Sustainable local development in the context of a short-lived mining boom: The case of Pajala in northern Sweden

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ABSTRACT

This paper examines the local economic impact of a recent short-lived mining boom in Pajala in northern Sweden. The case study considers the Kaunisvaara iron ore mine, which started production in late 2012 but soon suffered financial problems and went bankrupt in the autumn of 2014. Mining emerged as a new economic activity in Pajala, and the paper considers how the local economy responded during the short life cycle of the project. The empirical data consists of selected indicators on local economic development and industry specialization, and the analysis is supplemented with qualitative information. Data on the years after the bust are not yet available, which means that the bust can only be addressed qualitatively. The study thus primarily focuses on how the local economy responded to the development of the mine. The results suggest that the local economy in Pajala was revived by the Kaunisvaara mine while it operated. Pajala gained a substantial amount of local jobs during the mining boom. During the period from 2009 to 2014, positive development occurred in overall employment, population, labour market participation rates for men as well as women, and incomes, which showed faster growth than the national average. The local economy became increasingly specialized in mining, and the paper addresses some implications of resource dependency for sustainable local economic development in light of the bankruptcy.

Keywords: *mining boom, local economic development, Pajala*

INTRODUCTION

The global mining industry underwent a boom development during the first decade of the 21st century, onset by the most sustained commodity price boom since the Second World War (Humphreys 2010). Söderholm and Svahn (2015) show that the

global rate of new mine openings increased significantly during the second half of the first decade of the 2000s as a response to the commodity boom. A particularly large number of new mining ventures opened in high-income countries, with Australia, Canada, the United States, Russia, and Chile accounting for 38% of the new mines (ibid).

In many mineral-endowed regions, the expanding mining industry triggered an increased attention to issues such as the impact of mining on local communities in terms of economic and social development. This is also reflected in the academic literature, and some relatively recent examples include Ivanova and Rolfe (2011), Fleming and Measham (2014), Kotey and Rolfe (2014), and Törmä et al. (2015), who have analysed the economic impact of mining on the local or regional level, while recent studies on the social impact of mining on local communities include Petkova et al. (2009), Carrington and Pereira (2011), and Petrova and Marinova (2013). Now that the boom has ended, mining towns and regions are again forced to cope with the downside of the boom–bust cycle that is often associated with the extractive industries.

Pajala in northern Sweden, which belongs to the Barents region, has recently experienced the realities of a mining boom and bust. In 2010, Northland Resources started construction of the Kaunisvaara iron ore mine outside Pajala. Production started in late 2012, and the mine was intended to reach full production a few years later, but financial problems eventually led to the company's bankruptcy in the autumn of 2014. The mine has since remained closed.

This article summarizes the results of a case study on local economic development in Pajala. The case study work took place during the spring of 2015 as part of the NEO-BEAR research project. The case study was originally intended to examine how the local economy responded to the new mine, and it should be noted that the study was planned at a time when it was not known that the mining company had financial problems and would ultimately close the mine. The case study thus focuses on a mining town that had recently experienced a boom and bust, but a weakness is that statistics covering the period after the bust were not available when the work was undertaken. The case study would have benefitted from access to such data.

The purpose of the article is to examine how employment and income – key indicators on local economic development – changed in Pajala during the mining boom, to

assess to what extent the mine generated local economic benefit. A secondary purpose of the case study was the question if the community would have been better off with or without the mining project. Due to lack of data, the article can only address the bust qualitatively. Thus, the secondary purpose is primarily tackled by reflecting on the combination of quantitative and qualitative results.

Previous literature on resource booms has often dealt with macroeconomic effects (e.g., Van Der Ploeg 2011) and sometimes also community impacts (e.g., Bone 1998; and, more recently Tonts et al. 2012). Often, such studies consider the cyclical nature of commodity markets, which poses challenges for resource-dependent economies whether they expand or contract. An important feature of the case study at hand is that mining was introduced as a completely new activity in the local economy, and the paper considers how it responded to a construction phase followed by approximately 1.5 years of production. The bankruptcy in the autumn of 2014 meant the end of mining in Pajala; the case thus reflects a turbulent period in the local economy, with short-term adjustments to a new economic activity which failed to persist – at least under Northland ownership . This paper also reflects on some of the challenges that lie ahead for the local economy, as iron ore prices have remained low compared to the boom period and the mine has remained closed. The discussion is underpinned by recent data and by qualitative information derived from desk studies and semi-structured, in-depth interviews with two respondents from the local economic development office who followed the mining boom closely

The rest of the paper is organized as follows. The next section discusses sustainable development in the context of mining, and addresses some implications for mining towns. Some basic theoretical concepts are introduced and implications of local specialization on mining are reviewed, given the boom–bust cycle often associated with the mining industry. A background description of the case is then given, including a survey of the limited number of project-specific economic impact studies undertaken *ex ante*. The section entitled "the mining boom in Pajala" examines recent data on economic development in Pajala during the boom, and supplementary qualitative information is also provided. The mining bust is then discussed briefly. In the absence of available data, the section is forced to focus only on qualitative aspects of the bust. The last section provides some conclusions of the case study.

MINING, SUSTAINABLE DEVELOPMENT, AND LOCAL ECONOMIES

Mining's potential to contribute to sustainable development remains contested, but the minerals industry has without doubt made important contributions to society over time (Hilson and Basu 2003; Onn and Woodley 2014; Eklund 2015). Mining supplies many of the materials that societal development has depended on, and continues to do so (ICMM, 2012). Moreover, mining has the potential to create significant economic benefits for its host economies (Eggert 2001), but it may also involve difficult trade-offs which should not be neglected. Many of the environmental problems associated with mining are not entirely preventable from the outset (Hilson and Basu 2003).

These trade-offs can be understood in terms of benefits and costs (Eggert 2001). Numerous studies (e.g., Labonne 1999; Azapagic 2004) have pointed to the industry's potential to create jobs and generate income as positives (benefits), while environmental impacts and social disruption constitute some of the negatives (costs). Eggert (2001) argues that taking a general stance is difficult, because the trade-off between benefits and costs is specific to a host community or nation. Thus, mining's sustainable development contribution at the local level can only be understood by carefully considering the context and the relevant circumstances.

The sustainability discourse on mining is further confused by the multitude of different definitions of sustainable development (Onn and Woodley 2014). The research on sustainable development has also pointed out more general difficulties in reconciling local, national, and global sustainability agendas (Voinov and Farley 2007). One of the most common definitions of sustainable development is that of the Brundtland Commission (World Commission on Environment and Development 1987), which defined it as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Hilson and Basu (2003) noted that the extraction of non-renewable commodities seems to contradict the very notion of sustainability contained in this definition. They provide a review of sustainability research on mining and minerals which identifies different and somewhat conflicting responses to the implications of mineral depletion for sustainable development: some authors suggest that mineral outputs should be regulated to ensure the needs of future generations, others emphasize the need for investing mineral revenue in other forms of capital to compensate for depleting mineral assets, whereas some contend that metallic minerals are not destroyed when they are consumed and can be recycled. Another direction of research often links sustainable development to exclusively environmental themes

Perhaps the most obvious challenge in achieving sustainable economic development in mining towns is the fact that mineral assets are finite. Still, Eggert (2001) offers several arguments which support that mining is more sustainable than it may appear: mineral exploration and development replaces reserves that mining depletes; improved technology can over time unlock previously unfeasible resources; and the economic benefits created by mining can be sustained through appropriate social investments.

Hilson and Basu (2003) focus on the corporate mining context of sustainable development and aim to provide insight into how sustainable development indicators can be developed for the industry. They propose an interpretation of mine sustainability which also emphasizes the socio-economic dimension, including aspects such as stakeholder concerns, public participation, education and consensus building, and an equitable distribution of benefits generated by mining.

Emphasizing the local community as an important stakeholder has gained increasing support in the mining industry and in academic literature throughout the 2000s. For instance, Solomon et al. (2008) notes that "the increasing importance of sustainable development ideas to the industry has provided a framework for raising the perceived importance of mining's social dimensions". Society's embrace of the sustainable development paradigm has also been identified as a reason behind the emergence of the concept of a social licence to operate (SLO). This is typically understood as "the ongoing approval and broad acceptance of society" of a mining project (Prno and Slocombe 2012).

The interpretation of mine sustainability proposed by, for instance, Hilson and Basu (2003) shares similarities with the one proposed by the International Council on Mining and Metals (ICMM), a mining industry initiative. The ICMM was founded in 2001 to improve sustainable development performance in the industry. In a relatively recent publication, ICMM (2012) proposes seven questions for addressing the sustainable development contribution of mining, which originally emanated from the Mining, Minerals and Sustainable Development project, or MMSD (see IIED 2002). These questions are summarized in table 1 below, based on the ICMM version.

Each question posed in table 1 is important in its own right, but the discussion in later sections of this paper is mainly limited to topic number 4. Moreover, this article will not focus on the reasons for the bust of the Pajala mine, but some brief reflec-

TOPIC	QUESTION
1. Engagement	Are engagement processes in place and working effectively?
2. People	Will people's well being be maintained or improved?
3. Environment	Is the integrity of the environment assured over the long term?
4. Economy	Is the economic viability of the project or operation assured, and will the economy of the community and beyond be better off as a result?
5. Traditional and non-market activities	Are traditional and non-market activities in the community and surrounding area accounted for in a way acceptable to the local people?
6. Institutional arrangements and governance	Are rules, incentives, programs, and capacities in place to address project or operational consequences?
7. Synthesis and continuous learning	Does a full synthesis show that the new result will be positive or negative in the long term, and will there be periodic reassessments?

Table 1. Seven questions that address the sustainable development contribution of mining

tions are given concerning the economic viability of the project. A more distinctive focus is placed on the second part of the question: "will the economy of the community be better off as a result".

An adverse aspect of mining is the boom–bust cycle that the industry tends to be associated with. This also holds implications for sustainable development. Mineral development projects often take place in relatively remote areas with small population bases and labour markets, and they can thus have large and disruptive effects on small local economies. In a "booming" mining community with sufficient capacity in place to develop economic linkages to the mineral venture, indicators on local economic development may reflect substantial positive effects such as rapid increases in

employment and incomes, but at the same time the local economy becomes increasingly exposed to volatile global commodity markets . Eggert (2001) notes that some of the costs associated with mining, besides environmental and social disruption, include living with market instability and dealing with structural changes during booms. Minerals in the ground are potential wealth, but whether this potential is realized depends on how mining and minerals are managed by governments, mining companies, and civil society (ibid).

There is a rich body of literature on the economic challenges that follow from natural resource dependency, although much of the literature considers the macroeconomic aspects (e.g., Davis and Tilton 2005; Van Der Ploeg 2011). On the local or regional level, boom periods may act disruptively by driving up wages (and thus labour costs) and prices across the board and thereby potentially offsetting some of the positive impacts in regional output and employment (Söderholm and Svahn 2015). In other words, a booming mining sector may hamper growth in other, unrelated sectors. If the local economy cannot achieve (or maintain, depending on the starting point) economic diversification and instead specializes in mining, the mining company's ability to cope with commodity price cycles will have an important influence on the economic well-being of the community. Even if a mine is depleted and eventually closes without dramatic commodity price busts, it is key in sustainable local economic development that alternative sources of employment are developed, or alternatively we accept that the local economy contracts and people move on to other localities.

This section has offered some reflections on sustainable local development and challenges that face mining towns as their local economies are exposed to global markets and risks that are far beyond the influence of local or regional governments. As the Australian valuation firm Propell (2015) put it in their report on house prices in mining towns, "buying a house in a mining town is not so much a real estate decision as a futures play on the global commodity market". There is however an upside to the risks involved in mineral ventures, in the economic benefits that mining can deliver with good governance. Society's dependence on mineral commodities persists (IIED 2002), and the embracement of sustainable development by the mining industry and society can provide avenues for improved management of the social risks associated with mine towns. Recent shifts in governance of mining have aimed at improving the sector's environmental and social performance, and have elevated the local community to a more influential role (Prno and Slocombe 2012).

CASE DESCRIPTION

Pajala in northern Sweden has recently experienced the realities of a mining boom and bust. Pajala is a municipality in Norrbotten County, located next to the Finnish border. The municipality comprises a central town and several villages, and had a total population of 6303 in 2015. The local economy has historically depended on forestry, but new technology and structural change during the 1950s and 1960s caused a loss of employment opportunities and initiated a process of depopulation, as in many similar areas. The population decreased from 15,400 inhabitants in 1954 (ÅF Infraplan 2011) to the current level of 6303.

In Sweden, past responses to weakened local labour markets have often involved state intervention by subsidized new jobs or investments (Tillväxtanalys 2015), but the recent decades have seen a transition towards more neoliberal policies which emphasize innovation and entrepreneurship, and promote cooperation between government, academia, and the corporate world. While labour market policy has undergone changes during the 2000s, various labour market programmes have remained important policy measures. Pajala has since at least the early 1990s consistently had a higher share of participants in such labour market programmes compared to the national and county-level averages (regionfakta.com 2015). The local labour market has thus been rather weak and the local economy has been relatively dependent on unemployment benefits.

The potential for a completely new trajectory appeared when global commodity prices soared. In the final years of the first decade of the 2000s, Northland Resources, a junior mining company initially based in Canada, revealed its plans to develop an iron ore mine in the village of Kaunisvaara located just north of Pajala. This was widely reported in the news media as a potential catalyst to reversing some of the decline Pajala had experienced during the last decades . Northland started construction at the mine site in 2010 and began operations in December 2012 at the Tapuli deposit. The company was developing a second deposit – Sahavaara – in 2014 and ramping up towards full production, when liquidity issues became too severe in addition to falling iron ore prices. The mining company went bankrupt in the autumn of 2014. As mining did not occur in Pajala before the Kaunisvaara mine was developed, the boom reflects a period of adapting to a new economic activity, and this paper primarily addresses how the local economy changed during the mining boom period.

The new mine's potential to create economic development in Pajala was emphasized by various stakeholders, including the local government. At least three economic impact studies were undertaken *ex ante*, mainly focusing on the potential for growth in employment. These reflected quite different results and reported employment multipliers which ranged from around 1.5 (Tillväxtanalys 2010; Ejdemo 2013) to above 2 (Ejdemo and Söderholm 2011): for every 1 job at the mine, 0.5 to more than 1 additional jobs could be created in the local economy. A key lesson emphasized by these studies is that the demographic outcome is central to the impact on local jobs . If non-local labour dominates (such as in FIFO mining operations), the induced impact on the local economy would be modest, but if local labour constitutes a substantial share of the workers and in particular if the project leads to population growth, the final demand linkages to the local economy are stronger, and hence the economic impact is clearly more pronounced (see also Measham et al. 2013).

The local government in Pajala also commissioned studies (ÅF Infraplan 2012), which reflected ambitious goals of increasing Pajala's population to between 9000 and 10,000 residents. Such an outcome could have had substantial impacts on employment, with multiplier effects of up to 3 according to the studies. The municipal budget for 2013 formulated the vision that Pajala would have a population of 10,000 in 2020, which would require substantial investments in housing. Due to the bankruptcy of the mine, this vision has now been abandoned.

THE MINING BOOM IN PAJALA: WHAT DO RECENT STATISTICS TELL US?

This section examines recent official statistics on population, employment, and incomes to analyse how the local economy changed during the mining boom. Key indicators on economic development include change in employment by sector; labour market participation rates for men and women; development of per capita income in constant prices; and location quotients (LQ) as a measure of local specialization.

A useful starting point is to consider the population development. Figure 1 shows this development in Pajala from the late 1960s. The persistent decline in population levels is largely explained by out-migration, which has resulted in a high share of elderly residents.

For the last few decades, the negative population development stems increasingly from the demographic structure ("natural population change"), but out-migration of

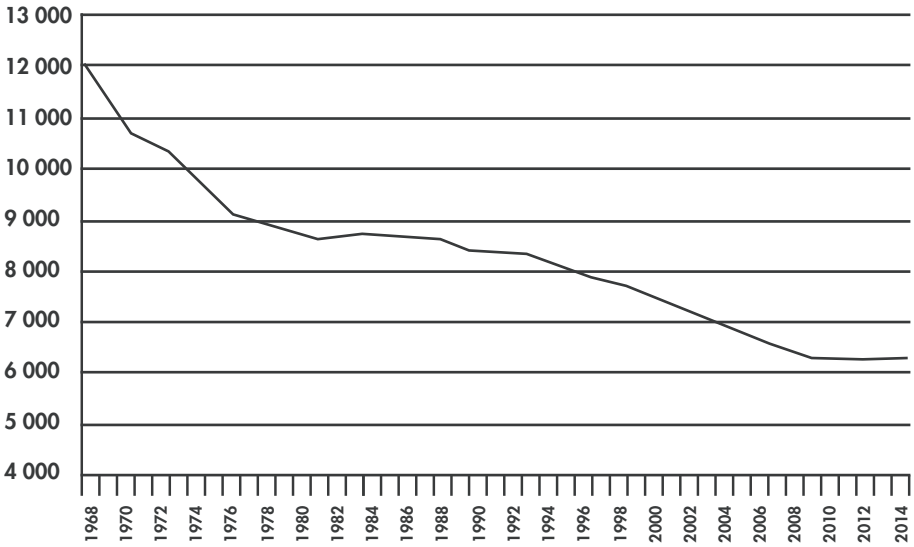

Figure 1. Population development in Pajala, 1968–2014. Source: Statistics Sweden (2015)

young people due to lack of jobs and other opportunities has remained a challenge. This is faced by many other regions in Sweden, in particular in the more rural areas. The negative development which had persisted for decades appeared to peter out around 2010 in conjunction with the development of the mine, but it cannot be assessed to what extent this only represents a temporary shift in the negative trend. As production at the mine ramped up and the permanent workforce started to grow, the population in Pajala even increased slightly.

Employment data provided by Statistics Sweden helps us to examine the change in employment during the mine development. As the only large-scale industry in the area, the mining operation had a significant impact on local employment during its few years in production. The most recent available data only covers 2014 when the mine was still in production, which means that the bankruptcy (the bust) cannot be examined quantitatively.

Table 2 reports the total number of people employed in Pajala by sector. The table compares 2009 before construction of the mine had started, against 2014 when the Kaunisvaara mine was in production. Despite never reaching full production capacity, the mine appears to have had had a significant impact on the local labour market. In 2009, the municipality depended heavily on the public sector and public services to provide employment, with around 43% of the local jobs in public administration, education, and health and social care. Other major sectors were forestry and basic manufacturing. However, in 2014 when the mine was operating, the distribution

INDUSTRY (Swedish Standard Industrial Classification (SNI),2007	2009	2014	CHANGE, 2009-2014
Agriculture, forestry, and fishing	195	280	+85
Manufacturing, mining, and quarrying	249	464	+215
Energy and water supply	12	18	+6
Construction	147	273	+126
Wholesale and retail trade; vechile repairs	173	228	+55
Transportation and storage	95	182	+87
Hotels and restaurants	34	97	+63
Information and communication	22	18	-4
Finance and insurance	13	14	+1
Real estate	31	40	+9
Business services	107	180	+73
Public administration and defence	117	115	-2
Education	287	299	+12
Health and social care	529	594	+65
Arts, recreation, and other services	112	96	-16
Unknown industry	31	42	+11
Total	**2154**	**2940**	**+768**

Table 2. Employment in Pajala by sector, 2009 and 2014

of the employment by industry began to look similar to other mine towns such as Kiruna. With the mine in production, employment had increased in nearly all sectors of the local economy; the major growth industries were mining ; construction; agriculture and forestry; and business services.

The public sector remained an important employer, providing around 34% of all local jobs in 2014, but the private sector increased its share of the local jobs significantly, and Northland was the biggest private employer in the municipality. More disaggregated sector-level data (not shown here) reveal that there were no local jobs in mining in 2009, whereas by 2014 the mining industry directly employed 196 persons in Pajala.

The most significant finding is that 786 new jobs were created during the mining boom in Pajala. In an interview conducted for this case study, representatives of the local economic development office stated that most of the new jobs in Pajala during these years (2009–2014) were a direct or indirect consequence of the mining project. One respondent said that "…without the mining project, I'm convinced that we would've had an overall decline" [in employment during the period 2009–2014]. One can thus argue that the impact of the project should be assessed against continued decline.

The data provided in table 2 indicates that the local labour market experienced a strong positive development during the mining boom. It should also be noted that the Kaunisvaara iron ore mine never reached full production , at which point the company anticipated having 400 employees at the mine site and another 300 in the ore transports operated by a sub-contractor. According to official data, 196 persons were directly employed in mining in Pajala in 2014, which is equivalent to about half of the anticipated workforce at full production. The transport sub-contractor was at similar capacity by this time.

When examining mining industry employment data, it is important to consider that a mining operation typically utilizes outsourcing of various functions (Knobblock 2013), and these firms may not be classified as belonging to the mining industry. In addition, they may not be local or even regional.

The development of a mine can be divided into three phases: *exploration, construction*, and *production.* The construction phase is temporary by nature, and when the

Kaunisvaara mine was developed, the construction period involved mainly non-local sub-contractors, as local firms lacked the capacity to take on such a large-scale project. Construction of the mine started in 2010 with a large and temporary workforce, creating local business opportunities in, for example, lodging, restaurants, and other services. A respondent from the local economic development office said that there had been about 1000 workers at the mine site at most during the construction period. The respondent mentioned an electrical company that had participated in the construction period and stated that they "…were flying in 270 people and that doesn't show in statistics like these, and there were other similar things going on". The respondent continued: "but a construction phase is temporary of course – it is in the nature of the construction industry". As the project transitioned from the construction phase into production in late 2012, new permanent jobs at the mine were added to the local economy and the construction workers moved on to other projects elsewhere.

The data reviewed here, supplemented by semi-structured, in-depth interviews with respondents from the local economic development office, indicate that the mine had a significant positive impact on employment, beyond the direct jobs at the mine site.

On the aggregate level, the positive impact on employment was reflected in improved labour market participation rates for both men and women, as figure 2 illustrates. From 2010 and onwards labour market participation rates for men and women in Pajala exceeded the national average. This represents a substantial improvement, as Pajala had experienced a weak local economy for decades.

Labour market participation rates were 81% for women and 83% for men in 2014. High labour market participation is typically considered positive, but it also suggests that access to local labour was becoming increasingly strained. Continued growth of the local labour market would have required an influx of new workers moving to Pajala or an increased use of non-local labour. One example is the fly-in-fly-out rosters often utilized in the mining industry (Storey 2010). A third option is a combination of local and non-local labour, which resembles the actual development of the local labour market until the bankruptcy of the mining company in 2014.

In an interview in late 2013, the Northland communications manager said that around 50% of their employees were locals at the time, and he anticipated that in five to seven years' time the figure would rise to around 70–80%. On the issue of skills supply, a respondent from the local economic development office said: "some [local]

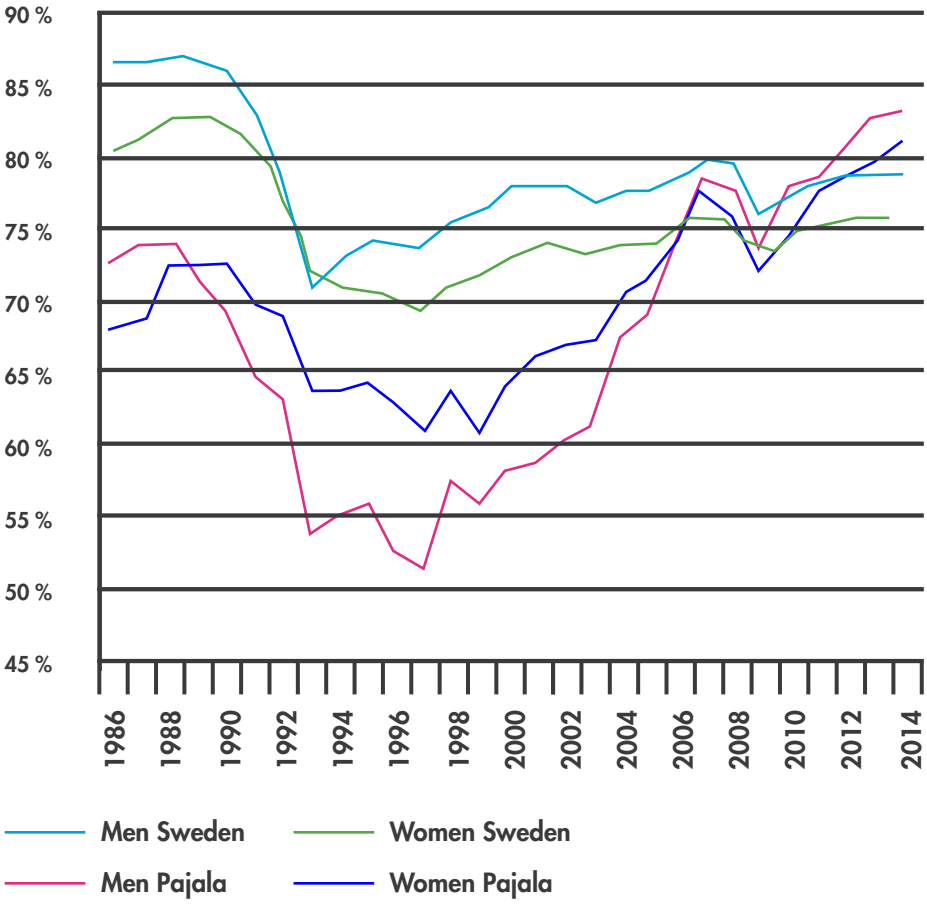

Figure 2. Labour market participation rates (% of people ages 20–64) in Pajala and Sweden Source: Statistics Sweden (own adaption

companies were worried that they would have a hard time competing with wages in mining, but they are actually saying that they have never had as many applicants as during the mining boom. Not everyone moving here wants to work in mining, or can work in mining".

Figure 3 illustrates the development of incomes in Pajala during the mining boom, reported as the sum of wages per capita in thousand SEK (constant 2013 prices). Data for 2014 was not available. As the figure shows, incomes in Pajala were still lower than the national average in 2013 but the growth rate exceeded the national average

between 2005 and 2013. The average annual growth rate of the sum of wages per capita was 6.5% for Pajala, compared to 2.2% for Sweden as a whole. The growth rate is especially pronounced during the later years in the figure, when the Kaunisvaara mine started producing and permanent jobs were added to the local economy.

The data suggests that the mine had a strong positive impact on the local economy in terms of income and employment. The transition towards a "mineral economy" also changed the structure of the local labour market, which had been dominated by public services.

A more detailed picture of the structural impact on the local labour market can be attained by calculating location quotients, which are used as indicators of specializa-

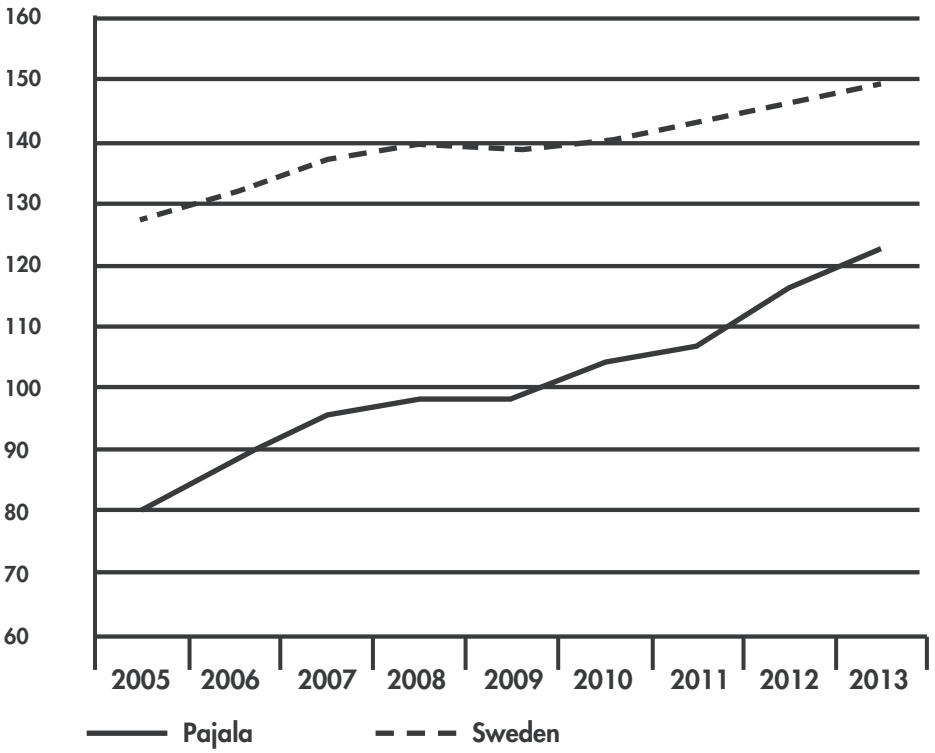

Figure 3. Income (sum of wages) per capita,
'000 SEK in constant (2013) prices
Source: Data from Statistics Sweden, own calculation

tion. These indicators measure the concentration of local employment in particular industries compared to the national average for that industry, as applied by Leigh (1970). Using data for 2009 and 2014, location quotients (LQ) were calculated for 51 industries following the notation used by Schaffer (1999) . These indicators are reported in table 3 and limited to industries with LQ >1 to save space. If the ratio for a particular industry is equal to one (1), the industry has the same share of total employment in the local economy as it does on the national level. The location quotient can thus provide a simple indicator of local specialization.

As table 3 clearly shows, mining (extraction of minerals), which did not occur in Pajala in 2009, quickly became an important specialization in the local economy. The very high LQ is simply the result of mining only occurring where the minerals are located .

LQ				
	2009	2014	LQ Change	Employment in 2014
Extraction of minerals	0.00	40.28	40.28	196
Manufacture of wood, wood products except furniture	6.14	5.08	-1.06	80
Agriculture, forestry, and fishing	5.09	5.06	-0.02	267
Manufacture of textiles, clothes	4.25	4.70	0.45	18
Social welfare services without accommodation	3.08	2.59	-0.48	312
Transportation and storage	0.87	1.55	0.68	155
Construction industry	1.01	1.51	0.49	255
Health and social care with accomodation	1.38	1.33	-0.04	160
Unknown	1.34	1.17	-0.17	33
Travel, security, facilities, and office services	1.02	1.15	0.13	94
Repairs and installations of machinery and equipment	0.09	1.13	1.04	12
Education	1.28	1.03	-0.26	263

Table 3. Industries in Pajala with LQ >0.9 in 2014. Data from Statistics Sweden (2015), own adaptation and translation

More interesting is the change in LQ's for several other industries which are clearly in the mining value chain: repairs and installations; construction industry (driven by investments at the mine as well as in new housing); and transportation and storage. Several other industries not included in the table (as their LQ is <0.9) were also affected by the mining boom in Pajala: notably, employment in hotels and restaurants more than doubled between 2009 and 2014, clearly benefitting from the mining project. The 12 industries reviewed in table 3 accounted for 76% of total employment in Pajala in 2013.

Overall, these indicators support that mining had an important indirect impact on the local labour market in Pajala. The local economy appears to have had the capacity to develop certain linkages to the mining project. But, the new jobs made Pajala an increasingly resource-dependent community. The period after the bankruptcy could not be examined in this case study due to lack of data. Further analyses with access to the necessary data are needed to better understand the impacts of the boom and bust. The next section provides some initial reflections based on qualitative data.

THE MINING BUST IN PAJALA: REFLECTIONS ON LOCAL SUSTAINABLE DEVELOPMENT

While the local economy experienced a strong positive development during the mining boom, there is also a need to discuss the implications for sustainable economic development. First, it must be emphasized that the timing of the case study was awkward, as the mine had recently closed due to bankruptcy. This makes the bust impossible to ignore, but since data on the years after the bust are not yet available, the bust can only be addressed qualitatively. The study is thus mainly limited to the period when the mine was developed.

Clearly the mine did not lead to sustainable local economic development, as it closed due to bankruptcy. The possibility is however still there, if global iron ore prices recover and new investors emerge, as the minerals remain in the ground. A respondent from the local economic development office recognized that prices had remained unfavourable: "It might take some time, a new owner may need to wait for iron ore prices to recover". The short-lived mining boom in Pajala exemplifies how important a mine's economic viability is for local communities and regions that depend on mining and need sustainable economic development. Crowson (2008, 393) emphasizes that the mineral industries' profitability "lies at the heart of their sustainability".

The Kaunisvaara mine quickly became a dominant force in the local economy. A respondent from the local economic development office said: "…a mine creates large effects, but the community becomes very vulnerable. People take loans, buy houses and things, but if iron ore prices fall, they could be out of a job. But that is market economy, politicians can't manage that." This vulnerability became evident in the autumn of 2014, when Northland's bankruptcy was declared. The mining operation was shut down, and hundreds of workers at the mine and in the ore transports were laid off.

The bankruptcy is typically attributed to significantly overrun capital costs to develop the project, combined with the unfortunate timing of falling iron ore prices. A brief review of literature on the subject shows that overrun capital costs are relatively common in the development of mining projects (Bertison and Davis 2008). Recently, Haubrich (2014) presented research which shows that average capital cost overruns of 20%–60% have been recorded since 1965. He presents a study based on 50 projects, which suggests that the most important factor causing capital cost overruns is the environment in which the cost estimate was generated. A "hot" market typically leads to higher overruns, and "marginal" projects also typically exhibit higher overruns. Haubrich concludes by calling for improved risk identification and management.

The International Council on Mining and Metals (IICM 2012) and the International Institute for Environment and Development (IIED 2002) have proposed "seven questions for sustainability" (see table 1) to consider when the sustainable development contribution of a mining project is assessed. One of these questions is particularly relevant to the topic of this case study: *Is the economic viability of the project or operation assured, and will the economy of the community and beyond be better off as a result?*

The fact that the mining project resulted in bankruptcy shows that the operation was not viable at that time. The project was developed when the market was "hot", using Haubrich's (2014) terminology. This drives up the cost of mine inputs, which contributes to capital cost overruns (ibid). This aspect is perhaps something that community stakeholders and financiers need to consider in future commodity price booms. After the bankruptcy, a "receiver" (trustee) appointed by the Swedish court of law has assumed control over the company and Northlands assets have been up for sale, but as iron ore prices have remained low compared to the "boom" period, the mine remains closed and without a new owner. The municipality's annual report for 2014 reflects concern about an uncertain future and a difficult financial situation.

The second part of the sustainability question posed by the ICMM (2012) – whether the community will be better off with the mine rather than without – is primarily relevant before and during project development. It can however be reformulated to ask if the local economy *would have been* better off without the mine. In hindsight, the project and the bankruptcy caused disruptions in several ways. Housing investments were made, workers and sometimes entire families relocated to Pajala, several firms that were contracted by the mining company did not get paid, and private investors lost money on investments in the company. This illustrates some of the risks faced by investors as well as communities that become stakeholders in mineral development, and these losses and social disruptions would have been avoided, if the project had never been realized. The resources that were consumed could instead have been directed at more sustainable activities.

If the mine had been economically viable, these investments would have been rewarded and the community would likely have been better off with the mine. Northland had by most accounts gained a strong "social licence to operate" from the local community (Koivurova et al. 2015), and as the previous section shows, the local economy experienced a strong positive development during the mining boom. A respondent from the local economic development office said that "…a positive aspect of the mining boom is that it vitalized a lot of markets, people could sell their houses if they wanted to, they could change jobs, because there was actually a demand for labour… [I]t was almost a Klondike [gold rush] feel, and it actually remains in a lot of people, that sense of optimism". This optimism is however likely to diminish the longer the mine remains closed.

When asked if the local economy was better or worse off now, a respondent from the local economic development office said that "[t]he entrepreneurship has absolutely improved. Local businesses are taking market shares outside Pajala. There is still a different mindset here compared to the past, people think more entrepreneurial, the skill level has improved a bit." The short-lived mining boom was clearly disruptive in many ways, but this statement suggests that it may have left some lasting positive impacts that are difficult to quantify.

The bankruptcy prompted some stakeholders to call for state intervention to support the mine because it was so crucial for the local economy. The most common suggestion was to explore the possibilities for the state-owned mining company LKAB

(Europe's largest iron ore miner) to operate the mine. State intervention of some form could have been more seriously considered only a few decades ago, as was the case in the 1970s, when the state intervened to save struggling companies in the steel and shipbuilding industries (Tillväxtanalys 2015). The contemporary response however reflected a more market-oriented view. The Minister for Enterprise and Innovation reportedly rejected the proposal and was quoted as saying that "…the state should not run companies", and furthermore emphasized that LKAB was a commercial enterprise and should operate accordingly.

In the summer of 2015, the processing plant (but not the actual mine) was sold to a group of private Swedish investors, who hope to resume mining operations at some point . On the topic of a potential restart of the Kaunisvaara mine, a local respondent expressed an optimistic view about the Kaunisvaara iron ore and said that "[i]t may last 100 years, you never know".

CONCLUSIONS

This case study on Pajala contributes to the knowledge about mining and local economic development in Sweden by compiling and examining transparent data on how the local economy responded to the new mine. This issue has mainly been analysed *ex ante* in Sweden, and the results of such studies are easily questioned as they depend heavily on assumptions. The paper shows that the local economy in Pajala was revived by the Kaunisvaara mine while it operated and nearly 800 new jobs were created. The mining boom had a significant impact on the local economy beyond providing direct jobs, until the mine closed in 2014 due to bankruptcy. More recent statistics covering the period after the bankruptcy were not available, which limits the ability to address the impact of the bust. During the observed period, which covers the development of the mine and its few years in production, positive development occurred in overall employment, population, labour market participation rates for men as well as women, and incomes, which exhibited faster growth than the national average. The mine thus clearly generated local economic benefit, while operating. The mining boom initiated a process of structural change; mining and related industries in its value chain became important specializations in Pajala. An important aspect of this transition towards an increasingly resource-dependent economy is the exposure to volatile global commodity markets and international investors, which made the local economy less sustainable as the mine was ultimately not profitable under the prevailing circumstances.

The Kaunisvaara mine clearly failed to provide sustainable development this time. It can be argued that the local economy would have been better off without this turbulent experience, as the local resources and effort consumed by preparing for the mining era could instead have been devoted to more lasting activities. The possibility of a new future mining era remains as the minerals are still in the ground, but these recent experiences have illustrated some of the risks involved in mineral ventures.

Although purely hypothetically, one can also argue that if the mine had been economically viable, it could have made a positive contribution to sustainable local economic development, as a number of key indicators improved during the short life of the project. With improved demography, incomes, and skills due to the mining project, a longer mining era could have increased the ability to make appropriate social investments, as suggested by Eggert (2001). These might have consisted of investments in related businesses, infrastructure, and human capital, as well as investments in more diversified economic activities that could have been sustained after the end of mining.

More comprehensive studies with access to data on the years after the bankruptcy are needed to provide a better understanding of the impact of the bust and the outlook for sustainable local economic development in Pajala. The future of the mine now appears to be at the mercy of the global commodity market and international investors. Perhaps this is also the case for the local economy, as long as the hope of a new mining era continues to linger as the way forward.

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