Royal College of Anaesthetists

e-LA e-Learning Anaesthesia

Sustainability: **Procurement, supply chain and carbon costing**

Version 1.00 October 2020

Dr Murray Connolly, Dr Tim Keady,
Dr Michael O'Sullivan and Dr Vincent Wall

Contents

Module Learning Outcomes

- Overview of procurement process and NHS supply chain.
- Scope 1, 2 and 3 emissions (see the Greenhouse Gas protocol).
- Carbon analyses – life cycle, cradle-to-gate and cradle-to-grave.
- Whole-life-cycle costing.
- Current supply chain and procurement models vs ideal sustainable system.

The procurement of the goods and services necessary for the NHS to function comes at a significant environmental cost. This module outlines the procedures surrounding procurement, areas where sustainability can be improved and summarizes the common concepts used to measure and reduce the total environmental impact of NHS procurement activities.

Overview of the Procurement Process and NHS Supply Chain

Procurement is the process whereby an organization meets their needs for goods, services, works and utilities by finding these amenities and agreeing terms with vendors. Procurement processes include many key steps, as described in Figure 1. Each of these offer an opportunity to improve the sustainability of the organization.

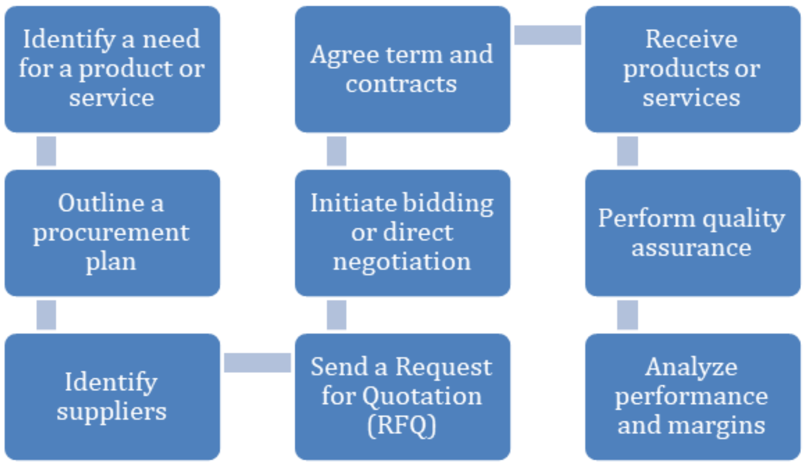

Figure 1: An example of a typical procurement process flow chart, designed by the authors

The compartmentalization of the NHS into Trusts means that there could be a risk of significant overlap in contracts and a high risk of inefficiencies. In order to minimize this the NHS Supply Chain manages the procurement of healthcare products, services and food for NHS trusts and healthcare organizations across England and Wales equating to more than 4.5 million orders per year, across 94,000 order points and 15,000 locations. Its systems aim to consolidate orders from over 800 suppliers, saving trusts time and money and removing duplication of overlapping contracts.[1]

Traditional tendering processes concentrated primarily on a single variable, the economic value. However, there is a growing realization that the "value" of a product or a service can also be measured by its social and environmental impacts.

The Sustainable Development Unit (SDU) introduced to the NHS the concept of the Triple Bottom Line (TBL) to develop services, processes and products that are truly sustainable. The TBL provides a framework which can be used to examine the performance of an organization according to three aspects: economic success, social variables, and environmental impact.

NHS Supply Chain is now giving far more consideration to this, and they have developed an ethical Procurement Strategy,[2] which aims to deliver environmental and economic savings, as well as ensure that the goods and services procured are produced in a socially responsible manner.

Current Procurement Models vs the Ideal Sustainable System

The NHS Supply Chain was created in 2006 to help the NHS deliver clinically assured, quality products at the best value, and to use the buying power of the NHS to negotiate better deals. However, a report into efficiency and productivity in the NHS, published in 2015, identified unwarranted variation in procurement across the NHS, and huge potential for financial savings.[3] Using the TBL framework, as promoted by the Sustainable Development Unit since its inception in 2008, there has been a drive towards more sustainable procurement.

What is ideal sustainable procurement?

The UN environment program defines ideal sustainable procurement as a process

“whereby public organizations meet their needs for goods, services, works and utilities in a way that achieves value for money on a whole life-cycle basis in terms of generating benefits not only to the organization, but also to society and the economy, whilst significantly reducing negative impacts on the environment.”[4]

See Figure 2.

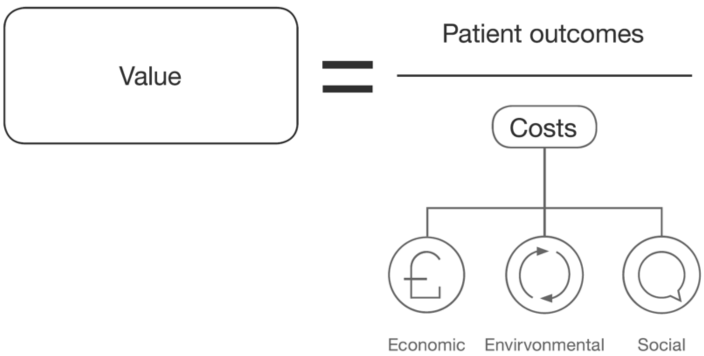

Figure 2: Value in Ideal Sustainable Procurement[5]

Fortunately, in most cases, environmental and cost savings go hand in hand. For example, the increasing problem of “Single Use Disposable” plastics in the NHS has recently been outlined.[6] Medical plastics account for 2% of global plastics production by value.[7] Potential practice changes including switching from single use to reusable items and the reprocessing and reuse of single use medical devices have unsurprisingly been found to be cost saving or cost neutral, while being safe for patients.[7] This area contains myriad opportunities for quality improvement initiatives that save money and protect the environment.

Scope 1, 2 and 3 Emissions: The Greenhouse Gas Protocol

The terminology of Scope 1, 2 and 3 emissions refers to a means of categorizing carbon emissions produced by an institution laid out in the Greenhouse Gas Protocol.[8] The standard helps companies identify greenhouse gas (GHG) reduction opportunities, track performance, and engage suppliers at a corporate level.

- **Scope 1** emissions are onsite or **direct** emissions from owned or controlled sources. e.g. fossil-fueled boilers, vehicles and chemical production. This also includes the GHGs released as part of clinical care, including inhalational anaesthetic agents, nitrous oxide, metered-dose inhaler propellants and sulfur hexafluoride.

- **Scope 2** emissions are **indirect** emissions from the generation or purchase of energy e.g. electricity use, energy recovery from waste disposal.

- **Scope 3** emissions are all **indirect** emissions not including scope 2 that occur in the supply chain of the reporting institution e.g. procurement.

This system of analysis is useful in identifying hotspots in the supply chain and activities of an organization. It also allows comparison from year to year and between organizations. However, it must be remembered that only measuring the GHG ignores other environmental impacts of an organization such as air pollution, waste, and water consumption. Further information on the additional impacts of unsustainable processes can be found in the accompanying e-modules; "*Health and climate change*", "*Waste - what happens to it*?" and "*Energy use and water consumption*".

The Sustainable Development Unit reports the carbon footprint of health and social care provision in the UK using four categories; core, commissioned, supply chain and community. These categories reflect the level of influence of the health system on these emissions. In the 2018 report it was calculated that the supply chain accounted for 57% of its carbon footprint.[9] The report identified three major hotspots: pharmaceuticals, medical equipment, and business services. All three of these are part of the supply chain and correspond closely to Scope 3 emissions. For this reason, reducing the carbon emissions of any health sector is a difficult task. However, there are certain tools which can enable clinicians, procurement officers and everyone involved in healthcare to choose the product or process that offers most value for money.

Life Cycle Assessment

Life Cycle Assessment (LCA) is a tool that may be used to measure the environmental impact of a product or process. It is a standardized practice that allows an organization to quantify the energy consumption, resource depletion and both direct and indirect emissions of a product at every step throughout its lifespan i.e. from cradle-to-grave (Figure 3).[9] Life Cycle Costing (LCC), which measures the financial cost of a product over its lifespan, will be discussed later.

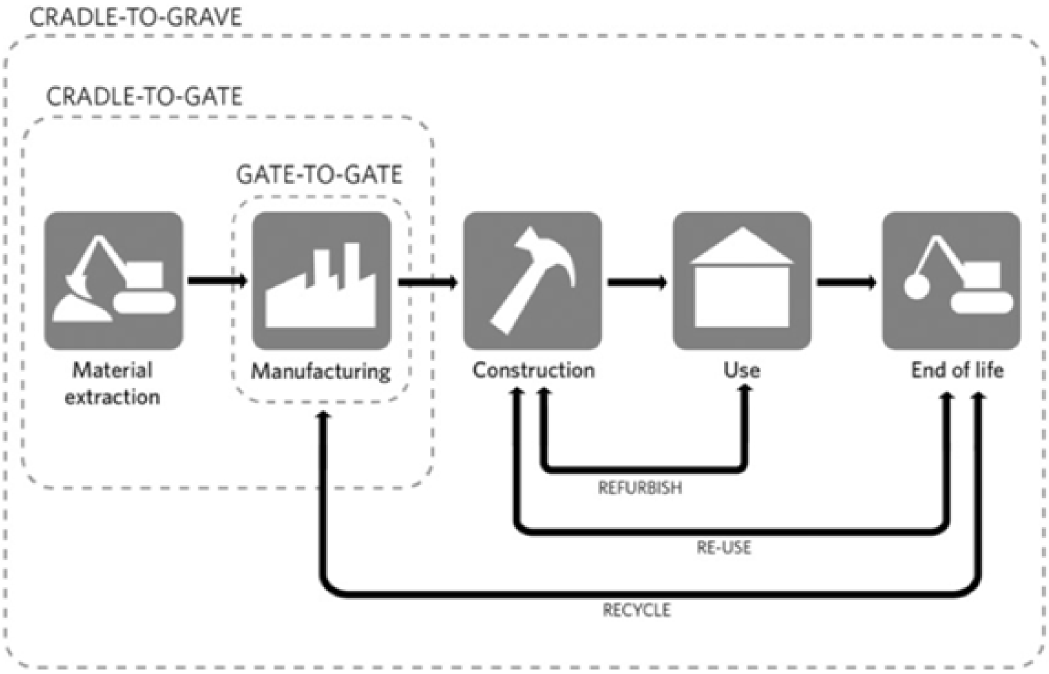

Figure 3: Life Cycle Assessment is a tool that can be used to measure the environmental impact of a product or process. The assessment may have a variety of boundaries. Manufactures sometimes assess the gate-to-gate or cradle-to-gate environmental footprint. A cradle-to-grave approach allows us to account for the re-use and recycling of products as well as their disposal. Adopted with permission from K Simonen, Life Cycle Assessment.

Carrying out an LCA requires the aggregation of large amounts of data relating to inputs and outputs (e.g. emissions) at every step in the life of a product or process. There are broadly two methods of conducting an LCA.

Process-based LCA

This method itemizes inputs and outputs of a process at every stage, using Life Cycle Inventory (LCI) databases that report emissions and direct measurements. For example, producing a laryngeal mask airway will require plastic for manufacturing, electricity for powering the machines at the manufacturing plant, transportation of the laryngeal mask airway to distributors and hospitals, and the eventual disposal of the airway. Consideration of the environmental impact of the process could potentially extend into impractical layers of data i.e. to include the emissions from producing the machines required for raw material extraction, etc. It is therefore important to set system boundaries that define the scope of the LCA. Process-based LCA is most useful in assessing and comparing the environmental footprints of small easily defined products. It is too labour intensive for most large systems.

Environmental Extended Economic Input-Output (EEIO) LCA

Economic input-output analysis is a method of measuring the monetary interactions of sectors of the economy. It is a dynamic matrix which evaluates how a unit of currency spent in one commodity sector can influence how money is generated or spent in another. This model can be modified to measure the environmental inputs/outputs throughout a supply chain. Environmental EEIO systems add resource consumption and energy outputs to the matrix and so measure how production in one sector leads to resource depletion in another. A relationship between energy flow and monetary flow throughout the whole model is established. Carbon emissions per monetary unit can thus be approximated, allowing the environmental footprint of large processes such as healthcare systems to be estimated. Environmental EEIO modelling does have some drawbacks, however. For example, if NHS supply chain were to begin purchasing a generic version of a pharmaceutical, this lower financial cost would seem to indicate lower carbon cost, but this may or may not reflect reality. Furthermore, the macroeconomic scale of the calculations can make it difficult to demonstrate modest emissions reductions.

LCAs in practice

In practice, a combination of the two modes of LCA is often used. A good example of how LCA can be applied to a medical supply chain can be seen in the work by Sherman et al[10] who compared lifelong greenhouse gas emissions generated by using volatile anaesthetic agents vs intravenous agents in the conduct of general anaesthesia. A four order of magnitude difference was found, in favour of intravenous anaesthesia.[10]

There are four main steps involved in carrying out a comprehensive LCA as defined by the ISO-14000 series of standards:

1. **Goal and Scope:** this defines the reason for the study, the intended application and audience. Systems boundaries for data collection must also be defined.

2. **Inventory:** Life Cycle Inventory (LCI) refers to the cataloguing of the environmental emissions of materials. Commercially available software such as Ecoinvent™ contains large databases which provide the input and output values for systems.

3. **Impact analysis:** this step uses LCI data to quantify the resultant environmental impact of the production system. Various tools are

available to conduct this analysis, one of the more popular being Simapro™.

4. **Interpretation:** finally, a conclusion of the assessment is provided along with limitations. Recommendations are then given based on the analysis of the results.

Incorporating LCA into the procurement process allows organizations to make conscious decisions regarding the environmental impact of a supply chain. This bolsters the Triple Bottom Line, increases compliance with local and international standards and encourages other industries to engage in sustainable procurement. But of course, LCA is time consuming and expensive.

Whole Life Cycle Costing

Whole Life Cycle Costing is at the heart of green public procurement. It refers to the combination of life cycle assessment (LCA) and life cycle costing (LCC). and addresses all the associated financial costs of a product over a period of analysis as well as the environmental and social effects.

LCA calculation has been previously addressed in this chapter. To calculate the LCC of a product, procurement managers need to consider much more than the invoice price: [11]

1. **Acquisition**: the purchase price or leasing cost of a product

2. **Transport**: if not already included in the cost of purchase

3. **Installation: for heating**, lighting or anaesthetic machines for example

4. **Operation and maintenance**

5. **Disposal**

Much of the whole life cycle costing literature focuses on construction projects and energy efficiency of buildings, some compare re-usable versus disposable medical products. For example, McGain et al performed a consequential assessment based in an Australian Hospital with six operating theatres showing that converting from reusable anaesthetic equipment would result in a 46% decrease in cost but a 9% increase in CO_2 (relating to coal generated electricity). A similar analysis produced an 84% reduction in CO_2 emissions in Europe and a 48% reduction in the USA (due to more sustainable energy generation), with significant financial gain.[12]

Summary

Procurement and Supply Chain account for the majority (57%) of the carbon emissions of health and social care provision in the UK. Although not under our direct control, we can influence these emissions by striving for ideal sustainable procurement. The evaluation of the cost and carbon footprint of products and processes is complex but Life Cycle Assessment and Life Cycle Costing can help us. These tools allow us to address the triple bottom line of environmental protection, social equity and economy, and are the key to achieving sustainable procurement.

References

1. About Us » NHS Supply Chain [Internet]. [cited 2020 Jul 16]. Available from: www.supplychain.nhs.uk/about-us/

2. NHS Supply Chain. Sustainable Development Strategy 2017-18 [Internet]. 2018 Available from: wwwmedia.supplychain.nhs.uk/media/2017/10/NHS_Supply_Chain-_ustainable_Development_Strategy_Commitments_2017-_2018_FINAL.pdf

3. Carter. Productivity in NHS hospitals [Internet]. 2015 [cited 2020 Jul 16]. Available from: www.gov.uk/government/publications/productivity-in-nhs-hospitals

4. Sustainable consumption and production policies | UNEP - UN Environment Programme [Internet]. [cited 2020 Jul 16]. Available from: www.unenvironment.org/explore-topics/resource-efficiency/what-we-do/sustainable-consumption-and-production-policies

5. Protecting resources promoting value: a doctor's guide to cutting waste in clinical care, Academy of Medical Royal Colleges, 2014 [internet] [cited 25/8/2020] page 23. Available from: www.aomrc.org.uk/wp-content/uploads/2016/05/Protecting_Resources_Promoting_Value_1114.pdf

6. Reducing plastic in the NHS [Internet]. [cited 2020 Oct 1]. Available from: www.sduhealth.org.uk/nhs long term plan/single-use-plastics/reducing-plastic-in-the-nhs.aspx

7. Rizan C, Mortimer F, Stancliffe R, Bhutta MF. Plastics in healthcare: time for a re-evaluation. *Journal of the Royal Society of Medicine* [Internet] SAGE Publications Ltd; 2020 [cited 2020 Jul 16]; **113**: 49–53 Available from: www.ncbi.nlm.nih.gov/pubmed/32031491

8. Corporate Standard | Greenhouse Gas Protocol [Internet]. [cited 2020 Jul 16]. Available from: ghgprotocol.org/corporate-standard

9. Natural Resource Footprint 2018 [Internet]. [cited 2020 Jul 16]. Available from: www.sduhealth.org.uk/policy-strategy/reporting/natural-resource-footprint-2018.aspx

10. Sherman J, Le C, Lamers V, Eckleman M. Life cycle greenhouse gas emissions of anaesthetic drugs. Anaesthesia and Analgesia 2012; 114(5): 1086-90

11. Noronha L. 2017 Global Review of Sustainable Public Procurement | UNEP - UN Environment Programme [Internet]. [cited 2020 Jul 16]. Available from: www.unenvironment.org/resources/report/2017-global-review-sustainable-public-procurement

12. McGain F, Story D, Lim T, Mcalister S. Financial and environmental costs of reusable and single-use anaesthetic equipment. *British Journal of Anaesthesia* 2017; **118**: 862–9

Royal College of Anaesthetists
Churchill House, 35 Red Lion Square, London WC1R 4SG
020 7092 1500 | e-LA@rcoa.ac.uk | rcoa.ac.uk/e-learning-anaesthesia
@RCoANews
RoyalCollegeofAnaesthetists
Information correct as at October 2020