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Management For Production and Recycling in E-Waste to Achieve Accuracy in Environmental MIS

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ABSTRACT

Ecological administration data frameworks (EMIS) speak to a critical commitment for the help of ecological security by organizations. In this commitment an exceptional component of EMIS will be centered around which bolsters the documentation and diminishment of the impressive measures of ecological harm caused by modern creation. An introduction of the establishments of EMIS and creation coordinated ecological assurance is taken after by an exchange of ideas of PC bolstered material stream administration and reusing arranging and administration.

Keywords Recycling, Environmental Management Information Systems, Manufacturing planning and control, Material Flow Management, Production

I. INTRODUCTION

E-squander is a well known casual name for electronic items nearing the finish of their helpful life. Anything that keeps running on power/battery or has wire and finished its life is e-squander . Electronic waste might be characterized as disposed of PCs, office electronic hardware, stimulation gadget gadgets, cell phones, TVs and fridges. e-squanders are viewed as unsafe, as specific segments of some electronic items contain materials that are risky, contingent upon their condition and thickness. The risky substance of these materials represent a risk to human wellbeing and condition.

Disposed of PCs, TVs, VCRs, stereos, copiers, fax machines, electric lights, PDAs, sound gear what's more, batteries if disgracefully arranged can filter lead and other substances into soil and groundwater. Electronic waste, e-squander, e-scrap, or Waste Electrical and Electronic Equipment (W.E.E.E) portrays disposed of electrical or electronic gadgets. There is an absence of accord with respect to whether the term should apply to resale, reuse, and renovating businesses, or just to item that can't be utilized for its proposed reason.

prone to reuse and repair gadgets. Some of classes include: Mobile Phones, Computers, ,Servers, Telecom, TV, Number crunchers, Audio, Scanners, Printers, Air Conditioner, Microwave, Washing Machine, Cartridges, Military electronic, Mother board, Alarm, Sirens, Automobile Exhaust system, Sensor, CD, Security Device and so forth. Mechanical transformation took after by the advances in data innovation amid the most recent century has drastically changed individuals' way of life. In spite of the fact that this improvement has helped humankind, fumble has prompted new issues of tainting and contamination. The specialized ability gained amid the most recent century has represented another challenge in the administration of squanders. For instance, (PCs) contain certain parts, which are very poisonous, for example, chlorinated and brominated substances, poisonous gases, dangerous metals, organically dynamic materials, acids, plastics and plastic added substances. The perilous substance of these materials represent an ecological and wellbeing risk. In this manner legitimate administration is important while arranging or reusing e-squanders. The paper features these issues and represent some solid proposals.

II. ENVIRONMENTAL MANAGEMENT INFORMATION SYSTEMS

The term Environmental Management Information Systems (EMIS) alludes to organizational technical frameworks for efficiently getting, preparing and making ecologically significant data accessible in organizations. Most importantly, these frameworks help in deciding the natural harm caused by organizations and outlining bolster measures to keep away from and diminish it (Hilty, Rautenstrauch, 1995). As opposed to general or supra-organization natural data frameworks, the errands of EM IS are not restricted to the natural space, rather are to be comprehended as building hinders for more mind boggling administration applications frameworks which fill organization needs.

The beginning stage for the improvement of EMIS in past years was not just the expanding interior requirement for data - e.g., for considering lawful directions in the casing of organization natural insurance - yet in addition of the outside requests made on organizations for data about natural harm caused by their items and generation forms.

From the perspective of a mechanical organization, the indigenous habitat serves, on the information side, as a source medium for (non-inexhaustible) normal assets which go into assembling as crude materials, and, on the yield side, as a getting medium for the emanation of strong, fluid and vaporous materials. Industrial manufacturing system.

III. FROM ADDITIVE TO INTEGRA TED SOLUTIONS

The natural environment is regarded, from the viewpoint of industrial management, as a production factor for whose preservation the following maxims should be followed :

• Take into account the limitations of the environment

• Stabilize ecosystems

• Minimize environmental interventions

• Use environmentally-sound production processes

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For the industrial domain, compliance with these maxims entails that not only the extraction of environmental materials, but also the environmental damage caused by the emission of waste products should be reduced.

A trend from additive to integrated environmental protection measures is currently observable in the industrial domain. *Additive environmental protection* is found where measures are taken either before or after actual production processes, which are, however, not affected by these measures (so-called "end-of-pipe" technologies). Examples of this are the addition of purification or filtration systems to production processes.

One speaks of *production-integrated environmental protection* if the production processes themselves are changed so that the quantity of inputs and emitted pollutants are reduced. In principle, we can distinguish among three types of strategy for meeting ecological

Demands on Production:

- changing production processes
- recycling
- changing products

The goal of changing production processes is to avoid unwanted incisions and evitable use of raw materials. This goal can be systematically reached above all through the adoption of production-integrated environmental protection measures, which often requires a thoroughgoing reorganization of the production process. The reorganization of production processes is a strategy for *avoiding* environmental damage and should therefore have the highest priority,

Ahead of recycling and additive measures.

In the following sections it will be shown how EMIS can support the reorganization of production and recycling processes. The design of environmentally-sound products is not dealt with here, since a treatment of this topic would exceed the frame of this presentation.

IV. CONCEPTS OF COMPUTER-SUPPORTED RECYCLING

4.1 Recycling as an additive environmental protection measure

Today the most commonly used recycling method is material recycling. With this method production residuals and discarded (scrap) products are shredded, converted into energy (e.g., waste heat), or disassembled to the point where secondary materials arc obtained which can be reused as materials in the production process. Figure 1 shows the connection of production and recycling processes in *material recycling.*

Since shredding, energy recovery and similar recycling procedures are relatively uncomplicated, computer-Supported planning of such processes is unnecessary. Disassembly is different. Since a great deal of effort must be expended in separating parts which are tightly connected and difficult to reach, disassembly is the chief source of costs in the recycling process. Consequently disassembling a product is only reasonable if the product complexity prevents reuse of the material in a single procedural step. This holds above all for complex technical goods like airplanes, machines, household appliances, etc. The advantage of disassembly as opposed to other procedures is that disassembly permits us to preserve a higher share of the value of the discarded complex

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product . It should be possible to reduce recycling costs with the help of EMIS in computer-supported disassembly planning by automating and systematically planning the disassembly process. *Disassembly planning system* domain.

One approach being developed at the Institute for Machine Tools and Manufacturing Technology in Berlin is based on a combination of foreseeable and reactive planning . In this approach, applied to the area of electronic scrap, first AND! OR graphs are constructed for modeling the disassembly process, and the most favorable path is determined by calculating a "recycling value". It can be, however, that the so-calculated most favorable process is not realizable in the regimen form due to technical framework conditions, so that a reactive component of the system may revise the regimen plan, taking into account the framework conditions. The here-developed system prototype was specially created for the recycling of TV picture tubes and today is being used profitably.

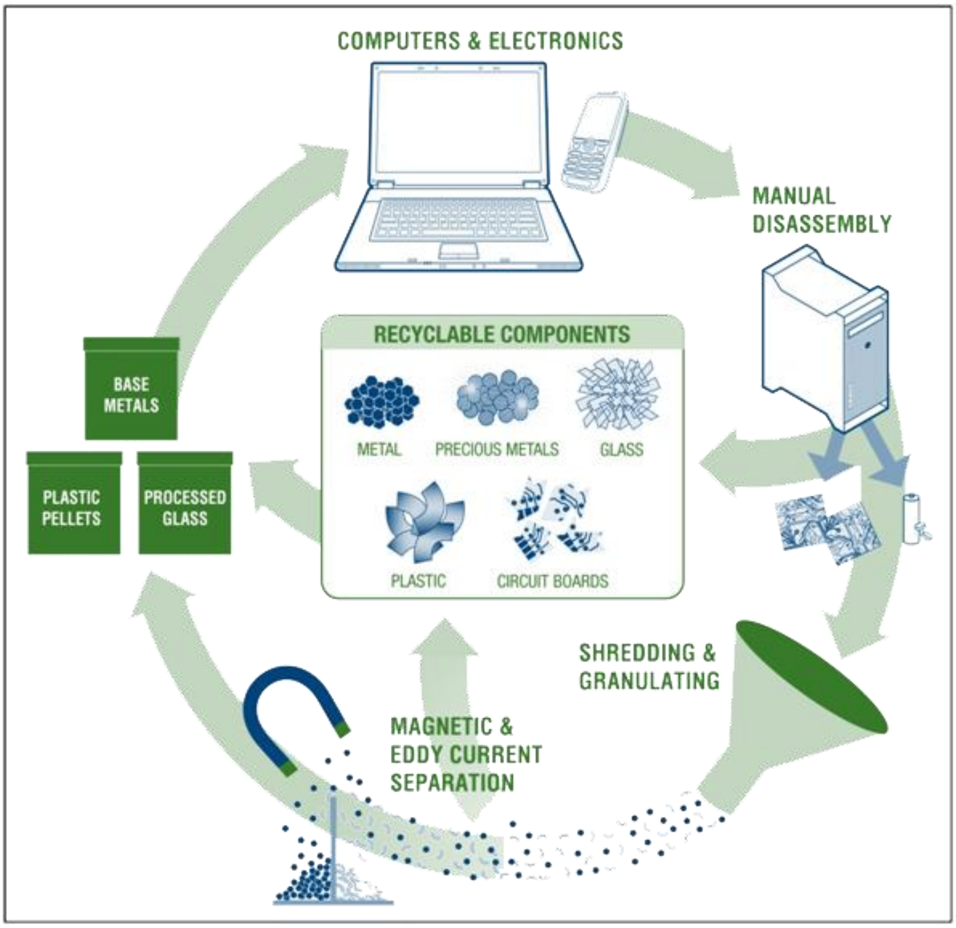

Fig 1. Recycling process Recycling as an additive environmental protection measure

Computer-supported disassembly planning is likewise the subject of a research and development project. the A disassembly planning system realized in the frame of this project supports the manual and automated disassembly of technical products. In the development of routing plans it is foreseen that construction and routing plan data will be borrowed from the production domain. Further, at the Franco German Institute for Environmental Research (DFIU) in Karlsruhe a prototype has been developed for electronic scrap recycling and disassembling architectural structures which determines the optimum sequence of disassembly activities with the aim of maximizing the return on investment.

V. EMIS FOR THE SUPPORT OF PRODUCTION-INTEGRATED RECYCLING

With recycling as a production-integrated environmental protection measure it is assumed that individual assemblies and parts of technical goods can have a higher "life expectancy" than the overall product. In this case it is more reasonable to introduce these assemblies or parts into the production process as secondary assemblies than it is to reduce them as serap products to the raw material stage and only then bring them back into the production process. The reintroduction of scrap products in a new use stage while maintaining the structure of the product is called *product recycling.*

For the realization of product recycling the availability of information on the construction of the scrap product is an essential prerequisite. This information can be acquired at least to a considerable degree from existing information systems. With the selection of materials and the determination of a manufacturing procedure, already in the anufacturing process and route planning, the framework conditions not only for the production, but also for the recycling of a technological product are determined. While production-relevant data can be managed in the form, e.g., of data from master parts files, bills of materials and routing plans in MPC systems, data on reusability and suitability for disassembly is systematically stored and processed neither in MPC systems nor in other management information systems. This gap is filled by recycling information systems (RIS). Such systems process production data in such a way that, with the aid of additional manual supplementation, information becomes suitable for the planning and management of recycling processes, as well as subsequent production processes into which secondary assemblies from recycling processes flow. An example of such a system is ooRIS (object-oriented RIS) .

The functionality of ooRIS is thereby directed at formulating recycling bills of materials (recycling BOM) and routing plans from the corresponding production data structures. The problem hereby is that in the course of being used, a product may be changed, wear and tear can sharply alter the quality of secondary goods, and individual parts can be built in or removed during use. Consequently the acquisition of recycling information is done using an ingenious semiautomatic process in which so-called recycling graphs are created from production data out of which recycling bills of materials and routing plans are then created. Recycling graphs are bipartite graphs whose nodes represent parts and disassembly work processes and whose connections indicate which parts are assembled with which procedures. ooRIS is available not only as an add-on-system for PPS systems, but also as a stand-alone system. The add-on version is developed as a prototype for SAP PP, and the stand-alone version disposes of comprehensive import/export data interfaces. A more extensive integration of recycling and production is possible, provided not only the recycling of scrap products, but also the recycling of production residuals is considered in planning, since the time interval between production and recycling processes is very short compared with that for scrap product recycling. Due to the high temporal proximity of both processes, there are not only technical, but also economic arguments for integrating production and recycling on the process level (see figure 2).

5.1 Integration of production and recycling processes

In the integration of production and recycling processes, processed residuals or rejected parts can flow back into the production process, either directly or indirectly. Direct reintroduction means that the secondary parts acquired through the recycling process flow back into the same production process from which they originated; in the case of indirect recycling, a temporal delay ensues before secondary parts are employed in the same or another production process. Both variants lead to a definite shortening of the recycling cycles, since for such processes the total disassembly or reprocessing of rejected parts or residual materials is not necessary, and through the earliest possible use of secondary goods there is a reduction in recycling-conditioned inventory levels. The prerequisite for indirect and direct reject and residual material recycling is that the corresponding production processes be known and input and output quantities, as well as points in time, be coordinated.

5.2 Manufacturing of products .

The manufacturing of products in a way that facilitates recycling, along with the development of efficient programmable machines and robots, makes possible the lise of company resources not only for assembly, but also for disassembly processes. Even if it still seems utopian today that on a single assembly line, e.g., scrap cars and half-assembled new cars can be delivered in any sequence to a robot which then promptly assembles or disassembles them according to specifications, it is nevertheless quite conceivable that the assembly and disassembly of products could be performed by machines of the same type. Recycling can thereby also contribute to the improvement of capacity utilization.

5.3 Reintroduction of secondary assemblies

The reintroduction of secondary assemblies into the production process leads to a shortening of recycling cycles, since as well here the total disassembly of a discarded complex product can be dispensed with, even if there are, besides technical, as well legal problems hindering the use of secondary assemblies. Thus, for example, the question of whether an end-product which consists to a certain degree of secondary assemblies can still be considered a "new" product has in general not yet become answerable

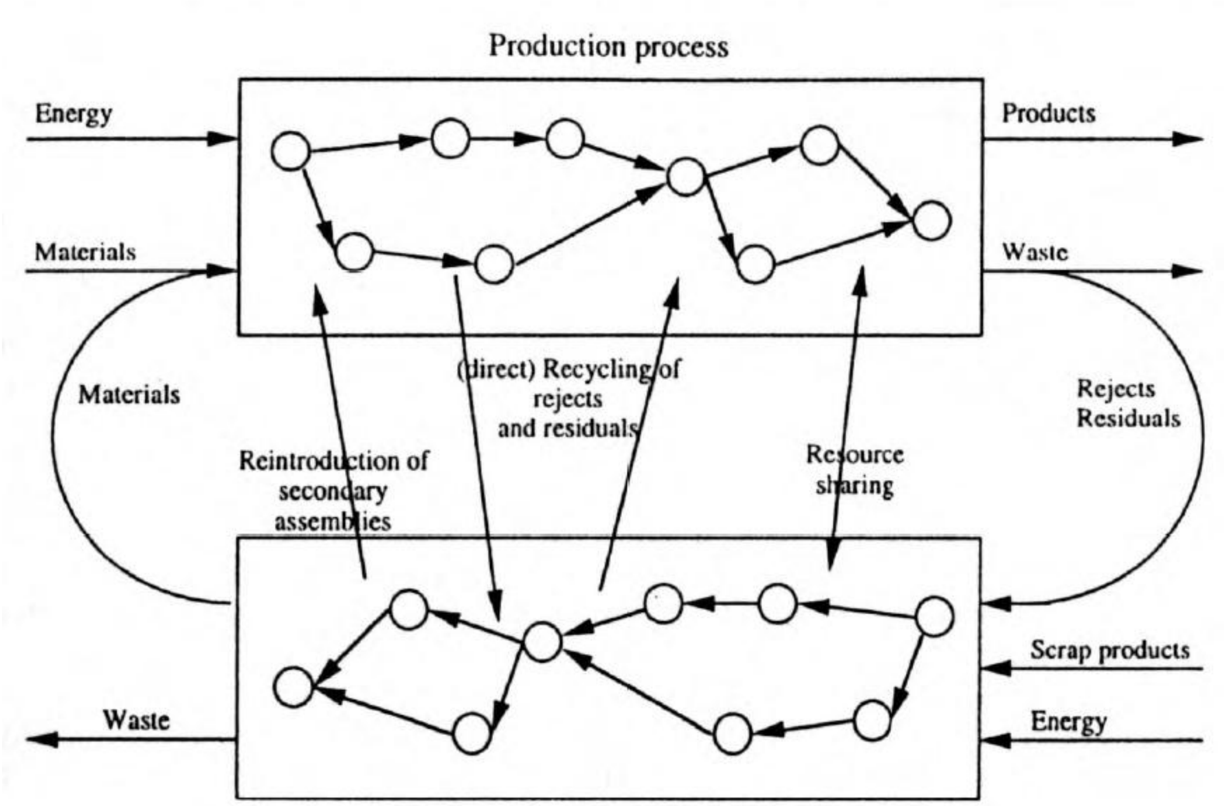

Fig 2. Recycling process

To make full use of the above-named advantages, integrated *manufacturing alld recycling planning and control systems (MRPC systems)* have been conceived as an expansion of MPC systems. They must meet the following requirements:

• All planning-relevant residual materials and rejected parts are to be taken into account systematically.

• These data must be used for efficient direct and indirect reintroduction into the production process.

• On the input side, the possibility must be taken into account that material needs could also be satisfied with secondary goods.

To fulfill these requirements, functional expansions and modifications of MPC systems are needed. The first expansion concerns data management. It must in principle include all the functions of a RIS and, in addition, be able to manage disassembly and recycling tasks. In the domain of the material management the expansions concern the following domains:

5.4 Inventory management

In the case of integrated recycling, the list of reasons for the accumulation of inventories (purchasing, production processes, goods returned by clients, etc.) must be supplemented with information on recycling processes and the inflow of scrap products. Further, special parts (e.g., manufacturing or operating supplies) can, as additions to inventory, create stocks to be recycled.

For recycling processes, quantity planning is to be carried out in which secondary waste management requirements are determined. Secondary waste management requirements arise through the accumulation of recycling materials from production or recycling processes.

Furthermore, with quantity planning for production the effects of direct recycling are to be taken into account. For this purpose no fundamentally new procedures are needed, since residual materials and rejects can be seen as complementary products. The calculation of gross and net requirements can therefore be achieved by adapting quantity planning procedures complementary production.

5.5 Calculation of waste management requirements

The calculation of waste management requirements must also be included. Waste management requirements can be differentiated into recycling requirements and disposal requirements. Recycling requirements arise through the accumulation of recyclable materials in production or scrap product recycling. In the case of intra-company recycling, the requirements which are determined become inventory stocks of secondary goods during the following period. In the case of inter-company recycling and wastes, waste management requirements become disposal requirements, because in both cases goods leave the company.

Since the waste management requirements for a residual product can be determined not only in a prognostic, but also deterministic manner, a possible deterministic preplanned waste management requirement must be included in cost calculations. Furthermore, possible

additional requirements must be calculated for unforeseeable events, and possible existing stocks must be taken into account from previous periods. A storage of wastes over one or more periods can, e.g., be reasonable, if a reduction of disposal costs can be expected.

5.6 Scheduling

Expansion of existing scheduling procedures is necessary in the case of direct recycling, since in this case cyclical material flows occur, and temporal dependencies exist between the production and recycling routines. Up until now no implementations of complete MRPC systems are known. However, standard MPC systems which also support concepts of complementary production can through skillful customization be adapted to the material economy, to the extent that backflows from reject and residual material recycling are taken into account

VI. CONCLUSION

The approaches and information systems discussed in this paper, aside from that of material flow management, have been positioned on the *operative level*. The realization of these approaches is an important basis for environmental information management. However, environmental information management is defined by management actions in a company with regard to environmental information and its preparation for use in *decision-making processes* through communication. Consequently, an essential further task for the development of EMIS is the preparation and aggregation of environmental data to obtain information on the basis of which company managers can make strategic decisions. An EMIS is more than an "green" CAP or MPC system; it should also provide decision support by systematically integrating economic, technical, and environmental data.

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