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Sustainability of surgical instruments



Clusters and Global Supply Chains

The umbrella term “surgical instruments” summarises the specific and mostly hand-held instruments used during an operation or a surgery (e.g. scalpels, clamps and forceps). Worldwide these instruments are mainly produced in two traditional clusters – in Sialkot, Pakistan and in Tuttlingen, Germany. Together, these clusters supply up to 75 % of the world demand of traditional hand-held stainless steel surgical instruments [1]. As Figure 1 illustrates, not all of the instruments made in Pakistan are directly sold to the end customer. Instead, many of the Pakistani instruments are first transported to Germany where they often get final finishing and quality control [2].

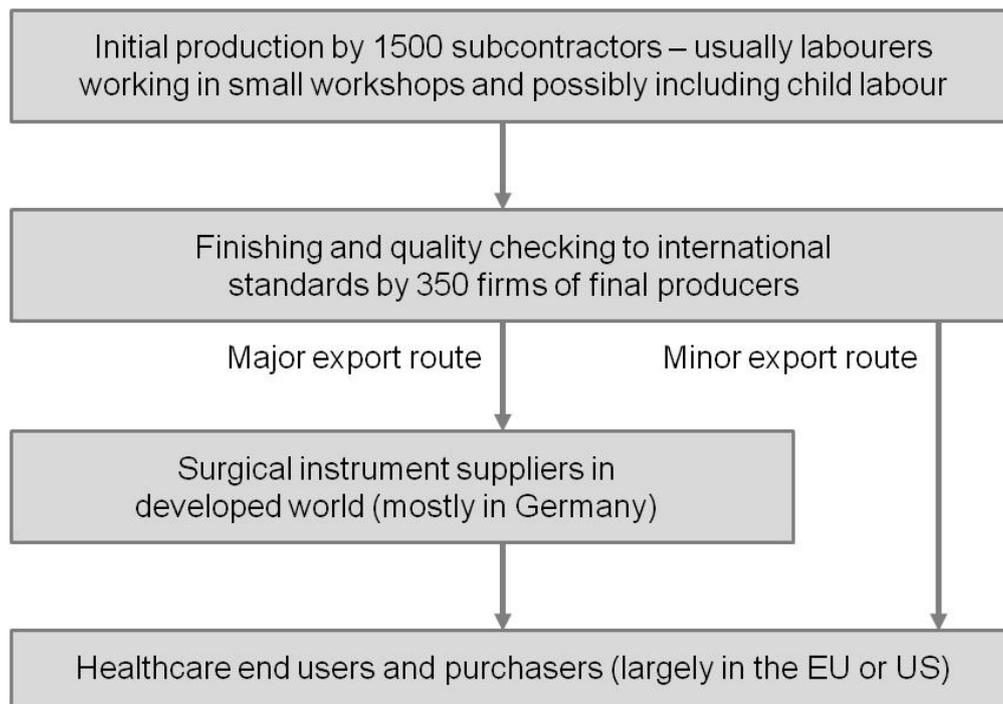


Figure 1: Global supply chains of stainless steel surgical instruments from Pakistan [2]

Social aspects

While German suppliers are benefited from this relationship, working conditions for the Pakistani manufacturers have been criticized by several organisations in recent years, among them the International Labour Organisation (ILO) [3] and Swedwatch [4]. The Medical Fair & Ethical Trade Group (MFETG) of the British Medical Association (BMA) summarises the situation as follows [5]:

“An estimated 10 million surgical instruments used in the UK each year are manufactured in northern Pakistan. Most of the 50,000 manual labourers in this industry are paid less than US\$1 per day for 12 hours of work (well below the living wage), with little job security and risk of serious injury from machinery. Poor remuneration contributes to the proliferation of child labour, and several thousand children are employed full-time in this industry, some as young as seven.”

Economical aspects

The instruments manufactured in Pakistan are often intended for single use. Stainless steel instruments directly manufactured by German owned companies are usually made of high quality material and can be sterilised and used again for several years. Additionally, rising cost pressure in health systems causes a trend to single use plastic products which are supposedly more economical. Those products were originally intended for exceptional circumstances or conditions where proper disinfection is of utmost importance but cannot be guaranteed (e.g. disasters like earthquakes, areas with a high rate of HIV infection). Nowadays, they are more and more replacing the conventional long lasting stainless steel products in daily hospital practice.

Environmental aspects – case study “surgical scissors”

The aforementioned aspects

- global supply chains (resulting in long transport distances),
- production standards in developing countries (with weak environmental legislation) and
- use of disposable instead of reusable products

may result in raising environmental impacts. A case study comparing different types of surgical scissors should reveal the effect of these factors. To assess the overall environmental impact of products and services throughout their whole life cycle, Life Cycle Assessment (LCA) has internationally become the method of choice. Steps according to ISO 14 040 [7] comprise goal and scope definition, life cycle inventory analysis, life cycle impact assessment and interpretation. During the procedure, all material and energy flows related to the product are balanced from raw material extraction through production and use phase to recycling or final disposal. Input and output flows of the product system are then accounted for their contribution to environmental impacts like global warming, acidification and resource depletion.

A comparative screening LCA showed the differences in the environmental impacts arising from the following types of surgical scissors:

- reusable scissors – made of stainless steel and manufactured in Malaysia (in a German owned factory)
- disposable scissors – made of plastic and manufactured in Malaysia (in a German owned factory)
- disposable scissors – made of stainless steel and manufactured in Pakistan.

As the cradle-to-gate results show on behalf of the Global Warming Potential (Figure 2, left), the supply of one pair of scissors (including processes from raw material sourcing, transport and manufacturing) leads to clear differences between the three types of scissors. Whereas the manufacturing of one pair of high quality stainless steel scissors in a German owned factory is connected with the highest possible emission of greenhouse gases, the stainless steel scissors from Pakistan cause approximately 40 % less of them and the supply of the plastic product even leads to a nearly 90% reduction.

When looking at the whole life cycle instead (“cradle-to-grave”) the expected life time of the reusable product has to be taken into account. While the technical properties of the steel product from the German company allow at least a 3000 times use [6], a new pair of scissors has to be supplied for every single use cycle in case of the disposable products. This difference leads to a clear shift in the ranking as can be seen in Figure 2 on the right-hand side. From a life cycle perspective, environmental burdens caused by the disposable products clearly exceed those of the reusable scissors which make up less than 2 % of the greenhouse gas emissions originating from the product manufactured in Pakistan.

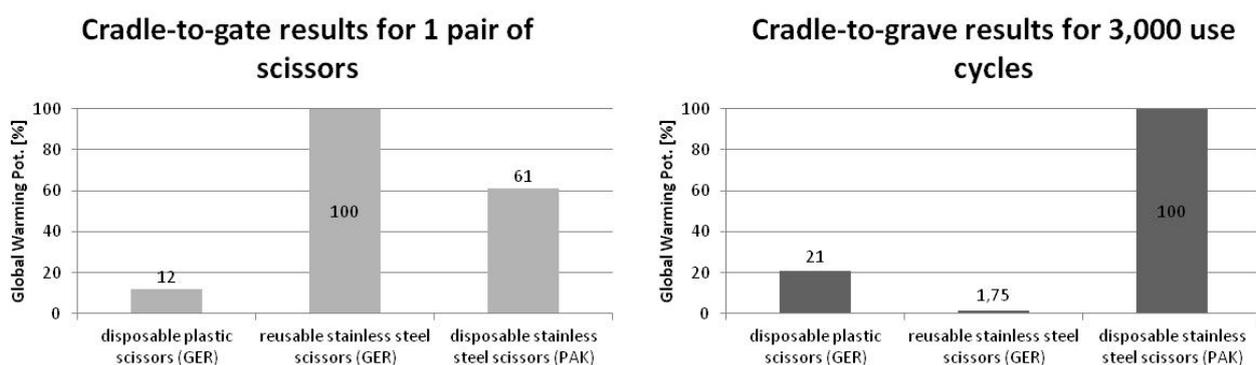


Figure 2: Comparison of Global Warming Potential regarding cradle-to-gate and cradle-to-grave processes

A closer look reveals that in every use cycle, the higher initial “environmental investment” (see y-axis) for the reusable scissors pays off a little more. As already mentioned it is compensated by lower impacts during the use phase due to the reusable scissors’ longevity. Figure 3 illustrates, on the example of Eco-Indicator 99 results, that the environmental break-even will be reached already after two times use in comparison to the stainless steel product from Pakistan and after eleven times use in comparison to the plastic product.

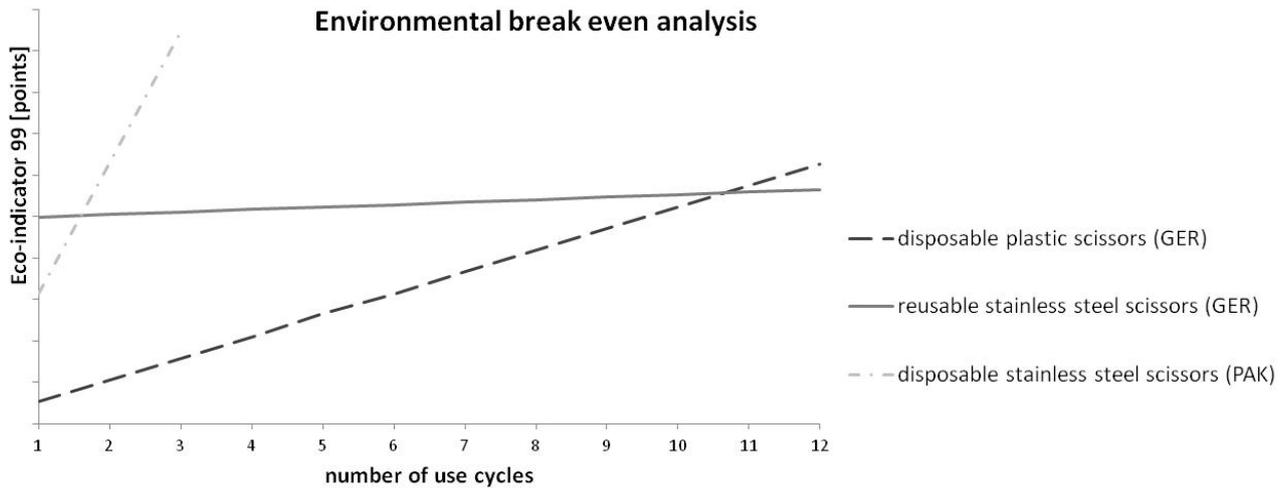


Figure 3: Environmental break even analysis of different types of surgical scissors for their Eco-Indicator 99 [6].

Consequently, consumers' choice has a direct influence on the environmental impact caused by surgical instruments. An analogue life cycle spanning observation of costs and social impacts could help to make possible goal conflicts more transparent which would be the basis for conscious / informed consumer decisions.

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Editorial

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