

ADDRESSING A MISSING ELEMENT IN THE TOLEDO DECLARATION WITH INDUSTRIAL ECOLOGY

Harn Wei Kua¹

Department of Building, School of Design and Environment, National University of Singapore, 4 Architecture Drive, S117566, Singapore

Abstract

Throughout the last four decades, important progress has been made in the development of the concept of urban regeneration in Europe. An important milestone was reached with the creation of the Toledo Declaration in 2010. However, amidst the call for an integrated approach to address sustainability challenges by the declaration, there is a predominant focus on using local actions to solve local problems. This loop-sided scope may give rise to policies that end up shifting problems beyond the local jurisdiction. Some of these problems can be deduced using key industrial ecology concepts, such as material flow analysis and life cycle assessment. A single, longitudinal case study was performed on the Sweden Gravel Tax to illustrate how policies aimed at solving local problems can give rise to trans-national problem-shifting. A few possible strategies to improve this tax were also proposed, on the concepts of integration and industrial ecology.

Keyword: urban regeneration; sustainable development; industrial ecology, life cycle assessment; material flow analysis

1. Introduction - confining urban regeneration discourse to the local scale

What is urban regeneration? The way urban regeneration is defined reflects the major contemporary concerns of the jurisdictions involved. In the mid-20th century, North American and European cities were concerned over the poverty alleviation; as such, the goals of regeneration were spelt out in terms of physical redevelopment by clearing slums. After the 1974 recession, the need for economic restructuring was reflected in the definition of urban redevelopment as “a political reconceptualization of the inner city as a spatial coincidence of more fundamental social, economic and environmental problems”, going beyond the traditional approach of slum clearance (Ward, 1994). One of the earliest policy documents to ever use the term “regeneration” was one prepared for Merseyside Country Council in 1975 (1975), in which urban regeneration was described as “proposed strategy [that concentrated on] investment and development within the urban county and particularly in those areas with the most acute problems, enhancing the environment and encouraging housing and economic expansion on derelict and disused sites. It would restrict development on the edge of the built-up area to a minimum”.

This document sets the tone for future development and between the late 1970s and early 1990s, urban regeneration was thought of as a series of strategies specially targeted at reaping certain economic and social benefits. For example, in 1994, the British Government’s priority for England was “to enhance the quality of life of local people in areas of need by reducing the gap between deprived and other areas, and between different

¹ Email address: bdgkuahw@nus.edu.sg

groups” (Department of the Environment, 1994). Couch (1990) also defined urban regeneration as a process in which “the state of local community is seeking to bring back investment, employment and consumption and enhance the quality of life within an urban area”.

It was until the 2000s that policymakers and scholars began to view urban regeneration as a highly multi-disciplinary approach that calls for a well-coordinated set of thinking and actions. In fact, the adjective “integrated” started to be used in describing the targets of regeneration. For example, Jon Ladd, Chief Executive of the British Urban Regeneration Association suggested that “urban regeneration is a comprehensive and integrated vision and action which leads to the resolution of urban problems and which seeks to bring about a lasting improvement in the economic, physical, social and environmental condition of an area”.

In 2007, a milestone for the European Union (EU) was reached. The Leipzig Charter on Sustainable European Cities (EU Ministers for Development, 2007) emphasizes on the need for integrated strategies and coordinated action in urban policies. Integrated strategies are defined as those in which “simultaneous and fair consideration of the concerns and interests which are relevant to urban development” are taken into account, and that “the involvement of economic actors, stakeholders and the general public is essential”. There are two important messages in the Leipzig Charter: firstly, integrated urban development should be applied throughout Europe and, for this to happen, the appropriate framework should be established at national and European level. Secondly, deprived urban neighbourhoods must receive political attention within the scope of an integrated urban development policy. This attention must be paid at all levels of government – local, regional, national and European. An underlying principle of the Leipzig Charter needs to be highlighted: that the skills required to play the role of implementing integrated policies must be developed at local level, by all the parties involved.

The essence of the Leipzig Charter set the foundation for the adoption of the Toledo Declaration, against a backdrop of a new overarching document describing EU objectives in urban development – the EU 2020 – A European strategy for smart, sustainable and inclusive growth (European Commission, 2010). Once again, the importance of having an integrated approach was emphasized, specifically that EU must embrace integrated urban regeneration to exploit its full strategic potential for a smarter, more sustainable and socially inclusive urban development in Europe. It is interesting that the Toledo Declaration has several implications on the preferred “geographical vision” that each EU city should embody, in order to put into practice the ideals outlined in the Declaration. These are implied in the following lines extracted from the Declaration itself:

- “[The need] to have a global and comprehensive vision of the city, conveniently framed within a territorial perspective, which harmoniously promote all dimensions of urban sustainability in an integrated way both in new urban developments and in existing areas of the city”;
- “Assuring citizens’ quality of life and welfare in all the existing communities and neighbourhoods of the city, stressing the need of their involvement in urban development through citizen participation, and also acknowledging the importance of

the alliance and implication of all other stakeholders as a crucial tool for an integrated approach”;

- “Recalling that the overall urban quality, determined by the quality of public spaces and urban man-made landscapes and architecture is an essential requirement for establishing a pleasant environment for the urban population and also for the global attractiveness and competitiveness of the city”; and
- “Taking into account the suitability of urban recycling, and/or compact city planning, where appropriate, as strategies to minimize land consumption, preventing unnecessary conversion of green-fields and natural areas to urban land, and therefore managing and limiting urban sprawl”.

In summary, the attention given to the integrated urban regeneration measures is confined largely to the local scale – usually the scale of a city or township. What is not clearly discussed, however, is how a “global and comprehensive vision of the city, conveniently framed within a territorial perspective”, can directly or indirectly contribute to a series of regeneration strategies aimed primarily at local level development.

Being the most recent document on the EU’s stance on urban regeneration, the Toledo Declaration can be seen as expressing the most advanced thinking that support the contemporary ethos on urban regeneration in the EU. Unless cities are isolated from one another within EU, chances are that the process of urban regeneration will involve the exchange of goods and services across national borders. Hence, it is reasonable to believe that the overall sustainability of the urban regeneration is also determined by the sustainability of any trans-national, cross-boundary activities necessary to support the regeneration process, including trade. Ignoring this will create an imbalance in the urban development vision, and this, regardless of how integrated the policies may be, will not bode well for the overall sustainability of EU.

The objective of this paper is two-fold: to highlight how focusing predominantly on improving local sustainability may have unintended consequences over the regional scale (that is, at a more global level), and to propose solutions to balance out any lopsidedness in the scale focus in the implementation of strategies.

The research methodology is a single, longitudinal case study conducted on a leading EU country in sustainability – Sweden. While the aim is not to cast doubt on its past achievements in the promotion of sustainability, the key aim of analysing Sweden is to highlight the spill over effects that are the consequences of certain national policies implemented to control the extraction of valuable domestic natural resources for its construction industries. Data utilized in our analyses were extracted from Eurostats and these were supplemented by several semi-structured interviews conducted mainly through electronic mail correspondence over the course of about one year.

2. The significance of a trans-national perspective in urban regeneration

Piana (2010) presented a typology of urban regeneration, according to what it may entail. Regeneration may be executed on:

- A single building. The building is usually abandoned or being used in a way not in accordance to existing acceptable urban planning master plan. In this case, regeneration serves the purpose to either totally or partially restore, refurbish or/and reuse the building.
- A street, a square, or a common area within a community.
- An iconic landmark in the city or town, to provide a new collective identity and spatial solutions to any existing problems.
- Multiple locations within a city or town, with the possible aim of creating new functions. This may involve certain degree of land reclamation.

Piana (2010) further opined that different combinations of regeneration may have the objective to either re-construct the whole "image" of the city or town, or result in a redistribution of roles in a network of cities. Such "redistribution of roles" may come in the form of creation of new employment opportunities and rejuvenating local tourism opportunities. Regeneration of an area also provides an opportunity for new ideas to be implemented linking the concerned area with neighbouring areas either physically or functionally; for example, refurbishment of the main Chinatown area in Singapore enabled it to be included into the overall tourism promotion blueprint planned for an area enclosed by New Bridge Road, Cantonment Road, Shenton Way and the Singapore River. In other words, the refurbishment of Chinatown allows it to be linked into other pockets in this area to form a network of services that attract visitors.

One may infer that regeneration will very likely involve construction activities, which in turn involve the use of some amounts of new building materials. Certainly, energy and other resources (including water and fuels) will also be utilized and consumed in the process. Matthews et al. (2000) reported the results of material flow accounting of five countries – Austria, the Netherlands, Japan, Germany and United States. Through detailed flow and stock accounting and assessments, they presented environmental information on these countries, such as tonnage of greenhouse gas emissions and electricity consumptions for these countries. The methodology that they employed – which is generally known as the material cycle method and has since been widely applied in the material flow analysis (MFA) literature – takes into account the fact that a functioning economy relies, to various degrees, trans-national flows of materials and resources. Specifically, imports and so-called foreign hidden flows (defined as the total weight of materials moved or mobilized in the exporters' environment in the course of providing commodities for economic use, which do not themselves directly enter the economy). Hidden flows occur at the harvesting or extraction stage of the material cycle. Therefore, if the total sustainability of a country is to be increased holistically, then we need to ensure that the overall sustainability of the products from exporting countries is also increased.

While MFA informs decision-makers about the types and amounts of material and resource that flow from one point to another, crucial information – such as the types and amounts of material and resources that go into the production and distribution of a product – is not available. Life cycle assessment (LCA) is a widely-used methodology to provide this kind of information. There are two main approaches in LCA; the more common approach is

known as Attributional LCA (ALCA). ALCA describes the relevant physical flows – inputs and outputs – in a product's life cycle and deduces the environmental impacts arising from these flows. In general, an ALCA begins with a scoping phase, in which the different relevant life cycle stages of the product under study are defined (this is also known as life cycle boundary definition). Most holistic LCAs include the material extraction and transportation phases, among others. Hence, if a jurisdiction obtains its required materials/resources from *outside* its geographical boundaries, then the environmental impacts due to the extraction and transportation of these materials/resources from the source jurisdiction must also be accounted for.

Similar to the argument put forth on MFA, if one aims to reduce the overall negative environmental impact of a product used in urban regeneration, then one must also aim to reduce the impacts that are embodied in this product as a result of processes that take place in jurisdictions that export the product. Therefore, MFA and LCA – both concepts of industrial ecology – help to reveal important functional and physical linkages between trading jurisdictions.

In summary, the contemporary discourse at the EU level has limited urban regeneration to addressing local developmental objectives, including increasing local sustainability. We argue that closer examination on the nature of urban regeneration reveals strong international and trans-national characteristics, which should also be integrally considered in urban regeneration strategies. Henceforth, if the goal of urban regeneration is to increase sustainability of a geographical jurisdiction in question, then a similarly strong case should be made for a need to increase the sustainability of other jurisdictions who may exchange goods or services with the jurisdiction in question.

In the next section, we present a case study on the Swedish Gravel Tax (GT), which provides evidence on how the reduction in domestic extraction of natural gravel has directly resulted in an increase in the need for import (from neighbouring countries such as Denmark). The main aim of this case study is to underline the fact that in considering the overall sustainability of local level strategies, it is crucial to also consider how that strategy may have sustainability impact elsewhere in the world, and therefore urban regeneration needs to address these trans-national spill-over effects.

3. Sweden's GT

The construction industry accounts for 11% of total European GDP; about 3.5% is attributed to construction materials and building products. It has also been estimated that construction materials and building products account for some 18–20% of EU manufacturing output (Council of European Producers of Materials for Construction, 2002). In 1998 alone, Sweden and Denmark contributed about US\$6.1 billion and US\$4.2 billion to building materials sale in Europe respectively. The construction trades account for approximately 26 million jobs in the European Union. Direct employment in the construction materials and building products industry was 2.5 million in 1998 (Council of European Producers of Materials for Construction, 2002).

After long, slow growth that lasted almost through the 1990s and a cyclical downturn in 2003–2004, the Swedish construction industry is in relatively good health. During the crisis of

the early 1990s, industry consolidation resulted in stronger companies acquiring many smaller producers. Today, a number of large groups, a shrinking number of middle-sized market players and a diminished number of small companies dominate the market (Swedish Institute, 2001). Only about 25% of building materials are direct imports. It is also an increasing trend for Swedish companies to be jointly owned by multinational partners.

Gravel is regarded as an invaluable resource in Sweden since it is an important material that lines the underground aquifers and thus essential for the national drinking water supply. In fact, the Swedish Environmental Protection Agency (EPA) recognized that “there is a great shortage of natural sand and gravel in many parts of Sweden” (Swedish EPA, 1997). These parts are mostly on the south of Sweden. The Geological Survey of Sweden predicted in 1994 that at the then consumption rate of these natural gravel, 80 municipalities would have exhausted their natural gravel resource by 2024; 40 of them are on the southern part of the country (TemaNord, 1999).

In 1995, Swedish gravel extractors were given permission to extract crushed rock and natural gravel for just 0.25 SEK per ton (US\$0.035 per ton). The charge was paid according to when the firms got the permission, the volume for which it is allowed to extract and the maximum duration of the allowed period of extraction. Soon, it was noticed that there were many explorations that went on without permission, because the penalty and costs are low compared to what one could earn from illegal quarrying (Andersson, 2004).

In 1996, the Swedish government introduced a Law Concerning a Tax on National Materials (1995: 1667), which imposed a tax on the extraction and sale of gravel. The overall purpose of the tax is to increase competitiveness for alternative materials and consequently decrease extraction and disposal of natural gravels (Sweden EPA, 2001). One of the main goals of the tax is to ensure that not more than 30% of the aggregate required nationwide comes from natural gravel, with its substitutes making up the rest of the 70% (Sweden EPA, 2000). The consumption of natural gravel should not be more than 12 million SEK (US\$1.68 million) in the year 2010. Any company that exploits a site that requires a permit under the Nature Conservation Act, Water Act or Road Act must pay this tax (ECOTEC, 2001). However, activities within gravel pits and for aftercare at the sites are exempted from the tax. *It is worth noting that the tax does not include imports; only domestic use and exports are taxable.*

In general, this tax is imposed wherever extraction

- Demands permission according to environmental law and regulations;
- Occurs with support of permission from environmental regulations, and for purposes other than use by landowners' household;
- Is conducted with support from the right to quarry on others' grounds according to section 38 of the Law of Public Roads.

The initial rate of the tax was 5 SEK (US\$0.7) per ton of natural gravel. This rate was chosen as a balance between effects from means of control and risk for early closedown of already active quarries (Sweden EPA, 2000). This rate stayed the same until in 2003; the government raised it to 10 SEK (US\$1.40) per ton (Arm, 2003) in order to have higher environmental effect. In fact, a proposal was forwarded to further increase the GT over and

above this increase. The Ministry of Finance rejected this proposal, a decision well supported by the local natural gravel industry ².

3.1 Other Environmental and Material Policies in Sweden

There are many other policy components that also inflicted indirect effects on the outcome of the GT. In the past fifteen years, Sweden has taken considerable political steps to promote sustainable use of natural resources in the construction industry. One of the most important policy tools closely related to the GT is the Waste Tax.

i. Waste Tax (SFS 1999: 673)

A waste tax of 250 SEK (US\$35) per ton of waste disposed in landfills was introduced in 2000. Since then, the rate has gradually been increased; in 2002, the rate was 288 SEK (US\$40.32) and 2003 the rate was raised to 370 SEK (US\$51.80). Waste tax is repaid for reused materials. The aim is to gradually reduce the amount of waste reaching landfills nationwide.

The Waste Tax applies differently to different waste categories and landfill types (Arm, 2003). It covers waste sent to a landfill at which more than 50 tons a year are either stored for longer than three years or finally disposed of. Waste such as mine waste, steel slag and blast furnace slag are exempted. However, incinerator ash, reclaimed asphalt, C&D wastes are affected. Scrap boulders and excavated materials are exempted if they are disposed of at a landfill site that does not receive taxable waste as well, such as C&D wastes. That said, technically, it is possible for disposers to make special arrangement to dispose of scrap boulders and excavated materials at special landfills with a limited annual collection volume.

The Waste Tax is about 40 times higher than the GT. Nonetheless, there are many other policy components in Sweden that determine the context within which these two taxes operate. Each one of them is described as follow.

ii. The Ecocycles Bill (Bill 1992/1993: 180)

The Swedish Parliament adopted this Bill in 1993. It states that 'It should be possible to use, reuse, recycle or finally take care of what is extracted from nature in a sustainable way, with less consumption of resources and without harming the natural environment'.

iii. Swedish Environmental Objectives (Bill 1997/1998: 145)

In 1999, the Swedish government adopted fifteen environmental quality objectives that described the state of the environment necessary to achieve sustainable development. The fifteenth objective, entitled 'A good built environment', states that 'Buildings and amenities must be located and designed in accordance to sound environmental principles and in such a way that they promote sustainable management of land, water and other resources.' More specifically, this objective requires natural gravel to be used

² The Swedish gravel industry is represented by the Svenska Bergmaterialindustrin, SBMI, the Swedish Aggregates Producers Association; SBMI is the aggregate industries' national trade association.

for construction purposed only when there are no possible substitutes in specific applications. Moreover, waste and residue should be separated accordingly and recycled on a co-operative basis in urban and surrounding rural areas (Arm, 2003).

iv. Swedish Environmental Objectives – Interim Targets and Action Strategies (Bill 2000.2001: 130)

Approved in 2001, these were proposed to achieve the fifteen objectives adopted in 1999. Basically, interim targets were proposed for each objective, indicating the directions and time scale of the actions to be taken. One of the targets reads: ‘The quantity of landfill waste, excluding mining wastes, will be reduced by at least 50% by 2005 compared with 1994, at the same time that the total quantity of waste generated does not increase’. It was also stated that by 2010, the extraction of natural gravel will not exceed 12 million tons per year and the proportion of reused materials will represent at least 15% of the total aggregate used. In fact, in 2001 alone, the corresponding figures were 23.4 million tons and 11% (Hartlen, 1996). The majority of this 11% was excavated rock and scrapped boulders.

v. Landfill Ban (SFS 2001: 512 and 2001: 1063)

To further reduce the amount of wastes diverted to landfills, the landfill ban was introduced for landfills involving sorted combustible waste in 2002; a ban the landfills involving organic waste was planned to come into effect in 2005. As a result, expansion of recycling capacity, especially waste incineration with energy recovery, is planned nationwide.

3.2 Combined effects of the GT and other related policies

The construction industry being familiar with mine waste and scrap boulders, companies in Sweden seem to respond well to the combined effects of the various environmental policies by turning away from natural gravels. In fact, about 6 months after GT was introduced, county administrative boards that process extraction permits applications noticed a notable increase in rock quarry application, which implies a shift towards crushed rock products. As shown in fig.1, the annual revenue from the GT decreases steadily after a momentary increase between 1996 and 1998. A likely explanation for the increase within that period is a delay in tax payment by eligible parties. Also in 1996, 46% of the 70 million tons of various aggregates used for construction are sand and gravel; this figure decreases to 40% of 75 million tons in 1998.

However, it is worth noting that before the tax was implemented in 1996 (fig.2), there was already a steady decreasing trend in the extraction of natural gravels. Hence, the impact of the GT is unknown, the extraction of crushed rocks first exceeded that of natural gravel around 1997, and the sustainability impact of such a substitution should be studied in greater details.

What are the impacts of the GT on the price of natural gravel and sand? The Natural Gravel Commission estimated that the price difference in extraction and production of natural

gravel and crushed bedrocks was between 7 SEK (US\$0.98) and 8 SEK (US\$1.12) (ECOTEC, 2001). Depending on the quality and location of mines, consumers have to pay between 40 SEK (US\$5.60) and 120 SEK (US\$16.80) per ton. Transportation cost for aggregates can be rather high – the cost of transporting low quality gravel 20–30 km may equal to the cost of the gravel itself (ECOTEC, 2001); the distance between gravel pits and consumers is thus crucial in determining the gravel prices. Overall, the GT actually increases the total gravel costs by 4%–12%, provided that this increase is passed to the consumers. There were some concerns about how the GT will impact local Swedish producers (Finansdepartementet, 2003). While it may be rare to transport large quantities of aggregates over long distances due to the high costs involved, Swedish exporters may find themselves paying two taxes – the GT for their export to Sweden and possible import tax in the importing trading partner.

However, as fig.3 shows, there was a dramatic increase in the import of key raw materials, including natural gravel, for 4 years beginning from 1998. There was also a momentary increase (albeit a very drastic one) in import of crushed stone. These trends correspond to the increase in domestic apparent consumption between 1997 and 1999, and between 2000 and 2001 (fig.5). If the avoidance of extraction of natural materials is associated to preserving the natural environment, and that the objective of the GT is to achieve this goal, then the increasing domestic demand might have shifted the associated environmental impact of gravel extraction abroad (to the importing country). To this end, the GT cannot be viewed as successfully promoting sustainable development, even though export of these materials dramatically decreased from 1996 onwards (fig.4). Fig.5 shows that although there was momentary decrease in domestic apparent demand (defined as import plus domestic extraction minus export) between 1999 and 2000, and again between 2001 and 2002, there has been an increase beyond 2002. Even though the current data shows that the increase in import may be periodic instead of being steady and long term, from the policymaking perspective, it is important to understand the forces behind such short term ‘problem-shifting’ and prevent it from becoming a long term and periodic trend.

3.3 Integrated policy solutions

The trends of increasing imports in Sweden imply that emphases to reduce domestic extractions of raw materials resulted in certain degrees of ‘problem-shifting’. Full sustainability impact assessments should be conducted even for alternate material (i.e. utilizing crushed stones instead of extracting natural gravel). From the perspective of MFA, if foreign hidden flows associated with importing gravel are to be accounted for, the overall environmental impact due to GT may not necessarily be lower than when GT was not implemented. Similarly, in LCA, one would account for the resources consumed in, and emissions from, the various life cycle stages of natural gravels, including trans-national transportation between exporting and importing countries. If the resources consumed and wastes produced during the transportation stage are to be calculated for the consequences of the GT, the overall life cycle impact of the GT may be higher than when it was not implemented.

Caution should also be exercised for a reliance on crushed bedrock as a substitute, especially if it increases the dependence on uneconomical long distance transportation and fuel. It is advisable for Sweden to expand its list of possible substitutes so that it also

includes sources that are produced or recycled from local sources. An example is processed construction and demolition wastes.

In fact, herein lies an irony: the Toledo Declaration emphasizes on the need to be “integrated” in urban regeneration, so that multi-dimensional sustainability problems can be effectively addressed. However, an over-emphasis by the Toledo Declaration on local actions that meet only local sustainability targets will shift problems beyond the local jurisdiction and thus create more dimensions to existing problems. Effective integrated solutions should henceforth include strategies addressing such trans-national problem-shifting.

How can the GT be further improved? Industrial ecology can be applied to address different aspects of the problems. Furthermore, strategies that gradually shift the industrial emphasis on gravel mining should also be formulated. Finally, based on the spirit behind LCA and MFA, a sustainability agreement between importing and exporting countries should also be formalized. In summary, the following is a list of key policy elements that we believe can help to make the GT more integrated:

- i. Accounting for any increase in energy and fuel usage, as a result of any substitution of natural gravels. A likely candidate tool for performing such a large-scale accounting is national-, state- or municipal-level MFA of the aggregate and related mining industry. More emphasis could be paid to promoting this research direction through the following policy instruments:
 - a. Diversion or addition of more funding, in the form of project grants, awards and/or prizes to encourage current research groups;
 - b. Initiation of more research collaboration among industrial, academic and government researchers to generate information useful for future policy-making.
- ii. Minimizing air emissions, water pollutions and toxic and non-toxic wastes treatment of mining activities, and ensuring that the increased activities in tapping substitute aggregates and salvaging construction and demolition (C&D) wastes do not result in increased environmental harms. We can do so by promoting adoption and innovation of pollution prevention technologies. This can be achieved by accounting for the inputs and outputs of these important life cycle stages.
- iii. Promoting research and development activities to further reduce the reliance on imported aggregates for civil engineering works. This should target at the collection, processing and evaluation of the use of C&D wastes for new constructions. This may include formulating and formalizing performance standards for the reuse of salvaged materials.
- iv. Diversifying jobs in the mining industry. Mining jobs are traditionally hazardous. Besides, skill-upgrading opportunities in the industry are usually low. Aggregate and mining workers should be trained to work in another related field during the periods with low demands for construction materials. Outreach program within the mining industry should be initiated to convey the advantages of cross-training; the safety mechanism that ensures that this does not deprive incumbent and existing workers in the second field of jobs and advancement respectively should also be communicated effectively. One possible measure is to pair the mining industry with another industry

that has a high potential for growth and in need of more employment. The recycling industry is a good example.

- v. Preventing problem shifting should become an integral part of international sustainable development. We should encourage Sweden's trading partners to be concerned of the environmental and health/safety impacts of the mining activities in their respective countries. An aggregate-certification program could be implemented in which exporting companies are required to comply to mutually agree upon sustainability guidelines in their production process. New import taxes should be collected from Swedish firms, part of the revenue of which is used to finance this scheme.

4. Conclusions

It was observed that the Toledo Declaration places a disproportionately heavy emphasis on the need to use integrated strategies to address local sustainability goals through the practice of urban regeneration and development. By using data on the GT of Sweden, this work shows how an over-emphasis on local level sustainability may give rise to trans-national problem-shifting. In the case of GT, this problem-shifting takes the form of how reduction in domestic gravel extraction has resulted in periods of increased import of gravel from neighbouring countries.

The concept of industrial ecology was proposed as a lens used to understand the trans-national nature of the problem. Industrial ecology was then used to outline several integrated strategies to address trans-national problems, as well as accelerating the switch of the industry away from natural gravel – either domestically extracted or imported.

5. References

- Andersson L. (2004). *Taxing Raw Materials - A Qualitative Study of the Swedish Tax on Natural Gravel and the Danish Tax on Raw Materials*, Lulea University of Technology, Department of Business Administration and Social Sciences, Division of Social Sciences, unpublished thesis
- Arm M. (2003) *Mechanical Properties of Residues as Unbound Road Materials - Experimental Tests on MSWI Bottom Ash, Crushed Concrete and Blast Furnace Slag*, KTH Land and Water Resources Engineering, Stockholm
- Couch, C. (1990). *Urban renewal: Theory and practice*. Basingstoke: Macmillan Education.
- Council of European Producers of Materials for Construction. (2002). <http://www.cepmc.org/links.htm>
- Department of the Environment.(1977). *Policy for the inner cities*. Cmnd 6845. London: HMSO.
- ECOTEC. (2001). *Chapter 11: Aggregates, Study on Environmental Taxes and Charges in the EU*, in association with CESAM, CLM, University of Gothenburg, UCD and IEEP (CR)

European Commission. (2010). Communication from the Commission — Europe 2020 A strategy for Smart, Sustainable and Inclusive Growth (Brussels, 3.3.2010), COM(2010) 2020 <http://ec.europa.eu/eu2020/pdf/COMPLET%20EN%20BARROSO%20%20%20007%20-%20Europe%202020%20-%20EN%20version.pdf> .

EU Ministers for Urban Development. (2007). Leipzig charter on sustainable European cities, http://www.eu2007.de/en/News/download_docs/Mai/0524-AN/075DokumentLeipzigCharta.pdf .

Finansdepartementet. (2003). *Naturgrusskatten: Maluppfyllelseochkonsekvenser*, Stockholm

Hartlén J. (1996). Waste management in Sweden, Waste Management, Volume 16, Issues 5-6, 385-388

Matthews E. et al. (2000). Weight of nations – material outflows from industrial economies, World Resources Institute, Washington DC, USA

Merseyside County Council. (1975). Merseyside structure plan, stage one report. Liverpool: Merseyside County Council.

Piana V. (2010). Urban regeneration, Economic Web Institute, <http://economicswebinstitute.org/glossary/urbanregeneration.htm>

Swedish Environmental Protection Agency. (1997). *Environmental Taxes in Sweden - Economic Instruments of Environmental Policy*, in Natural Gravel Tax, 104-105.

Sweden Environmental Protection Agency 2000:5077, *Naturgrusskatten: utvarderingavskatteeffekterna*, Stockholm: Naturvardsverket

Sweden Environmental Protection Agency 2001:5155, *Avgifter, skatterochbidrag med anknytning tillmiljovard*, Stockholm: Naturvardsverket

Swedish Institute. (2001). *Swedish Construction Industry and Infrastructure*.

TemaNord. (1999). *The Use of Economic Instruments in Nordic Environmental Policy 1997-1998*, 142

Ward, S. (1994). Planning and urban change. London: Chapman.

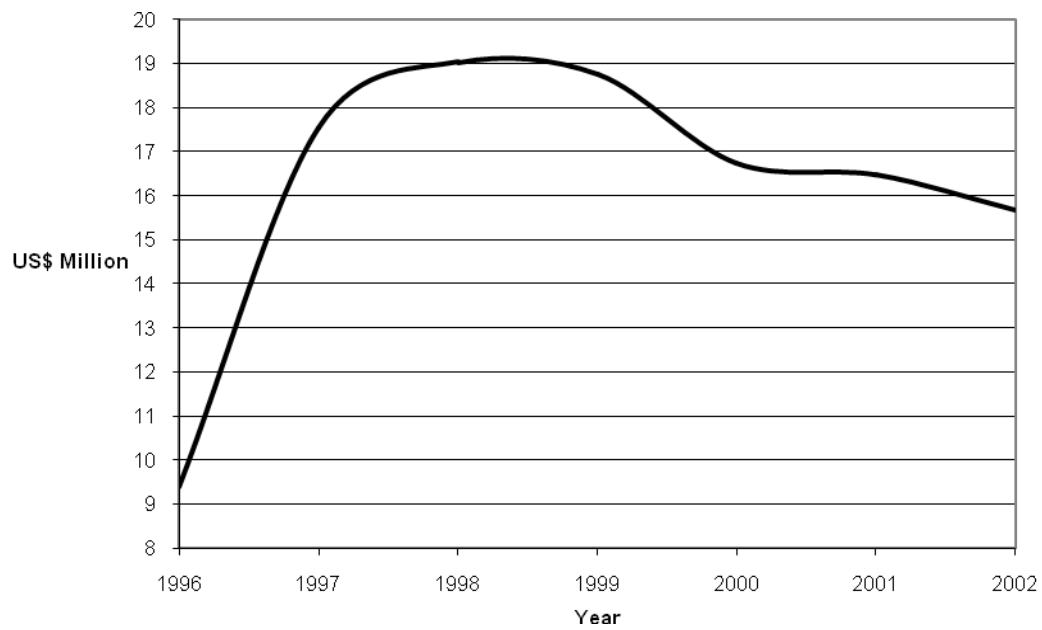


Fig.1. Annual revenue from the Swedish GT (Sweden EPA, 2000; ECOTEC, 2001).

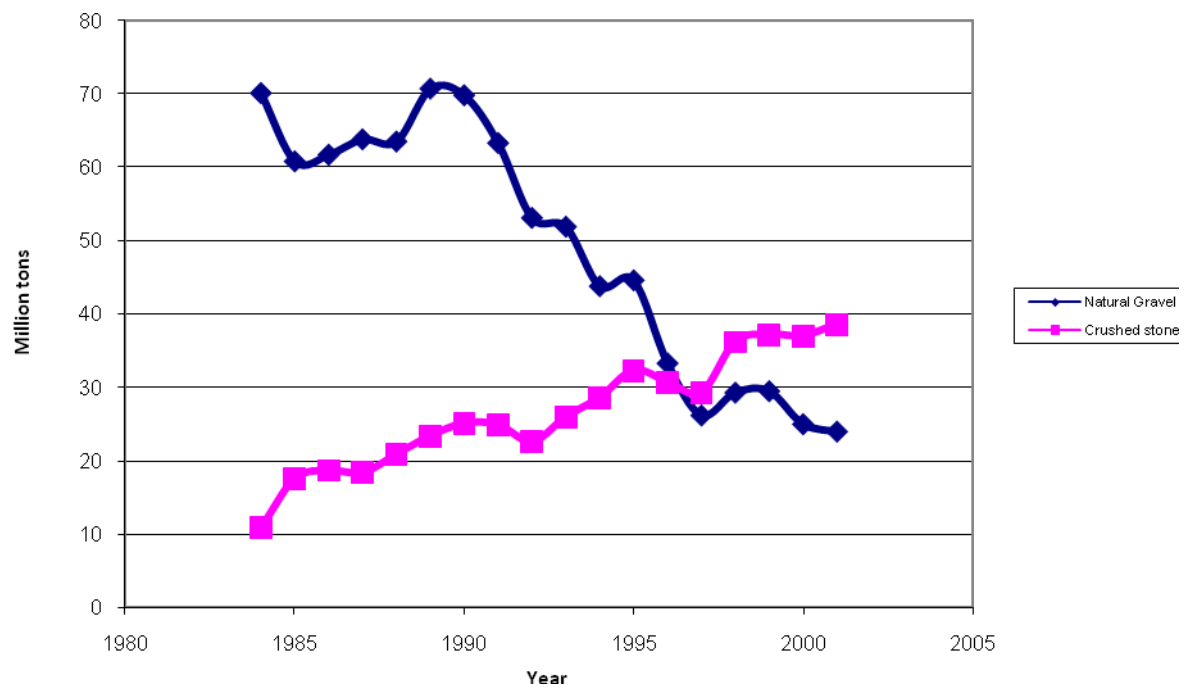


Fig.2. Annual productions of natural gravel and crushed stone in Sweden (Swedish EPA, 2001)

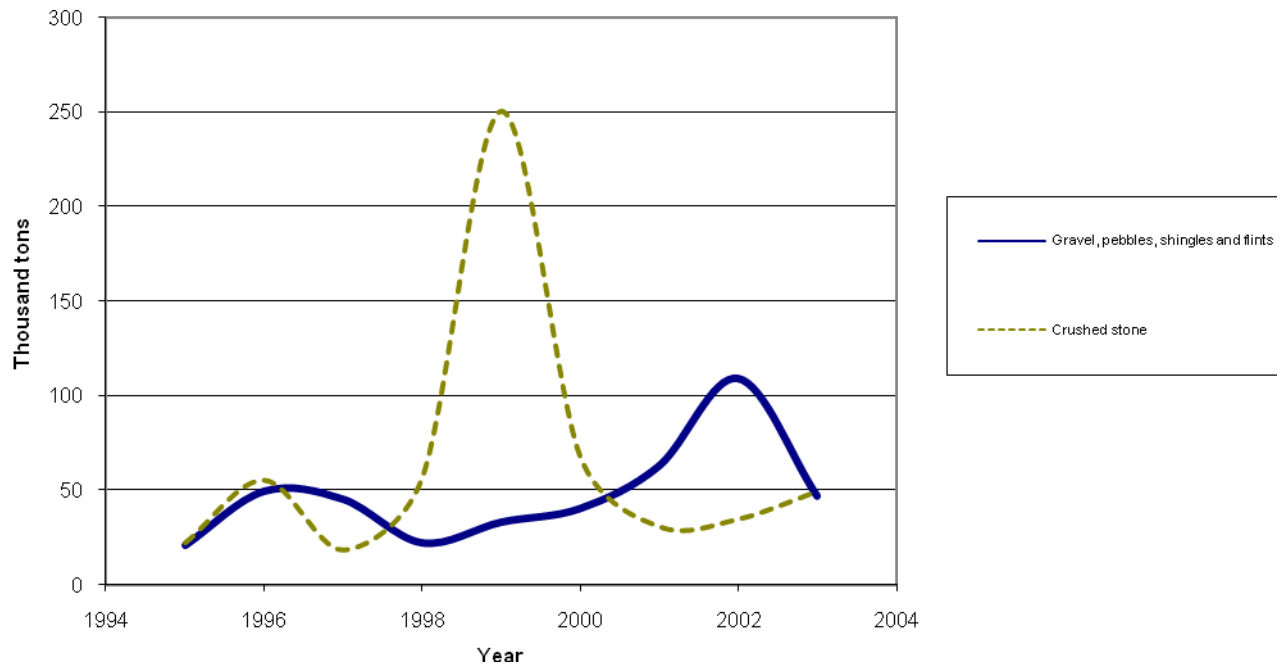


Fig.3. Annual import of gravels, crushed stone and other related construction materials by Sweden (Eurostat, 2005)

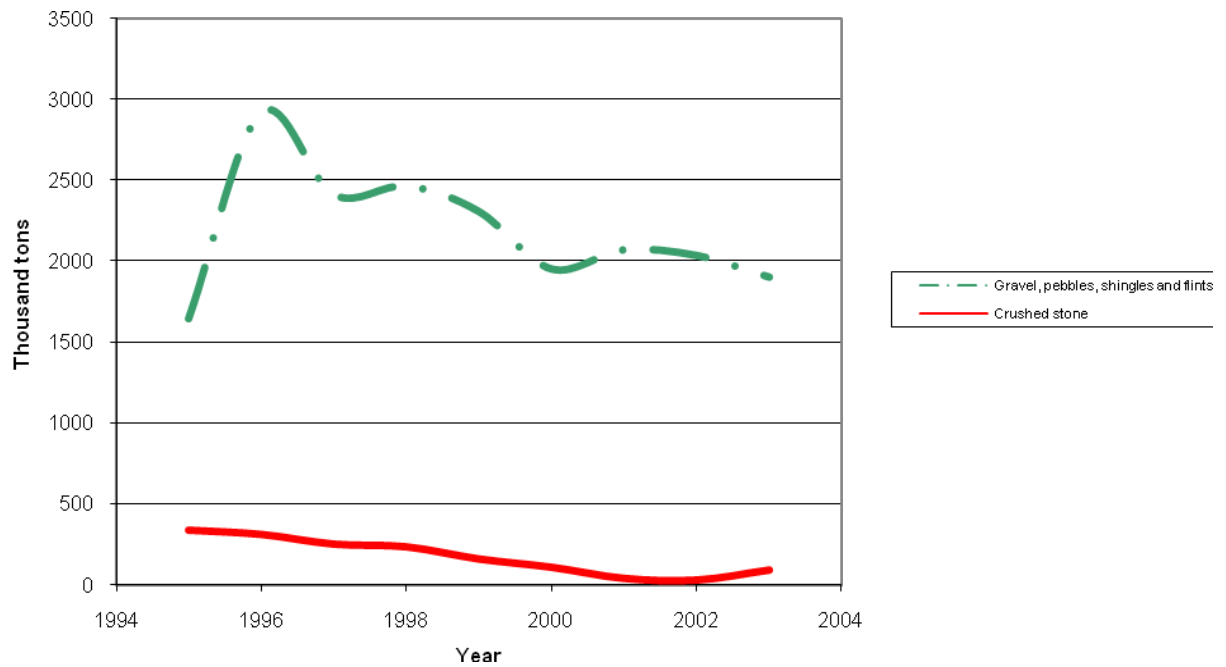


Fig.4. Annual exports of gravel, crushed stone and related construction materials of Sweden (Eurostat, 2005).

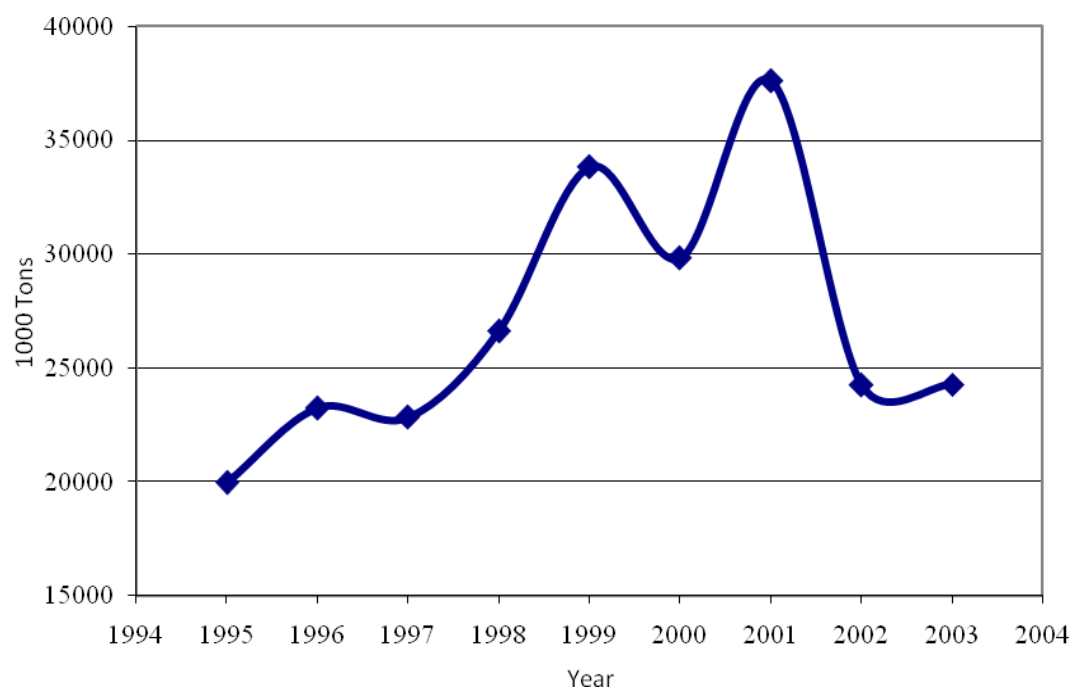


Fig.5. Domestic apparent consumption of gravels, crushed stone and other similar building materials used as aggregates (Eurostat, 2005)