Clarifying the Definitions of Various Reuse Options for Effective Recovery of Resources from Waste Streams

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Abstract

Earth's natural resources are finite. To be environmentally sustainable, it may not only be necessary to use them 'efficiently' but also 'effectively'.While Gharfalkar et al. (2015)consider 'repair', 'recondition', 'refurbish' and 'remanufacture' to be 'reuse' options, not all researchers agree. Also, there is lack of clarity between the different options that are likely to be challenging for both; the policy makers who formulate policies aimed to encourage 'reuse' of 'waste' products and for decision makers to initiate appropriate action for recovering 'reusable resources' from 'waste streams'.This dichotomy could result into more 'waste' to landfill. Asystematic review of literature is conducted tounderstand whetherinconsistencies and/orlack of clarityexist between the definitions or descriptions of identified'reuse' options. The review confirms existence of inconsistencies such as the omission of one or more of identified options from 'reuse' (23%) andlack of clarity between options (59%). This paper proposesa'hierarchy of reuse options' that plots the relative positions of identified 'reuse' options vis-à-vis five variables, namely work content, energy requirement, cost, performance and warranty. Recommendations aremade on how to incentivize original equipment manufacturers (OEMs) to 'remanufacture'. Finally, an alternative 'Type II Resource Effective Close-loop Model'is suggested and a conceptual 'Type II/2 Model of Resource Flows' that is restricted tothe use of environmentally benign and renewable resources is introduced. Thesesuggestions are likely to help decision makers toprioritisebetween 'reuse' options, drive resource effectivenessand also environmental sustainability.Further research is required to propose alternative definitions.

Key words: EOL, waste**,** reuse, repair, recondition, refurbish, remanufacture

Introduction:

Considerable research has been done on 'reduce-reuse-recycle' of waste products but the lack of clarity and inconsistencies between the definitions and/or descriptions of the various 'reuse' options indicates the need for a systematic literature review on this subject. While Gharfalkar et al. (2015)consider 'repair', 'recondition', 'refurbish' and 'remanufacture' to be 'reuse' options, in majority of cases, 'remanufacturing' is shown distinct from 'reuse' when logically it is part of 'reuse'.

This paper is based on the hypothesis of the '5Rs of Resource Effectiveness' (Fig 1) that identifies 'repair', 'recondition', 'refurbish' and 'remanufacture' as different 'reuse' options.The logic is that any measure or an operation that results in 'reuse' of 'waste'objectseither in part or in full needs to be considered as a 'reuse' option. Also, these options lead to 'reuse' and therefore, conversion of a 'waste' into a 'non-waste'. The European waste directive 2008/98/EC, defines 'waste' as 'any substance or object which the holder discards or intends to discard or is required to discard'(Directive, 2008).

The Remanufacturing Institute indicatesthat many terms such as 'used', 'repaired', 'restored/reconditioned', and 'recycled' are often confused with 'remanufacturing'(TRI, 2014). Ziout et al. (2014) identifies 'resale', 'maintenance', 'repair', 'replacement', 'refurbishing' and 'remanufacturing' as some of the other ‘reuse’options but concludes that clear cut definitions and distinctions between these options do not exist in literature or practice. A few examples (anecdotal evidence) of inconsistencies observed in the definitions and/or descriptions of the identified ‘reuse’ options are described below. These examples capture the inconsistencies such as exclusion of some of the identified measures or operations or options from ‘reuse’, lack of clarity in the understanding and the nature of ‘remanufacturing’ etc.

i) The six Rs of ‘Reduce, Reuse, Recycle, Redesign, Recover and Remanufacture’ identified by Gaussin et al. (2013) clearly indicate that ‘remanufacture’ is distinct from ‘reuse’.
ii) Seitz and Wells (2006) describes the outcome of a product take back using reverse logistics as, returned products that are recovered through different options such as ‘recycling’, ‘reuse’, ‘remanufacturing’ and ‘cannibalisation’. This clearly separates ‘remanufacturing’ from ‘reuse’.
iii) Seitz and Wells (2006)observe that ‘remanufacturing’ transforms worn-out goods into products with an ‘as good as new’ condition. This is substantiated by an example of ‘remanufacturing’ of car engines by grinding, machining and abrading of individual parts such as cylinder block or the cylinder head. Emphasis is laid on retaining the morphology of individual parts. The lack of clarity that exists on ‘remanufacturing’ is evident from the mention of ‘European remanufacturingworkshops’. Workshops are not equipped to ‘remanufacture’ but to ‘repair’ or ‘recondition’ or ‘refurbish’ and ‘rebuild’ a product. Moreover, due to intellectual property rights, not all workshops have access to OEM specifications and are therefore unable to offer OEM warranties and/or ‘as new product’, a pre-requisite of a ‘remanufactured’ product.

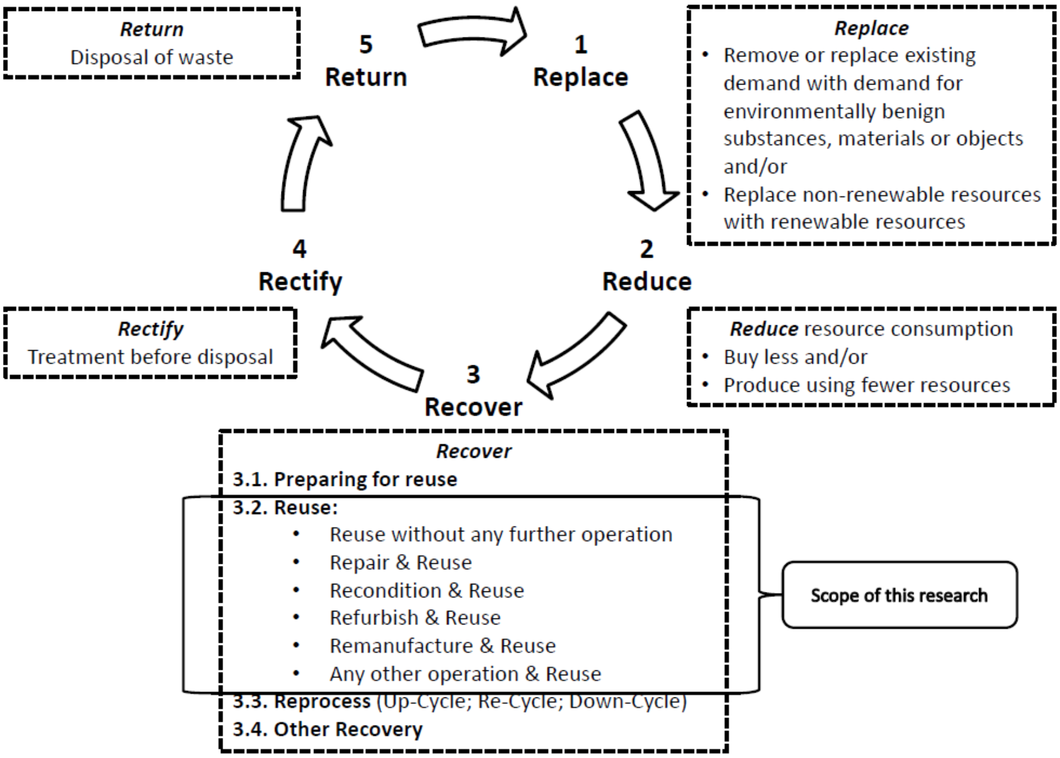


Fig 1: 5Rs of Resource Effectiveness by (Gharfalkar et al., 2015)

This research conducts a literature review to understand whether any inconsistencies and/or overlaps exist between the definitions and or descriptions of various ‘reuse’ options and with further research, aims to proposealternative ‘definitions’ for each one of them.

Materials and Methods:

Based on the hypothesis that ‘repair’, ‘recondition’, ‘refurbish’ and ‘remanufacture’ are one group of the many ‘reuse’ options, this paper conducts a systematic literature review to highlightthe lack of agreement and inconsistencies that exist between these ‘reuse’ options. The search is conducted by identifying peer reviewed articles published in the English language. The search was conducted using the‘Discovery’ database search engine. This database consists of literature published in170 databases including Business Source Complete, Emerald Insight, Sage Journals Online, Scopus, Science Direct, and others.Titles, subject terms (keywords) and abstracts of literature in these databases wereBoolean searched using the search phrase “repair or refurbish or recondition or remanufacture”, for the period beginning 1987 to 2015. The publication of the Brundtland Commission report in 1987 made ‘sustainable development’ prominent for the first time. This is the reason for setting the cut off year for literature search as 1987. Overall criteria for selection of relevant literature are described below. The literature identification and selection process is illustrated in Fig 2. The number of useful articles that were identified through this process are summarised in Table 1.

a) Articles published in English language between January 1987 to April 2015
b) Articles restricted to environmental sciences discipline
c) Articles restricted to mechanical and electromechanical products
d) Articlespublished in a peer reviewed journal
e) Full text of the articles available on-line
f) No cross references are considered

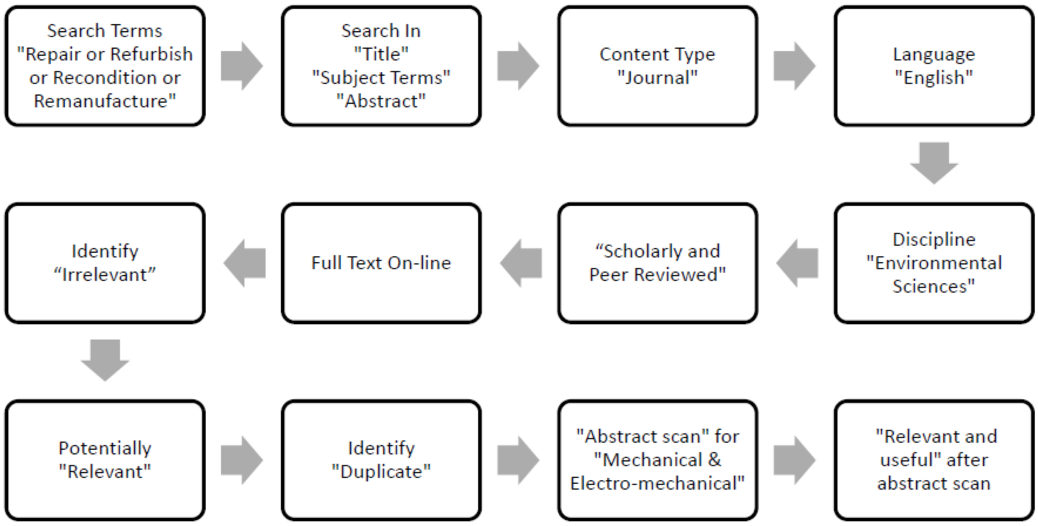


Fig 2: Flow chart for selection of journal articles

Description	“Title” Search	“Keyword” Search	“Abstract” Search	Total Articles
Total Articles from all disciplines	144199	181094	294665	
Articles from environmental science	384	1683	1962	
Scholarly and peer reviewed articles	353	1566	1868	
Articles with full text online	140	614	860	
Irrelevant articles	125	598	833	
Potentially relevant articles	15	16	27	58
Duplicate articles				18
Potentially useful before abstract scan				40
Identified as useful after abstract scan				17

Table 1: Summary of database search

The seventeen peer reviewed articles identified as useful (Table 1) were analysed using the two simple criteria described below. The outcome is discussed in the next section:

a. Doesthe definition and/or description of ‘repair’, ‘recondition’, ‘refurbish’ and/or ‘remanufacture’ in the identified literature, consider it to be as one of the many ‘reuse’ options?
b. Dothe definitions and/or descriptionsdistinguish one ‘reuse’ option from another and/or indicate a lack of clarity between different ‘reuse’ options?

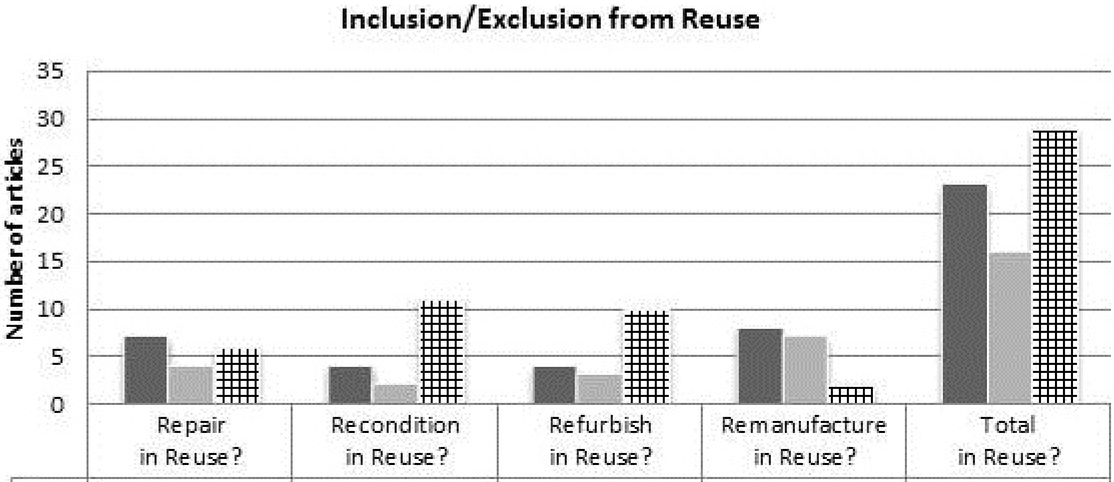
Results:

Table 2 summarises the outcome of the analysis of the seventeen articles that were identified as 'useful'. The analysis is based on the two criteria described in the previous section. Each article was analysed to check whether the definition and/or description of each of the identified 'reuse' options was considered to be part of a 'reuse' option or not. It is observed that very few articles describe or discuss all 'reuse' options and very few actually define 'reuse' options, although some cite original definitions from other sources. The decision as to whether the authors of this paper consider a particular measure to be a 'reuse' option is based on the definition and/or description of that measure and/or the description of that measure vis-à-vis other measures.Fig 3 illustrates the outcome graphically. it is evident that while 34% of articles consider either 'repair' or 'recondition' or 'refurbish' or 'remanufacture' as a 'reuse' option, 23% do not and 43% have either not defined nor sufficiently described or discussed at a sufficient level to conclude whether or not the option can be considered as a 'reuse' option. Also, each article was analysed to check whether the definition and/or description distinguishes one 'reuse' option from another and/or indicates a lack of clarity between different 'reuse' options.The majority 59% of the articles lack clarity between options while 35% of the articles either define or describe only one 'reuse' option or the description is insufficient to conclude whether there is a lack of clarity between 'reuse' options.

Reference	R1 In RU?	R2 In RU?	R3 In RU?	R4 In RU?	Lack of clarity or overlap?
A holistic approach for decision on selection of end-of-life products recovery options. (Ziout et al., 2014)	Y	N.D	Y	Y	Y
A network model to assist 'design for remanufacture' integration into the design process.(Hatcher et al., 2014)	Y	Y	N.D	Y	N/A
A review on remanufacture of dies and moulds. Chen et al. (2014)	N	N	N	N	Y
A tool to implement sustainable end-of-life strategies in the product development phase.(Gehin et al., 2008)	N	N.D	N	N	Y
Design for remanufacture: a literature review and future research needs.(Hatcher et al., 2011)	N.D	N.D	N.D	Y	N/A
Disassemblability of end-of-life vehicle: a critical review of evaluation methods. (Go et al., 2011)	N.D	N.D	N.D	N	Y
Eco-design methods focused on remanufacturing.(Pigosso et al., 2010)	N	N	N	N	Y
Incorporating component reuse, remanufacture, and recycle into product portfolio design.(Mangun and Thurston 2002)	Y	N.D	N.D	N	Y
Initiating automotive component reuse in Malaysia. (Amelia et al., 2009)	N.D	N.D	N.D	N	N/A
Is European end-of-life vehicle legislation living up to expectations? Assessing the impact of the ELV Directive on 'green' innovation and vehicle recovery. (Gerrard and Kandlikar 2007)	N.D	N.D	N.D	N	N/A
Making sense out of industrial ecology: a framework for analysis and action. (Cohen-Rosenthal 2004)	N	N.D	N.D	Y	Y
Reducing waste: repair, recondition, remanufacture or recycle? (King et al., 2006)	Y	Y	N.D	Y	N
Remanufacturing of turbine blades by laser direct deposition with its energy and environmental impact analysis.(Wilson et al., 2014)	Y	N.D	N.D	Y	Y
Reuse of secondhand TVs exported from Japan to the Philippines. (Yoshida and Terazono 2010)	Y	Y	Y	N.D	Y
Sustainable life cycle engineering of an integrated desktop PC; a small to medium enterprise perspective.(Fitzpatrick et al., 2014)	N.D	N.D	Y	N.D	N/A
Towards cleaner production: a roadmap for predicting product end-of-life costs at early design concept. (Cheung et al., 2015)	Y	Y	Y	Y	Y
Waste management Life Cycle Assessment: the case of a reciprocating air compressor in Brazil. (Zanghelini et al., 2014)	N.D	N.D	N.D	Y	N/A

Table 2: Results as per criteria (a) Inclusion or exclusion from reuse& (b) lack of clarity

R1: Repair R2: Recondition R3: Refurbish R4: Remanufacture RU: Reuse



	Repair in Reuse?	Recondition in Reuse?	Refurbish in Reuse?	Remanufacture in Reuse?	Total in Reuse?
Yes	7	4	4	8	23
No	4	2	3	7	16
N.D	6	11	10	2	29

Fig 3: Whetherthe article considersrepairs, recondition, refurbish and/or remanufacture as ‘reuse’ option
N.D:Not defined, described or discussed or the information is insufficient to conclude

Table 3 uses selected examples to indicate that the defined or described option (measure) is not considered as part of ‘reuse’ option and/or existence of lack of clarity between different options.

Reference	Description
Ziout et al. (2014)	The authors identify ‘resale’, ‘maintenance’, ‘repair’, ‘replacement’, ‘refurbishing’ and ‘remanufacturing’ as ‘reuse’ options and observe that clear cut definitions and distinctions between these options do not exist in literature or practice.
Chen et al. (2014)	This paper is on ‘remanufacturing’ of dies and moulds. The authors mostly use the term ‘repair’ for ‘remanufacturing’ and also use terms such as ‘refurbishing’ and ‘reconditioning’ to describe the same individual stage of the ‘remanufacturing’ process without clarifying the commonality or difference between these terms.
Gehin et al. (2008)	This paper only considers direct ‘reuse’ (without further operation except resale) as a ‘reuse’ option. Also, the 3R strategy of Reuse, Remanufacture and Recycle for end-of-life (EOL) products clearly indicate that ‘remanufacture’ is not considered as part of ‘reuse’.
Go et al.(2011)	‘Remanufacturing’ is not considered as a ‘reuse’ option. This is evident from the statement “apart from recycling, there are other EOL options including reuse and remanufacturing”. Also, the flow chart for ‘physical product life cycle’ describes ‘reuse’ of parts for ‘remanufacturing’ as ‘recycling’ of parts (recycling is getting back EOL objects that cannot be reused, to raw material constituent stage).
Pigosso et al. (2010)	‘Reuse’ is restricted to ‘resale and reuse’ of used objects. Also, the flow chart of ‘typical material product life cycle’ shows ‘remanufacturing’ as a distinct option to ‘reuse’. Overlap between ‘reuse’ and ‘recycling’ is evident from the statement “recycling is the process of collecting used products, components, ….to disassemble, …, and process them as recycled products, components, and/or materials”. Lack of clarity between ‘repair’ and ‘refurbish’ is evident from “The main recovery strategies….are direct reuse, reuse after small repairs (also known as refurbishment)”.
Cohen-Rosenthal (2004)	The ‘hierarchy of material use and reuse’ identifies ‘autogenesis’, ‘reuse’, ‘repair’ and ‘remanufacture’ as options of ‘extended use’. This indicates that ‘repair’ and ‘remanufacture’ are considered distinct to ‘reuse’. But while describing ‘remanufacturing’, they observe that “remanufacturing is a term increasingly in favour for a process that is a subset of reuse”. Surely there is lack of clarity whether ‘remanufacturing’ is a ‘reuse’ option or not.
Wilson et al.(2014)	The article describes ‘repair’ or ‘reconditioning’ or ‘refurbishing’ of a worn out turbine blade by a third part (not OEM) as ‘remanufacturing’. The article mostly uses the term ‘repair’ to describe ‘remanufacturing’. Also, ‘reuse’ does not appear in the article even once. “Laser direct deposition lends itself to ‘repair’ non-repairable components…..repairing defective voids….”. Another inconsistency is - Due to lack of access to OEM specifications (intellectual property), third party cannot offer ‘as new warranty’.

Table 3:Examples of lack of clarity and/or overlap between different options

Discussions:

Hierarchy of Reuse Options:

Ijomah et al. (2005) proposes a ‘hierarchy of secondary market production processes’ that puts ‘repair’, ‘refurbish’ and ‘remanufacture’ in increasing order of i) work content, ii) performance and iii) warranty. While discussing the best closed loop option, King et al. (2006) cites the second law of thermodynamics and observes that ‘repairing’, ‘reconditioning’ and ‘remanufacturing’consumes energy in increasing order. Increased work content and energy consumption is related to increased cost. With the addition of inputs on energy and cost, a‘hierarchy of reuse options’ is being proposed (Fig 4) as an extension of the‘hierarchy of secondary market production processes’developed by (Ijomah et al., 2005).The proposed ‘hierarchy of reuse options’ is based on five parameters namely,i) work content, ii) performance (life), iii) warranty, iv) energy requirement and v) cost. The hierarchy is not absolute but it only indicates relative positions of different ‘reuse’ optionson these fiver parameters. Further research is required to establish the ‘level of upgrade’ that is offered by different ‘reuse’ options. Once established, the ‘level of upgrade’ (new, updated or latest features) could form the sixth parameter.

The five main levels of ‘reuse’ described in Fig 1 are included in the proposed ‘hierarchy of reuse options’. These are, i) reuse without any treatment, ii) repair and reuse, iii) recondition and reuse, iii) refurbish and reuse and v) remanufacture and reuse. While the hierarchy between ‘repair’, ‘refurbish’ and ‘remanufacture’ have already been validated and established by Ijomah et al.(2005), the authors propose to include and place ‘refurbish’ above ‘recondition’ in the proposed hierarchy. This is because, ‘reconditioning’involves bringing an object to an acceptableworking condition. This is generally inferior to that of original model without the latest functionality or aesthetic styling of a new product(King et al., 2006). On the other hand ‘refurbishing’ has an element of upgrade to it as established byZiout et al. (2014)who observes that the main objective of ‘refurbishing’ is to improvefunctionality and appearance of a product by adding new items or replacing obsolete items with better performing items. However, further research may be required to validate and establish thedifference and hierarchy between ‘recondition’ and ‘refurbish’.

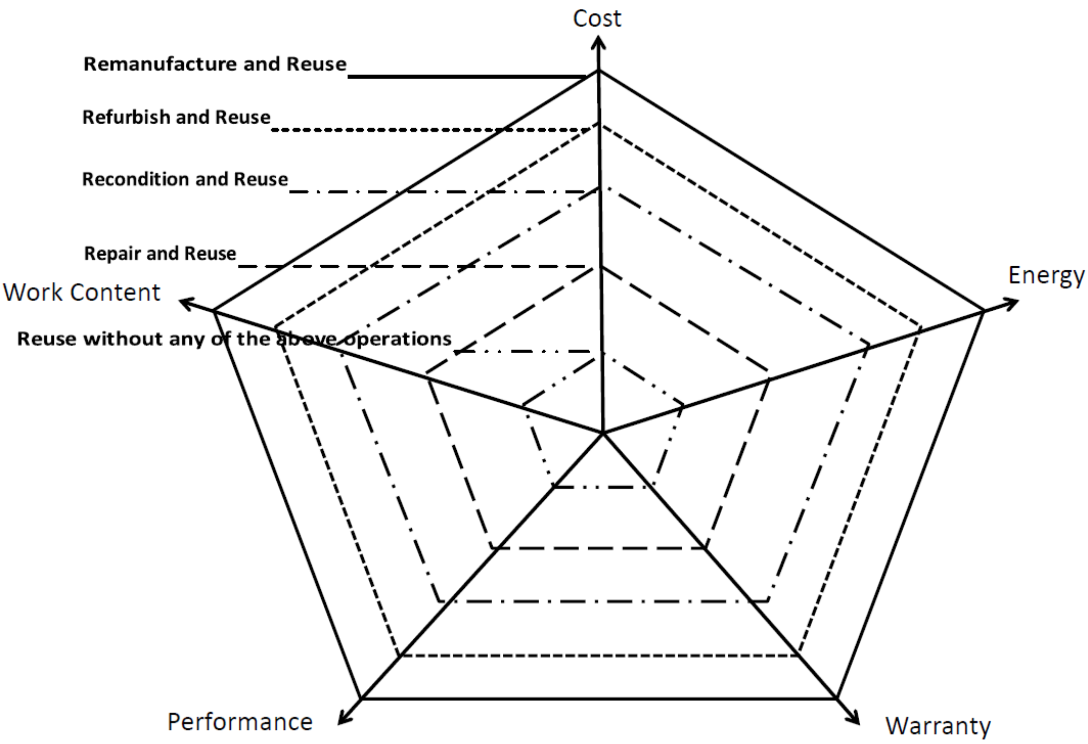


Fig 4: Hierarchy of reuse options

Remanufacturing debate:

'Remanufacturing and reuse' has great potential in recovering reusable resources from end-of-life (EOL) products. Two things that matter most to consumers are 'fitness for use' and manufacturer's 'warranty' of the final product. Both can be achieved by 'remanufacturing'. Lavery et al. (2013) identifies one of the key barriers to remanufacturing as lack of clear legal definition for remanufacturing. As a result, reconditioned, refurbished products are wrongly marketed as remanufactured products. The first report on 'remanufacturing' by the All-Party Parliamentary Sustainable Resource Group (APSRG) observes that a "key barrier to the uptake of successful remanufacturing is the return of end-of-life products (core) from the consumer to the remanufacturer". A recent inquiry by APSRG and the All-Party Parliamentary Manufacturing Group (APMG) on 'Remanufacturing – Resource Security and Opportunities for Growth'posed following key questions in addition to others on 'remanufacturing' (Policy-Connect, 2014):

a. What can manufacturers do to ensure they get their products back at the end of their first life?
b. Are there any Government initiatives needed to drive this?
c. What regulations or incentives are still needed by Government to encourage remanufacturing?

While Lavery et al. (2013) identifies and APSRG and APMG (2014) confirms "banning of remanufactured components in new goods" as a regulatory barrier to remanufacturing, they do not provide an answer. This barrier does not apply to leasing, renting or servitization models. But where these models cannot be applied and there is a techno-economic or environmental potential for 'remanufacturing and reuse' of products, the adoption of following initiatives would 'incentivise'OEMs to be involved in the business of 'remanufacturing':

a. Current regulations could extend the definition of a part or a component to include part or a component recovered from EOL products as long as they satisfy the OEM specifications and standards of a new part or a component. Recovered parts or components can meet OEM specifications, with or without 'repairing' and/or 'reconditioning' and/or 'refurbishing' of each of the recovered part or a component.
b. Merging of 'remanufacturing' with 'manufacturing' operations. Recovered parts or components can be legally allowed to be used in the manufacturing of not just 'remanufactured' products but also 'new' products as long as they meet OEM specifications and standards of new parts or components.

c. Enshrine the ‘extended producer responsibility’ into manufacturing laws that will place the primary responsibility of circulating EOL products into the ‘reuse’ loop for a longer time, on the OEMs.

One of the main obstacles to ‘remanufacturing’ cited by OEMs is the ‘cannibalization’ of their market share(Atasu et al., 2008). The fear is that ‘remanufactured’ products eat into the market share of new products. A counter argument is that if OEMs get involved into the business of ‘remanufacturing’ their products, then the fear of ‘cannibalization’ becomes invalid because:

a. At any point in time, total market demand (D) is fixed (Fig 5). The decision on whether to buy a ‘new’ or a ‘used’ or a ‘repaired’ or a ‘reconditioned’ or a ‘refurbished’ or a ‘remanufactured’ or any ‘alternative product or solution’ will depend on the ‘perceived value’ of that product or solution and not just on the ‘valuation’ or ‘sales price’ of the product or solution.
b. Profit margins of ‘remanufactured’ products are either comparable or more than new products. It is considered as a low cost alternative to ‘new’ product (Atasu et al., 2008).

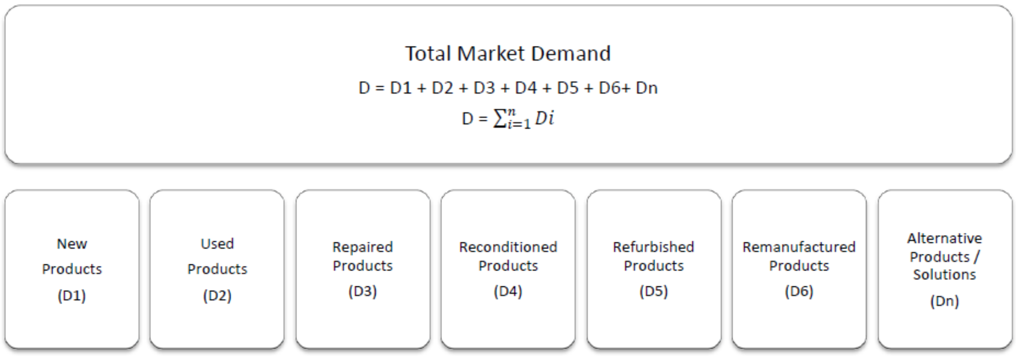


Fig 5: Market demand for various categories of products at a particular point in time

Closed Loop Resource Flow Models:

The three resource flow models envisaged by Graedel and Allenby(1995)are fundamental to understanding how sustainability can be achieved. It is clear that the Type I linear model of resource flows(extract-make-use-dispose) is detrimental to sustainability. Consumption of natural resources exceeds the capacity of the planet to supply these resources and to sustain its consequences. Therefore, the closed-loop systems represented by the Type II or ideally by the Type III resource flow model are considered inevitable if sustainable development is to be achieved(Rashid et al., 2013).

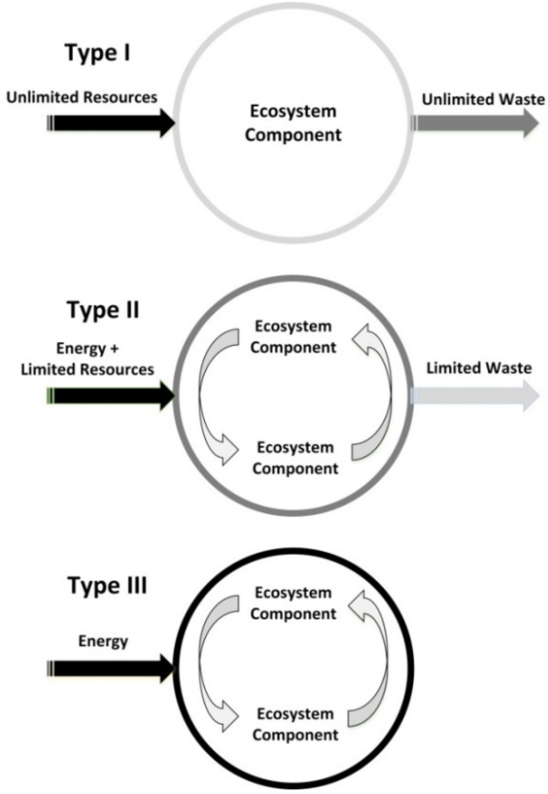


Fig 6: Resource Flow Models by (Graedel and Allenby, 1995)

While the Type I resource flow model is unsustainable, Nasr and Thurston (2006)conceptualised and elaborated the Type II resource flow model into its individual elements. But this model does not consider 'remanufacture' as one of the 'reuse' options and also does not include other 'reuse' options such as 'repair', 'recondition' and 'refurbish' in it.Rashid et al. (2013)identified certain shortcomings in the Type II resource flow model developed by Nasr and Thurston (2006)and proposed a modified concept of Type II closed loop product system, which they named as a Resource Conservative Manufacturing (ResCoM) Product System. But this model also does not consider all 'reuse' options and therefore the authors of this paper propose an alternative Type II Resource Flow Model that is described in the next section.

Alternative Type II Model of Resource Flows:

Graedel and Allenby (2010)argue that the current levels of population, urbanization patterns, economies and cultures are linked to how we use, process, dispose of and recover materials and energies. As indicated earlier, both the Type II closed-loop product system (material flows) conceptualized by Nasr and Thurston (2006)and the modified version of ResCoMproposed by Rashid et al. (2013)ignore other options of 'reuse'. In order to overcome these shortcomings, an alternative version of the Type II model named the 'Alternative Type II Model of Resource Flows' is being proposed (Fig 7). Different 'reuse'options that are captured under this model are includedfrom the '5Rs of Resource Effectiveness' (Fig 1).

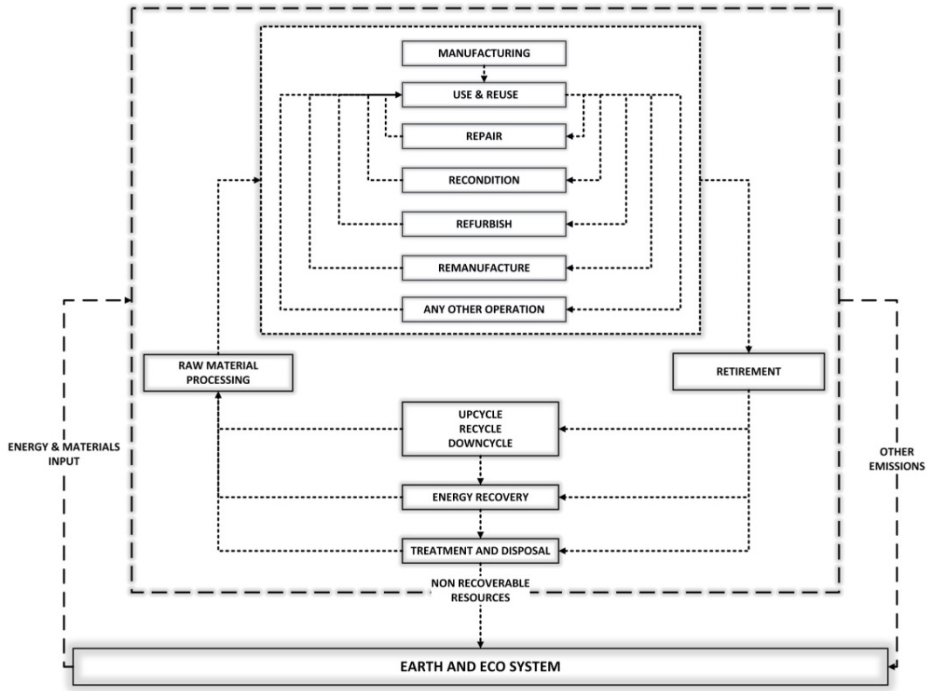


Fig 7: Alternative Type II Model of Resource Flows

Introduction of Type II/2 Model ofResource Flows:

As per Rashid et al. (2013), the contemporary closed-loop product system that represents the Type II resource flow model is intended to fulfil three key demands of sustainability:

i) Minimisation of material and energy consumption.
ii) Maximisation of expended resources.
iii) Minimization of adverse environmental impacts.

But without an emphasis on the type of scarce natural resources that are used, even the alternative Type II model of resource flows (Fig 7) will not be able to achieve sustainability. The Type III is an ideal model but practically it is difficult to achieve. Therefore, none of the Type II resource flow models can ensure sustainability. Hence there is a need for a practically achievable but sustainable resource flow model that falls between the Type II and Type III. This could be defined as ‘Type II/2 Model of Resource Flows’ (Fig 8). The main difference between the Type II and Type II/2 models is the ‘replacement’ of ‘non-renewable’ and ‘hazardous’ natural resources with ‘renewable’ and ‘environmentally benign’ natural resources at the input that would result in an ‘environmentally benign’ output (adopted from first R of the 5Rs of Resource Effectiveness in Fig 1).

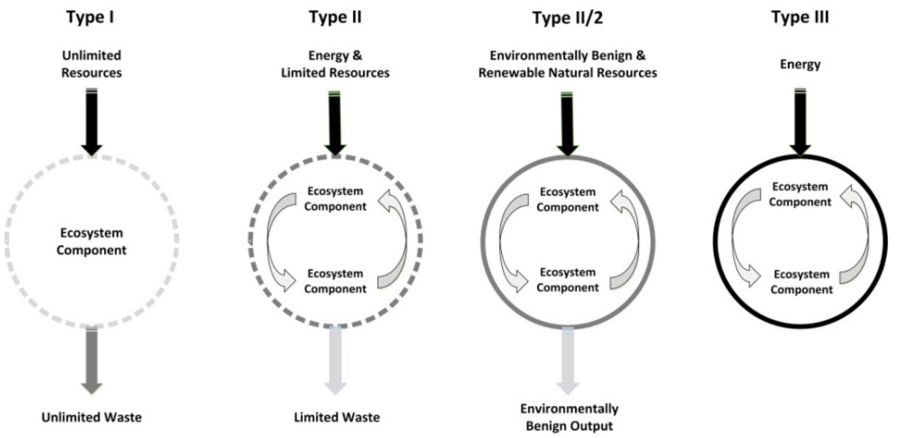


Fig 8: Introduction of Type II/2 Model ofResource Flows

Conclusion and future work:

The main objective of this research was tounderstand whetherinconsistencies and/or overlaps exist between the definitions of identified'reuse' options. The literature review undoubtedly confirms that in the majority, 59% (10 out of 17) of cases, a lack of clarity does exist between the different 'reuse' options. Albeit, for the identified literature within the 'environmental sciences' discipline for mechanical and electromechanical products. Further research may be conducted by widening the scope of literature search to the 'engineering' discipline and also to government reports/policy documents, business and environmental dictionaries.

The second objective of this research was to propose alternative 'definitions' for the identified 'reuse' options.Although this analysisconfirmsthe inconsistencies that exist between different 'reuse' options, very few of the reviewed articles have defined each of the 'reuse' options. The research at this stage is inadequate to propose alternative definitions. It may be necessary to extend the scope of this research to studying the 'definitions' of these options in environment dictionaries, business dictionaries, regulatory bodies and government environment agencies and also to peer reviewed articles in 'engineering discipline'. Future study could include study of policy/regulatory documents of organizations such as the United Nations Environment Programme (UNEP), the Organization for Economic Cooperation and Development (OECD), The U.S Environment Protection Agency (EPA), the European Environment Agency (EEA), Department of Environment and Rural Affairs (DEFRA) and Waste and Resources Action Plan (WRAP).

Finally, with only 3 ISO and BSI standards for 'remanufacturing' as against 122 for 'repairs' and none for 'reconditioning' or 'refurbishing', there is a gap and the need for establishing appropriate standards for all the 'reuse' options is clear. However, before establishing standards for various 'reuse' options, it will be necessary to standardise the definitions. To do this, it may also be necessary to understand which of the 'reuse' options could be applied at product, assembly (module), sub-assembly and component level. Further research is also required to confirm the differences and hierarchy between 'recondition' and 'refurbish'.

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