solving the e-waste problem

Business Plan Calculation Tool for Manual Dismantling Facilities

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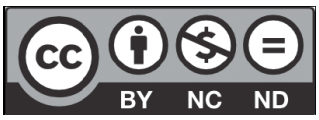

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Business Plan Calculation Tool for Manual Dismantling Facilities

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1 Summary

Waste Electrical and Electronic Equipment (WEEE), or e-waste, is the fastest growing waste stream and can cause harm to human health and the environment when not treated properly. Especially in developing countries e-waste is often treated under critical health conditions and inadequate technologies are causing negative environmental impacts. Without proper legal framework conditions and control mechanisms specialized formal and informal recyclers are using rudimentary methods focusing mainly on reclaiming valuable recycling fractions, like ferrous and non-ferrous metals, while dumping the hazardous ones. To improve this situation effective e-waste management strategies are required. The StEP-Business-Plan-Calculation-Tool supports entrepreneurs to set up an economic viable e-waste recycling business in an environmental sound manner. It can be further helpful for policy makers to understand the present economic framework conditions for e-waste recycling in their region. This paper gives an introduction into the design and structure of the calculation tool explaining its features. Further, possible use and benefits are illustrated.

2 Introduction

The generation of e-waste rapidly increased worldwide during the last decade. According to the ITU statistics the subscription to mobile phone providers raised from 87 Mio in 2005 to 582 Mio in 2013 [1]. It is expected that by 2030 a majority of obsolete computers will be generated in developing countries [2]. The current lack of e-waste management strategies and infrastructure in most developing countries bears a risk for the concerned countries and also contributes to the loss of important resources.

The Solving the e-waste problem (Step) Initiative with its members supports countries to establish the technological and institutional capacity to grasp the opportunity rather than suffer with the challenges. A well-established system to collect and treat used or obsolete electrical and electronic equipment on national level leads to an improved economic situation through the creation of green jobs and a decreasing impact on the environment and on human health. It also supports increased resource efficiency by substantially reusing material and not losing it through improper treatment by primitive recycling practices.
Dismantling of WEEE can be an opportunity for entrepreneurs to set up sustainable recycling businesses and creating green jobs. However a lot of challenges have to be faced when implementing a new dismantling facility, e.g.:

- An efficient strategy for collection of e-waste from different input streams (households, B2B-collection...) has to be identified and set up. Eventually purchase prices have to be paid for receiving the e-waste.
- Some of the collected appliances like desktop-PCs or notebooks have an intrinsic value where revenues from trading fractions coming out of the dismantling of these appliances can cover the treatment costs. This is different for quite a few other appliances like CRT-devices where dismantling expenses and disposal costs are higher than the achievable revenues.
- For each of the produced output fractions downstream partners have to be found. Some of the fractions, like copper, steel and aluminium can

usually be commercialised locally. For other fractions like printed circuit boards a global market with quite volatile characteristics exists where prices offered for the same fraction can vary up to 40% within one year.

- Depending on the location of the facility transport costs for the output fractions to the different downstream partners (material recovery or disposal facilities) on national, regional and international level may significantly reduce the potential revenues.
- Depending on the local wage level and existing mechanical recycling plants in the region, it might be necessary to dismantle appliances into as many pure materials as possible or to apply a more superficial dismantling strategy focusing on depollution only and leaving material separation to mechanical recycling plants.

The presented Business-Plan-Calculation-Tool facilitates this complex planning process with a focus on manual dismantling facilities. Entrepreneurs can get a clearer picture about the achievable financial performance of a planned e-waste recycling business and support them to make the right strategic decisions based on the local market conditions.

A first version of the tool was developed by KERP[1], DRZ and EMPA[2] in 2012 within a project funded by StEP. It was further developed by DRZ and EMPA within an UNIDO-project aiming to implement an e-waste treatment facility in Kampala, Uganda [3].

3 Design, structure and features of the calculation tool

The Business-Plan--Calculation-Tool for manual dismantling facilities is Excel-based and exists in two versions:

- an open source version for the calculation on an annual basis
- a version distributed within workshops - mainly for entrepreneurs - containing features to calculate an entire 5 years' business plan

The core source of the tool is the result of a dismantling campaign conducted by the D.R.Z-Dismantling and Recycling Centre in 2013. Within this campaign the composition of output fractions after dismantling 13 relevant appliance groups (desktop PCs, notebooks, monitors, TV-sets, printers, mobile phones, etc.) has been analysed. The average times for dismantling these appliance groups have been collected for three different efficiency-scenarios (high, medium, low). This data has been collected for the following three different dismantling levels (see Figure 2):

a) Hazardous components and high valuable components, like printed circuit boards are removed only and the remaining parts are destined to mechanical separation/ recycling.
b) Apart from removing hazardous components manual dismantling of components into more or less pure materials and recyclable fractions is conducted where viable with reasonable effort.

[1] KERP Competence Center is a global software and consulting partner for optimizing cross-enterprise business processes based in Vienna, Austria
[2] EMPA is an interdisciplinary research and services institution for material sciences and technology development

c) Appliances are dismantled up to a point, at which further separation into pure materials is not possible without mechanical shredding.

The extended version of the tool, which is distributed through workshops, contains an additional feature, where further treatment steps like depollution of CRT-tubes, cable stripping, shredding of plastics and depollution of fluorescent tubes can be selected as part of the process flow.

The overall process flow mapped within the calculation tool (extended version) is pictured in Figure 1. Concerning collection, different input streams can be selected: Delivery of e-waste to the facility, B2B-collection and decentralised collection via collection points. For each output fraction the destination for further treatment (recycling or disposal) has to be chosen. It can be distinguished between local, regional or international market.
To use the tool some essential data has to be provided. This data includes the following:

- Average salaries and annual working hours in the country
- Local price situation for energy and fuel
- Average rental and construction costs
- Purchase prices for investment of

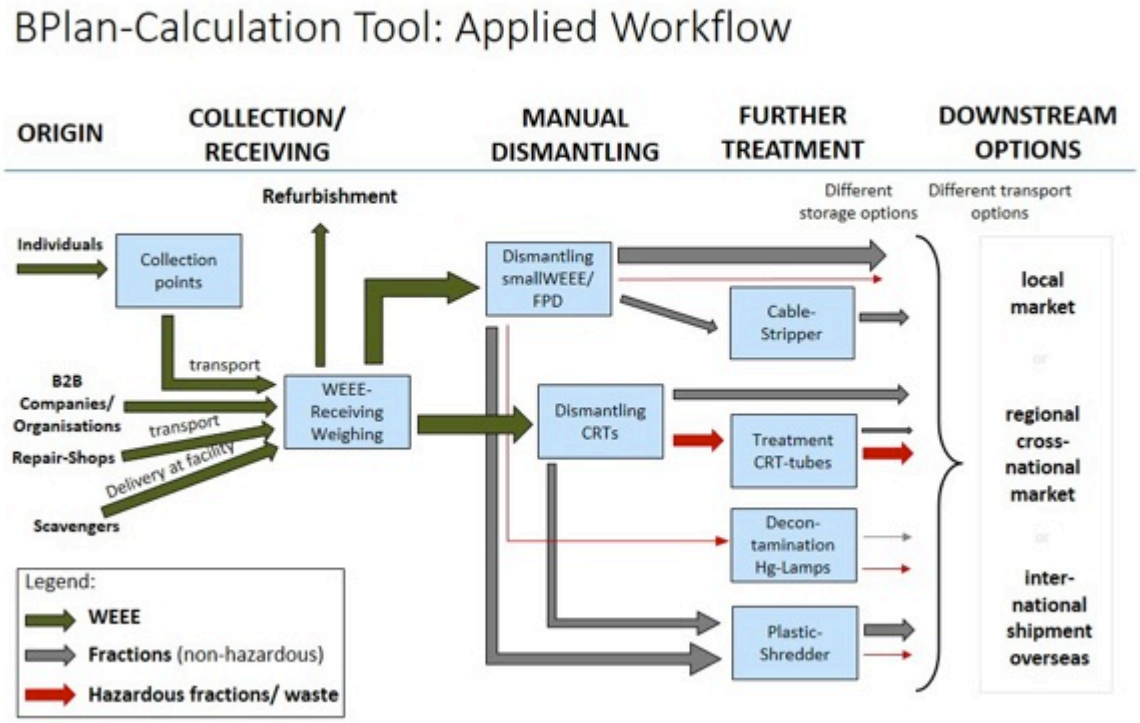
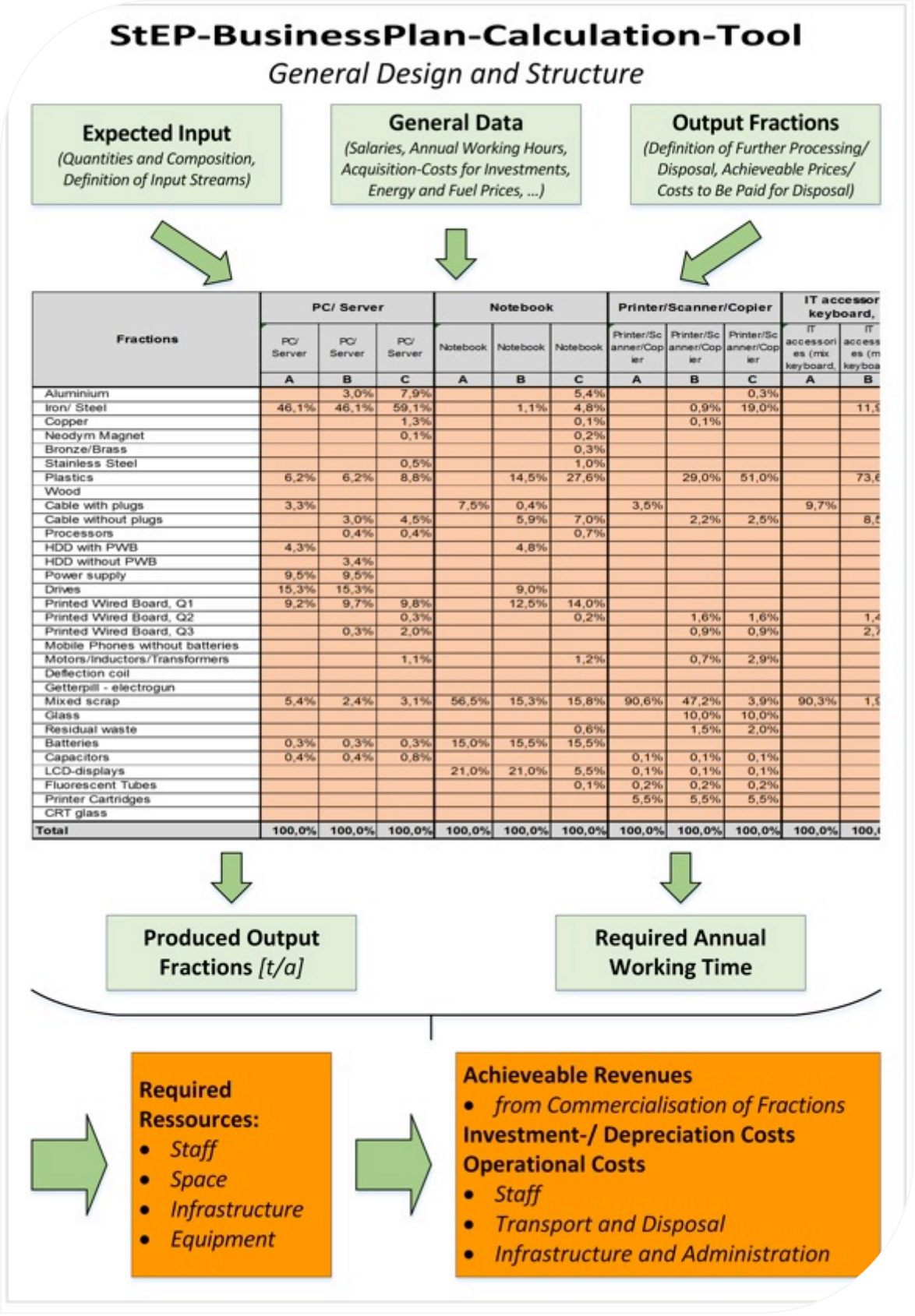


Figure 1: Processes mapped within the calculation tool

equipment and infrastructure
- Achievable revenues or disposal costs for each output fraction
- Average transport distances for each collection and downstream scenario
- Local interests for credits and savings,
- Taxes to be paid
- Depending on the cost and price situation in the applicable region and the chosen scenarios concerning collection, dismantling and further recycling/ recovery, the entire business plan automatically calculates the following on an annual basis:
- Quantities of produced output fractions
- Required staff, investments and equipment
- Required space for administration, dismantling, storage, etc.
- Expected revenues and operational costs
- Entire profit and loss forecast
- Computed break-even



Fractions	PC/ Server			Notebook			Printer/Scanner/Copier			IT accessor keyboard,	
	PC/ Server	PC/ Server	PC/ Server	Notebook	Notebook	Notebook	Printer/Scanner/Copier	Printer/Scanner/Copier	Printer/Scanner/Copier	IT accessories (mix keyboard,	IT accessories (m keyboa
	A	B	C	A	B	C	A	B	C	A	B
Aluminium		3,0%	7,9%			5,4%			0,3%		
Iron/ Steel	46,1%	46,1%	59,1%		1,1%	4,8%		0,9%	19,0%		11,5
Copper			1,3%			0,1%		0,1%			
Neodym Magnet			0,1%			0,2%					
Bronze/Brass						0,3%					
Stainless Steel			0,5%			1,0%					
Plastics	6,2%	6,2%	8,8%		14,5%	27,6%		29,0%	51,0%		73,6
Wood											
Cable with plugs	3,3%			7,5%	0,4%		3,5%			9,7%	
Cable without plugs		3,0%	4,5%		5,9%	7,0%		2,2%	2,5%		8,5
Processors		0,4%	0,4%			0,7%					
HDD with PWB	4,3%				4,8%						
HDD without PWB		3,4%									
Power supply	9,5%	9,5%									
Drives	15,3%	15,3%			9,0%						
Printed Wired Board, Q1	9,2%	9,7%	9,8%		12,5%	14,0%					
Printed Wired Board, Q2			0,3%			0,2%		1,6%	1,6%		1,4
Printed Wired Board, Q3		0,3%	2,0%					0,9%	0,9%		2,7
Mobile Phones without batteries											
Motors/Inductors/Transformers			1,1%			1,2%		0,7%	2,9%		
Deflection coil											
Getterpill - electrogun											
Mixed scrap	5,4%	2,4%	3,1%	56,5%	15,3%	15,8%	90,6%	47,2%	3,9%	90,3%	1,5
Glass								10,0%	10,0%		
Residual waste						0,6%		1,5%	2,0%		
Batteries	0,3%	0,3%	0,3%	15,0%	15,5%	15,5%					
Capacitors	0,4%	0,4%	0,8%				0,1%	0,1%	0,1%		
LCD-displays				21,0%	21,0%	5,5%	0,1%	0,1%	0,1%		
Fluorescent Tubes						0,1%	0,2%	0,2%	0,2%		
Printer Cartridges							5,5%	5,5%	5,5%		
CRT glass											
Total	**100,0%**	**100,0%**	**100,0%**	**100,0%**	**100,0%**	**100,0%**	**100,0%**	**100,0%**	**100,0%**	**100,0%**	**100,**

Figure 2: Business-Plan-Calculation-Tool: General design and structure

4 Use and benefits

Sustainable e-waste management requires both environmental sound disposal of hazardous substances from e-waste appliances and state-of-the art recovery of materials destined to material recycling.

Using the Business-Plan-Calculation-Tool planning processes for e-waste dismantling facilities can be set up based on environmental and financial sustainability with consideration to local conditions in the different regions of the world.

The tool provides support to entrepreneurs planning to set-up an e-waste dismantling facility to get a good overview of the expected costs and revenues. For established facilities this tool is helpful to identify options for improvement in the current process to optimize their dismantling operations. In addition to the benefits for the business, the tool brings advantages to decision makers as it gives detailed background data which is useful when designing an e-waste policy framework.

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solving the e-waste problem

About the Step Initiative:

"Step envisions tobe agents and stewards of change, uniquely leading global thinking, knowledge, awareness and innovation in the management and development of environmentally, economically and ethically-sound e-waste resource recovery, re-use and prevention."

Step is an international initiative comprised of manufacturers, recyclers, academics, governments and other organizations committed to solving the world's waste electrical and electronic-e-waste-problem. By providing a forum for discussion among stakeholders, Step is actively sharing information, seeking answers and implementing solutions.

Our prime objectives are:

- Research and Piloting
  - By conducting and sharing scientific research, Step is helping to shape effective policy-making
- Strategy and goad setting
  - A key strategic goal is to empower proactivity in the marketplace through expanded membership and to secure a robust funding base to support activity
- Training and Development
  - Step's global overview of e-waste issues makes it the obvious provider of training on e-waste issues
- Communication and branding
  - One of Step's priorities is to ensure that members, prospective members and legislators are all made aware of the nature and scale of the problem, its developmentop-portunities and how Step is contributing to solving the e-waste problem.

The Step initiative came about when several UN organizations, whowere increasingly aware of the growing global e-waste problem, saw the need for a neutral, international body to seek real, practical answers that would be supported by manufacturers, recyclers and legislators alike.

Step's core principles:

1. Step views the e-waste issue holistically, focusing on its social, environmental and economic impact – locally, regionally, globally.
2. Step follows the lifecycle of equipment and its component materials from sourcing natural resources, through distribution and usage, to disposal.
3. Step's research and pilot projects are "steps to e-waste solutions".
4. Step vigorously condemns the illegal activities that exacerbate e-waste issues, such as the illegal shipments, recycling practices and disposal methods that are hazardous to people and the environment.
5. Step encourages and supports best-practice reuse and recycling worldwide.

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