Generating innovative ideas through systematic literature review and research synthesis: A design of a practical methodological framework for literature review.

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Degree of Bachelor of Science in Innovation Technology

Mälardalen University – Academy of Innovation, Design, & Technology

VT2021

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Abstract

This is an action-oriented study aimed at designing a practical methodology for generating evidence backed solutions for practical problems by means of literature review. Three iterations of systematic review are applied which evaluates different search strategies and reporting structures to provide a framework for an ideation technique. Resulting in an adaptation of a previously used framework which can be deployed to different extents that appears to result in design propositions alongside individual interventions.

Key words: Management review; use of evidence research; systematic literature review, ideation, design methodology, brainstorming, CIMO-logic.

Abbreviations:

ADR – Action design research

BIE – Build, Intervene, Evaluate

EBD – Evidence based design

EEC – Energy Evolution Centre

NPD -New product development

PEB – Pro environmental behaviour

R&D – Research and development

SLR – Systematic literature review

URE – Use of research evidence

Foreword:

This process has certainly been a learning experience foremost. It has further emphasised my admiration towards research and the importance of a rigorous pre-study.

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1. Introduction

Ideation and design processes can take a multitude of different forms, and how they emerge may vary from inside the organisation known as bottom up (Tidd & Bessant, 2013) to groups of people outside of the organisation which is often far greater in comparison (Salter et al, 2015). What these approaches have in common is that they are human-centric. Throughout this study an alternative approach is problematized and realised that generate evidence-based solutions through an individual's ideation through research synthesis of published literature. This systematic ideation process aims to provide value for practitioners by being an approachable and surmountable tool that can generate decision-basis for early-stage innovation processes. This thesis is based on a case study through a collaborative project between the researcher and Energy Evolution Centre (EEC). Although the thesis is based on this collaboration, this thesis adheres to the theoretical standpoint of generating interventions to solve complex problems through use of evidence research (URE). URE is commonplace within management- and administration research where best practise of policy and workplace interventions are sought after (See, Mccormick, 2010; Tranfield, Denyer, & Smart, 2003), also seen as benchmarking where business practises are investigated and compared.

The layout of this thesis is introduced with a background providing a broad understanding of the problem space, research area, definitions, and descriptions of commonly used terms and themes discussed throughout the study as well as seen in practise. Followed by a literature review that more comprehensively covers past work and the state of the field of evidence use in both practise and in research. The literature review contains the theoretical framework that the rest of the work is then built upon. Subsequently, the methodology is presented. The results from the method are then shown, analysed, and discussed, finally concluded with closing statements, future research agendas and the practical implications as well as research limitations.

1.1 Background

1.1.1 Applied practical problem:

While exploring how URE may effectively be applied, a practical problem of the collaborative partner is investigated during the process as the subject of the searches. Energy Evolution Centre (EEC) is a project organisation tasked with a program covering sustainability goals as set by the European Union (EU) and followed by the Swedish government in an agreement set 2017 (Werther-Öhling, 2018). Effect goals of the program include an enhanced public awareness and engagement on a regional level regarding energy use and production. This effect is sought after by several initiatives that hope to achieve said effect. However, as social behaviour and environmental sustainability are deemed to be complex problems (Zaval & Cornwell, 2017; Senbel, Ngo & Blair, 2014) we cannot be certain of initiatives efficacy. Therefore, parallel projects of EEC have followed traditional design methodologies when procuring solutions, such as user involved strategies. The alternative approach through literature review is explored

in this iteration of the project. This applied problem also acts as a practical example of the applications of the suggested framework which may be applied when basing the design off of published literature.

1.1.2 Solving a complex problem:

Complex problems are complex due to the vast number of variables and their unpredictable nature (Eseryel et al, 2013). Moreover, the variables are often interconnected and determining cause or causality is thereby often equally complex (Brown & Harris, 2010). Attacking a complex problem such as this is not achieved by a panacea (a one fits all solution for all problems). Complex problems require a network of innovative holistic solutions as there is no panacea that covers all the facets of the nature of complex or wicked problems (Brown & Harris, 2010). Each facilitated solution spawns a wave of new uncertainties and issues to deal with (Brown & Harris, 2010; Ritchey, 2014). Developing a multitude of initiatives may collectively contribute to a greater change (Liedtka et al, 2017) especially if done on several levels of society. If procuring a multitude of initiatives to enhance public engagement is the approach than an efficient way of ideating these social innovations is sought after. This has in recent history been done with user involvement through e.g., design thinking workshops (ibid) or democratized innovation principles (Liedtka et al, 2017; Björgvinsson et al, 2010). The emergence of remote working does also have an influence on the ideation techniques that are conducted. As seen by recent studies Bourgeois-Bougrine et al (2020) where brainstorming activities were conducted in both a virtual- and physical environment while solving a complex problem, that showed that virtual environments benefited the outcome of the group task. This experiment did however show that individual performance could be hinderer. Sommer et al (2020) explored two search strategies for idea generation to solve complex problems. Where they found that nominal group techniques are more adept at handling higher complexity problems, as opposed to lower complexity problems suitable for strictly collaborative brainstorming structures where participants may negatively influence one another and become fixated on early findings (Sommer et al, 2020).

1.1.3 Alternative ideation techniques:

While brainstorming activities focus on capturing the creativity of the collective mind, organisations have a plethora of other deployed strategies for external knowledge search and inquiry. Departments or organisations working with research and design projects are often categorized as an *adhocracy* due to their different approaches for solving complex problems (Forslund, 2013). This is categorized by their adaptive structure to allow for different problems and non-determined way of working. These efforts may include user-involvement, in-house research (R&D), or scanning activities.

A department that is often spotted in larger organisations is the prevalence of business intelligence. Something otherwise often outsourced as the skills are not always properly organised in such a way for organisations to effectively conduct the practise (Ruff, 2006). Business intelligence is a basis for strategic decision making and leading innovation

efforts in a pro-active manner (Sarpong & Maclean, 2011). The term is an umbrella for practises for surveying trends and happenings. The practise also benefits from scenario planning and scanning for trends on different levels of society as well as multiple sectors of interests (Ruff, 2006) (e.g., PEST). Internal research & development (R&D) departments may conduct their own business intelligence. While some companies encourage employees to set aside a few sets of hours each work week to conduct their own unstructured business intelligence to widen their own perspectives and collectively contribute to a greater understanding of their business surroundings. Organisations have different abilities of scanning technological- and market environments for knowledge acquisition (Bessant et al, referenced in Tidd 2006). Through several empirically derived case studies shown in (Tidd, 2006) generic activities occurring in NPD innovation search phase were determined, which were active environmental scanning (e.g., PEST); active foresight; and experimenting in R&D. In scanning activities, the sources used contain a wide array of types of data, ranging from hearsay to scientific journals (Genf & Laurent, 2014). Genf & Laurent (2014) does however recommend finding the original source of any found data to ensure its quality, e.g., when reviewing news articles, and the authors also actively encourage deploying criticism of all sources.

The design approaches both applied in industry and very commonly academia, can take many forms as well (c.f.Martin & Hanington, 2018). Aimed at exploring complex issues and generating innovative ideas and designs to combat the problem. These approaches include literature reviews and evidence-based design through secondary research (Martin & Hannington, 2018).

1.1.4 Knowledge brokers:

Ehls et al (2020) coin the term *decoupled search* where an organisation manages but outsources the search process to a consulting firm. Where search for solution initiatives is managed by being directed to a certain problem in a pro-active manner. The consultant in this case generates possible solutions whereas the ordering organisation (client) chooses what solution to proceed with. This approach allows for an influx of research from unfamiliar but valuable knowledge sources (Ehls et al, 2020). These sources may be from competing firms, customers, or universities. This approach challenges the traditional management responsibility of R&D departments and allows the research to take place independently of the firm. This leads to higher originality in NPD and a greater capability for problem solving (ibid) but may miss out on valuable knowledge already persistent in the organisation. Ehls et al (2020) goes on to call for innovative managers to develop their own ways of searching that may increase performance, as a heap more of research is necessary. One example of such a consulting firm is “The Evidence Network” that work with conducting literature reviews to support informed decision making. Another such institution is Cochrane that are active in everything health related and serving evidence-based decision basis.

Tranfield, Denyer, & Smart (2003) presents cases where systematic literature reviews (SLR) have been implemented to support informed decision making. The phenomenon

originates from medical industry and academia where sense is tried to make of the complex nature of health and social issues. In this field the methodology has been refined to improve transparency and reproducibility, whilst spreading to other fields and practises. Such as “What Works Programme” where interventions were sought after that would reduce crime; “The Evidence Network” that sought to inform and improve decision making in governments regarding public health policies (Tranfield, Denyer, & Smart, 2003) (not to be confused with previous mention of The Evidence Network, different organisations). These past examples have all been initiatives made across the UK and there have since sprung up similar evidence-based initiatives to tackle complex social issues.

Starkey & Madan (2001) highlighted two emerging problems provided by the access of the internet: Information overload; and how to screen the ever-increasing information available to generate better relevant knowledge. Traversing this vast landscape of literature, conference reports, and books is a daunting task for the inexperienced (ibid). Sannö et al (2018; 2019) have shown that co-production measures through academic and industrial joint ventures is a strong approach for these types of issues, but requires a great deal of resources, contacts, and time. Additionally, balancing the interests of involved partner introduces new and daunting challenges to address (Sannö et al, 2018, 2019). Hence universities may only act as knowledge mediators or brokers that act as translators for the academic language to a practical one (Starkey & Madan, 2001).

1.2 Problematization

The gap between research and practical implementation is evident as the relevance of research does not always align with the practical problems of management (Starkey & Madan, 2001). Briner, Denyer, & Rousseau (2009) state that evidence-based reviews should be conducted by the practitioner and not the scholar. However, the current methodological framework does not account for the time constraints of managers (Mccormick, 2010) and are instead resource consuming endeavours that require extensive resource allocations in terms of time and thereby cost. Instead, a low resource with less rigour approach is sought after that therefore may expand the use cases of SLR’s to practical implementations, while still maintaining some validity of the original research. Fu, Yang, & Wood (2016) argue in their suggestions for future research directions that author experience should be joint with the search of published literature to decrease the level of bias in the discovery of existing solutions. Furthermore, the authors suggest researching adding even more rigour to the processes to enable greater repeatability (Fu, Yang, & Wood, 2016). Snyder (2020) contribute by saying that these traditional reviews often lack rigour and are conducted sporadically.

Otherwise outsourcing the ideation phase does not solve the issue of cost nor time while often overlooking the internal knowledge of the organisation. First-hand research through gathering data to analysing it is also a demanding task that is not particularly popular amongst mechanical designers (Fu, Yang, & Wood, 2016). Instead, a low resource alternative is suggested that is perhaps best executed in a co-production setting such as

this. By utilizing the rigour of systematic reviews, a substantial number of feasible and scientifically backed propositions may be generated that support further development with a deepened understanding of the problem space and the underlying factors. Through this approach the following value may be presented for the collaborative partner of this thesis: The best suited idea may be further developed and realised; a backlog of feasible ideas may be generated for future reference; as well as creating a proof of concept for the methodology for future use and adoption. It is through these three increments that this thesis aims to deliver value to both praxis and theory. All the while adhering to the role of the scholar according to Briner, Denyer, & Rousseau (2009) which is to facilitate the infrastructure required for manager to conduct their own systematic reviews. And increasing relevance and practical implementation of the research base (Denyer, Tranfield, & Van Aken, 2008). Denyer & Tranfield (2006) also argue that developing custom research syntheses, can lead to effective means of generating practical knowledge. Denyer, Tranfield, & Van Aken (2008) argue for the CIMO logic to apply for design propositions instead of a mere understanding of input and output. Where understanding similar interventions and why they work is a valuable addition to new projects' development (ibid).

Before any research or project initiative, the proper pre-study should be conducted, as you should not try to reinvent the wheel (Bryman, 2011; Alvesson & Sköldberg, 2018). The solutions may already be out there, just not implemented in your particular setting. Uncovering these existing solutions in various areas may show to be a valuable source of innovative ideas that already have scientific backing, as there are heaps of data out there, the problem for the practitioner is dissemination & understanding, and if the practitioner becomes more accustomed to the resource databases, the language gap may tighten which could lead to greater novel collaborative research.

1.3 Purpose

The purpose of this study is to design and evaluate a systematic approach to ideation through literature review and research synthesis that is resource effective.

1.4 Research question

- How can a systematic literature review be deployed as an ideation technique?

1.5 Scope

The ideation process is delimited to one external search agent. This study includes a comprehensive but not all-inclusive meta-review of SLR development and current standing of URE. The work of Tranfield, Denyer, & Smart (2003) Denyer et al (2008) is built upon and transformed alongside additional literature and the ADR cycles. As guidance on search strategies are commonplace in the research base, more focus is instead put on reporting structures and the creative synthesis of data, while still applying different search strategies.

2. Literature review

In this chapter the existing theory in the use of evidence research is shown. As well as previous methods for developing ideation techniques and methodologies as meta-research.

2.1 Previous methods for developing and evaluating ideation techniques and literature reviews

Dixon-Woods et al (2006) explored the implementation of qualitative data into systematic reviews, this was done via exploring the issues posed in four areas: 1. Searching; 2. Appraising; 3. Synthesising; and 4. Synthesising the qualitative data with quantitative evidence originating from a medical SLR published in the Cochrane Database of Systematic Review, also known as a Cochrane review (Cochrane, 2021). The work was done via a multidisciplinary set of professionals that created a rich dialogue (Dixon-Woods et al. 2006) this was in fact the general methodological approach to the article, consensus through debate and conflict on the best suited approach according to the involved reviewers. Dixon-Woods et al (2006) aimed to not only update the Cochrane review to encompass qualitative data but to create a holistic understanding of the given issue. The result was a time consuming and resource heavy endeavour as the search scope becomes extensively large. Three search approaches were tested: thesaurus terms; free-text terms; and broad-based terms applied to six databases. The result of which was that all three approaches were necessary to avoid missing valuable data as they comprised of complimentary results. One of these hinders was pointed at the infancy of the electronic resources used (Dixon-Woods et al, 2006), a factor that hopefully should be irrelevant 15 years later. The general diversity of qualitative studies makes it difficult to include or exclude studies depending on predetermined criteria (ibid).

Wohlin (2004) provided guidelines on how to conduct snowballing in SLR's within the field of software engineering. The methodology Wohlin (2014) described was using his own experience and experimenting with different approaches. What followed was educated recommendations on the best practises for the methodology used in an SLR.

Popay et al (2006) provided guidelines on performing narrative synthesis in systematic reviews. Their methodology started off by systematically reviewing existing methodological literature and guidance which could then be implemented in their guidance for a narrative synthesis. Searches were made in three ways, database, internet, and serendipitous findings by the research team. The resulting guidance was then applied to two demonstrative syntheses with two different focuses. These two demonstrations where then used as illustrative tools for providing further guidance for the methodology and included in the final version of the guide (Popay et al, 2006). Petersson & Lundberg (2018) developed a framework for an ideation method to apply in multidisciplinary groups of engineers. This was done by adapting action design research into a *build, intervene, & evaluate* (BIE) cycle. Their starting point was past research and established ideation methods which was then built upon through the iterative development cycle.

2.2 Current knowledge about the use of evidence research

At a first glance the literature regarding this subject seems scarce. Farley-Ripple et al (2020) made an effort to comprehensively collect and show the use of evidence research (URE) throughout different geographical locations and academic fields through a series of surveys and network analyses. Through this effort they found that there were several distinct and separate developments with their own respective terms and phrases that were used which made it much more difficult to find collective data. URE and evidence-based design (EBD) is one of the examples of different terminology that encompasses the same principles but from different fields and traditions. This led into a rabbit hole of similar implementations which should be summarized using a SLR in its own work hence the delimitation presented in the scope of this thesis. Continuing that path, Tranfield, Denyer, & Smart (2003) states that evidence reviews have been largely underutilized by practitioners and organisations in aiding them for guidance and insight. Therefore, the authors evaluated the systematic approach of SLR's for management to inform evidence-based decisions and creating an organisational knowledgebase related to their context (Tranfield, Denyer, & Smart, 2003). Challenges that such a methodology pose are presented as first ascertaining whether data is either relevant or of high quality, especially in regard to qualitative data as Dixon-Woods et al (2006) also incline. Tranfield, Denyer, & Smart (2003) suggest evaluating the relevance between research question and methodology to assess the general quality of the literature. Secondly, the issue of the ontology of the field which has become increasingly dispersed through the years as further shown below by Farley-Ripple et al (2020) and Ehls et al (2020). Van Aken (Referenced in Tranfield, Denyer, & Smart 2003) argue for the methodology being a part of the design sciences in which it may be contextual, and solution oriented instead of the previously formal nature of systematic reviews and to where the fragmentation of the field would not bear as much weight.

Tidd (2006) places systematic review of projects in a competence learning cycle which is a type of learning cycle for organisations, where knowledge is transformed into new products. This helps identify missing competencies as well as providing a knowledge basis for project screening and selection.

> *"Innovation is about creating, capturing and combining knowledge – creating new possibilities through combining different knowledge sets" (Tidd, 2006).*

Publications have an inherent benefit of being linked to a certain field in which adaptation of certain techniques can be analysed. New products require a wide combination of technical fields to fully cover each aspect (Tidd, 2006). This application is more industrial than it has to do with complex issues however intricate products or services are created, but it shows the importance of scanning across specific industries and applications. One of the main ways for screening projects before commitment is through probability of predicted market share and technical- & commercial success. Which are criteria deemed

more valuable for complex product projects according to Tidd (2006) as well as criteria such as alignment with core principles and competencies.

2.3 *CIMO*-Logic:

Oppose to the traditional IO-logic (that of input and output correlation), The CIMO-logic instead involves a learning process that also describes why and where interventions work (Denyer, Tranfield, Van Aken, 2008). The logic contains four variables behind the logic of prescription according to Denyer et al (2008). Behind a design proposition there is a field problem being solved, these propositions must be validated through field testing. In the Context *C* using intervention *I* invokes generative mechanisms *M* to reach outcome *O*. For these purposes we focus on searching for variable *I*. These variables together describe the entire problem, how to solve it and what we reach by doing it (ibid). The purpose of this logic is not merely to provide a list of past solutions but that they in combination can lead to extravagant results through the various factors and outcomes that are presented. Much like the nature of complex problems, the solution(s) may also be complex and multifaceted. A comparison of the CIMO-logic can be made to the PICO structure which is instead used as a search strategy which investigates: Population, Intervention, Control, and Outcome in medical research.

Watson et al (2020) applied the CIMO-logic for identifying organisational practises that created successful partnerships amongst traditional organisations and non-profits, following five case studies. Denyer & Tranfield (2006, referenced in Denyer et al 2008) argue that customised synthesis reviews can provide valuable means of generating pragmatic management knowledge. Other methods presented in Denyer et al (2008) include those created by Dixon-Woods et al (2006) and Boaz et al (2006) which adapt to the qualitative manner of data gathered compared to medical fields that SLR's have been developed in Denyer et al, (2006). The CIMO-Logic is later applied in the first iteration of the action research cycles where further description of its application can be seen, 3.3.2 Reporting. In the following section 2.3.3, the state of meta-research on systematic reviews are briefly described, and how the CIMO-logic applies within.

2.3.3 Systematic literature reviews

According to Merriam & Tisdell (2016) reviewing existing literature is an important way to frame and understand any given problem. By understanding the already completed research on your topic one can avoid pitfalls and may stumble upon interesting connections. Some design questions can also be answered by reviewing the literature and thus reducing the future resources needed (Merriam & Tisdell, 2016). SLR's are considered to be on the top of the evidence hierarchy (Tranfield, Denyer, & Smart, 2003; KIB, 2021), although that is when a specific research question is answered through multiple points of evidence are located to answer a specific RQ. The status of SLR is also due to the relatively unbiased nature and replicability of the studies.

Before commencing a SLR there are a few points to consider that determine whether the applied problem or RQ is relevant for the methodology (Petticrew & Roberts, 2006):

- When there is uncertainty regarding the effectiveness of a policy or a service. And there has been previous research of the issue.
- It should be performed in early stages of the development.
- Is there a wide range of research available? And your specific question is not explicitly answered yet.
- Is there a need for an overreaching view of the research topic to direct future research needs?
- When an accurate picture of past research and past methodological research is required to promote the development of new methodologies

Narrative reviews are a subgenre of SLR's that contain less rigour and a story telling reporting scheme. Popay et al (2006) developed a method for narrative review synthesis of interventions through four steps. Consisting of first a theoretical model of how interventions work, for why and whom (i.e., the context and the mechanism); second, creating a preliminary research synthesis; third, assessing the relationships between different findings and interventions; lastly, addressing the validity of the resulting synthesis. Bear in mind that this research was conducted in the field of medicine but referenced by Denyer et al (2008) and used in their framework for management review. According to Alvesson & Sköldberg (2018, p 75) being able to spot convergent themes between research fields is a key characteristic of creative research. Systematic reviews have become increasingly relevant and mandatory to avoid reinventing the wheel and grasping the ever-increasing publications (KIB, 2021). So far as to spot systematic reviews of systematic reviews (ibid).

2.4 Opposing statements to the systematic approach

In an interview, David Kelley of IDEO and d.school states that complex problems specifically require breakthrough ideas that should originate from multidisciplinary teams and prototype testing with users. Design Thinking according to Kelley is a way to generate ideas for such problems (Camacho, 2016). Kelley continues with that innovation comes from reframing a problem before solving it. Which means taking it apart, putting it back together and preferably taking it apart again to study the components and get a better understanding of the fundamental issue (ibid). Furthermore, Kelley lays a lot of weight on the importance of teams and groups as that is what they teach at d.school. However there also exists such a parallel program without such an emphasis on multidisciplinary backgrounds and problems are not as rigorously reframed, but directly delivered from clients. Irrespective of how novel innovations are, those that come as a market push are more reliant on customer needs as customers do not buy a *product* but instead purchase or interact with it for the benefit that it provides (Tidd, 2006, p. 12).

Farley-Ripple et al (2020) mapped the use of research evidence (URE) in policy and practise where they found that there is still diffusion in the understanding of the phenomenon. As well as fragmentation in the development where there is little interaction between researchers, Farley-Ripple et al (2020) goes on to say that

metascience often overlooks the past research on the topic, which in this case would be extremely hypocritical.

> *There is, in our view,*
> *no silver bullet and no easy answer to how evidence can be made*
> *and used more effectively; there is no substitute for human*
> *interaction and learning, and for joint thinking. But this takes*
> *time, investment in people and careers, and a shared endeavor*
> *founded on intellectual humility and generosity.*
> *(Farley-Ripple et al, 2020)*

Ehls et al (2020) said the same as Farley-Ripple et al (2020) regarding the fragmentation across different fields. By providing a synthesis of the existing developments Ehls et al (2020) hope to better inform current practitioners and firms of the possibilities for external knowledge search. The *decoupled search* achieves an alternative to the locked in inter-organisational knowledge-search attempts while also removing the dependency on existing networks (Ehls et al, 2020).

2.5 Unanswered questions and current state of research

Ehls et al (2020) point towards three research directions needed in future research, these are external sources, organisation search behaviour, and search performance management. These fields are not extrapolated that much but potential research questions are suggested. The current maturity of the phenomenon has arrived at managing the search interface. Which means managing the common border between the client and search agent and combining their knowledge bases for a common ground which may sometimes be vastly different (Ehls et al, 2020). Examples of potential research question in relation to the scope of this study hover around formulating problem statements, what goes into a problem brief, and what queries and combinations render which results in a search (Ehls et al, 2020). Moreover, to what degree informal knowledge sources should be handled and included, such as tacit knowledge that occupy an organisation or personal insights from expert and practitioners (ibid). Their research also provides influential authors in each respective period that are considered within the development of this study's methodology.

Table 5. Research Phases of External Knowledge Search

Phase	Recognizing the Need for Search	Organizing Search Capabilities	Leveraging External Sources of Innovation	Managing the Search Interface
Start	~1963	~1990	~2001	Today

Fig 1. field development by Ehls et al (2020)

One recommendation by Ehls et al (2020) is that practitioners may develop novel ways of searching for external knowledge. Which in turn can lead to innovative methods that help develop the field.

3. Methodology

Following the previously applied methodologies in similar research instances (Popay et al, 2006; Wohlin, 2004; Petersson & Lundberg, 2018; Dixon-Woods et al, 2006) (presented in section 2.1), the design of this endeavour is done through iterative learning cycles that contribute to a resulting framework that is applied to the fullest as a search and ideation method. All three major work tasks or methods are visualised below (fig 2) influence the development of the framework. For clarification, a method according to Kothari (2004) refers to a technique being deployed as a research operation. While a methodology is the systematic approach to which the RQ or hypothesis is being answered (Kothari, 2004) which may also be described as the research design. Hereinafter, the term method thereby refers to the work tasks visualised below; methodology or framework refers to the object of study, being the SLR framework; and the methodology of this thesis is instead referred to as research design.

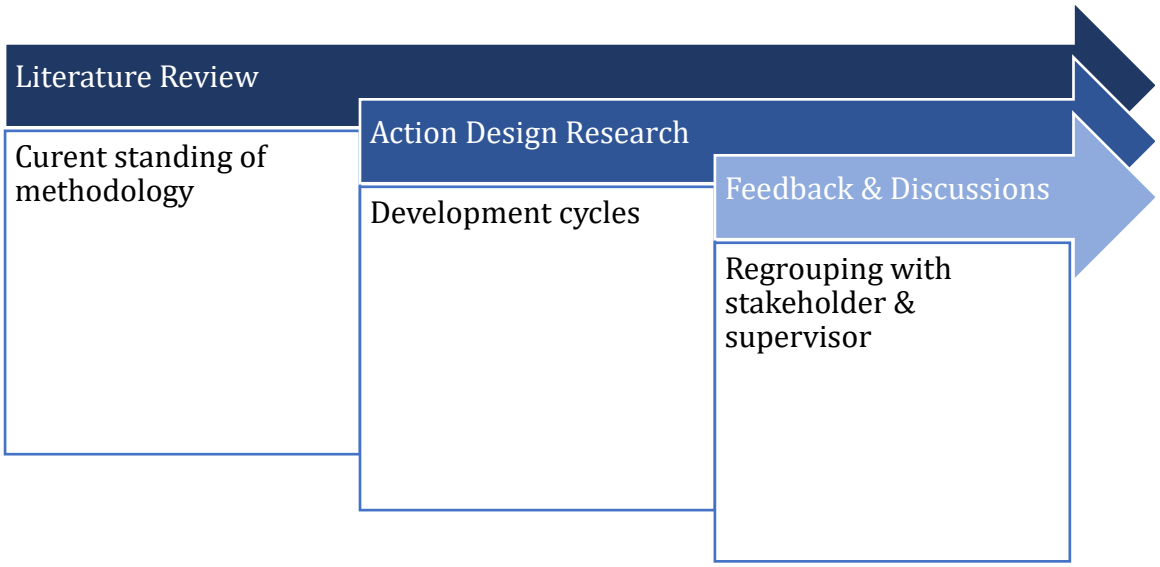

Fig 2. Research design

3.1 Approach to elements of co-production.

This study unfortunately does little to include and interact with the collaborative partner EEC in this work. The cooperation is delimited to the application of the practical problem and evaluation of generated solutions. Where the aim is to provide a solution through the suggested methodology. As well as if the methodology is suitable for further practise to be employed by the partner or similar organisation is question for future research. Thereby producing value for both academic and practitioner interests, however certain factors such as time requirement and problem formulation are up for deliberation. As the view on those two factors often to differ (Sannö et al, 2018). The evaluation of the ideas are left up to the collaborative partner to delimit bias and also further evaluate the reporting structure. This is done under a final rendezvous where the ideation results are

presented individually and scored according to predetermined criteria, see more in section 3.4 Idea evaluation.

3.2 Action design research

The methodology for the review process has been adapted and developed based on identified past literature. The development and final methodology have followed an iterative learning cycle where each iteration results in feedback that goes into the following planning phase of the next cycle. The decisions along the way have been based on the first-hand experience of the researcher from applying the criteria and reviewing the literature. The reasoning for the ADR approach is that exploring what does not work is equally interesting to what does work (Sannö et al, 2019) this applies both in the ideas generated as well as methodological decisions along the way. By using this research design, several approaches and reporting structures are evaluated and those that do not benefit the ideation process simply further add to the knowledge revolving the methodology. The first two cycles are only evaluated in a qualitative manner; hence the resulting ideas are not evaluated in the same rigour as the final approach. This is due to the cycles not being executed to their full extent as too many changes to the methodology instead moves the cycle on to the next stage. Premature evaluation of ideation results would render inconclusive and non-representable results, the qualitative findings are instead presented and built upon. Each cycle is initiated by building or designing the search queries and reporting structure, then the search is conducted, and changes are made as needed. Then the cycle is evaluated based on the experience of conducting it and how the resulting report communicated the findings. Lastly, the evaluation creates the basis for the development of the next cycle.

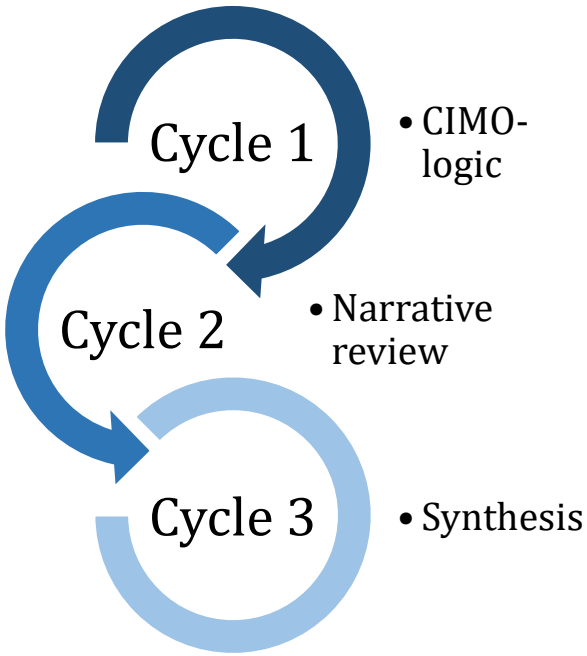

Fig 3. ADR cycles

Each cycle is its own delimited SLR. As the development of the methodology for ideation purposes proceeds, the approach also becomes more rigorous. The first cycles were cut short as the *ad hoc* changes became too substantial and a new effort was instead required. Not until the third cycle that the methodology is conducted until completion, thus also completing the third stage of the SLR framework, see fig 4 below.

3.3 Systematic Literature Review

The methodology that Tranfield, Denyer, & Smart (2003) developed is put to further use. Unfortunately, little development has been made since 2003 and no citing articles have been identified that continue Tranfield's work outside of his own involvement. An extensive literature review has been conducted to find a basis for the methodology as well as other parallel developments that this work may be influenced by. Snowballing both back and forth through references to find the most developed standing of the theory and all areas of implementation. Where backwards snowballing entails finding articles in the reference list of the literature you are starting from, whereas forwards snowballing is finding other articles that have cited the starting literature (Wohlin, 2014) hence going forward in time. This is easily accomplished through database functions. This has been done to counteract the arguments of Farley-Ripple et al (2020) that said that the fragmentation on the topic of URE research is too evident. These practises have also been applied in the cycles of conducting SLR to shape the framework for the purposes of ideation.

There is also the argument for applying a narrative review to explore a problematic theme, however the applied methodology is still more in line with the systematic approach only with less rigour as the scientific publication requirements are not applied. As Sannö et al (2019) put it:

> *"It is not expected that management research will match the rigour and precision of research in the basic sciences. In applied science, the progress in management research depends rather on applying the best methods and is a continuous improvement of the methodological tools."*
> *(Sannö et al, 2019)*

The narrative approach does not provide enough objectivity or reproducibility, even though the ingoing features are more in line with a narrative review compared to the distinction between SLR and narrative review by Cook et al (1997) within medical research. Both methodologies are subject to error and bias whilst the systematic approach does more to counteract these issues (Cook et al, 1997).

3.3.1 SLR framework

The methodology of Tranfield, Denyer, & Smart (2003) is a highly resource intensive act, requiring a panel of practitioners and academia to apply judgment. The work is also passed through an editorial board to ensure the quality of the paper, as the purposes here are only for knowledge inquiry and practical implementation the methodology is delimited in terms of reproducibility and objectivity. The below figure illustrates on the left the current methodological framework that this thesis uses as a starting ground. On the right that model is initially adapted according to the purposes of implementation as well as influential literature.

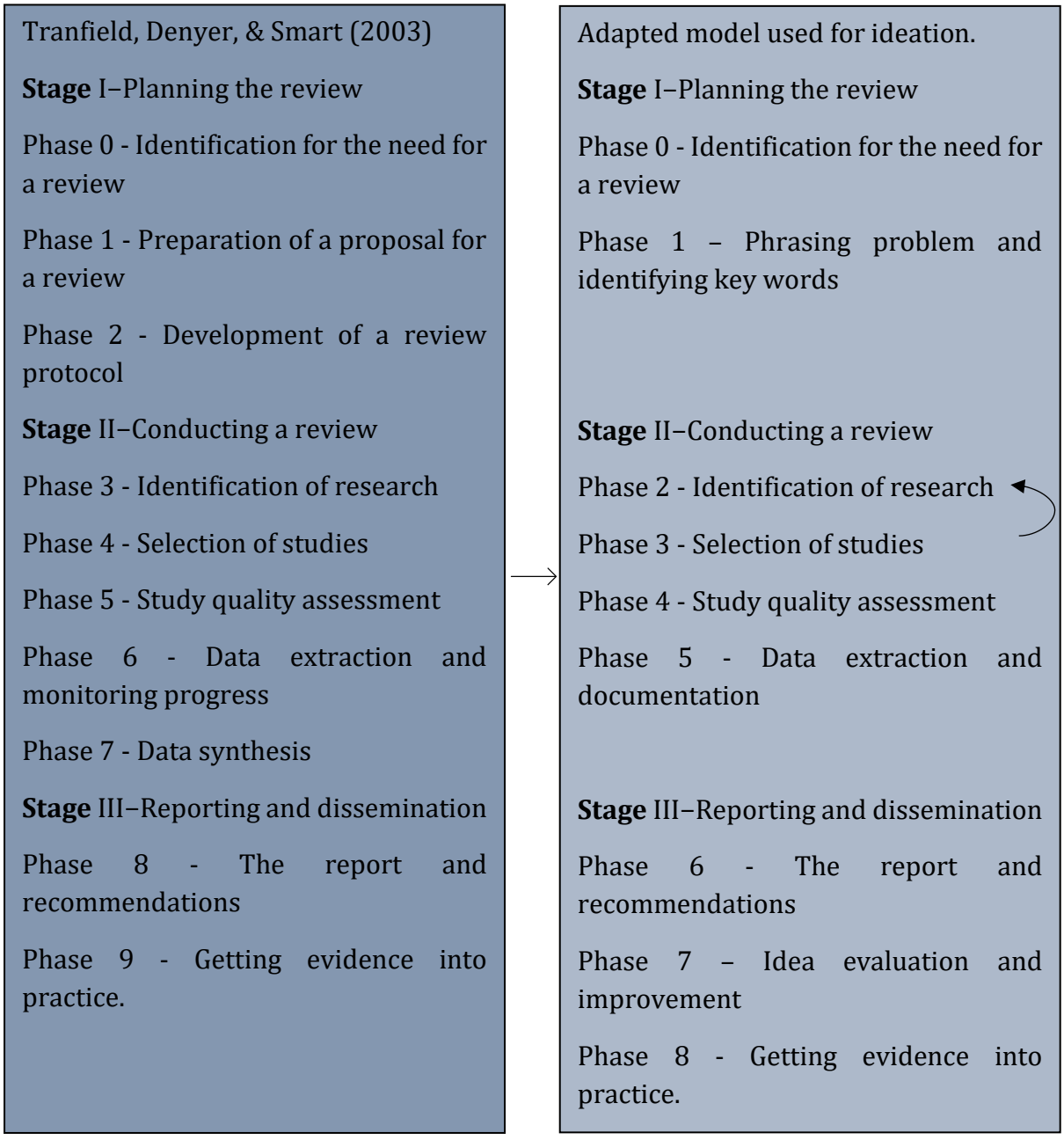

Fig 4. Referenced framework and applied framework

With this work as a starting point the rest of the process follows what others have done through experimentation with changes and first-hand experience of using the methodology. This creates a suitable ground to perform an action design research endeavour where iterations of the methodology can take place and changes made to it can be made to observe changes to its efficacy. The decision of what is determined to be 'good' adaptations or implementations is hereby dependant on the interpretation and judgement of the author in conjunction with the presented literature. The decisions are made between iterations of the literature search with some changes being implemented *ad hoc* and retrofitted into the search strategy. A retrofitted change thereby applies to previous search results in the same cycle, thus reiterating the current cycle without starting a completely new one. More detailed descriptions of decisions taken, and cycle developments is presented as the result of ADR in chapter 4.

The process laid out by Tranfield, Denyer, & Smart (2003) has been streamlined for the purposes of this study, thereby achieving a less resource demanding procedure by cutting back on factors that mostly contribute to the rigour and reproducibility of the methodology. When the methodology is applied as an ideation tool then the requirements for publication and scientific values are not as relevant. The selection criteria follow Denyer et al (2008) 'fit for purpose' in where the researcher determines whether or not the retrieved literature adds to the current knowledge of the phenomenon being investigated, thereby also including interventions of poor or negative results. The literature is then further probed and investigated to fill the CIMO-logic. The same judgement is put on the article by the researcher to determine any useful additions to the keywords or search phrases that may render relevant results. Once a piece of literature has been identified, the quality of the content is based upon the RQ relevance to the methodology (Tranfield, Denyer, & Smart, 2003) as well as conclusion to determine whether the added knowledge is justified and valuable to the investigation. Due to the ethical concerns review by Mccormick (2010) an ethical consideration has been implemented in the early stages of problem formulation.

What has been discussed in this section is the starting point for the action research cycles, with what has been described here being the first methodology applied in the AR cycle. Stage II of the framework is the focus of the ADR cycles and phase 6 was held until the final cycle was complete, which only included ideation results generated from the last cycle. However, the creation of the report in phase 6 was also a consideration that depended on the proceedings in the previous stages.

3.3.2 Reporting

Starting off, how the results of the action research cycles are presented in this study is more focused on the qualitative aspects of the first-hand interactions with the methodology. The resulting report of each cycle is visible in section 4 and appendix 8.1. But as the first two were not completed until completion they are relatively vague. They do not provide much additional value other than showing the pragmatic steps taken in the review process of selecting literature and how the report was structured.

First cycle reporting was done through the CIMO-logic; however, the logic was deemed unfit after qualitative data was difficult to transfer into a table. Additions were made that included notes from the search agent as well as original authors, this created a tableau of listing that each intervention could fill that reminded more of traditional quantitative review reports. This still was not enough to create a representable view of the findings of the literature as an ideation process. Therefore, the second approach adopted was a narrative synthesis that could encompass the qualitative notions as well as supporting synthesis of data that better created valuable combinations of the literature findings and interventions, while also allowing for the creative input of the search agent and or researcher. The second cycle became a one-page summary that was compiled using the identified literature, complete with references. The CIMO-logic was still applied for explanation where applicable. All search results were nullified between cycles and final ideation results are only presented in the next chapter along with the recommended methodology for the ideation process at that point. The third cycle combined the previous two approaches and thematised the findings and listed findings accordingly with qualitative dissemination and appropriate recommendations based on the identified literature and the combined knowledge they facilitated.

The reporting structures were evaluated based on their abilities to communicate the findings from the original source while allowing for synthesised conclusions that delivered to the objective of the review.

In the semantic communication of the report, it is important to set a proper tone to successfully communicate the findings to the practitioner (Starkey & Madan, 2011). Sannö et al (2018) also state that it should not be expected of practitioners to read academic reports and then grasp the entirety of the content. Although one should avoid such prejudice as to assume that someone does not possess a background of academic work or studies based solely on their current position. Fu, Yang, & wood (2016) state that including a simple metric as a timestamp provides a valuable sense of context for the then relevant trends and situations that may influence the performance of the design. Which is fulfilled easily by referencing the originating source by time of publication. Bear in mind that studies may have been conducted in years prior to the publication date, but for ease of use the year of publication is used and in some instances the timespan of the studies are mentioned to communicate the context better.

The final SLR report including the synthesis and summary was sent to the collaborative partner once the steps in the methodology were complete.

3.3.3 Databases

The searches have all been conducted through the library tool Primo administered by the library of Mälardalen University. The reasoning behind this choice is the open availability to conduct searches as no log in is required. Even though the researcher in use has access to more often used compilation databases such as Scopus the suggested application of this methodology may this way be more easily adopted by practitioners. The search engine Primo is itself a compilation search engine combining results from multiple

databases. The engine provides reference data when available which includes back- and forth snowballing as well as abstracts. Some literature sources may even allow access without proper credentials, such as DOAJ and Unpaywall.

3.4 Idea evaluation

Evaluating the ideas generated enables more room for continuous improvement of the suggestions according to Harvey & Kou (2013) and Girotra et al (2010). Therefore, a step is added in stage III that allows for the search agent, and subsequently the client to evaluate the ideas and integrate their tacit knowledge of the area. The quality of an idea was determined based on three factors, which were scored rather than ranked, which according to Girotra et al (2010) and Cui, Kumar, & Gonccalves (2019) showed to produce more accurate and representable results of efficacy. The scoring in this thesis is based on the criteria of feasibility (time & cost), viability (efficiency) and longevity (long-term effect). All criteria are graded separately to enable deliberation of each criterion seperatly. The evaluation was conducted during the final discourse where the ideation results were presented and ranked according to the formerly described criterion.

This step also allowed to develop the questions posed by Ehls et al (2020), concerned with how the tacit knowledge of the organisation is managed in a decoupled search. Thus, the regrouping allows for the input of their internal knowledge and further development of ideas. Furthermore, the evaluation of the ideas enables future research directions to compare the level of the ideation results with dissimilar approaches such as workshops or focus groups.

3.5 Ethical considerations

The fact that the researcher conducts the review process that is being evaluated as an ideation technique is a matter of discussion. As the research becomes a first-person inquiry, one's own values, beliefs, assumptions, ways of thinking, strategies, and behaviour become influential (Coghlan & Brannick, 2014) and should therefore be contemplated. However, there is still significant merit to the reproducibility of the approach taken and thereby should strengthen the arguments for validity. How viable the approach is as a general approach for other applied problems remains to be evaluated. The results from other applied problems may vary depending on the formation of the first two steps of the systematic process. i.e., the availability of research in the applied field; and the process of generating keywords sufficiently. The results presented to the collaborative partner are communicated in such a way as to inform of the uncertainties and considerations required of the research implications. Additional merit to the transparency is that the full report including sources are handed over. As little to no involvement is conducted with participants commonplace ethical values does not need to be considered. Instead, the ethicality of intervention strategies is a matter of discussion which is demonstrated in the results (see section 4.3.1).

3.6 Validity

The ethical undertakings guide the validity of this study. It remains difficult to assess the validity of the underlying claims of the decision made to the framework, other than viewing the protocols and discussion of each cycle, as well as the referenced literature. According to Coghlan & Brannick (2014) action research requires its own criteria for determining quality. As the decision of what is considered to be a 'good' change is done in the present, importance lie in these four following steps (Coghlan & Brannick, 2014, p. 15-16):

1. True representation of the process which the action research cycles were conducted in.
2. Challenging and validating one's own assumptions.
3. How contradictive opinions have been addressed in the results.
4. How well the interpretations are grounded in scholarly principles.

Addressing these four questions affect both the validity and the ethical considerations (Coghlan & Brannick, 2014). (1) the reflections and process are clearly presented as part of the results of this study; (2) own assumptions have been supported by literature findings in the arguments where possible; (3) contradictive opinions typically refer to the object of study which is usually human-centric in action research, in this study the contradictive statements are instead gathered from conflicting literature. Which are brought up and debated equally in the results and reports visible in the appendix; (4) as the study is grounded in literature, and literature use is the object of study, the interpretations are well rooted in the scholarly principles, only with slight deviation from the traditional quality assessments tasks from traditional SLR's.

As this research stems from the social sciences, the terms for validity of Bryman (2011) for qualitative research are also addressed. The external validity refers to the ability of transferring the results to other contexts (Bryman, 2011). This thesis does not speak greatly to the ability to generalize the methodology to any complex problem. More real-world issues should be formulated and treated through each methodology in the experiment. To further empathize any potential real-world application. Regarding the internal validity which refers to the relevance between observations and produced theory (ibid); the reproducibility should dismiss cases of bias from the researcher, the resulting synthesis is however not as replicable as it utilizes the creative analysis of the compiler. It would be interesting to explore whether a different perspective would create different proposals, in addition to the effect of additional search agents. Further arguments regarding the validity of this study includes the proficiency of conducting the research as cycles got faster and faster, as the personal knowledge base was increased less further reading was necessary to determine publications value. While also streamlining the search and review proficiency. Furthermore, the methodological decisions strictly follow the identified literature and observations which should indicate that the observations align with the theoretical outcome. The trustworthiness of the search agent or researcher is brought up on a meta-level in the discussion.

4. Results of ADR.

Cycle 1: The SLR framework from fig 4 was applied and rendered the following observational results:

The dissemination of findings was done by extracting the relevant data from the literature and inserting into a table with a CIMO-logic layout. This approach discarded observational, purely analytical research, research that otherwise did contribute to an overall understanding. CIMO was determined to be of value but that it should not exclude research that does not fit. Original author suggestions were also prevalent, but they included little explicit data on the proposed interventions efficacy other than the original authors' ethos while the CIMO-logic demands more to be fulfilled. The search strategy was however efficient at producing interesting results. By encompassing a large set of diverse data, instead of becoming stuck in a narrow solution space. While also maintaining bias in an advantageous manner.

Title	Author & Year	Method	Context	Intervention	Mechanism	Outcome	Search Phrase & added search phrases
Using social norm to promote energy conservation in a public building	Liu, Verissimo, & Farhidi (2016)	Field Study, gathering signatures	University, Atlanta	Petition	Social Norm	5% increased signing petition to change thermostat 2 degrees F.	public energy conservation
Promoting energy conservation behaviour in public settings: The influence of social norms and personal responsibility	Dwyer ,Maki, & Rothman (2015)	Observation/field study	Public restrooms, University,	Having to switch the light on manually	Social Norm, personal responsibility	Ca 3x as many people switched the lights of. From 11.7 > 32.4%	public energy conservation
~~Developing Students' Energy Literacy in Higher Education~~	~~Cotton et al (2014)~~		~~University, UK~~				~~Student energy~~
~~The Influence of Information Intervention Cognition on College Students' Energy-Saving Behavior Intentions~~	~~Yang et al (2020)~~	~~Self-Efficacy~~	~~University, China~~	~~X~~	~~X~~	~~Economic factors are the greatest; Group pressure can affect strongly both negatively and positively; publicity and education lack a significant effect.~~	~~Student Energy~~
Impact of Middle School Student Energy Monitoring Activities on Climate Change Beliefs and Intentions	Christensen & Knezek (2018)	Survey	Middle school, USA (Several states)	Monitoring effect of standby appliances	Active learning	Belief in climate change increased, and intention to personal betterment	
The effects of information regarding sustainability issues and behavioral self-management instruction on college students' energy conservation	Mosher & Desrocher (2014)	Pre & post test, hard to see what actually had the effect, workshop or monitoring/goals?	University,	Workshop & energy monitoring	Information about environmental issues, and how to change personal behaviour	Changing behaviour and awareness	

Fig 5. First cycle result.

The CIMO-logic worked well when concrete interventions were implemented and evaluated through a controlled study, But as Wisecup et al (2017) note, the data is often too inconclusive regarding interventions efficacy. Tranfield (2003) concur saying that management evidence is often incomplete or insufficient. The data is often also vastly different and multidimensional which therefore causes datapoints to have different metrics which makes comparison difficult, thus rendering the logic insufficient. Fruitful

options include a narrative reporting structure where *juxtapositioning* of findings is easier (Popay et al, 2006), where you can place two seemingly opposite objects in close relation. The spontaneous combination of intervention results did pose an interesting opportunity for new innovative ideas but were however difficult to include in the CIMO structure without a qualitative reporting structure, which would allow for more creative and narrative freedom from the search agent and researcher in this case (Denyer, Tranfield, & Van Aken, 2008). The implicit knowledge gathered and created in the search process could not be easily disseminated through the CIMO-logic.

A common exclusion criterion based on the methodology and the validity that the specific method could render were self-reporting surveys, where respondents themselves evaluated their efficacy or intentions in certain categories. Often pre- & post intervention surveys where authors themselves often placed a lot of scrutiny on the approach.

A total of six articles had been chosen when the cycle was concluded, out of a database scan of 40. Two of which were since excluded due to methodology. References acquired through snowballing were not added to the acquired literature list but was instead phased onto the next cycle. The full or relatively incomplete search process and report is visible above, as the next cycle began soon after several core changes had been made.

Cycle 2: The following changes were made to cycle one's methodology:

- Created a qualitative reporting structure.
- Added exclusion criterion for self-reporting surveys. As user have a likelihood of over-reporting positive behaviours (Bulunga & Thondhlana, 2018).
- Changed CIMO-logic to apply in free-form text instead of tabulation.

The qualitative reporting structure required additional time but was experienced to synthesise the literature preferably while providing better linkage between separate literature sources, especially whilst snowballing through a thematic field.

Process conducted in cycle 2

Stage II–Conducting a review

Phase 2 - Identification of research

Phase 3 - Selection of studies

Phase 4 - Study quality assessment

Phase 5 - Data extraction and documentation

Stage III–Reporting and dissemination

Phase 6 - The report and recommendations

Fig 6. Approach of cycle 2.

Truly innovative ideas seemed to appear from the combination of different knowledge sources. Thus, creating a more holistic and inclusive solution within the solution space by encompassing multiple interventions and their findings. Quality evaluation and analysis of outcomes became a constraining task requiring much time and deliberation. Such intricate studies generated difficult content to be summarised. Hence the approach did not adequately communicate the findings of the original studies nor the synthesised knowledge gain. Neither did it delimit the approach in terms of resource requirements.

A total of five articles were gathered, analysed, and evaluated out of a database scan of 40. Additional references were added through snowballing and subsequently analysed and evaluated. Three articles were finished in the report when the approach was determined to be too time consuming. The full or relatively incomplete search process and report is visible in appendix 8.1, as the final cycle began soon after several core changes had been made which can instead be seen implemented in the cycle below.

Cycle 3

- Adds a thematic analysis and dissemination of literature to the narrative synthesis.
- Adds relevant journals as a search source. Inclusion when multiple selected articles stem from the same corresponding journal.
- Focus on combination and creative discussion.
- Probing outside of the solution space was also applied. To look at more overreaching solutions that encompass that of energy conservation such as pro-e behaviour (PEB). The probing implies more free searches outside of databases, whilst still documenting sources and queries.
- Quality evaluation was removed to free up resources. Quality of a statement is instead determined by the number of mentions from different sources.
- Added an identified intervention list were all seen interventions were listed independently. To keep track of all interventions used throughout the studies to better create an overview. Which also provides an easy to spread, list of ideas to relapse to the purpose of generating simple solutions.

More focus was put on the actual ideas stemming from the data synthesis and combination of knowledge sets. Ideas were generated through reading and combining, whilst the literature could support the arguments being made. Thereby creating a scientifically backed idea. The idea was coupled to the originating sources and built upon using the gathered knowledge and understanding of the problem area. All the while still linking interventions to their outcomes (Denyer, Tranfield, & Van Aken, 2008).

4.1 Search log of final cycle

Problem: How to enhance student engagement in energy conservation and production.

Search terms: Articles containing the below terms, the first 20 results titles scanned.

1. Student + Electricity/Energy – "physical activity"-magnetism
   12 titles included and had abstracts read. Out of which 5 were included based on abstract and then read in full.
2. Behaviour* + intervention + Electricity
   14 titles included and had abstracts read. Out of which 13 were included based on abstract and then read in full. Pro environmental was identified as a commonplace key word.
3. Student + engagement + "pro environmental"
   15 articles included based on heading. Whilst only 1 included after further reading, due to several method exclusions and lack of new value for the knowledge base, thereby indicating diminishing returns from search.
4. Free searches were placed for probing outside of the solution space. (e.g. Cryptocurrency mining, and vampire devices). The web resource Semantic scholar was used for fast paced abstract reading and snowballing.

The first 20 results of each search were inspected by title, then abstract, then in full text. Following full text analysis, notes were taken, and interesting references added to a backlog of literature to investigate. This was continued until no further knowledge was added based on the identified literature whilst also limiting the report to a manageable size.

Exclusion criteria: Self-reporting surveys; apparent inadequate quality; Duplicate article; unavailable in full text.

↓

Inclusion criteria: Does the literature add to the current knowledge base regarding the investigated problem? (Martin & Hannington, 2018)

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25 articles were applied in the final report. The practical result of which is a four-page report plus references which can be found in appendix 8.1. The methodological results of final cycle are discussed below.

4.2 Reflections on final cycle

According to Mccormick (2010) projects should commence by figuring out *what* to do before exploring *how* to do it to prevent any uncalled-for work. Most of the results from this cycle have been specific regarding a set of generic interventions and how to proceed. The searches have rendered a narrow view into the solution space and more probing and brief searches should be conducted to expand the space into recent practical interventions outside of the research knowledge base. A possible explanation for this is that the concluding suggestion synthesised all the identified interventions into one solution, instead of many small interventions. Thereby creating one design proposition alongside the identified list of interventions. Important to note is that the ideation result must be viewed as a proposition which much be tested in the context of implementation. As the transferability of the original studies should be contemplated, if specified solutions are sought after then strict criterion on context of selected literature should be posed.

The cycle was concluded by the final meeting with the collaborative partner where the ideation results of the cycle were scored and built upon. As the resulting synthesis did not only deliver a list of identified interventions from previous research, but also a synthesised solution which encompasses a greater extent of them all; the evaluation process was followed by a dissemination of the resulting summary and its implications. This sparked a discussion revolving the findings and how it may be implemented in ongoing projects with similar characteristics. Which also facilitated the inclusion of tacit knowledge from the experience of the practitioner to influence the design proposition, which highlighted certain valuable findings and their implications for possible solutions. Thereby influencing *phase 8* of Tranfield, Denyer, & Smart's (2003) framework.

An anecdotal excerpt from this meeting was that the practitioner primarily seeks the key points of literature reviews due to time constraints of conducting reviews, which dilemmas will be further deliberated under chapter 5 discussion.

4.3 Resulting recommended framework

Based on the final cycle of completing the method and the learning it facilitated, the following suggestions are proposed for the methodology to be used as an ideation design technique. The illustration on the right shows the tasks of each stage. Most delimitations of the methodology come from the extraction of items that increase validity and decrease bias. The adaptability of the approach comes from adjusting the amount of resources placed on stage II, either more pieces of literature can be added or they can be analysed more methodically. The number of iterations conducted in stage II should be determined based on diminishing returns. Below is a description of each task along with constructed examples.

4.3.1 Detailed overview of developed framework

Phase 0: The ethical consideration is placed early on to potentially minimize wasted research. If the issue cannot be intervened ethically then the project should halt even if it leads to profits (McCormick, 2010). McCormick (2010) places the examples of Casinos expanding their customer to middle-class workers as unethical. Additional examples may include: Gas company wants to be perceived more environmentally friendly to encourage sales; or law enforcement wants to increase arrests to improve their funding.

The novelty of the issue may require external searches to conclude. Nonetheless, if the problem is truly novel then it cannot be assumed that there exists previous research on similar issues. Therefore, first-hand research should be conducted and the literature review that that entails shall proceed.

Phase 0 - Identification for the need for a review

- Ethical consideration
- Novelty of issue

Stage I–Planning the review

Phase 1 – Phrasing problem and identifying key words

- Briefing of problem
- Framing the issue
- Test searches
- Determining criteria

Stage II–Conducting a review (iterative)

Phase 2 - Identification of research

- Search strings
- Snowballing

Phase 3 - Selection of studies

- Title, abstract, full text
- Add to the knowledge base

Phase 4 - Data extraction and documentation

- Document sources
- Highlight valuable text
- Summarise

Stage III–Reporting and dissemination

Phase 6 - The report and recommendations

- Connect sources
- Synthesise and summarise

Phase 7 – Idea evaluation and improvement

Phase 8 - Getting evidence into practice.

Fig 7. Suggested framework

Stage I

Briefing of the problem implies a discourse between client and search agent in the case of a decoupled search. Otherwise, if conducted by an internal stakeholder the briefing may take form as an internal deliberation of the problem- space and subsequently solution.

Framing the issue involves defining the solution space by either constraining or expanding the desired mechanisms. Example: increased electricity awareness may also be achieved by heightened general pro-e behaviour. Or improving police funding may instead be solved by policy change or legislative action. Hence the effect goals of the project should be considered above the delivery goal.

Test searches should be applied to evaluate strings efficacy and add additional terms or phrases alongside knowledge.

When determining the criteria, the context of application should be discussed, thereby limiting the sample set of metrics such as time, location, demographic, or industry. This should follow the general transferability of the examined problem. I.e., brand recognition might not be that dependent on geographical location but the more on demographic relevance. Thus, reducing the arguments for interventions transferability over cultures, different industries, or national boundaries (Lilrank, 1995).

Stage II

This stage is an iterative process meaning that the phases are conducted in a cycle. Preferably until no further knowledge is added by continuing. The strategy may be delimited by constraining to what extent literature is read, and how many pieces of literature are included.

Conduct searches and read through titles, interesting titles may then be read as abstracts, if the content is still of interest, then the full article may be analysed to the extent that the scope allows for. Interesting statements and references may be highlighted or annotated during the reading to make it easier to backtrack, preferably through a thematic scheme. Whilst adding all found literature to a suitable list or folder. Continue this process of new searches and snowballing until no new knowledge is created.

Stage III

The gathered information may then be compiled and extracted into the corresponding thematic titles in a report or done implicitly if the time does so require. The pieces of literature should be connected under the identified themes to create a holistic understanding. A summary of all themes may be conducted to synthesise all knowledge into one or more educated design proposition. Further evaluation of the proposal may lead to further improvements via contributing with internal knowledge and experiences that are relevant and valid.

The final phase mandates action, thus commencing a build phase of whatever project methodology is used. The gathered knowledge should lead the initial construction and choices which should then be adapted through the proper methodological approach to suit the desired context of implementation.

5. Discussion of the process & results

Hereinafter the claims of the process and resulting methodology is discussed. Alongside the implications of observations posed in the ADR cycles.

The development of the methodological framework has hereby been influenced by literature revolving URE and SLR amongst similar subjects, as well as through the practical use and experience of applying said framework, lastly affected by feedback from involved stakeholders in the research project. There are arguments to support that the fulfilment of the need for a review is contended through means of co-production. Where the academic partner transmutes the vast literature into a condensed and relevant format for the industrial partner to reap from, which also is a desire from the collaborative partner of the applied problem. The next step of research and development for the framework should revolve around applying traditional design methods in course with observations of practitioners' proficiency and experience of utilizing the framework for their practical problems. Else, practitioners may adapt the framework at their own leisure while considering the validity and reproducibility of their search. Another course of discussion is through what means the search process is conducted and the effects that it has on the produced results. If the aim to delimit the prerequisite knowledge required as well as time spent on the search, perhaps following through the framework in a workshop setting is a viable alternative.

The extent of contradictive statements makes it difficult to draw any conclusions of what interventions or combinations thereof, may be the most optimal. The framework does however instead act as a breeding ground for new innovative ideas by synthesising the different research studies. However, the effect of which must be determined in a study of its own, which will then be delimited to the context it is placed (Guo et al, 2018).

Considering the argument of applied resources in conjunction with maintaining aspects of validity, one must value and balance each factor. The documentation and implied rigour of the approach may communicate a certain credibility by being transparent. But that does not attest to the actual validity of the proposed claims. Thus, only creating a façade of ethos while undermining the underlying logos that is so highly valued in this approach. Hence the importance of adapting and verifying the designs in the context of the implementation. Limiting the amount of time allocated for thoroughly reviewing literature and assessing its quality and relevance may be detrimental to the outcome of the review, thus wasting resources. Furthermore, when synthesising datasets and interventions, how much of the original empirical evidence is still applicable? Which is further enforced by the notion of the complexity of the issues, that they are unpredictable. Also considering that if creative leaps are made in the synthesis, then they may include assumptions on the original authors conclusions that are not actually implied. An interesting avenue to explore would be the effect of added participants in the review process, which are presumed to be positive. An added perspective on articles and mode for discourse could render valuable insights while also contributing to the validity. That

enables the opportunity to enact the framework in a workshop setting, which may also be perceived to be a more surmountable approach to the methodology.

Regarding the applied problem, one can be more selective of included study based on context; as university students are overrepresented in research due to their availability to researchers (Peterson & Merunka, 2014). Therefore, other demographics may pose more challenge in exploring with strict inclusion criteria based on context. As a riposte to the forementioned argument, the solution space for the final cycle was expanded as to not only include those based in the context of university students but also research on residential housing and their energy use behaviour.

As to how representable this work is for other problems, it should rely on the novelty of the applied problem alongside the maturity of published literature on the topic. The decisions taken in the execution and evaluation of the framework is also debatable, arguments have been supported in the extent that has been possible by agreeing literature. However, as the study has shown, finding contradictive statements or results is not highly unlikely and the proposed changes may therefore also have contradictive statements from otherwise unidentified literature in this thesis. Relying on the intuition of the researcher has been supported by the previous methodological approaches in identified literature. However, those original researchers were and are experts on the matter which is not the case by any means in this thesis. It is therefore the proposed changes have been supported by agreeing literature as solely relying on the intuition of the researcher would not suffice considering the level of expertise. Which is also why greater changes have not been made. Continuing the investigation may lead to more significant improvements as the framework and experience of applying it matures.

6. Conclusions

6.1 Purpose

- *The purpose of this study is to design and evaluate a systematic approach to ideation through literature review and research synthesis that is resource effective.*

Changes have been made to the original framework of Tranfield, Denyer, & Smart (2003) which removes stages that add to the rigour and validity for publication. Additional amendments have included early-stage ethical considerations and to the tasks of the original phases. As well as an evaluative phase which implements the tacit knowledge of the contributors. Additionally, some communicative changes are made to highlight the iterative tasks of the methodology.

6.2 Research question

- *How can a systematic literature review be deployed as an ideation technique?*

As to how well the methodological approach to ideation suffices in procuring a list of ideas is contested. What the approach instead facilitates is a learning experience revolving the applied problem which may result in a design proposition that includes the different aspects of gathered research. The result of the approach should only be received as a proposition which needs further testing and adaptation to the planned context to excel. Further steps in developing the methodological framework should include traditional design approaches to shape the framework to accommodate to the current practises and needs of practitioners.

6.3 Research implications

This study adds to the body of knowledge determining the applications of the approach. That research synthesis through systematic review can provide detailed intervention designs that describe the underlying behavioural mechanisms behind interventions potential effect. Practical implication of the theoretical results includes applying practical problems when teaching the ways of systematic review in higher education, potentially as another design method. Preferably as a collaborative or delegated task of co-productive partners. Thereby emphasising the practical value of the methodology other than academic interests of surveying a field of research as is the common application. There may be an opportunity to adjust the framework to unfold in a workshop setting where it could be conducted in group from start to finish over the course of a day. Where it could supplement brainstorming sessions by having a similar structure but including literature in the process.

6.4 Implications for applied problem

The results suggests that there may lie value in performing a broad literature review before deciding upon which intervention to develop, and subsequently performing a more rigorous review to develop the intervention. The systematic review process is not the most efficient approach to generating innovative ideas but should be deployed prior to committing to a specific intervention in an innovation project, to steer the project in

the right direction and facilitate the learning that transpires. Which stands for the case of the applied problem. The results of the final cycle of SLR steered the potential development project to what should be developed. The results also contributed with insights to ongoing parallel projects of the collaborative partner EEC, through the wide array of gathered knowledge of similar interventions.

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8. Appendix

8.1 Cycle reports

Cycle 1: Visible as excerpt in section 4.

Cycle 2:

Enhancing university student's engagement in energy conservation

Search Terms: "Student Electricity", First Analysis based on abstract, followed by in depth reading.

Schultz, Kohn & Musto (2017) evaluated the combination of three interventions with the goal of addressing long term (1 year) behavioural change by measuring a student housings (female) energy consumption. The applied interventions were as follows: Signs motivating energy conservation measures were allocated throughout the residency; Incentive rewards for achieving savings goals; and a common room poster board that visualized the current savings. The study included a control group where no interventions were placed. During the first semester the intervention had a decrease of 13 kWh used compared to a 5% decrease in the control group. Second semester the poster board was updated to a digital display and the houses were switched. Resulting in a 19% kWh decrease in the intervention house and a 2% decrease in the control house. The results however indicate a change in electricity usage before the interventions were implemented pointing towards a mere effect by being participants in the study. The authors recommend exploring options like competitions between residences and savings being donated to charities as incentives (Schultz, Kohn, & Musto, (2017).

Wisecup et al (2017) explored the efficacy of combinations of interventions in student halls to encourage energy savings. The study took place over the course of two years and four groups of students in different halls were included. The combinations of interventions were as follows: One control (I.e. no intervention); One with an interactive dashboard (passive) that display energy usage and compared it to how much coal would be required, also water usage and additional tips were available; the other was an active approach (active) were students participated in environmentally themed movie screenings, distribution of flyers and water bottles, as well as competitions that encouraged energy saving behaviour; the fourth group was a combination (combo) of the dashboard and the active interventions. The results showed that energy consumption rose in all groups but compared to the control group the most effective ones were the single interventions i.e. active and passive showing similar and significant reductions compared to the control group. The combination of active and passive intervention showed similar results to that of the control.

Forward snowballing: Bull et al (2018) investigated the long-term effect of an EU led energy saving competition. Bull et al (2018) found several simple behavioural interventions that had a significant effect of about 7% decrease seen in a large and diverse sample size. Results does not point to the significance of dashboards but provides

qualitative data from focus groups of students discussing what they wish to see in a dashboard. The importance of student-led initiatives is highlighted with an emphasis on practical implementations. Meaning that students should have control over what they aim to change through the behavioural interventions.

Cycle 3:

General guidelines

Research on decreasing consumers electricity consumption has been a popular research topic for decades (c.f. Schultz et al, 2017). Usually through behavioural interventions where short term effects have been measured. Newer studies can be seen to be case studies revolving social projects to incentivize electricity conservation (c.f Casals et al, 2020; Bull et al, 2017) with projects such as SAVES, EnerGAware , these projects are often more elaborative and diverse than momentary research studies.

Intervention strategies must be adapted to the context of the implementation (Guo et al, 2018). Interventions should be viewed as design propositions that need to be field tested in the desired context (Denyer, Tranfield, & Van Aken, 2008).

Reoccurring theme is that the audience must have control over the things they are informed about (Bull et al, 2018; Bulunga & Thondhlana, 2018). Places where student's electricity bill is included in the rent payment, electricity used was 35% more than the alternative (Dietz, referenced in Bulunga & Thondhlana, 2018). "Free" electricity often incentivizes cryptocurrency mining which is detrimental to the environment (Alexandre, 2019).

Raising people's awareness is preferable over regulatory changes (Bulunga & Thondhlana, 2018). Awareness should be raised together with providing tips for how to practically improve (ibid).

Competitions as a form of incentive mechanism

Wemyss et al (2018) used gamification to test a collaborative design versus a competitive one and found that the two strategies were equally efficient at collectively lowering the electricity consumption overall compared to the control group. Important note is that gamification includes notions such as incentives through achievements, information regarding issues and tricks to improve (Wemyss et al, 2018).

Information regarding environmental benefits over monetary gain are endorsed by Steinhorst & Matthies (2016) at least for an already pro-environmental target group such of that often seen in universities (Petersen et al, 2007). The financial benefit of electricity saving are often too small to make an significant impact (Steinhorst & Matthies, 2016). Mizobuchi & Takeuchi (2013) recommend combining these two perspectives by including rewards for energy savings. Schultz et al (2017) suggest that the monetary savings should instead be donated to charities as an incentive joint with a competition.

Wemyss et al (2018) also conclude that monetary rewards are often ineffective or even counterproductive.

Sintov et al (2015) also applied the commonplace elements of information, feedback, and incentives in a competition between residents in a student hall in Southern California, resulting in an average 6.4% electricity savings over the three-week competition. Sintov et al (2015) also argue that incentives may not be a suitable approach for long term effect. They may however work as a good start incentive in combination with more long term interventions. How well competitions work post intervention was not measured. The 6.4% decrease is significant but could potentially be higher if the students had more control over their consumption.

Informative

Leslie et al (2014) state that aiming efforts at reducing consumption is the most cost-effective measurement. As people consuming less leads to less electricity use as less appliances or devices are in the household. However, only creating an environment where little energy is used, does little to change the behaviour of users, when for example creating an energy efficient student housing (Wemyss, 2019). Instead giving the control over to the users and then incentivising them to improve the usage is preferable.

Information that is user led with clear and specific actions are better than generic information (Bulunga & Thondhlana, 2018). The SAVES program was a competition built upon a student led initiative called 'student switch off' (Jennings & Romanowicz, 2017).

Information regarding phantom loads (also known as vampire devices) can lead to reductions of up to 8% in the home, seen in (Gill & Lang, 2018). Vampire devices are products on standby that trickle use electricity. Estimations of their consumptions vary but are in the range of up to 10% of household electricity, and according to an electric utility company, account for 2% of Sweden's electricity use which is a significant amount.

Communicating savings:

When visualizing electricity savings, kWh's are not always intuitive (Wemyss, 2018), while also being easily compared to the monetary costs or gains which should be avoided according to Steinhorst & Matthis (2016) and Wemyss et al (2018). Instead Wemyss et al (2018) recommend translating the gains to different elements or graphically.

Therefore, for a competition style intervention. The goal should be donations to charities communicated through other means than financial. E.g. water bottles, soap, etc. When forming groups to compete individuals in groups should have a pre-existing relationship (Wemyss et al, 2018) while the opposing teams should also be known for the comparisons to matter (Bull et al, 2018; Senbel, Ngo, & Blair, 2014).

Source of information:

Frick et al (2017) found that willingness to partake in energy conservation measures was higher when communicated from a social group rather than a government entity.

Current levels of awareness and custom feedback

One important note is that target groups may need to be delimited as they have different levels of awareness for the current issues and therefore already apply some energy saving strategies. Tang et al (2009) said that when compared to the norm, lead users may regress back whilst those under the norm tend to better themselves. Wang et al (2018) grouped residents depending on their current level of awareness for climate issues and customized the feedback appropriately. Recommending that interventions apply different strategies depending on the current behaviour of the user. Also stating that economic incentives may be more appropriate for those who are not prone to behavioural change (Wang et al, 2018). Shen et al (2020) concur, applying customized sets of interventions depending on users predetermined behaviour group based on a multitude of factors.

Social norm:

People are more likely to change their behaviour to conform to the social norm (Berger, 2021) and thereby not stand out. Bergquist (2020) showed that users in Sweden often report themselves as better than the average in pro-e behaviour. Which may in turn lead to an obstacle in continuing improvement as users do not perceive the same room for improvement compared to the norm. Therefore, enlightening users on their actual positioning may induce greater pro-e behaviour. Berger (2021) had an interesting result that showed the complex nature of interventions. When implemented in an environment with low pro-e behaviour the norm effect showed a negative respons, thus people moving to less sustainable behaviour.

Wemyss et al (2019) reported data from interviews with study participants that there may be added value from increased cross participant interaction to create a sense of belonging. Social norms work in reducing electricity consumption (Sintov et al, 2015). In settings with multi-occupancy creating a group identification is valuable for this reason. This also aligns with the return to norm effect shown by Tang et al (2009).

Multiple interventions.

Combining intervention leads to improves savings (Leslie et al, 2014). However, this also has contradictive statements from Wisecup et al (2017) that showed that combining two interventions had a lower effect than the two interventions on their own. Bulunga & Thondhlana (2018) examined the use of single versus multiple interventions in student housing located in South Africa where they determined the multiple interventions to produce better results. Shen et al (2020) Mosher & Desrochers (2014) also state that multiple strategies are generally optimal to increase environmentally beneficial behaviour.

Goals:

Setting surmountable goals is a good strategy to combine with other interventions (Mosher & Desrochers, 2014).

Long-term effect

There are many contradictive results on whether there persists tacit knowledge post intervention, with many studies observing a return to baseline post study. Which motivates the implementation of continuous feedback or information (Leslie et al, 2014). Peterson et al (2007) found participants were encouraged to continue their saving behaviour post research. While in a follow up study, Wemyss et al (2019) saw the long terms effects of their gamification intervention and saw diminishing results as time progressed. The authors suggest maintaining monthly challenges and push notifications with tips, or energy news. That perhaps can be combined with existing utility bills from electricity suppliers (Wemyss et al, 2019).

Summary & suggestion

When implementing multiple interventions, tread carefully as the outcome is unknown due to complexity (Shen et al, 2020). Counterproductive results may follow. When multiple interventions are wanted, instead place them sequentially to create iterative interventions that can create long lasting effects. Considering the context of application, the current social norm should be adequate to ensure a positive social tipping effect. However, due diligence should be pursued by conducting an analysis of the behaviour of the specific target audience.

The aims of the project should be communicated through peers that can form social groups, for example an existing student association or the creation of a new one. This association can facilitate the long-term interventions and continuously develop new initiatives. The possibilities of enabling students to receive more control over their consumption should be investigated to enable more room for improvement and awareness, while also preparing them for post-university life.

A springboard of the initiative could be a competition where different student housings compete against each other, and earnings go towards a charity or a common interest and is communicated through non-financial means. Students should receive non-intrusive and spread-out information on where to improve their behaviour and how to do it. A comparison can be made with a current competition “pluggpeppen” where students are encouraged to exercise and compete with other student groups for most points earned.

To enable a general greater pro-e behaviour more than electricity use may be communicated, such as food wastage, transportation, and electricity source. Below are different intervention means that can be utilized.

This could create an potential avenue for future novel research. If the organisation has access to electricity usage of student housing then controlled studies could be made where certain interventions were placed on housing. Thus not only initallly reliang on preexisting research and subsequently producing knowledge accustomed to the context. In joint research with both academic and business stakeholders such as Kfast & research departments.

Interventions: Sorted by implemented context.

1. Student housing
    a. Financial responsibility
    b. Competitions between housing (Suggested by Schultz t al (2017))
    c. Interactive dashboard
    d. Realtime resource use feedback
2. Campus
    a. Smart lighting
    b. Workshops
    c. Project oriented assignments
    d. posters
3. Social networks
    a. Competition between social groups
    b. Champions

Identified Intervention List

- Dashboard
- Pamphlet
- Competition
- Lecture
- Workshop
- Social tipping (An intervention designed to create a ripple effect of pro-e behaviour) In this case reusable coffee mugs versus single use in the university cafeteria (Bergen, 2021).

Projects:

- SAVES
- EnerGAware

IDEAS for rating:

Campus Dashboard

Student Hall Dashboard

Informational flyers distributed to housing.

Energy saving competition.

Creating more energy efficient housing

Workshops/Projects

Make students in charge of utilities.

OR provide feedback on consumption

Self-efficacy survey with tips to improve (ex climate hero)

posters