UNEP


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WASTE OR WEALTH?
KEEPING IN TOUCH NEED NOT COST THE EARTH
BASEL CONVENTION

Hey !
I've got a new mobile!

Where is your old one ?

Mandated by the Basel Convention, the Mobile Phone Partnership Initiative (MPPI) was an innovative public-private partnership which developed guidance for parties and raised awareness on the environmentally sound management of used and end-of-life mobile phones. As one of the fastest-growing – and almost universal - source of electronic waste (e-waste), the recycling and safe disposal of mobile phones is of urgent importance to the environment and human health and is also of great economic significance.

Although mobile phones present no environmental or human health hazard in ordinary use, hazardous substances may be released into the environment from certain landfills, incinerators and recovery and recycling facilities if the phones are not properly handled. Guidance produced by MPPI includes such considerations as collection, processing, refurbishment, material recovery and recycling as well as reducing or eliminating releases to the environment from waste disposal and treatment processes. Recycling and disposal needs to be done in the best possible way, not only to ensure maximum possible recovery of useful materials, but also to protect workers from exposure to harmful chemicals and waste.

Taking its inspiration from the MPPI guidance, this publication illustrates the challenges and opportunities associated with the environmentally sound management of mobile phones throughout their life-cycle.

# Waste or Wealth?

## *KEEPING IN TOUCH NEED NOT COST THE EARTH*

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# Foreword

By 2011, almost 6 billion mobile phone subscriptions were active worldwide, with a global penetration reaching 87% and 79% in the developing world. While this is a great achievement in communication with substantial positive impacts on the development of economies, the end-of-life mobile phones and other communication equipment can pose a serious threat to the environment when they become electronic waste, or e-waste, if not treated in an environmentally sound manner. Bearing in mind that mobile phones have an average lifespan of less than two years, this is an extremely fast-growing problem.

Already in the 1990s, e-waste was brought onto the political agenda of the Basel Convention. In 2002, the Mobile Phone Partnership Initiative (MPPI) was launched, when twelve manufacturers and three telecom operators signed a declaration entering into a sustainable partnership under the umbrella of the Basel Convention and in cooperation with other stakeholders, to develop and promote the environmentally sound management of end-of-life mobile phones.

MPPI was very productive and developed in a short period of time an overall guidance document with five sub-guidelines on awareness raising, design considerations, collection of used and end-of-life mobile phones, transboundary movement of collected mobile phones, refurbishment of used mobile phones, and material recovery/recycling of end-of-life mobile phones.

Public-private partnerships like the MPPI are a successful model to provide a structure for result-oriented problem solving. They create a network of expertise from different perspectives, including manufacturers, users, refurbishers, recyclers, academia, as well as governments, public interest non-governmental organizations, and international organizations. While the stakeholders agree to work together in a strictly neutral structure, the achieved results have a very high degree of acceptance in all stakeholder groups.

MPPI was followed by a similarly successful Partnership for Action on Computing Equipment (PACE), proving the usefulness of the partnership approach to develop solutions for waste minimization and, where possible, waste avoidance, through environmentally sound life-cycle management.

Based on the outcome from the MPPI, this book is published to provide an illustration of the life cycle of mobile phones, the materials needed to produce these highly-welcomed communication tools, and also the risks when they are not produced and recycled or disposed of in an environmentally sound manner.

Marco Buletti
Chair
Mobile Phone Partnership Initiative

It is my pleasure to take you on a journey through photos to highlight the wonderful transformations and also the environmental and health risks that mobile phones have brought to societies and communities around the world. The negative consequences are not unsolvable as we have systems in place in this age of globalisation to effectively address those challenges, for example through innovative partnerships between producers, distributors, consumers and recyclers. The Secretariat of the Basel, Rotterdam, and Stockholm Conventions is mandated by its parties to bring attention to these issues and encourage everyone to be part of the solution.

At the last count, it is estimated that there are 6.8 billion mobile phones either in our pockets, sitting at home or dumped somewhere in the environment. The environmentally-sound management of mobile phones is a part of the wider question of sustainable management of chemicals and waste in general, just as chemicals and waste are an integral part of the transition to a greener, more inclusive economy worldwide.

In order to achieve a life of dignity for all, society must find ways to organise our production and consumption according to a life-cycle approach, minimising waste and ensuring proper management and re-cycling of as much of a product as possible, and safe disposal of the rest.

As stressed at the first ever United Nations Environment Assembly (UNEA) in June 2014, environmentally sound management of chemicals and waste is one cornerstone of this transition, as will hopefully be reflected in the new Sustainable Development Goals – or SDGs – which will guide the international community for the coming years.

Development cannot work unless it is inclusive, participatory, and based on partnership. In this context the Basel Convention partnerships programme is a good example, leading as it did to joint initiatives such as the Mobile Phone Partnership Initiative (MPPI), drawing on the strengths of public-private partnerships to pave the way for implementation of Basel Convention issues on the ground, improving peoples' lives and safeguarding the environment. The ground-breaking MPPI also acted as a model for other successful partnerships, including the Partnership for Action on Computing Equipment (PACE).

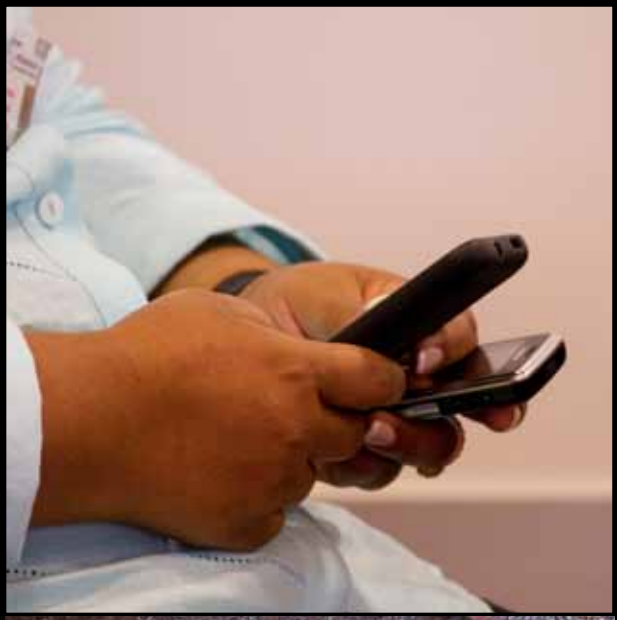
This book highlights the issues of importance to mobile phone users. Posing the question: "Waste or Wealth?" it paves the way forward for more sustainable management of this ubiquitous and important piece of technology.

Rolph Payet
Executive Secretary
Secretariat of the Basel, Rotterdam, and Stockholm Conventions

# Mobile Phone Uses and consumers

Prashanth Vishwanathan (CCAFS)

The use of mobile phones has grown exponentially from the first few users in the 1970s, to an estimated 6.8 billion in 2013. Sooner or later, these phones will be discarded, whole or in parts. Often, this takes place even before they cease to operate. According to some recent studies, the first owner will generally replace her/his mobile phone within two years.



D. Wardhana Hasanuddin(UNEP)

Jeannie O'Brien.

Prashanth Vishwanathan (CCAFS)

# Mobile Phone Materials

Whilst mobile phones differ from manufacturer to manufacturer and from model to model, a typical mobile phone is composed of about 40% of plastic, 32% of non-ferrous metals, 20% of glass and ceramics, 3% of ferrous metals and 5% of other materials. Some 40 elements might be present, including base metals such as copper (Cu) and tin (Sn); special or "critical" metals such as cobalt (Co), indium (In) and antimony (Sb); and precious, platinum-group metals such as silver (Ag), palladium (Pd) and gold (Au).

Considering one ton of mobile phone handsets (without batteries) this then equates to 3.5 kg of silver, 340 g of gold, 140 g of palladium, and 130 kg of copper. However, other constituents of concern for end-of-life management, such as bromine, lead, chromium and arsenic, are typically found in minor quantities of less than 1% content. Mobile phones also contain plastics and halogens (including chlorine and bromine) which, when burned, lead to the formation of dioxins and furans, both highly toxic and carcinogenic.


Jét
SAMSUNG

# Mineral Extraction

D. Wardhana Hasanuddin(UNEP)

D. Wardhana Hasanuddin(UNEP)

Minerals are everywhere around us. Minerals that are of economic value can be classified as metallic or non-metallic. Mineral extraction (e.g. iron, cadmium, copper) can have a severe impact on health and the environment, and may even destroy important ecosystems. To reduce the impact, recycled metal products can be used instead, which increases the amount of time a mineral or metal remains in use, while decreasing the demand for new production.

D. Wardhana Hasanuddin(UNEP)

# Iron

A mobile phone is made of about 3% iron, found in the case, frame, charger and battery.
Iron is derived from two sources:

1) Extraction and processing (refining) of the raw material, called 'primary production';
2) Recycling of discarded iron, called 'secondary production'.

Very little scrap iron is recycled, but large quantities of scrap steel are recycled.

M. Crozet (ILO)

M. Crozet (ILO)

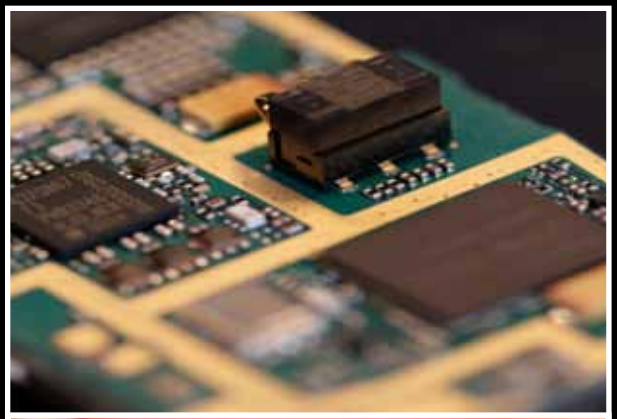
M. Crozet (ILO)

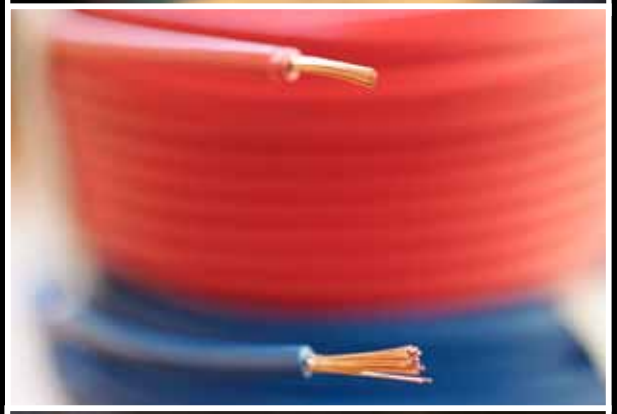
# Copper

A mobile phone contains about 16 grams of copper, found in the circuit board, wires, connectors and battery. Like iron, copper comes from two sources:

1) Extraction and processing (refining) of the raw material, called 'primary production',

2) Recycling of end-of-life products, called 'secondary production'.





M. Crozet (ILO)

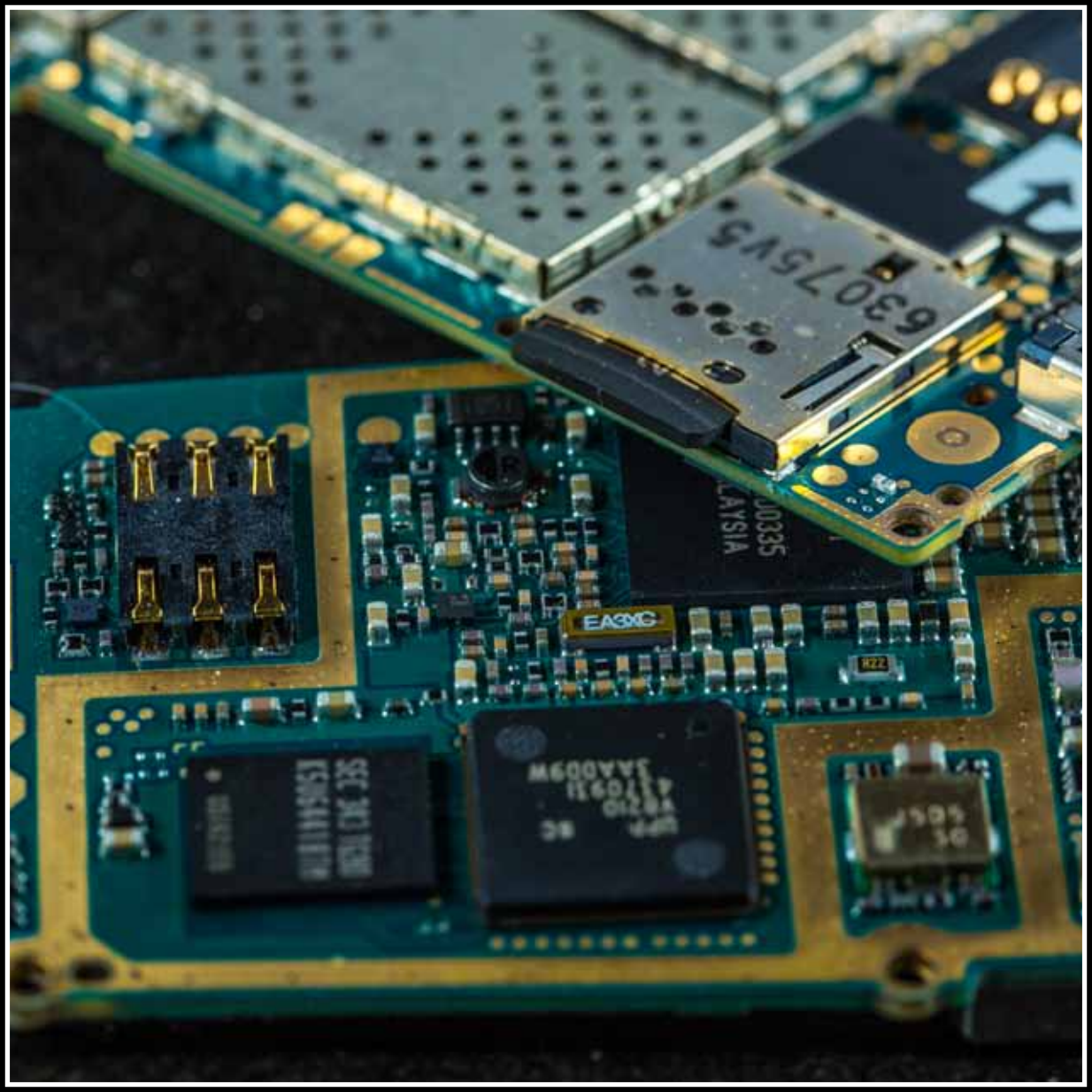
# Silver

A mobile phone contains about 0.35 grams of silver, found in the circuit boards and keypad. Silver is found in lead, zinc, and copper ore deposits.

M. Crozet (ILO)

A full two-thirds of the silver resources in the world are found in association with these other metal ores. The remaining third is found in association with deposits of gold.


D. Wardhana Hasanuddin(UNEP)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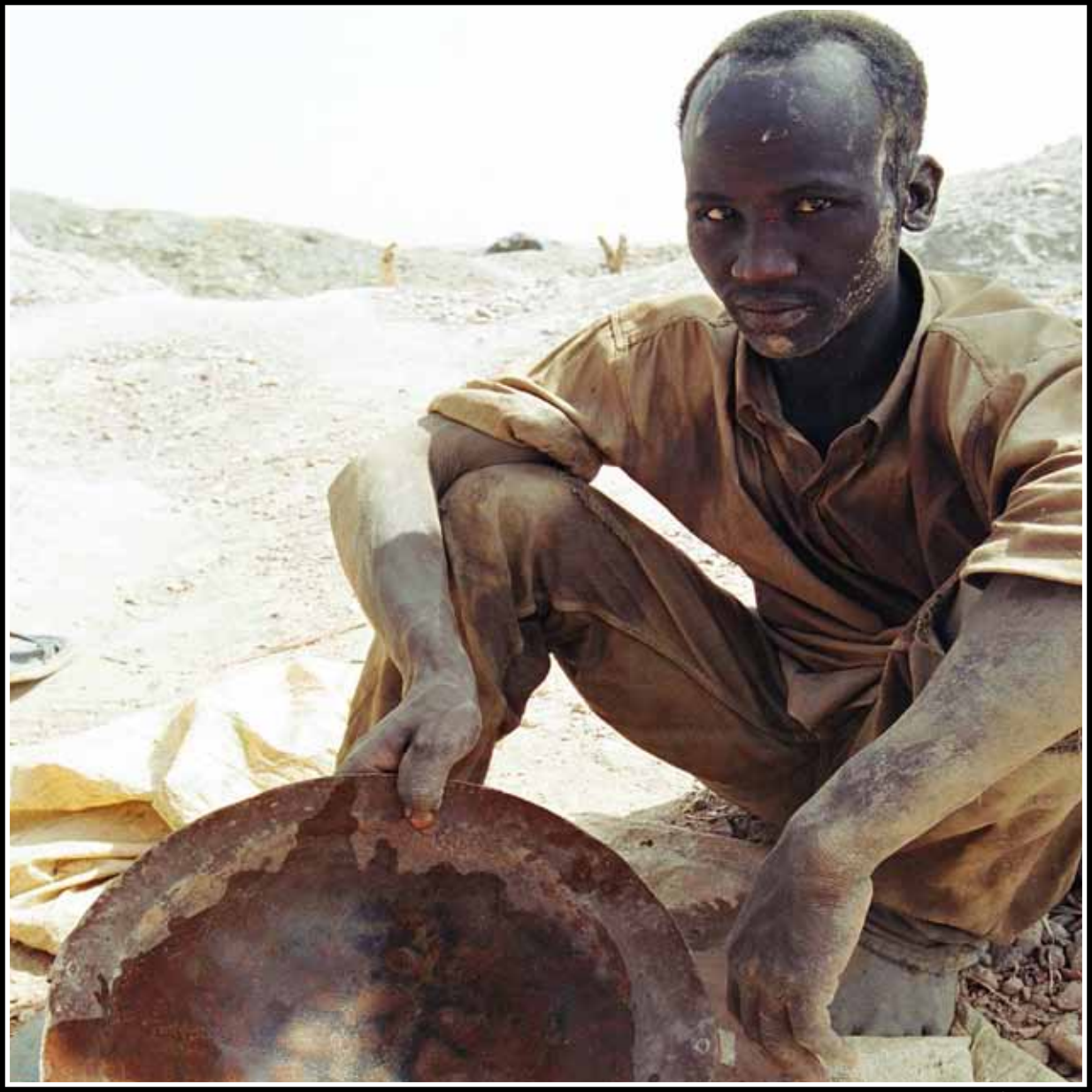
# Gold

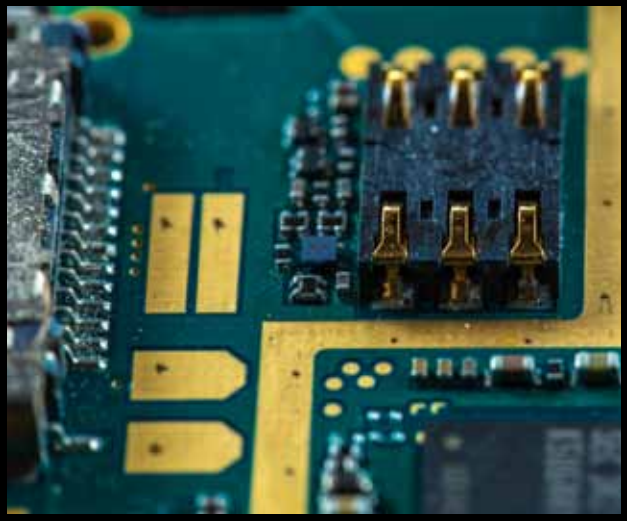


M. Crozet (ILO)

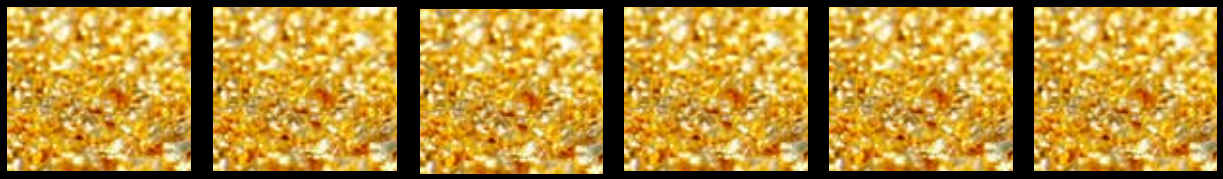
A mobile phone contains about 0.034 grams of gold, found in the connectors and circuit boards. Gold is chemically stable and conducts electricity, hence its use in electronics.

M. Crozet (ILO)

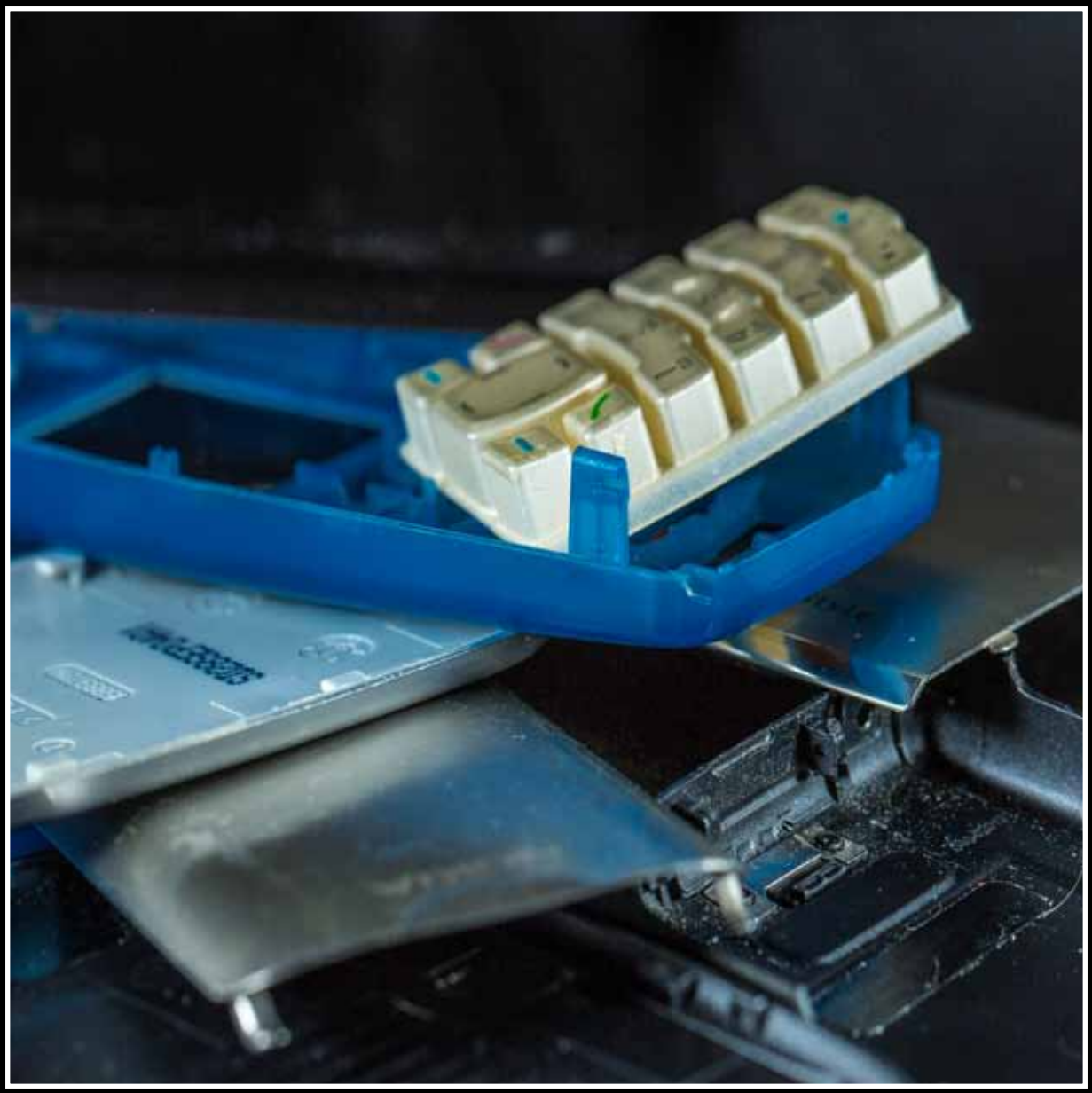
M. Crozet (ILO)



One tonne of circuit boards yields about the same amount of gold as 110 tonnes of gold ore. One tonne of recycled mobile phones can produce up to 230 grams of gold.



# Plastics



D. Wardhana Hasanuddin(UNEP)

Mobile phones are composed of about 40% plastic compounds. The case of a mobile phone is typically made of PC/ ABS plastic, a mix of polycarbonate (PC) and acrylonitrile butadiene styrene (ABS). The case of the charging station is typically also made of polycarbonate.

# Batteries & Chargers


It is not just the mobile phones themselves which require proper recycling and disposal. The batteries and re charger units also need to be properly managed. End-of-life batteries and any associated circuit boards or electronic assemblies containing lead-based solders have to be managed in an environmentally sound way, in accordance with the Guideline on Material Recovery and Recycling of End-of-life Mobile Phones developed by the Mobile Phone Partnership Initiative (MPPI) under the Basel Convention.

# Collection and Reuse

Environmentally sound management of the used mobile phones should include the collection of used mobile phones into a system with three goals to:

1. divert end-of-life mobile phones from waste streams destined for disposal in landfills or incinerators;
2. repair, refurbish and preserve used mobile phones in working order, so that they can be used again; and
3. channel unusable (end-of-life) mobile phones for environmentally sound material recovery and recycling.

Floyd Wilde

M. Crozet (ILO)

Recent figures estimate that recycling collection rates of mobile phones peak at around 7-15% in developed countries and 1-5% in developing countries. Clearly, much of the economic value of used mobile phones remains uncaptured, and more could be done to protect the environment from this waste.

# Dismantling

Only a small percentage of the millions of mobile phones retired and discarded annually are dismantled and recycled. When large numbers of mobile phones become obsolete, large quantities of valuable metals end up either in storage or in landfills. As many as half of all mobile phone users may be even unaware that recycling is possible.

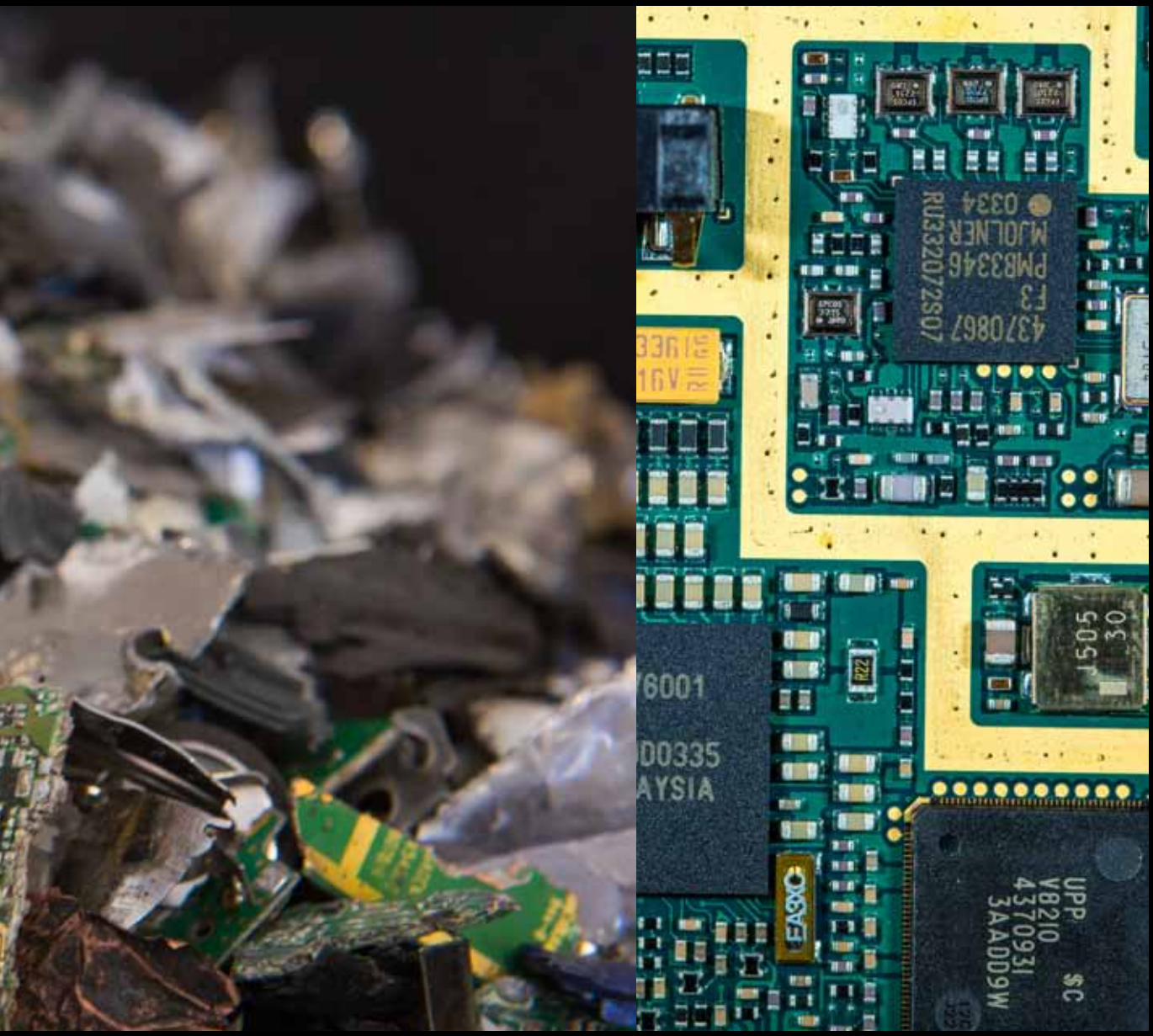
If captured, the quantity of potentially recoverable metals would make a significant addition to the total recovered metals from recycling and would replace and supplement virgin metals currently extracted from mining.

# Dismantling Facilities

Like other electronics, mobile phones contain a variety of substances that require sound handling and processing during material recovery and recycling, in order to prevent risks to workers, the public and the environment.

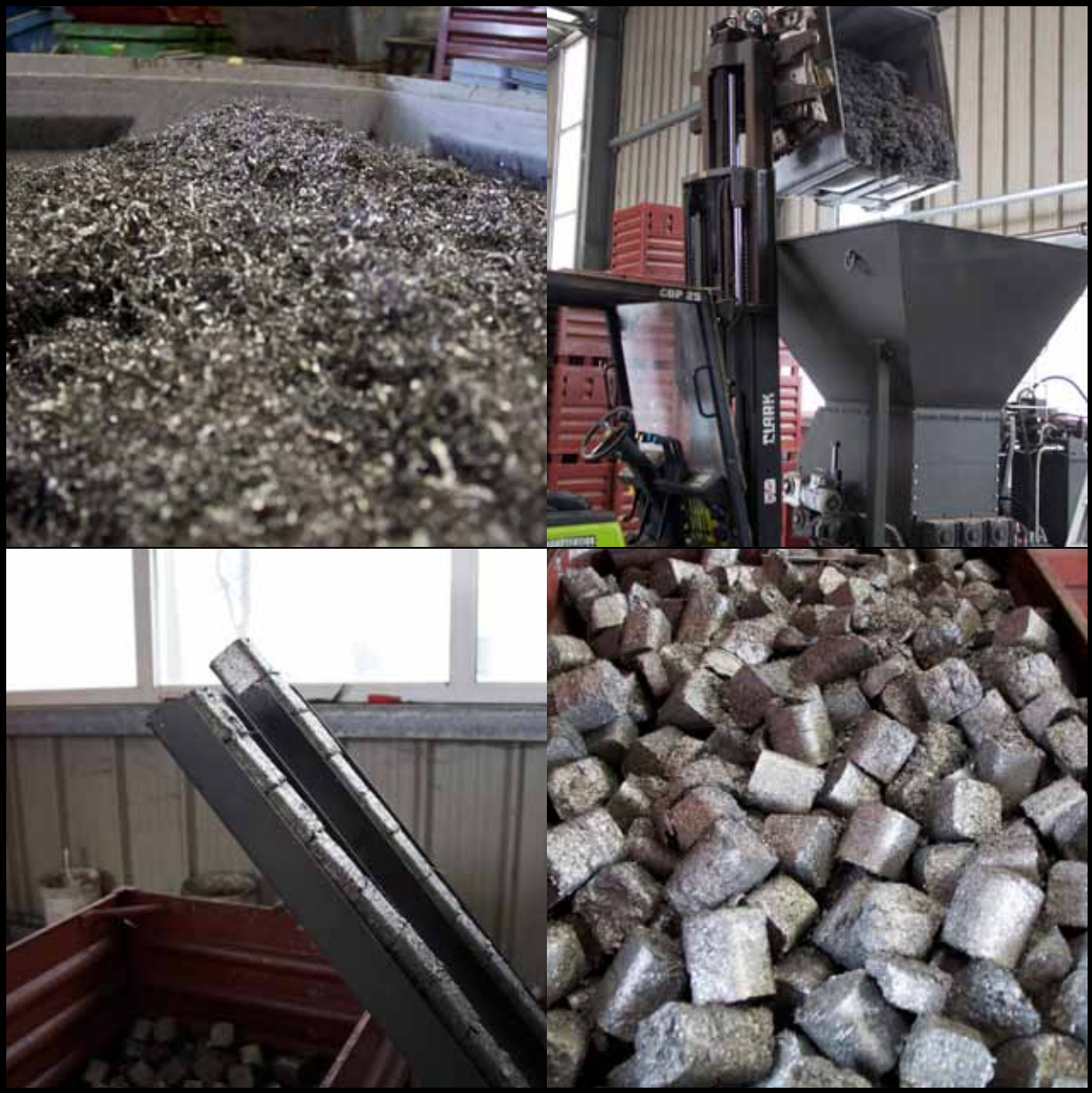
Without appropriate health and safety procedures, including special provisions for hazardous wastes, impacts upon human health are likely to be severe.

Dusts may be generated during the shredding of mobile phones, during the subsequent handling of shredder outputs and during the handling and/or processing of smelter slags. Toxic fumes may be generated during electronic components removal, metal sampling and similar processes, as well as during certain steps in plastics recycling, such as granulation.



# Recycling Process

Prior to material recovery and recycling of end-of-life mobile phones, several items need to be separated and sorted. Batteries must be removed before mechanical or pyrometallurgical processing, i.e., prior to any shredding and/or smelting. Accessories may also be sorted and separated from the mobile phone handset. The metals of economic interest and of environmental concern are mostly located in the electronic circuitry inside the handset. The extracted metals – including gold, platinum, palladium and silver – are later put back into productive use. 'High value' materials make up about 16% (by weight) of a typical mobile phone.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# Recycling Products


D. Wardhana Hasanuddin(UNEP)

End-of-life mobile phones are, when collected in sufficient volume, a useful source of metals, including copper, gold, silver, and palladium, amongst others. And from an environmental point of view, the recovery and recycling of these metals has the greatest positive impact (eco-efficiency) at this time.

As much as 95 % of the materials in a mobile phone can be recycled or recovered as energy. The remainder can be used in inert construction aggregates.

D. Wardhana Hasanuddin(UNEP)

Dinuraj K

# Informal Disposal

Informal activities in the e-waste recycling chain are present in many developing countries and include collection, manual dismantling, open burning to recover metals, uncontrolled smelting and open dumping of residual fractions.

Whilst it is good to collect and recycle, as pointed out above, it must be done in ways which protect both the worker and the environment.

Open burning of units is especially dangerous, yet is widely practised.

Mobile phone components are burnt to recover metals, such as copper, steel, and aluminium from plastic-insulated wires and other components of electrical and electronic equipment. The direct impacts of such informal practices on human health and the environment are severe due to the resulting toxic air pollutants emissions, including dioxin and carbon monoxide.

D.Wardhana Hasanuddin(UNEP)

Collection points are not only required for consumers, it is also important to create a collection system for repair outlets as well, both formal and informal, to ensure that the scrap does not end up in landfill.

# Disposal

Worldwide, between 15-30% of the old mobile phones collected are beyond economic repair and need to be recycled. The "Guidance document on the environmentally sound management of used and end-of-life mobile phones" from the Basel Convention Mobile Phone Partnership Initiative provides information on how to manage used and end-of life mobile phones from collection to refurbishment, material recovery and recycling.

This includes design improvements to introduce reuse and recycling information into product marking, and further reducing the use of hazardous substances, making

reuse, refurbishment, material recovery and recycling easier and extending the life of products.

# Economic significance - what can I do ?

There is 40-50 time more gold in mobile phones, per unit weight, than in typically commercially extracted gold ore. Similar calculations can be made for all metals contained in mobile phones. An increase in the metal-recycling rate increases also the material efficiency. Reuse, refurbishment and recycling contributes significantly to the economic growth of countries. The goal of sustainability is to ensure that the non-renewable resources are not wasted but kept in the material life-cycle as long as possible.

Refurbishment and recycling also have an important socio-economic impact, particularly in developing countries. In Lagos, Nigeria for example, a collector on dump sites earns about 0.2-05 US$ per day, door-to-door collectors up to 3 US$. The owner of a refurbishing workshop, however, can have a daily income of up to 200 US$.

Recycling is an effective way to address resource scarcity and mitigate environment impacts associated with metal mining, processing and use, while at the same time it creates jobs and income while facilitating the product's life-cycle. Let's give our mobile phones the chance for a place in a sustainable life-cycle. As a first step, do not throw your mobile phone away, recycle it!

World Bank

# The Mobile Phone Partnership Initiative

The Mobile Phone Partnership Initiative (MPPI) was established under the Basel Convention in December 2002, when twelve manufacturers signed a declaration entering into a sustainable partnership with the Secretariat of the Basel Convention, telecom operators and other stakeholders to develop and promote the environmentally sound management of end-of-life mobile phones.

The MPPI Working Group was composed of mobile phone manufacturers, telecom operators, representatives from countries, the recycling and refurbishment industry, industry associations and environment non-governmental organizations.

Under the MPPI five technical guidelines were developed and tested:
- Awareness-raising on design considerations;
- Collection of used and end-of-life mobile phones;
- Transboundary movement of collected mobile phones;
- Refurbishment of used mobile phones;
- Material recovery/recycling of end-of-life mobile phones.

In addition, an overall Guidance Document was prepared which contains summaries and recommendations, taken from all five technical guidelines. It was finally adopted by the Conference of Parties to the Basel Convention in October 2011. All five guidelines and the overall Guidance Document are available at the Basel Convention website.[1]

International organizations, such as UNEP, benefit by the fact that partnerships such as the MPPI make concrete contributions to the implementation of sustainable development goals outlined in environmental agreements such as the Basel Convention, thereby also contributing towards the implementation of Agenda 21, and the Johannesburg Plan of Implementation.

The working structure of MPPI served as a successful example for partnerships under the Basel Convention. Partnerships like the MPPI complement government's initiatives to deliver on goals and objectives under various environmental agreements, while promoting cooperative sustainable and transparent working arrangements with all stakeholders.

Based on the positive experience with MPPI, stakeholders from industry, academia, governmental institutions and public interest non-governmental organizations came together and established a new Partnership for Action on Computing Equipment (PACE)[2] which was launched in 2008 by the ninth meeting of the Conference of the Parties to the Basel Convention.


[1] http://www.basel.int/Implementation/TechnicalAssistance/Partnerships/MPPI/Overview/tabid/3268/Default.aspx.

[2] http://www.basel.int/Implementation/TechnicalAssistance/Partnerships/PACE/Overview/tabid/3243/Default.aspx

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