 2007

In the beginning of 2008 the staff of Alcoa Fjarðaál plant consisted of 400 persons. 54% of them originated from East Iceland. Most of them or 70% were living in the municipality where the plant is located i.e. Fjarðabyggð but the remainder was mostly living in the town Egilsstaðir and vicinity some 35 km from the site of the plant. Females were at this point in time 32% of the staff and this was the highest share among Alcoa's aluminium plants[1]. In 2008 it was decided to increase the number of staff to 450 due to more processing of aluminium. In September 2009 there were 464 working in the plant. Around half of the workforce originated in East Iceland, 47% came from other locations in Iceland and 3% came from abroad, most of those were Icelanders. In September 2009 females had dropped to be 26% of the workers. Besides the jobs in the plant, there were 301 other persons working on the site of the plant in maintenance jobs, catering, transportation, janitorial services and so on, i.e. directly induced jobs. Altogether the number of staff on site was thus 765

[1] It had even reached 33% in the spirng of 2007.

which is huge compared to the size of the town Reyðarfjörður in 2002 before the project commenced, or 625.

4. RESEARCH ON SOCIO-ECONOMIC IMPACTS

The University of Akureyri Research Centre (RHA) carried out socio-economic studies in East Iceland 2004-2009, monitoring the impacts of the projects in the surrounding region. The research was financed by the government and carried out according to a parliamentary resolution. There was a sociological emphasis in the research which had the purpose of using the opportunity during the construction of the large scale projects in East Iceland to monitor its diverse effects. Thus the findings may be used to minimize negative impacts of future large scale projects and maximise the positive. Furthermore the research is important for the field of regional development studies.

Three large surveys were carried out among individuals in the region. Two surveys were sent out to companies and qualitative interviews taken with 15-20 individuals in four rounds. Statistics on demographic development and similar were collected and analysed. Data from municipalities was furthermore collected and analysed as well as data from the main contractors on the projects. The research project ended in 2009 and covered changes in the region during the period 2003-2008. In total, 9 reports were published.

4.1. Research area

At the onset of the research project the impact area of Alcoa Fjarðaál and Kárahnjúkar hydro project was considered to extend well outside of East Iceland. In cooperation with local actors the impact area was defined as the eastern part of Iceland, divided into three sub-regions. These were a *central impact area* which was limited within two hours average driving distance from the main building sites, and two more remote areas; the *northern and southern impact areas* outside beyond this distance to the outer boundaries of the total impact area. This geographical division can be seen on the map below.

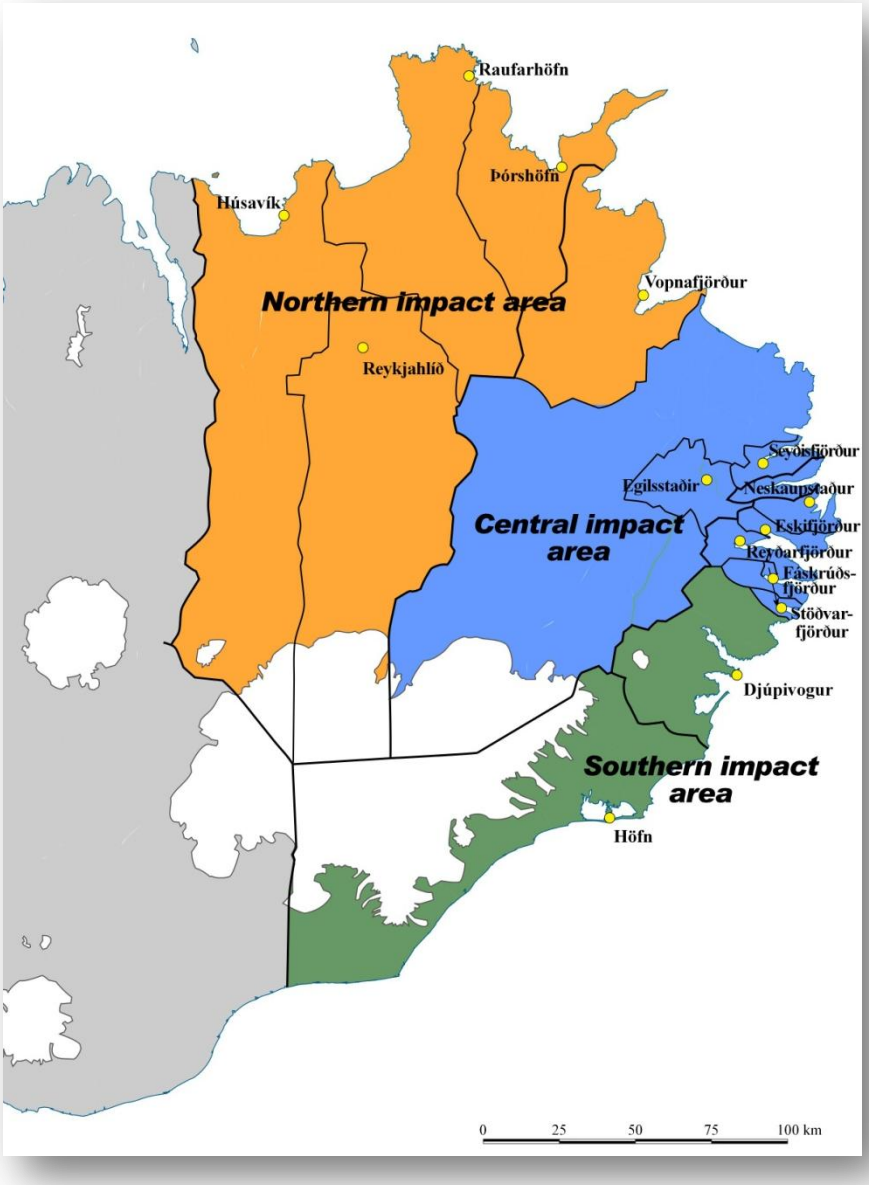


Figure 4. The impact area and its three sub-regions.

Generally the three sub-regions; central-, north- and south impact areas were used for data analysis. However, another geographical division into other 14 other sub-regions can also be seen on the map above. These sub-regions got their names from the main urban settlement within their boundaries. It is important to stress that this is not based on administrative division. The problem with using this geographical division is the low population number in the smallest areas.

In 2008 15 municipalities were in the study area but the number was 26 in 2002.

Table 1. Municipalities and inhabitants Dec. 1 2008.

Municipality	Inhabitants Dec. 1 2008	Municipality	Inhabitants Dec. 1 2008
Norðurþing	2,998	Seyðisfjarðarkaupstaður	717
Skútustaðahreppur	388	Fljótsdalshérað	3,707
Tjörneshreppur	58	Fljótsdalshreppur	143
Þingeyjarsveit	945	Fjarðabyggð	4,736
Svalbarðshreppur	108	Breiðdalshreppur	197
Langanesbyggð	511	Djúpavogshreppur	456
Vopnafjarðarhreppur	674	Sveitarfélagið Hornafjörður	2,110
Borgarfjarðarhreppur	142		

4.2. Fields of study

Even if impacts from the projects can be observed widely, some spheres of society will observe more impacts. This is depended on distance from the projects in two ways. On the one hand impacts are observed due to geographical proximity as has been discussed. On the other hand impacts can be observed due to sociological proximity where certain actors may be involved due to close contact with contractors or even taking part in the project. Beforehand it can be difficult to define exactly which spheres will observe most impacts. In the research the following spheres have however been identified:

- Economy and possibilities to earn income
- Labour market
- Population development
- Municipal affairs
- Housing
- Housing
- Private services
- Public services
- Land use and resources
- Tourism

There is for the most part a consistency with the social impact analyses carried out beforehand[2].

4.3. Data

At the onset it was decided to make use of different data sources and build upon ideas on methodological triangulation (Denzin, 1970; Silverman, 1997). In this way,

[2] That is, the ex-ante studies.

both qualitative and quantitative data was used to search for better understanding of the processes taking place in the communities. Furthermore both primary and secondary data were used. The importance was on data that shed a light on the changes in the communities while they were taking place.

The primary data consisted to a large degree of three large mail surveys carried out in 2004, 2007 and 2008. The surveys in 2004 and 2008 were carried out only among persons living in the impact area while the survey in 2007 was carried out in the whole of Iceland. These mail surveys used the same questionnaire with little changes during the three surveys which enable comparison of changes between surveys. Two mail surveys were sent to all companies in the impact area, in 2005 and 2008.

Other primary data consisted of interviews with individuals living in the central impact area. These interviews were carried out in 2002[3], 2004, 2007 and 2009. Interviewees were chosen on the basis of location; both towns and countryside, a mix of different economic sectors and gender. 15-20 individuals were interviewed each time. These interviews were not meant to describe the opinions of the general public but rather give an insight into how individuals experience changes in their community. Also this proved important to direct the study into certain directions.

Data from Alcoa Fjarðaál, Landsvirkjun[4] and the contractors building the projects were also obtained. However, it proved difficult to obtain some of the requested data. This may be a result of the short time span of the projects and their relative complexity regarding number of contractors and many nationalities involved. This kind of data appeared to be less accessible than in former projects in Iceland.

Statistics were important for study of issues such as population development, economy, labour market, housing and municipalities. However, the nature of such data and delays in making them available may make them more suitable in ex-post studies.

The objective of the research was to study the changes taking place in community as the projects were carried out it. The researchers believe that the initial emphasis on

[3] The interviews in 2002 were a part of another study of RHA but gave important information on issues such as expectations towards the projects before the commenced.

[4] The national power company and owner of Kárahnjúkar power plant.

primary data from surveys and interviews was right. Relying to a larger degree on statistics and data from the companies and contractors would have resulted in less sufficient data due to delays and unavailability.

5. RESEARCH FINDINGS

The research findings have been delivered in a total of nine reports in Icelandic. Three of these are main reports; two interim reports and a final report. Other reports deliver findings from surveys among individuals and companies, one focused on the requirement for housing and one reported on a special survey among workers on the project sites.

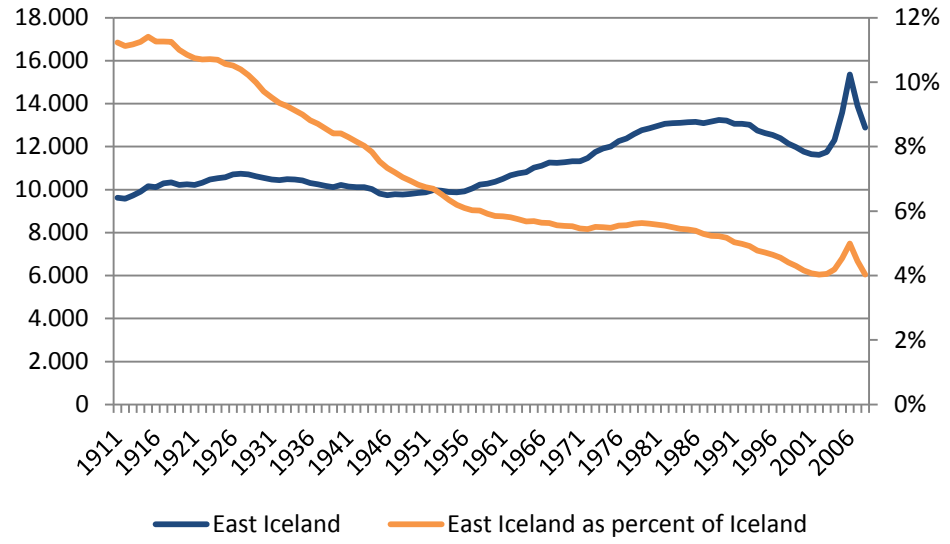
The single most important finding of the study is how confined the impacts of the projects were within two municipalities closest to Alcoa Fjarðaál and Kárahnjúkar power station[5] (Hjalti Jóhannesson ed, 2010). Individuals' responses in surveys indicate that there was much optimism about the impacts. This had to do with issues such as personal income, diversity of jobs and diversity of services. Background information in the last survey in 2008 indicated, that there is relatively much commuting for work to the town Reyðarfjörður where the plant is located. Similarly, there is much commuting to the town Egilsstaðir, the main service centre in East Iceland some 30 minutes driving distance from Reyðarfjörður. Qualitative interviews indicate that individuals experience much change in the local spirit i.e. more optimism and belief in the future of the region. Data from the municipalities show e.g. that financial impacts are seen in three municipalities. The area originally defined as the impact area for the research counted however 15 municipalities.

5.1. Demography

In East Iceland[6] there was a little population growth during the 20th century. During the first half of the century there was however little change and the population number remained around 10 thousand. After World War II population increase took off and until around 1980 there was a relatively steady growth. Slow growth continued until 1989, and at the end of that year there were 13,243 persons living in the region. During the last decade of the 20th century there was however a population decline as was the case with rural Iceland in general while the capital region was growing rapidly.

[5] Fjarðabyggð and Fljótsdalshérað (4,637 and 3,465 inhabitants respectively in Dec. 2009)

[6] Note that this in not the same geographical area as the impact area of this study but a statistical region used by Statistics Iceland (see. appendix) and also one of the constituencies during the period 1959-2003.



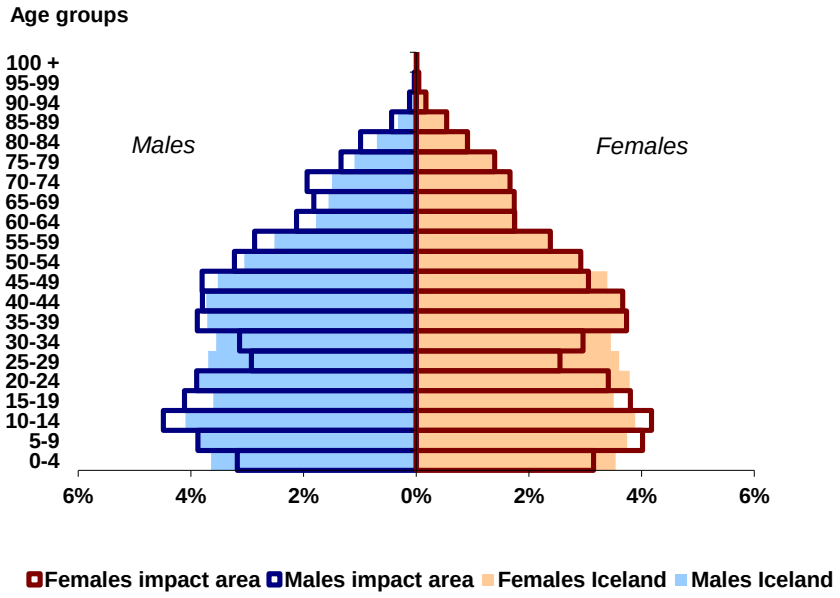
Source: Based on data from Statistics Iceland.

Figure 5. Population development of East Iceland 1911-2008.

This development can easily been identified in the figure above as the relative size of East Iceland's population has been decreasing. In this report the focus will be on the last few years on the figure above, the construction period, when the population experienced a sharp rise followed by a decline, primarily due to in- and out migration of foreign workers.

Demographic characteristics at the onset of the projects

When the project commenced in 2003, demographic conditions in the impact area were to a large degree similar as in Icelandic rural areas in general. Males outnumbered females by 52% to 48%; young adults were underrepresented as well as young children. East Iceland shared these general characteristics with most of rural Iceland which has generally experienced out-migration to the capital region. As is the general trend in migration patterns, young adults are overrepresented among migrants as well as women. Older males are overrepresented in the local population compared to the Icelandic population. The population pyramid below demonstrates this situation:



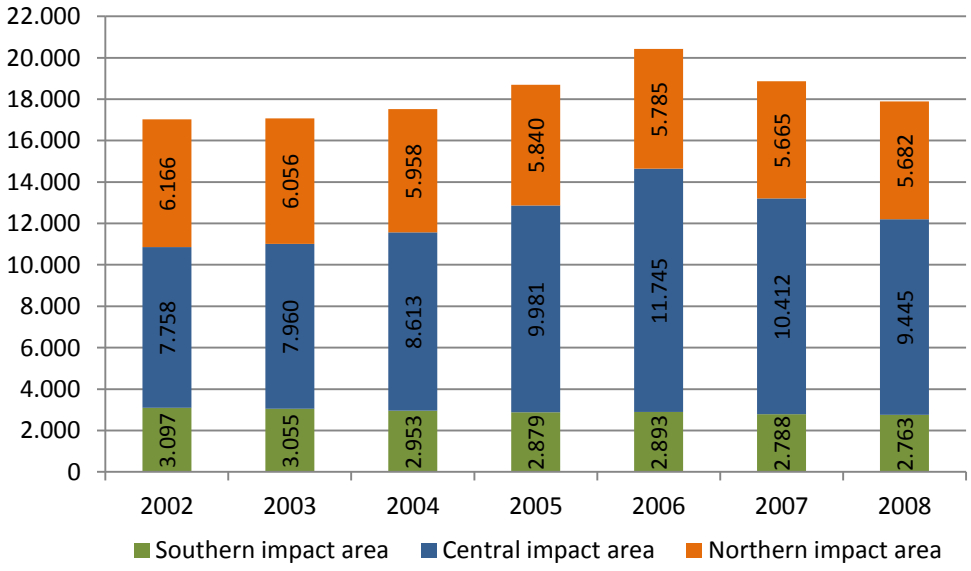
Source: Based on data from Statistics Iceland.

Figure 6. Age and gender structure of the impact area in 2002.

The three sub regions of East Iceland; central, north and south had similar characteristics in this regard prior to the projects.

Population development 2002-2008

Population increase as a result of the megaprojects was confined to the central impact area. Population decline continues in the southern and northern impact areas. The figure below shows this development by the three sub regions:



Source: Based on data from Statistics Iceland.

Figure 7. Population development by the three sub regions 2002-2008

In the central impact area the growth was to a large degree caused by influx of foreign workers. During the latter half of 2007 the maximum number was reached and just fewer than 11,800 persons were registered in municipalities of the central impact area. As expected, the population declined again after this but at the end of 2008 when most of the projects were finished the population growth in the central impact area was 22% from 2002. In the southern impact area the decline was 11% and 8% in the northern area. Net population increase in the impact area as a whole was therefore around 900 persons and it was very unevenly distributed between municipalities. In fact at the end of 2008 there were still foreign workers registered in area even if most of the construction work was finished.

But how well did the population change compare with estimates put forward in social impact assessment? In a SIA report from 2006 it was estimated that inhabitants would increase to 11,400 in central East Iceland in 2007 and then decrease to just less than 10,000. The end result was similar as 1 December 2009 inhabitants of the central area were 9,781. However, for those who wanted the impact area to be defined as large as it was, these results must have been a disappointment. This could e.g. be seen in reactions of local politicians in 2007-2008 as the geographical distribution of impacts was taking on a shape.

5.2. Economy

The long-term impact of the construction project on the economy of East Iceland relates first and foremost to the aluminium plant, for which the building of the power plant is a necessary premise. Otherwise, the impact of Kárahnjúkar power plant on the economy of East Iceland during its period of operation mainly focuses on the fact that the power plant has 13 employees and that, jointly, the plant and Landsnet, which owns and operates the power grid; pay approximately ISK 80 million per year in property tax[7].

It is estimated that ISK 36 billion of total investment in the aluminium plant has entered into the Icelandic economy. It is not known how large a proportion of this amount found its way to East Iceland, apart from the fact that Fjarðabyggð municipality received approximately ISK 3 billion in the form of local income tax. In

[7] NB. The exchange rate of EUR 11 May 2010 was 164 ISK.

2009, compensation of employees at Alcoa aluminium plant was ISK 3.6 billion, with average salaries being ISK 540 thousand per month. The purchase of goods and services from domestic operators amounted to ISK 13 billion and tax and payments to Fjarðabyggð municipality of taxes and other charges were ISK 600 million. Probably 40-45% of the income of the aluminium plant finds its way into the Icelandic economy.

According to sample surveys, the number of people increased who were satisfied with their employment income in the central impact area. It is of particular interest to note that the survey from 2007, which was carried out countrywide, indicated that a proportionally larger number of people in the central impact area were very satisfied or rather satisfied with their income than was the case in the capital and its impact area, as defined in this particular survey. When respondents were asked in autumn 2008 whether they felt the heavy industry construction had improved their financial situation, about half of the respondents in the central impact area, either strongly agreed or rather agreed, compared to just below one in five in the northern impact area and 13% in the southern impact area. Belief in improved financial situation connected with the operation of the aluminium plant is geographically limited to the central impact area.

It proved difficult to estimate the crowding-out effect of the advent of the aluminium plant. Jobs in fish processing were sharply reduced during the construction period, more, in fact, than had been predicted. The aluminium plant, however, is unlikely to have been the main cause of this additional downward trend. The crowding-out effect appears to have been for the most part positive; i.e. companies which previously had been under pressure to maintain the level of employment, were now given the opportunity to economise and reduce staff, thus building strength for the future. With a view to this steep reduction in fish processing jobs, which probably would have occurred to a large extent whether the aluminium plant was built or not, the population of East Iceland probably would have fallen significantly without the advent of the aluminium plant - even by a thousand persons or more.

5.3. Labour market

As for the labour market, a highly significant aspect of surveys among the residents was their increased satisfaction with diverse job opportunities. One of the Achilles heels of the provinces has long been monotony of employment and lack of

opportunities for young people who have obtained an education. It would seem, therefore, that in this respect a satisfactory result has been achieved in the respondents' opinion. According to a survey in 2007 which was conducted all over the country, satisfaction with job diversity was highest in the central impact area of East Iceland, second only to the capital region, which must be regarded as a significant result. In the northern and southern impact areas, attitudes to this aspect resembled those expressed in other regions of Iceland and there was little change. When the survey was repeated in 2008, it was found that satisfaction in this regard had to some extent diminished in the central impact area.

The degree of residents' participation in the construction work was examined. As was to be expected, participation was highest by far in the central impact area, where approximately 30% of respondents aged 18-65 were directly connected to the construction project in 2007, according to a survey conducted in that year. Next in line were the capital area with 11% and the northern impact area with 12%. With regard to the strong impact in the capital area, the development of the transport- and communications system should be kept in mind, which is a related aspect of considerable significance. Air communications with Reykjavík, for example, are excellent and heavily used. Furthermore, the diverse industries and services of the capital area, as well as the size of its economy, are bound to contribute to a proportionally significant extent to a construction enterprise of this type.

The proportion of women in the total workforce of the aluminium plant has been high, reaching 32% in autumn 2007. In February 2008 this proportion was at approximately 28% and 26% in December 2009. This is a considerably higher ratio than in other aluminium plants in Iceland. Thus, the proportion of women in the total workforce of Norðurál in western Iceland was 20% in December 2009 and 18% at the Rio Tinto Alcan plant in the capital region. The Alcoa Fjarðaál plant received recognition by the Equal Opportunities Council for its successful recruiting of women 24 October 2008.

In the aluminium plant's social impact assessment, certain objectives were established with regard to the level of education of the plant's workforce. Those objectives were very satisfactorily achieved and probably the company's recruitment policy has been decisive in obtaining a result so close to what was specified in the social impact assessment. When 400 employees had been hired,

about 17% were university educated, 19% had an upper secondary certificate, 20% a trade qualification and 42% had completed compulsory school.

With regard to the labour market, work shift schedules are among those aspects which the researchers believe need to be carefully considered when a large employer is located in a small population area. It is clear that in such a setting the place of employment has a decisive influence on the social rhythm. As brought out in interviews with municipal and state church employees, situations may arise where the 12 hour shift schedules, originally chosen by the Alcoa Fjarðaál staff, are ill-suited to the needs of a family. In such cases, for example, supervision of employees' children after school or playschool hours may be impossible to arrange. The researchers recommend a revision of these work shift schedules and their impact; it is seen as positive that a work shift committee, consisting of employee representatives, has been appointed at the plant to look into such matters on behalf of the company.

A survey in autumn 2008 demonstrated the importance of Reyðarfjörður as an employment centre attracting people from other regions. Thus, it might be said that this former traditional fishing village has now been transformed into the main employment magnet for the entire region of the East Fjords.

Changes in education level have occurred between individual surveys and in the last survey, from autumn 2008, this is slightly lower in the southern impact area than elsewhere. When considering the major shifts in the demographic composition of the central impact area, with people being recruited for the aluminium plant and related work, a significant change in level of education need not come as a surprise. It is worth noting that the number of respondents with compulsory education grows proportionally in the central impact area, after a reduction between surveys in 2004 and 2007. The number of people who have completed a first university degree goes down again, however, after a very significant increase between surveys in 2004 and 2007. There is, nevertheless, a steady rise among those with a postgraduate degree. It should be kept in mind that since this the research spans a considerable length of time, a concurrent upward swing is taking place in the national level of education. The proportions regarding several categories of education are similar in the central impact area, the northern impact area and the Akureyri region in north Iceland. Approximately 45% have completed compulsory education, 6% have gained a matriculation certificate, 11% a trade qualification, 10% a lower secondary school

certificate and 25% have graduated from university. In the southern area, the level of education appears to be somewhat lower.

5.4. Housing

This is the policy area where the most obvious mistakes were made during the construction period, the most striking of which being the excessive building of residential housing. Two specialist reports presented the assessment that 70-80 thousand m2 of residential housing needed to be added in Central East Iceland in the wake of the aluminium plant construction. When the municipalities allocated building permits, however, little regard was apparently paid to those forecasts. When the end result was achieved in 2008, residential housing had expanded by 135,000 m2, or 60,000 m2 in excess of research estimates. Population growth in the central impact area, however, was 1,687 during the period 2002-2008, or similar to what had been forecast in the two specialist reports.

House prices rose dramatically at the outset of the construction period, but this trend had mostly reversed itself when the plant began operating. This is shown, for example, by comparisons with other provincial areas. Prior to the commencement of construction house prices were similar or higher in the fishing towns than in municipalities within the plant's central impact area. This changed significantly during the construction period, with house prices in the central impact area surpassing to a considerable extent those of other Icelandic regional communities. When the aluminium plant became operational, however, the situation appeared to be reverting to an earlier pattern. Thus, house prices in the central area appear not to have undergone a permanent change, as a result of the advent of the aluminium plant, in comparison with other fishing towns. Too many houses were built in the central impact area during the construction period, which has negatively impacted house prices. One may ask what the current prices would be, if the building programme had been properly adjusted to circumstances. This question probably cannot be answered, until perhaps many years from now. It is by no means unreasonable to maintain, however, that the advent of the aluminium plant raised house prices in the area in the long term, but that this trend was temporarily blocked by oversupply.

In October 2009, 218 apartments were vacant in the area, thereof 73% in multi-dwelling buildings. As a result, the question is being asked whether the building of apartment blocks has not been placed too high on the agenda. The proportion of

detached houses is higher in many outlying regions than in the capital area. In 2002, single family dwellings constituted 12% of all residential housing in Reykjavík, whereas at that time this proportion was 57% in Egilsstaðir, East Iceland. The proportion was totally different in housing built during the construction period. In Reyðarfjörður, East Iceland, detached houses constituted only 17% of all housing built from 2003 until and including 2008. The proportion of single family homes in this case, therefore, appears to be more in line with the capital area, rather than the proportion of single family housing characterising regions like Central East Iceland. The experience of this house-building programme demonstrates that municipal councils must ensure, not only that a suitable quantity of housing is constructed, but also that the type of houses built conforms to community practice in each location. This must be kept in mind the next time an employment development programme is embarked upon outside the most densely populated areas of Iceland, and, in fact, anywhere in the country. According to the respondents, there appears to have been a certain amount of competition between the municipalities Fljótsdalshérað and Fjarðabyggð with regard to building programmes and new inhabitants settling down in connection with the construction project.

In hindsight, it might have been advisable to pay more attention to the external appearance of new buildings and the overall visual impact of towns and town districts. The opportunity to design population centres in the area, almost from scratch, as it were, as was the case in Reyðarfjörður could have been utilised in a more felicitous manner.

But there were cases of overinvestment and general lack of prudence and caution in other areas than that of the building industry. Some contractors acted unscrupulously and invested excessively. When conditions became tougher due to lack of available work and, later, with the addition of a poor state of the economy and the concomitant devaluation of the Icelandic krona, some people were unable to live up to their obligations. It should be remembered that the society in general was characterised by high expectations and a strong degree of optimism at this time, and, as a result, other parts of the country experienced similar troubles and tribulations, especially in the capital area.

5.5. Infrastructure

The new infrastructure created by the construction of an aluminium plant and power station in East Iceland, has been of use to the local communities in different

ways and to differing degrees. As would be expected, the effect of this is more obvious in areas closest to the construction sites. New roads in the region of the plants would be used by those travelling in that part of the highland, and improved road conditions within Fjarðabyggð are of the utmost importance. New port installations at Mjóeyrarhöfn, along with regular import and export from that area, are among the most significant new developments. The port is the second largest in the country, with regard to cargo volume, and many jobs have been created in connection with this transport operation. Alongside the construction itself, considerable work has been underway to build up a powerful telecommunications system on the sites themselves and in the immediate neighbourhood. Many respondents, both experts and members of the general public, express the opinion that to reap the best and most positive benefits from the plants, further improvements to the roads in the region will have to be made. In this connection, the aspects most often mentioned are tunnels to Norðfjörður and Seyðisfjörður. The authors of this report are in full agreement with that view. Flights to and from Egilsstaðir Airport increased significantly because of the huge construction projects, and domestic traffic through the airport doubled between 2002 and 2006. There was also some international air traffic through Egilsstaðir, as well as chartered flights carrying foreign staff connected with these major construction enterprises. Air communications constitute one of the aspects which could have gone better when planning the construction operations, For example, the extension of the airport facilities in 2007, came rather too late to meet the increased flow of passengers. With regard to overland communications, one of the most important undertakings has been the tunnel between Reyðarfjörður and Fáskrúðsfjörður, which increased the employment area, and is extremely important for the central and southern impact areas, although these cannot, strictly speaking, be directly linked to the construction of the plants.

5.6. Municipalities

The income of the municipalities in the central impact area rose considerably; thus the increase in municipal income tax during the period 2002-2006 was proportionally highest in the country in Fjarðabyggð, Fljótsdalshérað and Fljótsdalshreppur. The large number of foreign staff who paid income tax to the municipalities was the main reason for this increase. The municipalities in the areas around the construction sites would have received much less income if the staff had

been made up of more Icelanders. Between 2007 and 2008, when construction rate began to decrease, the total income of Fljótsdalshreppur, and to a lesser extent Fljótsdalshérað, also decreased. The income of Fjarðabyggð, however, has continued to grow, since there the changeover from construction phase to operations phase is more economical there than in Fljótsdalshérað municipality. A sharp fall in income does not, therefore, explain the sluggish operating result for 2008 in Fjarðabyggð, and only partly accounts for that of Fljótsdalshérað.

Anticipating an increase in population, the municipalities grossly overinvested in facilities. For example, we may mention the planning and construction of new residential areas together with the relevant infrastructure and the development of buildings to house sporting activities. It is obvious that there was a certain degree of competition between municipalities to attract new residents to their respective areas with the evident result that many new houses now stand empty in Fjarðabyggð and in Fljótsdalshérað, together with underused infrastructure in the form of roads and drainage systems. From this, the conclusion may be drawn that more consultation between municipalities regarding planning would have been desirable. Also, in connection with this, the advantages and disadvantages of further amalgamating the municipalities of East Iceland might be deemed worthy of consideration.

5.7. Society and lifestyle

Among both politicians and the general public there were high expectations and, as far as can be seen, little was done to damp these down. In such conditions, there is always a certain danger of disappointment if all does not go according to plan. Those responsible for making decisions and planning the constructions must draw up as realistic a picture as possible of changes which could occur and keep expectations within the limits of moderation.

5.8. Structural changes in the economy

The crowding-out effect of the aluminium plant is very unclear, i.e. how many jobs were cut because of its construction and operation within the labour market of Central East Iceland. Jobs in fish processing fell greatly in number during the construction time, more than in the previous years. The large decrease in jobs in fish processing leads one to consider how the economy of East Iceland would have developed had there been no heavy industry on the scene. It is impossible to give a

definite answer to this question, but there is every indication that the communities would have had to fight a highly defensive struggle with recession, and a decrease in population, the latter even to a significant extent. In a survey carried out among tourism services within the impact area, it appeared that about 20% of the companies said that some changes in their operations after 1 January 2002 could be traced back to the construction of the plants and over 30% considered that other changes in society, excluding the plants, had a great influence on their operational conditions. Other changes within the community seem, therefore, to have had more influence on their service operations than the construction projects. It would appear that the tourist services have connected themselves in a rather positive way to the construction enterprises, in spite of negative forecasts by many relating to the alleged incompatibility of heavy industry and tourism. The construction phase seems to have brought operators in tourist services considerable extra income, especially those providing accommodation and restaurant facilities.

6. SHORT INFORMATION ON THE PLANNING PROCESS OF KÁRAHJÚKAR HYDROPOWER PLANT AND ALCOA FJARÐAÁL PLANT

Below is some background information on the history of attempts to attract energy intensive industry to the region of East Iceland. These planning initiatives have been looked upon as desirable and important for the future economic development of the regions. By locals it has been considered important that the energy sources found in the region should be harnessed to create jobs locally. In fact there has been competition between different locations within Iceland to host such an industry. For East Iceland this vision finally materialized with the megaprojects which are the subject in this report. Furthermore, until then, the only energy intensive industry had located in the vicinity of the capital Reykjavík. Opinions of interviewees and results of surveys carried out in the study on socio-economic impacts in East Iceland must be looked at against this historic fact - this lengthy waiting period.

6.1. The background of megaproject planning in East Iceland

For nearly three decades there had been discussions or plans on constructing large industrial projects in East Iceland by harnessing the glacial rivers in the region. The site of a possible manufacturing firm was during the whole time designated by the fjord Reyðarfjörður. That site had already in the early eighties been identified as suitable due to location factors in a project comparing and identifying such locations all over Iceland (Staðavalsnefnd um orkufrekan iðnað, 1983). Below are the main cairns on the path towards establishing a manufacturing plant in the region. Following information is derived from www.karahnjukar.is (visited, 6 May 2010):

1975-1976 the Norwegian company Norsk Hydro examined possibilities of building an aluminium plant in Reyðarfjörður. The power was to come from a proposed Fljótsdalur hydro power plant.

1980-1985 the Australian company Rio Tinto Zink had plans about building a silicon metal plant in Reyðarfjörður. The power was again to come from a proposed Fljótsdalur hydro power plant. This project was well on its way before it was abandoned.

1989-1990 the multinational firm Atlantal, owned by Hoogovens, Alumax and Gränges, was searching for a site for an aluminium plant. The final choice was however Keilisnes in SW-Iceland and power was still to come from proposed

Fljótsdalur hydroelectric power plant. The National Power Company, Landsvirkjun, had already started constructions when the project was suspended in 1991.

In 1998 discussions were taken up again with Norsk Hydro about an aluminium plant and a hydroelectric power plant in East Iceland. Memorandum of understanding was signed in June 1999, for a 120.000 tonnes smelter and a power plant in Fljótsdalur with reservoir at Eyjabakkar, known as the Noral Project. In 2000 investors came to the conclusion that the smelter needed to be bigger in order to be profitable. In May 2000 a new memorandum of understanding was signed for an aluminium plant of 240.000 tonnes annually with a second stage of 120.000 tonnes. A company jointly owned by Norsk Hydro and Icelandic investors was to develop the plans but Landsvirkjun would supply power by Kárahnjúkar hydro power station.

The Alcoa plant Kárahnjúkar hydropower station begin to materialize

March 2002 Norsk Hydro however announced it could not meet deadlines set in the decision process but clamed interest in the project at a later stage. The Icelandic government however immediately established a commission to look into other company's interest in the project and shortly afterwards talks started with Alcoa.

April 2002, a joint action plan was signed with Alcoa to explore the possibility of constructing an aluminium plant in East Iceland. Alcoa would own and operate a 320,000 tonnes plant which would receive power from a 500+ MW hydro power station in East Iceland, constructed and operated by Landsvirkjun.

July 2002 a memorandum of understanding was signed in Reykjavík between the Government of Iceland, the national power company and Alcoa formalizing their cooperation on a 295,000 tonnes plant in East Iceland. Landsvirkjun should begin development of a 630-megawatt hydro power facility in East Iceland, and Alcoa should complete environmental and engineering studies of the smelter near Reyðarfjörður. The memorandum also encompassed a harbour facility by the smelter as well as related infrastructure improvements in East Iceland.

March 15 2003, marks the date when these three parties signed an agreement to commence the Kárahnjúkar project.

This lengthy process has had its impacts in the region of East Iceland. Inhabitants had in fact begun to wait for a construction of manufacturing facility for a very long time. During the same period the population in the area went into a relatively steady decline due to out-migration and consequent demographic changes. For example

there were fewer young adults and women. Furthermore, rationalization took place in the mainstay of the economy, the fisheries and fish processing, needing fewer and fewer hands. Also a quota system in fisheries introduced in 1983 has had tendency to shift ships and quota to larger and fewer companies and locations. At the same time the economy of the capital Reykjavík and the capital region was booming and the region consisted of 63% of the total inhabitants by the time Kárahnjúkar and Alcoa Fjarðaál projects commenced and this ratio has little changed since. These conditions must be considered along with the fact that the majority of the public in the region welcomed the project when it was decided in March 2003. On the other hand there was much opposition towards the projects in the capital region especially on the grounds of environmental reasons but also economic reasons, fearing that the projects might cause too much strain on the Icelandic economy. Protesters' demonstrations on the projects were more than previously seen in Iceland both on building sites in East Iceland as well as in the capital, Reykjavík.

Building of the Kárahjúkar project commenced in 2003 and it began delivering power to the aluminium plant in 2007. It was formally opened in November 2008. The aluminium plant reached full capacity in the spring of 2008 creating 450 jobs, additional 300 derived jobs and undefined number of induced jobs.

6.2. The planning process of Kárahnjukar hydro power project

The Kárahnjúkar project involved harnessing, in a single hydro power plant, two glacial rivers which originate in Vatnajökull glacier and water from several rivers in the eastern part of the highland. The impact area includes the highlands by the glacier as well as land along the rivers in question and the eastern coastline (Landsvirkjun, 2001). Icelandic environment is on the edge of the Arctic region, the soil is vulnerable to erosion due to volcanic ash and wind-blown material. The highlands in the project area resemble, to a large extent, other Arctic regions having similar vegetation with limited productivity, large rivers and a limited variety of fauna. On the other hand, Iceland is unique for its geothermal activity and young soil and bedrock. The catchment area of the two glacial rivers involved, represents 7% of Iceland's total watershed.

The project went through the process of environmental impact assessment (EIA) according to Icelandic law. This was finalized in May 2001. The main conclusions of the EIA were as follows:

The area disrupted by Kárahnjúkar Power Plant, particularly through dams, reservoirs and roads, is unique in many respects, and certain parts of it are considered to have high conservation value. The Kárahnjúkar plant will impinge upon the wilderness north of the glacier Vatnajökull, and "untouched wilderness" in Iceland.

The Kárahnjúkar hydropower project will leave a lasting impression on its impact area. Changes will occur in the natural terrain and land use in areas where vegetation and fauna are sensitive. These are the main aspects of nature which would change or be lost with the establishment of the plant:

- Structures reduce by 925 km^2 undisturbed open spaces in the highlands.
- The formation of Hálslón reservoir covers an area of approximately 57 km^2.
- Valuable habitats of vegetation and small animals are lost under Hálslón.
- About 32 km^2 of vegetation is submerged by Hálslón and an additional 8 km^2 disappear under other structures and reservoirs.
- Considerable changes in the flow of two large glacial rivers. Volume increases in the third river where water is directed to (Lagarfljót) but average flow in Jökulsá á Dal decreases significantly.
- The appearance of Hafrahvammagljúfur canyon will be modified considerably, with almost no water flow below the dam.

Other negative changes concern reindeer grazing, migration routes, dust from glacial sediments on the shores of reservoirs, submerged geological features, darker colour of river due to glacial sediments, changes in groundwater levels and changes in coastline, due to less sediments.

Positive impacts were in particular connected to the sale of energy to large-scale industry, increased export, jobs and economic activity in East Iceland and Iceland in general.

The Icelandic National Planning Agency ruled August 1 2001 against the project on the grounds of considerable environmental impact along with insufficient information on individual factors of the construction and its environmental effects. This ruling was appealed to the Minister for the Environment.

On 20 December 2001 the Icelandic Minister for the Environment however approved the project with a list of twenty conditions, demanding significant changes to the power plant in order to reduce its environmental impact. This reduced the energy producing capacity and was costly to implement.

The Minister of the Environment engaged Icelandic and foreign scientists and consultants to treat the environmental effects of Kárahnjúkar Power Plant in detail. This was concluded in a ruling of around 150 pages. (www.karahnjukar.is)

6.3. The planning process of Alcoa Fjarðaál aluminium project

A memorandum of understanding dated 19 July 2002 was signed between the Government of Iceland, Landsvirkjun (the National Power Company) and Alcoa Inc. on evaluation and potential implementation of an aluminium plant in eastern Iceland. An EIA had already been carried out for a similar plant which Norsk Hydro had planned to build (see above). Using the same EIA as the Norsk Hydro project was protested. The high court of Iceland ruled in 2005 on a new EIA to be carried out for the Alcoa smelter which used a different technology and scale of operation than the previously planned Nork hydro project. The site and harbour facilities for the Plant at Mjóeyri in Reyðarfjörður were to be provided by the Government and the municipality of Fjarðabyggð. The Government and the municipality should also take responsibility for developing other necessary infrastructure requirements. (www.karahnjukar.is). Building of the project commenced in 2004 and was planned to finish in 2007. As said earlier a new EIA process was carried out but the project which had then already started when ruling on this had been passed by the high court. A renewed EIA process was finished in 2006.

7. DISCUSSION

It is right, here, to emphasise how difficult it can be to separate the impacts of construction projects such as the one studied here from other aspects occurring in society at the same time, and which have also proved themselves to be highly influential. At the top of the list must be the credit crunch which hit in October 2008, alongside a price explosion in the property market and other areas.

Expectations ran high and, as far as can be seen. Little was done to damp these down. In such conditions, there is always a certain danger of disappointment if all does not go according to plan. Those responsible for making decisions and planning the constructions must draw up as realistic a picture as possible of the changes which could occur and keep expectations within the limits of moderation.

Before construction work was set in motion, an environmental impact assessment was carried out, as required by law, where it was attempted to forecast the probable effect of the project. At the conclusion of the research, it may be said with certainty that too many backward looks had been brought into play regarding the possible effect of the construction work, i.e. too much attention was given to how previous projects had been organised. Conditions in society can change with lightning speed and this is true of the period under discussion here. The effect of globalisation had most likely become stronger than people of Iceland realised. That applies to the impact of the "four freedoms" which came into being through the European Economic Area Agreement and other aspects. It is clear that Iceland is no longer an island in every sense of the word. This is certainly true as far as economic effect is concerned. The Icelandic system of governance was not sufficiently prepared for the project and it can probably be seen in other areas of society, that the Icelanders were not equipped to live in an open economic system with its resultant free flow of labour, capital, goods and services. One of the consequences of this was that the participation of foreigners exceeded forecasts and this put a great deal of pressure on official institutions. However, the influx of hundreds of foreign workers caused less social disruption than might have been expected.

The emphasis placed on assessing the construction phase, as was done in this research, is of particular interest and clearly demonstrates what many people have seen as the most desirable stage of the entire construction enterprise. The construction phase can be an attractive period, but it was certainly not so in this case, as compared to the operational period, as was foreseeable. The construction

phase was shorter than was desirable in order to allow for better preparation of the project, and also to give the people of the area more time to fully understand the changes which were on the horizon.

It is therefore right to emphasise the fact that the impact area of the construction work was different and narrower than had been imagined in the beginning, since the impact area does not exactly follow municipal boundaries or constituencies.

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