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Title: Adapting to adopt sustainability: organisational change in UK water and sewerage companies

Theme: ‘Beyond Today’s Infrastructure’

Abstract: This paper reports on research employing the Five Capitals model of sustainability to identify and facilitate the exploitation of opportunities for improved incorporation of sustainability appraisal within the asset delivery practices of a major UK water and sewerage company (WaSC). The main aim of the paper is to identify and characterise the factors which influence the way in which sustainability appraisal changes are adapted and employed (adopted) by the WaSC concerned. The Five Capitals sustainability principles were applied as a questioning framework in a series of focus groups to create a shared comprehension of sustainability, whilst mapping the perspectives of the business unit as to the form and efficacy of current sustainability appraisal activities. Subsequently, attempts were made to deepen appraisal activities in areas perceived as poorly managed through the development of a set of sustainability Key Performance indicators (KPI). Finally, both processes were analysed to identify the factors which influenced sustainability appraisal change. The eventual adoption or rejection of the proposed KPIs were influenced by the (i) extent of their alignment to company leadership visions and policies; (ii) the extent to which relevant data and expertise already existed and could be easily utilised for KPI reporting, and; (iii) the extent to which business changes involved in KPI production, reporting and reviewing fit with existing divisions of responsibility and management between business units. The case-study of organisational sustainability adoption presented here illustrates factors that influence the ability of large water utilities to change. The results demonstrate that improved incorporation of sustainability will probably proceed incrementally and may require significant changes in organisational structure, expertise and vision.

Keywords: sustainability appraisal; water utilities; organisational change; Five Capitals; water and sewerage; adoption.

1. INTRODUCTION

The ambitions of sustainability and sustainable development have been argued as being central to the management and delivery of water and sewerage services (Foxon et al., 2002). In England and Wales these services are delivered by a set of fully privatised and regulated water and sewerage companies (WaSCs) and water only companies (WoCs) (see section 2 for

more information). The economic regulator for water companies in England and Wales, OFWAT (www.ofwat.gov.uk), has been slow to define its position on sustainability, leaving UK WaSCs with the challenge of identifying an appropriate sustainability framework and values, and to develop and embed the corresponding business processes in order to improve their performance. A set of indicators has been developed by the water company representative body, Water UK, but these are designed for use sector wide, rather than for company specific reporting and performance improvement.

Water utilities are infrastructure intensive businesses, with a high dependence on long term physical assets. Given the capitally intensive nature of asset planning and delivery, cost rather than sustainability criteria traditionally dominate decision making. As water utilities increasingly look to make changes to asset planning and delivery to contribute to financial performance and sustainability it is pertinent to examine these change processes. What challenges do they present? How they might be better managed?

The main aim of this paper is to contribute case study evidence regarding the factors which influence the adoption of new sustainability appraisal practices by WaSCs (more generally water and wastewater service providers). By adoption, we mean the process by which proposed organisational process changes are adapted and then implemented. The aim of the paper will be achieved by interpreting the findings of research to identify, design, pilot and evaluate sustainability appraisal practice changes into the asset delivery function of a major UK WaSC (see section 2 for a description of UK WaSCs).

Many factors have been identified which inhibit or promote business change. Models of organisational change identify the requirement for a shared vision or understanding of needs before change processes can begin (Jick, Kanter, & Stein, 1992; Kotter, 1996; Lueke, 2003), and in turn such visions are the products of pressure for change (Cooper & Zmud, 1990; Jick et al., 1992; Kotter, 1996; Rogers, 2003; Van De Ven & Poole, 1995; Weick & Quinn, 1999). The Technology Acceptance Model (TAM) shows that ‘perceived usefulness’ and ‘perceived ease of use’ are the most significant drivers for individual adoption of new technologies (Venkatesh & Davis, 1996). With regards to the adoption of information systems, Burton and Swanson (1994) have shown that such technologies can come with significant knock-on effects to surrounding business processes, whilst van de Ven (1986) argues that new innovations may create additional work through the need to establish new inter-departmental coalitions and resource (re-) allocations. The combined implications of these findings are that to change WaSC business practices to incorporate sustainability appraisal, (i) a clear, shared vision is needed; (ii) that existing processes and information systems should be utilised wherever possible, and; (iii) that the scale and scope of process change should be commensurate with the level of buy-in to the vision. The research reported here followed these principles. To achieve this, capturing and interpreting the views and perceptions of the employees were principle to this research.

2. RESEARCH CONTEXT

The principal functions of a WaSC in England and Wales are the treatment and distribution of potable water and the safe removal and disposal of sewage (domestic, commercial and municipal). Each WaSC has a large and complicated system of network and treatment assets to replace, improve and maintain under its control. The Asset Delivery Unit (ADU) in the WaSC considered here is responsible for the delivery of solutions to business risks (see

below), typically through the replacement of built assets. ADU is divided into five investment areas referred to as Streams. Four of these Streams relate directly to asset infrastructure types - 'Reservoirs' are reservoir related assets; 'Networks' are typically pipe infrastructure for the transmission of potable water and sewage; 'Medium Treatment' is infrastructure used to change the chemical or physical properties of sewage, sludge or water for drinking, and; 'Other Installations' are assets such as pumping stations and those related to telemetry. 'Large Schemes' differs from the other streams as it is determined by project cost – any solution greater than ten million pounds. Each ADU Stream has a Stream Delivery Manager (SDM) who is responsible for the delivery of a stream of solutions to risks. To achieve this, each stream has a team of Project Managers (PMs) who are responsible for managing the resolution of a number of business risks. A business risk may be a factor, such as changes in population, legislation, failures in effluent emissions or infrastructure, all of which would inhibit the utility's ability to maintain the required service level. PMs liaise with partner organisations selected for their skills in design and construction of the solution infrastructure, and commission new assets for delivery from these partner organisations.

3. METHOD OUTLINE

Five steps were undertaken to identify, pilot and evaluate sustainability appraisal changes within ADU, as described below. This paper will focus mainly on steps 2 - 5.

Step 1. Selection of a relevant sustainability framework to apply to the activities of a WaSC. This step ensured that a coherent, relevant and comprehensive understanding of sustainability was selected to form the conceptual basis for the research.

Step 2. Mapping of business processes that influence the management of aspects of sustainability (from the selected sustainability framework). This step enabled the identification of aspects of sustainability which are perceived as less well managed by the business, and where changes to ADU present an opportunity for performance improvement.

Step 3. Identification of opportunities for improvements in sustainability performance as a consequence of changing ADU processes and practices.

Step 4. Conversion of research findings into a proposal for business change through which the WaSC is better able to appraise and influence sustainability performance. This step was important as the WaSC identified the need for a convincing business case prior to change.

Step 5. Assessment of business influences on the adoption of the proposal from 'Step 4'.

4. RESULTS

4.1 Step 1. Selection of a relevant sustainability framework

The full results for this step will not be presented in detail here. In brief, to select a sustainability framework suitable for adoption four criteria were applied. First, *completeness* i.e. that the framework should cover a set of identified core sustainability dimensions (core problems or topics of interest). Core dimensions of sustainability were identified, through review of literature related to the development of sustainability, and each framework then assessed in relation to inclusion / coverage of each dimensions; Second, *targeted* i.e. that each

framework should contain principles that clearly illustrate the desired state or direction of organisational change; Third, *Receptivity* i.e. that the source of the sustainability principles, are likely to be respected and accepted by the target group. The criteria by which this was assessed, was either by association to or endorsement by relevant institutional supporters or adopters (government, sector or similar organisations); Fourth and finally, *clarity* i.e. that the proposed principles do not require users to undertake complex and difficult to understand steps to identify relevant impacts. To ensure the identified framework could be easily interpreted across the business, the project steering group agreed to adapt the ‘principles’ (or rules), by simplifying some of the language into shorter, more concise, statements of intent.

The framework that was selected was the ‘Five Capitals’ model, developed by Forum for the Future (Porritt, 2007). The Five Capitals model defines five capital stocks and describes a number of principles to guide the management of these stocks (see Table 1). The model proposes that a sustainable organisation should seek to maintain and, where possible, enhance these stocks rather than deplete or degrade them. The ‘Five Capitals model’ may not be simply defined as Weak or Strong Sustainability, as it encompasses both. The application of the principles suggests a transition from one position to another, e.g. from a behavior of reducing the depletion of Critical Natural Capital (CNC), Weak Sustainability, to one of eliminating the use of CNC, thereby not permitting substitution of CNC, a strong sustainability position.

4.2 Step 2. Mapping of business processes that influence the management of aspects of sustainability

Using the adapted five capitals from ‘Step One’ two focus groups were held with ADU Project Managers. The participants represented geographically separate managed areas of the WaSC covering both clean and waste water service provision. Targeting the views of the employees assisted in the development of a proposal to meet needs identified by the business. Participants were instructed that the meeting objective was ‘to better understand where, when and how sustainability is addressed by the business, specifically within investment delivery’.

Table 1 the Five Capitals model

Natural Capital the natural resources (energy and matter) and processes (direct and indirect) needed by organisations to produce their products and deliver their services.

Human Capital incorporates the health, knowledge, skills, intellectual outputs, motivation and capacity for relationships of the individual.

Social Capital is any value added to the activities and economic outputs of an organisation by human relationships, partnerships and co-operation.

Manufactured Capital is material goods and infrastructure owned, leased or controlled by an organisation that contributes to production or service provision.

Financial Capital, those assets of an organisation that exist in a form of currency that can be owned or traded, including (but not limited to) shares, bonds and banknotes.

Participants were presented with the Five Capitals sustainability principles and asked to read through each principle carefully. The author then asked the participants to respond to the following questions for each principle with regards the work of the ADU:

- How does your business manage this sustainability principle?
- Do you believe this principle is effectively managed by the business?
- Can ADU influence the performance of this principle? If so, how?

Table 2 WaSC's asset delivery unit perceptions on the management of (adapted) Five Capital principles across six aspects of asset delivery - 'Investigating Risk'; 'Design'; 'Construction'; 'Operation'; 'Decommissioning' and 'Post project evaluating, monitoring and learning'.

A Principle perceived as undermanaged by the WaSC							
B Principle requiring management (but no additional comments or discussions)							
C Conditional- Perception of management efficacy dependent on interpretation/application of the principle							
D Principle perceived as effectively managed by the WaSC							
E Respondents did not know							
F Principle deemed irrelevant to the process							
% Percentage identified as undermanaged (columns A + B) of total comments (SUM A:F) >65% were highlighted for stream managers attention	%	F	E	D	C	B	A
Natural Capital (NC. x Adapted principle)							
NC. 1 Protect/improve habitat, biodiversity & ecosystem function.	58	0	0	3	2	2	5
NC. 2 Reduce emissions of substances to a concentration that can easily be assimilated by natural systems: a. chemical concentrations & nutrient loads; b. GHG , Ozone depleting substance; etc	83	0	2	0	0	1	9
NC. 3 Reduce/eliminate dependency on materials that are naturally scarce.	83	2	0	0	0	1	9
NC. 4 Reduce/eliminate use of virgin materials & resources	83	2	0	0	0	1	9
NC. 5 Reduce/eliminate dependency on & accumulation of man made substances that may prove harmful to ecosystem or human health substitute all with substances that can be easily assimilated broken down by natural systems.	100	0	0	0	0	6	4
NC. 6 Use renewable resources only from well-managed & restorative eco-systems.	89	1	0	0	0	2	6
NC. 7 Reduction/elimination of waste	73	0	0	3	0	4	4
NC. 8 Increase/full recycling of resources	100	0	0	0	0	4	6
NC. 9 Reduce/eliminate dependency in the use of fossil fuels	82	1	0	1	0	1	8
NC. 10 Reduce energy demand	58	0	0	5	0	2	5
Human Capital (HC. x Adapted principle)							
HC. 1 Ensure adequate Health & Safety standards are met	0	0	0	12	0	0	0
HC. 2 Respect human rights throughout their operations & geographical regions	9	0	0	10	0	0	1
HC. 3 Respect human values & their different cultural contexts	11	0	0	8	0	0	1
HC. 4 Give employees (where possible) access to training & education	10	0	0	9	0	0	1
HC. 5 Educate & promote for higher standards of health & support mental wellbeing.	11	0	0	8	0	0	1
HC. 6 Provide a reasonable living wage & fair remuneration for employees & business partners.	11	0	0	8	0	0	1
HC. 7 Allow for & enhance recreation time & support individuals' active involvement in society.	11	0	0	8	0	0	1
HC. 8 Ensure supply chain partners apply the same principles to fulfilling employee needs.	89	0	1	0	0	0	8
HC. 9 Create opportunities for varied & satisfying work.	25	0	0	6	0	0	2
Social Capital (SC. x Adapted principle)							
SC. 1 Source materials ethically & treat suppliers, customers & citizens fairly.	50	1	0	1	2	4	0
SC. 2 Reduce emissions of persistent compounds that are harmful to ecosystem or human health.	60	0	0	0	4	6	0
SC. 3 Respect & comply with local, national & international law.	60	0	0	4	0	6	0
SC. 4 Provide a supportive family friendly labour policy.	60	0	0	4	0	6	0
SC. 5 Prompt & full payment of taxes & support of social infrastructure.	60	0	0	4	0	6	0
SC. 6 Minimise of the negative social impacts of products & services or maximisation of the positive	43	1	0	3	0	2	1
SC. 7 Support the development of the community in which the organisation operates, including economic opportunities).	100	0	0	0	0	6	0
SC. 8 Assess the wider economic impacts of the organisations activities, products & services on society e.g. in creating wealth in the communities in which the organisation operates	100	0	0	0	0	4	2
SC. 9 Encourage & engage in transparent consultation & communication with relevant internal & external stakeholders,	67	0	0	3	0	4	2
SC. 10 Fulfil commitments made with suppliers, customers/citizens & regulators.	50	0	0	5	0	5	0
SC. 11 Effective Communication throughout the organisation , reflecting shared Values & objectives	0	0	0	1	0	0	0
Infrastructure Capital (IC. x Adapted principle)							
IC. 1 Ensure that systems, processes & infrastructure performance are maintained under a robust set of future operating scenarios.	70	0	0	1	2	5	2
IC. 2 Seek to maximise the flexibility & adaptability of infrastructure to respond to diverse set of future operating scenarios.	70	1	0	1	1	4	3
IC. 3 Develop infrastructure that facilitates ease of maintenance: a. Design for disassembly ; b. Modular designs (to minimise potential negative opex spend)	22	2	0	5	0	2	
IC. 4 Have sought to reduce or eliminate waste & emissions in production systems.	70	1	0	2	0	3	4
IC. 5 Where appropriate replace products for service contracts.	67	2	0	1	0	3	3
IC. 6 Optimisation of infrastructure/technologies & processes in a way that uses resources most efficiently.	70	1	0	1	1	4	3
IC. 7 Optimise the recycling of resources.	70	1	0	2	0	4	3
IC. 8 Identifying & utilising synergistic production systems where one organisation's waste streams are another's resources.	91	1	0	0	0	3	7
IC. 9 Seek improvements & innovation in the design of product systems (eco-efficiency & eco-innovation).	88	1	0	0	0	4	3
IC. 10 Apply sustainable construction techniques when looking at new infrastructure.	67	1	0	2	0	4	2
Financial Capital (FC. x Adapted principle)							
FC. 1 Employ prudent financial management	0	0	0	12	0	0	0
FC. 2 Efficient use of financial resources (reducing & minimising costs)	0	0	0	12	0	0	0
FC. 3 Management of financial risk (over both short & long term)	0	0	0	7	5	0	0
FC. 4 Internalise environmental & social costs & assign an economic value to them.	8	0	0	0	1	0	1
FC. 5 Effective total costs under a robust set of future scenarios e.g. unit running/capital /Remediation/ infrastructure/manpower/Ext services ratio/Imported (raw and treated) water ratio/ Energy ratio (costs) etc.	0	0	0	12	0	0	0
FC. 6 Effective management of financial risk exposure.	0	0	0	7	5	0	0
FC. 7 Timely fulfilment of contracts	0	0	0	12	0	0	0

Participants were asked to answer the questions with regards to each of the life-cycle stages in asset delivery (investigation, design, construction, operation and decommissioning), in relation to the business units which have an impact on investment delivery (Human Resources, Program Planning, Supply Chain and Procurement) and in relation to the tools employed by the WaSC during asset delivery (company policy, asset standards, engineering specifications, key performance indicators, and cost models). Responses were categorised as principles perceived as ‘undermanaged’, ‘requiring management’, ‘conditional’ (undermanaged in some situations), ‘effectively managed’, ‘did not know’, or ‘not relevant’ (to the work of the water company). Results were reflected back to the respondents for further comments, to encourage participants to challenge or verify results. The researcher then used the information gathered to identify those principles perceived as least well managed in investment delivery and under the control of ADU (see Table 2).

4.3 Step 3: Identification of opportunities for improvements in sustainability performance as a consequence of changing ADU processes and practices.

A series of interviews were held with the Stream Delivery Managers (SDM). The Five Capitals principles were presented to the managers, with principles perceived as being less well managed highlighted in orange (those with orange highlighted % undermanaged figures in Table 2). The objective was to identify priority principles for ADU, and to reveal the perceived business benefits from incorporation of those principles into process and practice.

SDM interviews were held on a one to one basis and each interview was allocated 1 hour. Each SDM interviewee was given a description of the methodological steps undertaken so far and presented with a list of asset investment classes (investment streams) that corresponded to the asset investment distinctions used by the business. To ensure that the interview captured relevant and informed information on specific investment streams, interviewees identified the stream in which they had most experience and took part from the perspective of that stream.

The managers were asked to review all the principles, placing a mark alongside each principle that they believed their stream had a significant impact upon. The interviewees were then asked to identify from the marked principles those which they believe their stream should prioritise (Figure 1 – ‘marked principles’). The researcher then requested the participants to review their selection using two adoption criteria – (1) those principles which would be easiest to make strong performance improvements against, and; (2) those principles which are most likely to result in business benefits and therefore likely to be adopted (Figure 1 – ‘selected principles’). Finally, interviewees were asked to select one principle, and to describe investment stream improvements they aspired to by adopting the sustainability principle for the stream (Figure 1 - ‘Desired stream investment improvements’).

4.4 Step 4: Converting research findings into a business change through which the WaSC will be better able to appraise and influence sustainability performance

The Project Steering Group had requested that the research carried out under steps 1-3 be converted into a set of measures to help monitor the sustainability performance of investments within ADU. Consequently, potential measures from the literature review carried out under step 1 were compiled in a spreadsheet, and sorted by relevance against capital and principle. As the worksheet related indicators to sustainability principles it was used to select and

propose indicators that could turn WaSC stream sustainability objectives into measurable indicators and begin the process of enabling the ADU to manage sustainability performance.

The spreadsheet information was then used in a series of meetings with the WaSC Environmental Strategy Team members (ESM), the ADU Reporting and Financial Manager (RFM) responsible for collection and dissemination of financial and technical data related to the activities of ADU, and an External Consultant (EC) charged with the development and delivery of performance measures to be applied to ADU partners as they deliver assets for the WaSC. These meetings identified factors that would assist the business in adopting and promoting change that would improve incorporation of sustainability (See Table 3).

Table 3 Sustainability appraisal change advocated

Source	Change characteristic
RFM EC	The number of separate indicators/measures used to assess the sustainability of ADU decision making should be as few as possible, in order to minimise resource use in administration or interpretation.
RFM EC	The data used in the development of the indicators/measures should be already collected by the business.
EC	The existing contractual arrangements between the WaSC and its contract partners will not leverage changes to the sustainability performance. The resultant measures/indicators can only be applied as soft influencing measures.
ESM	The addition of operational and embedded carbon should be a business priority.

The researcher incorporated these factors into the change proposal by developing a set of sustainability Key Performance Indicators (KPIs) (see Figure 1) which uses existing data from the WaSC and its Partners. These aim to reveal more and less sustainable practices for the purposes of influencing partner behaviour and promoting stream specific sustainability understanding within ADU. For example the proposed indicator for ‘Energy in Construction’ utilised data already collected by the Environment Strategy Team (transport fuel and energy use) and data from Health and Safety monitoring (man hours on site), creating a cost neutral or low cost indicator.

Step 5. Assessing the business influences on the adoption of the sustainability proposal

Once the WaSC had finalised its decision on adopting the proposed KPIs (or not) a series of follow-up interviews were held with the RFM, EC and ESM. Interviews were digitally recorded, transcribed and analysed for themes. Participants were asked to review the proposed sustainability KPIs and respond to the following questions:

- i. Was the KPI adopted or rejected?
- ii. What characteristics of the KPI contribute to its adoption position?
- iii. What organisational factors contributed to its adoption position?
- iv. What methodological process contributed to the adoption position of the KPI?
- v. Were there any specific internal or external events that altered or gave rise to the adoption position of the KPI?

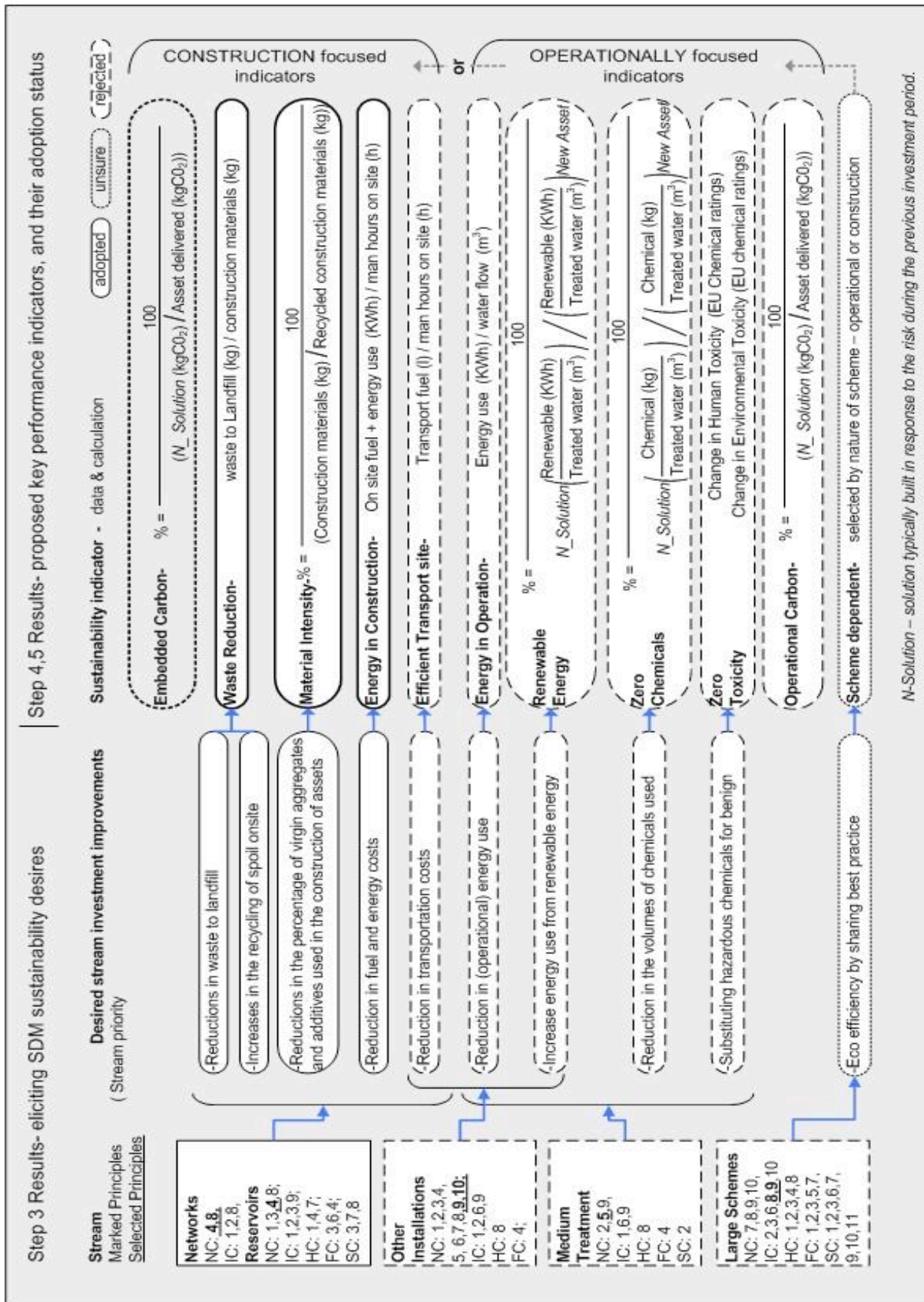


Figure 1 Results: (Step 3) eliciting ADU sustainability desires; converting these into a proposal of sustainability Key Performance (Step 4); adoption status (Step 5).

The interviews revealed three key themes: data availability, alignment and fit. Interviewees most frequently commented that data already being collected by the business was a significant factor. Data already collected by the business was not subject to the following barriers: the need to demonstrate data utility to partner and the WaSC, the additional cost associated with data acquisition, the development and sharing of methodology and boundaries for data collection or the development of relevant technical authority and leadership. Additionally the interviews revealed that existing organisational strategy (advocated by the WaSC management in policy documents and statements) did not clearly advocate principles supported by the KPIs. Alignment with the views of the WaSC leadership or the extent to which the proposal aligned with the perceived views or plans of the regulatory authority had a significant impact on the adoption position of the proposal. Finally the fit of the proposal with the roles and responsibilities of the significant business units would impact on adoption.

Where the proposal transgressed responsibilities of a business unit it required a reappraisal of responsibilities. Where these responsibilities are entrenched in contracts employed by the business unit, they may significantly limit the WaSC's facility to alter decision criteria or data sharing activities without financial implications. In such circumstances, timing becomes a significant factor in ability to change.

5. DISCUSSION

This research demonstrates that the alignment of leadership vision and policies to the sustainability principles impacted on which principles were incorporated into WaSC decision making. Results from Steps 2, 3 and 4 all perceived that sustainability principles under the capital headings Social, Financial and Human were well managed. The consensus was that these principles aligned with the WaSC's existing leadership vision and the policy: *Service, Compliance, Value and People* (SCVP). Sustainability principles related to infrastructure and natural capital were perceived by ADU as significantly less-well/under managed by comparison and the SCVP policy has very little inclination towards the management of these principles. The findings, that leadership (Eisenbach, Watson, & Pillai, 1999; Poole & van de Ven, 2004; Romanelli & Tushman, 1994) and shared vision (Jick et al., 1992; Kotter, 1996; Lueke, 2003) impact on organisational change are supported by the academic literature. This suggests that a realignment of leadership visions and policies to incorporate principles perceived as poorly managed will support sustainability change processes. Such realignment may be achieved rapidly only through transformational change that discards existing frameworks and practices to set up new policies and visions, referred to as 'second generation organisational development (OD) approaches'. Or by 'third generation OD approaches' which allow past orientation and frameworks to play a role in the change by re-orientating the existing policies, a change event referred to by Nadler (1989) as organisational frame bending. For UK WaSCs an environmental constraint and source of change leadership is the regulator (Correia, 1998; Helm & Oxford Economic Research, 2003). Step 5 revealed that the adoption position of the proposed 'embodied carbon' indicators fluctuated with the business's interpretation of the regulator's plans. Additionally a lack of external leadership (from the regulator) or internal expertise made it difficult for the business to select and promote a methodology for the capture of data.

Gersick (1991) suggests that despite strong leadership any OD will be subject to resistance due to environmental and internal inertia that surrounds the existing system. Data collected in Steps 3 to 5 identified multiple internal themes: data, cost, and the existing division of

organisational roles and responsibilities, all constraints to the process of improved incorporation of sustainability. The persistent demand placed on the sustainability change, that the '*data acquisition must be cost neutral*' limited change to options that relied on existing routines or knowledge stocks and made no or as little a possible alteration to the allocation of resources. It is these freedoms, to allocate resources for creative or strategic behaviour, that Sharma (2000) terms 'Managerial Discretionary Slack' and he links this to an organisation's facility to adapt to environmental problems. The themes resulting from Steps 3-5 consistently alluded to both cost and the existing data activities (or routines) as having a significant bearing on adoption. Changes that utilized data from existing routines (environmental reporting) or were cost neutral/savers were more likely to be adopted. A further contributing factor to the preferencing of existing routines and data already collected by the business may be explained by the Technology Acceptance Model TAM model, where the 'perceived ease use and 'perceived usefulness' that contribute towards a decision towards the adoption of a technology are both moderated by 'experience' (Venkatesh & Bala, 2008). It is important to note that much of the data already collected by the business contributed to cross sector annual reports. Although this has not necessarily influenced the decision criteria, the ease of related principles being embedded in future decision frameworks has increased by reducing barriers to data acquisition.

A final source of internal constraint identified by the research was the extent to which changes fit with existing divisions of responsibility and management between business units. In Step 3 the desired sustainability improvements of the SDMs for '*Medium Treatment*' and '*Other Installations*' suggested that the priority sustainability impacts of concern for the SDMs was the operational performance rather than the impacts associated with construction of the infrastructure(See Figure 1). The ADU primary responsibilities are the economic and timely construction of infrastructure assets. The sustainability indicators proposed that are operationally focused transgress the traditional responsibilities of the business unit. The adherence to these responsibilities was noted by EC and RFM as a factor that contributed to the rejection of many of the operational KPIs. As a result the adopted indicators expose sustainability impacts of construction focused streams but will fail to expose the impacts of streams for which priority sustainability concerns were primarily operational.

In summary, the pace of change for improved incorporation of sustainability into UK WaSCs will probably proceed incrementally as a function of either the 'buy in' generated through adaptations based on the manipulation of cost neutral data or of leadership to invest resources. Ultimately it is likely the adoption of sustainability will require the WaSCs of today to transgress boundaries in structure vision and expertise.

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