



UNIVERSITY OF LEEDS

Workshop Report – CVORR

Complex Value Optimisation for Resource
Recovery – NERC RRfW Catalyst Project

REPORT

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Introduction

The Complex Value Optimisation for Resource Recovery (CVORR) project aims to ensure that the benefits for the environment and human health are fully integrated in to a 'whole systems approach' in the recovery of resources from waste.

The development of the novel valuation framework will draw on different tools to synthesise a new concept of complex process/product value. The framework will provide an overall system optimisation rather than assess the value of optimising one process or sub-system which may then cause problems (negative values) up- or down-stream of the process: this systems approach will permit for dynamic consideration of system boundaries. The aim is to move beyond established concepts of waste and resource recovery to provide an objective assessment of a system producing different products and by-products. The assessment will use a multidimensional value that considers environmental, social and economic criteria in order to approach optimum value for a given scenario and perspective.

This intensive workshop brought together organisations and individuals interested in being involved in the project and/or interested in the project outcomes. The main focus of discussion was conceptualising the functionality of the framework from an end-user perspective. Identification of challenges, opportunities and

Presentations

Members of the CVORR team provided three very short, introductory presentations outlining the general concept, existing tools and techniques, recent studies with read-across capacity, and a case study demonstrating how the framework might be used. The presentations were recorded and are available to view: <http://adm-leeds.adobeconnect.com/p92v81vyzwj/>.

Workshop

The emphasis of the two-day intensive workshop was to assess and evaluate the theoretical framework. Through various round table discussions and brain storming exercises, the workshop explored the challenges and opportunities provided by the CVORR approach as well as the key elements of the framework based on different and often conflicting needs of end-users, to build up a protocol (Day 1). This was then critiqued to provide the basis for an initial draft proposal (Day 2).

Brain storming

What are the challenges for CVORR?

A large number of challenges were identified by participants and are listed (unedited) in Appendix A. The key challenges identified can be summarised as:

- CVORR runs the risk of being too detailed (not easy to use, too many assumptions) or too coarse (ignores potential outputs/links to processes)
- The framework is very dependent on where the boundaries are drawn
- A system interrogated today will provide different results when looked at in the future or over a different time period (i.e. temporal variation) – different processes, different technologies and/or different values, so needs to be adaptable
- A system interrogated in one location might have very different values/outputs to a similar system in another location (spatial variation) so consideration must be given to ‘geo dimensions’
- A positive value for one system might be a negative value for another system, community or even an individual so clear guidance must be provided on the approach
- Global issues vary considerably and therefore must consider how to account for different/contradictory economic, environmental and/or social factors. Similarly, the values will differ when considered at micro, meso or macro levels (local, regional/national, global).
- The end-user must be considered – policy makers are very different to academics, business community, industry etc. and a ‘one size fits all’ would not work: who would buy/use it / who would be the nominated representative in a company to use it?
- Similarly, different sectors are very different, with different systems, inputs, outputs and values; deliberate (manipulation) or accidental misuse could affect outcome
- The output of a model can be interpreted in different ways hence guidance on communication of modelling output is essential
- It is essential that the correct tools and techniques are identified for inclusion in the framework/approach and that the CVORR team have the necessary expertise
- CVORR can take different forms and it is important that it is clear which one will be developed (and for which purpose): it can be a policy instrument or provide practical guidance but can it do both?
- Does CVORR already exist as IEMA, ISO 14001, waste audits, waste flow?
- Legislative barriers preventing something classed as a waste from being de-classified
- Need to consider uncertainty of the approach from the start and not as a ‘bolt-on’

What are the opportunities for CVORR?

Many of the opportunities resemble the challenges. The unedited list appears in Appendix A but can be summarised as:

- CVORR will be a valuable tool informing policy making, key industry decisions, innovation etc. if done correctly; different levels of output analysis can offer different levels of details for different audiences
- Integration of modular elements in to the framework rather than development of a holistic framework would create a dynamic and versatile tool; a

combination of protocol and modelling capability will create a flexible tool applicable to a wide range of sectors and uses

- Provides a valuable pathway between vision and practice, and can result in rethinking of waste as a resource
- A flexible system boundary will allow different perspective to be taken according to individual scenario and can also adopt a flexible approach with variable depth and complexity of assessment – from protocol to model
- An opportunity to develop different valuation approaches and assessment methodologies – not just recycle existing approaches (such as MCDA, LCA etc.) – or make full use of existing and complementary approaches e.g. NISP
- Use of different size and scope of case studies – local to global will demonstrate reach of framework
- Potential to link to existing or build on recent initiatives such as TSB Sustainable Design Guide, TSB Resource Dashboard, C-CALC, NISP (industrial symbiosis)etc.
- Even the process of attempting to develop CVORR will be a useful exercise in uniting different sectors and areas of expertise/thinking, leading to unforeseen outcomes
- CVORR could better align prices/costs with the benefits e.g. improved link between economic incentive and carbon dioxide reduction
- Make better use of industrial symbiosis feeding into development plans at different scales (local to national)
- Has the potential to link to some very topical issues including food, water and energy security, more efficient use of natural resources, effective use of existing data etc.
- Could expand values to include technological value and aesthetic value; energy/exergy is another value
- Depending on success of framework development, could lead to service provision and the opportunity to train relevant professionals in CVORR application
- Could lead to a better pricing structure for goods and services that considers reuse in other systems and/or final disposal when zero value
- Has the potential to inform the development of new legislation such as a Materials Framework Directive (cf. Waste Framework Directive)
- Could consider GDP+ i.e. values beyond \$

A number of other comments were received from participants: these are also listed in Appendix A. All comments were used to inform a roundtable discussion which is summarised in the next section.

Roundtable discussion: challenges/opportunities

Discussion highlighted a number of the points made in the opportunities and challenges brain storming:

- Systems boundary: don't like tight small scales. Need country, global views. Multiple layers, we agree. Changing boundaries changes the view. Need to look at supply chains.
- The general public needs to be engaged: does not do what 'he's supposed to do' – education – simple Govt. messages – Energy, Water, Food, Cement, Steel, Glass, commodities that we are using every day. Focus on these at the start. Worldwide global supply chain.
- Take whole system (power plant, cement) – who would do the number crunching? Not companies, not in their interest.
- What is value? Value optimisation, of what? Does the economic value always win?
- Pragmatism of what fits in one part of the country because you have the right partners there, may not fit in another. Local, cultural things. Symbiosis is geographically 'spotty' [beware textbook industry symbiosis]. Can CVORR show that optimum might drive local councils to invest in e.g. attracting symbiotic industries.
- Complex problem, in terms of functionality if not maths. Spreadsheet model may miss the functional complexity
- Output should be a protocol re thinking about complex value, rather than a precise model. Guidelines rather than procedures. How to design, rather than what to design. E.g. health practitioners could be given guidance how to interact and value their input, rather than have it specified. [qv systems of provision?]
- System boundaries will be crucial. This is a framework will help with decisions (A, B, C). People with vested interests will set the system boundaries where they like? If it's not in their interests to expand the system boundary, then they won't do it.
- Global implication – has to be able to deal with systems at a global level, we export and import. Value may vary in different locations. Flexibility to deal with time is required.
- Work towards a specific case study. Can address what is our point of view, who are we implementing it for. Relatively large case study to capture global aspects. Even material flows are beyond UK.
- Public engagement. Make sure outputs from this process allow public to understand how decisions have been made.
- Simple, easy criteria for success = are clients happy? Access to data. More challenging criteria = vision led; use of the framework leads to a change in the mindset of the people working in the waste industry → move towards circular economy rather than talking about it. How should the pricing/economics look to drive circular behaviour?
- Decision making tool? More successful as a protocol – like that idea.
 - Thinking vs operational; need a tool. If you don't put it into action, nothing will happen.
- Vision – thinking – framework – case studies.

Grand Vision

Four tables containing a mix of workshop participants discussed what the framework would look like, who it should be aimed at, what benefits might be gained from using it and who would be likely to adopt it first – the ‘Grand Vision’. The output from each table was not too dissimilar:

Optimising UK plc

- VISION: Utilising lessons learned from lean manufacturing. 7 value streams of waste. Circular economy – redefining the waste hierarchy. Connectivity between product design and post-disposal. CVORR should be bold, measurable, SMART, transformational, realistic, understandable, waste as a currency: a grand theory of everything.
- LOOK & FEEL: Framework containing a protocol; framework that could be used as a skeleton for an MSc module; CVORR Jnr/Padawan – usable by everyone, educational; CVORR Jedi – service provision, complex, training, trainers who go and do it, consultancy; accreditation for CVORR; versions that are qual/quant.
- USERS: Public (Jnr), practitioners (Jedi)
- BENEFITS: UK plc, basis for designing incentives into project prices, financial incentives.

The Leeds Lens - 20 years time

- VISION: Stress value optimisation rather than value recovery (as more ‘end of pipe’). Useful to develop branding e.g. The Leeds Lens.
- LOOK & FEEL: Looks like a framework which is a set of guidelines and questions to ascertain why the user wishes to use the approach (the ‘why’); a protocol to assess data availability/awareness (the ‘how’); and the tools which allow the assessment to take place (the ‘what’). Includes uncertainty and fuzzy boundaries. Who are your agents; at what scale are you going to apply it? Literature on value chain theory/SoP will be helpful.
- USERS: tool for economists. Used by industry (esp large) not really something that will cascade down to all companies. Adopting the Leeds Lens will give standardised approach across and between sectors. Aggregate impacts and effects. Govt and industry focussed.
- 1ST IMPLEMENTATION. Somewhere with lots of data. Perhaps look to see where case studies have been done, revisit with Leeds Lens. Sensitivity analysis when you expand system boundary.
- Struggle with system boundaries – will need to analyse this first.

Resource efficiency approach

- VISION: ensure efficient management of resources: energy, water, food.
- LOOK & FEEL: methodology for analysing the systems, make decisions about optimum values, guide policy makers. Provide info to the public. Generally raise awareness of econ, env and social factors; highlight opportunities for synergies; highlight problems with current practices; highlight dominant metrics that control the value of the system.

- Framework needs to be dynamic, select the relevant inputs. How do we stop people selecting the inputs that suit them? Level of uncertainty associated with outputs.
- USERS: targeted at regulators or governments. A key user could be the media – reporting CVORR analyses of new industrial practices.
- BENEFITS/IMPLEMENTERS: UKplc as the focus. Incentivise the economy/companies to do something. How are the factors weighted should be among the key outputs.

Waste management perspective

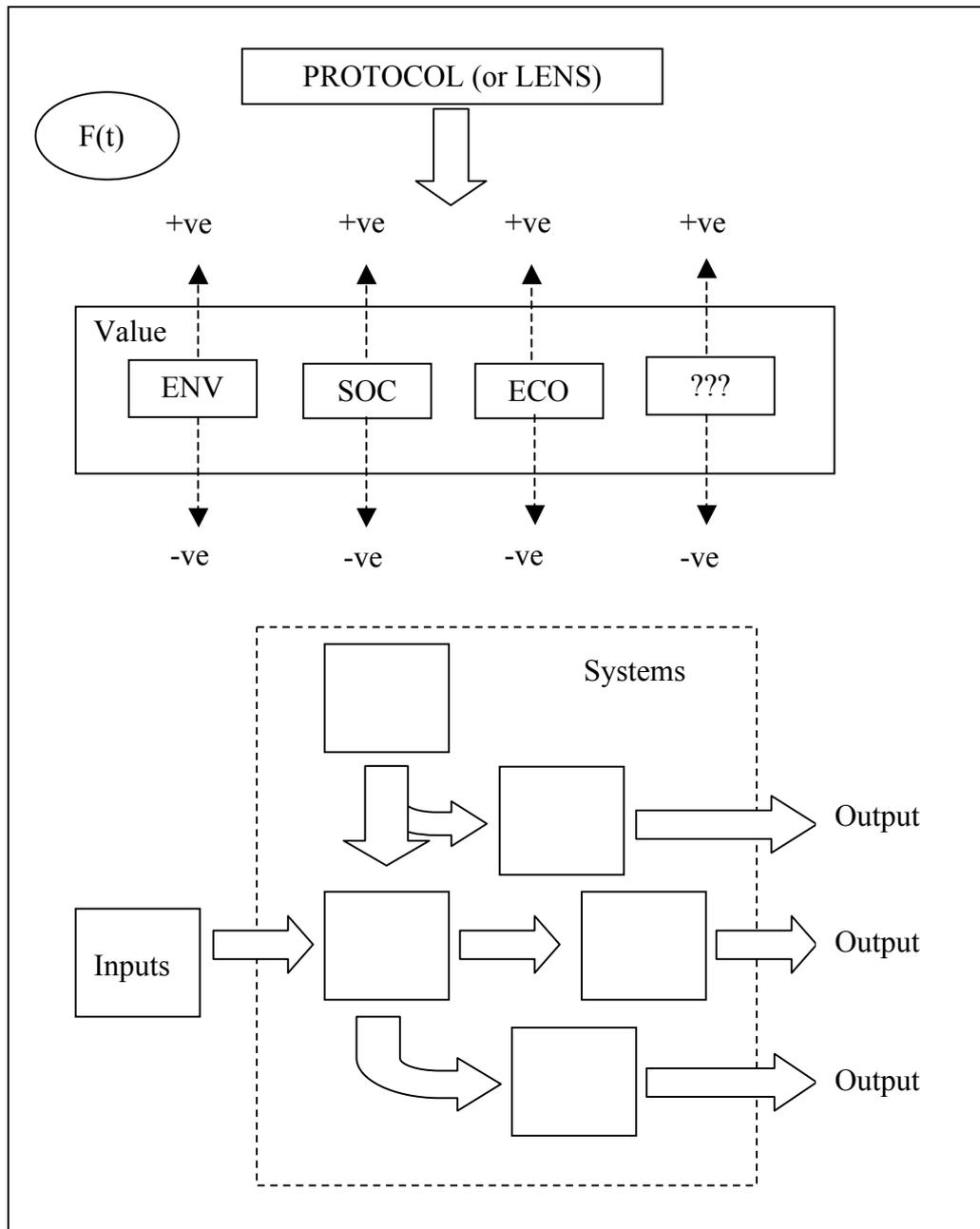
- VISION: Removing waste by thinking of whole systems of materials flows. Multiple values – e.g. do not assess social value when currently recovering values from waste. Importance of understanding the WM industry, as this is closing the loop. Make sure there is a value for this industry. Is it a framework, a tool, a methodology, a protocol? Is thinking in first place, rest follows. Not just Excel, need a user-friendly interface. Is protocol any different?
- LOOK & FEEL: Optimisation will be geographically dependent – scale, local availability, regional to global if possible.
- USERS: Different potential users and stakeholders should all be users in different ways. All should be able to use and communicate.
- BENEFITS: Cradle to cradle approach – how are we going to use it in decision making? Optimising for different values involves trade-offs.

Summary of Grand Vision

- PROTOCOL – development of a way of thinking
- UNCERTAINTY & VARIATION – defining the precision
- WASTE = CURRENCY
- INCENTIVES – design in disassembly = discount
- VITAL STATISTICS OF KEY RESOURCES – health of UK plc
- COMBINING METHODOLOGIES – using tried and tested methodologies in a more efficient and joined up way

CVORR framework

The framework developed through workshop discussion is best represented as a diagram:



The protocol is the ‘checking exercise’ – why is the user intending to use the framework, do they have the necessary data/expertise, etc. The protocol will guide the user through to subsequent stages – the application of the value optimisation approach to a (complex) system or group of interlinked processes.

Proposal development

With a general approach to the development of the CVORR framework agreed, workshop participants identified four key questions:

1. Value chain analysis for economic, political and social value assessment
There will be something in the bid on social, political, economic valuation. We will have to establish what is included in this value assessment. Current approaches which are relevant include the ecosystems services valuation approach which is utilitarian, this approach is sponsored by DEFRA etc. It involves valuing the ecosystems services and the implications of interventions in these services for the value of the ecosystem. We want to take a more objective approach to valuation. There is a well-established objective theory of value and wellbeing (e.g. Sen's capabilities approach). This will also link to environmental indicators of value although the literature on value chains is all based on the objective theory of value (needs based). It is not possible to base it on a utilitarian theory of value.
2. Alternative indicators – beyond environmental, social and economic values
Legislative drivers, health, technological/innovative solutions, technical/functional use and material components have inherent values which may cross the environmental, social and economic categories – and might even fall outside their definitions. Another dimension that potentially overarches all categories is ecosystem services as it includes social via culture and provisioning (water, food); environment via regulatory, provisioning and supporting; economics via payments for ecosystem service (PES). PES seen as subsidies e.g. agricultural subsidies, land management subsidies but this is not correct. Ecosystem services can be value indicator/option (risk that it is not considered – excluded as not economically viable currently) or built in to the system framework so automatically considered in all model assessments (a system element).
3. Depleting and dispersing waste in CVORR leading to a new definition of waste
Legal definition of waste needs to change and reflect dispersion: when the benefit of recovery becomes environmentally worse than extracting the raw material then it is a waste. When a product becomes unrecoverable, then it is then waste. It can then be destroyed or stored. If designing a new product, and waste is designed out, the manufacturer receives a benefit: a positive incentive (carrot not a stick).
4. CVORR case studies and approaches to benchmarking/testing outcomes of the approach: 3 tiers of information required
 - For the bid we need some examples for the purpose of informing the evaluators – simplistic (for example in this instance it might look like...)
 - We will also need to do some case studies within the course of the project to demonstrate that it does actually have validity
 - We need the ultimate 'market' for (rationale for) this study – how will it be applied once it has been demonstrated and is 'out there'

Case study suggestions – some of which can be used to develop the framework and others to test or benchmark – extend from concrete/power station example and possibly a waste oil/biodiesel example for inclusion in proposal, with plastics, food waste and a spatially fixed example (e.g. industrial park) for the project.

When writing the proposal, consider:

1. Why must we do this (research)?

- Global instability- climate change.
- Material resources- scarcity, closer link to economics.
- Challenge existing assessment tools- circular economy, waste definition, more consideration of natural degradation, long-term. Focus on society/environment as a whole.
- Improve competitive edge – existing infrastructure
- Social responsibility – waste everybody's problem

Existing methods are not working or producing the desired changes in behaviour.

There is evidence of strain on global systems, by material scarcity and climate change. These results from the failure of existing models to value resources including the definition of waste itself. A new system of attributing value to resources that reflects damage to the environment and society as a whole, that shapes behaviour and decision making in a way that addresses these imbalances.

2. Why must we do the research now?

Waste: We are living in unsustainably and landfill is not a long term solution

Opportunities: Opportunity to be the leader of the global waste revolution and for the UK to set the global standard to reset the waste agenda

Resource: Consumption of raw materials is escalating with many becoming increasingly rare and so expensive. Yet we are disposing of these resources to landfill/incineration in existing products – a disconnect.

Policy-Economics: Opportunity to stimulate economic growth in period of recession and austerity. Better able to respond to supply chain threats.

Climate Change: a very real threat and is affecting /happening now and requires urgent action

3. Who will benefit (from the research)?

NERC: developing leadership in this area, training of researchers in area potentially imp to UK economy, significant impact, lots of industry links

Tax payers: ultimately make better use of (financial) resources, improving environment, involvement in process

UK + EU + WORLD plc: develop UK as skills provider/exporter of expertise, new business development in resource recovery sector, GDP +

Industry: new business opportunities, more reliable framework of assessment

Humanities: whole system approach linking industry, public, government and environment

Regulators: better able to target funding planning, design out waste from systems, reduce regulatory burden/ effect, evidence based regulation, greater accountability

Possibly differentiate/ make specification of stakeholders benefiting according to timeframe (short term, mid term, long term)

4. How will we make sure that the benefits (from the research) are realised?

Tools: A multi-level tool would be useful for the dissemination of the concept – Padawan and Jedi (but beware copyright!) this would make it ‘tangible’ i.e. people can become licensed practitioners or similar for Jedi but Padawan is accessible by all. For the simplified approach, could use a binary system (either 1 or 0). Tool to reveal potential for systems change, with waste-based corrections of externalities (take waste into the value chain). It should be able to be used for measuring ‘waste-risk’ to calculate a shadow price to align economic and material values and inform economic incentives.

Carrots and sticks: Should be able to use the outputs to devise financial incentives and shape penalty systems (such as landfill tax). Use to demonstrate economic development (for UK plc).

Education: Should be able to be used as an educational resource – a communication method to build understanding of resources being kept as resources (not lost as wastes in eco-systems) – and awareness raising.

Industrial/end users involvement: Must respond to industry needs and involve end-users (industry, regulators, NGOs, academics etc.) in the development process as ‘champions’.

Case studies: Industry-led case studies that are focused and quantify the benefits as well as demonstrating a complex mechanism with a simple interface.

COMPLEX VALUE OPTIMISATION FOR RESOURCE RECOVERY WORKSHOP

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