World Development

Designing development interventions: The application of service design and discrete choice experiments in complex settings.

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19Th April 2022

Cover Letter

Manuscript Type: Research Article (WD-19535R1)

Manuscript Title: *Designing development interventions: The application of service design and discrete choice experiments in complex settings.*

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Dear Dr. Jampel Dell'Angelo,

Please find attached the latest resubmission of our paper.

We were very grateful for the time and consideration taken by the reviewers to comment on our paper.

We were glad to see that in the latest round of revisions the requested changes were relatively minor, and we are pleased now to resubmit with the confidence that we have complied with all necessary requirements and hope that the paper will not be accepted for publication.

Whilst the point was once again repeated at some length by Reviewer 1 during their latest comments, we were happy to read that the Reviewer had changed their position and now acknowledges that their primary contention - that the Service Design phase of the study did little more than act as a qualitative component of the Discrete Choice Experiment – has been addressed. Nonetheless, wanting to allay any lingering concerns that this distinction was still not clear enough, or at least not made explicit enough, we therefore decided to specify for the reviewer exactly where we had repeatedly made this difference apparent. Furthermore, reflecting that perhaps other readers may have similar concerns, we have included a new Figure 2. in Section 4.4 which precisely engages with this specific point. Reviewer 1's supplementary question about 'willingness to pay' drew our attention to a potential source of confusion which we have addressed in the text.

Reviewer 2 was very positive in the progress that the paper had made, and simply wanted clarification on some specific point that they felt we had either not fully addressed or had missed in the previous revision. We were happy to comply with almost all of these requests and make the necessary changes. It is clear that as a research team we have a slightly different opinion around the relative prioritisation of some studies qualitative and quantitative components (i.e. Schaafsma et al, (2017), Rabkin et al, (2020) etc.) but given the Reviewers clear authority in this area we (nearly) always complied with their directions. Where the Reviewer asked for further elaboration, we have now provided this text in the manuscript.

We feel that the paper has improved tremendously from the previous iterations and would like to thank the editorial team and reviewers for the guidance during these revisions, and now feel that it is now worthy of acceptance in *World Development*.

Yours sincerely,

Dr Matthew Osborne

Title Page (WITH author details)

Designing development interventions: The application of service design and discrete choice experiments in complex settings.

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Abstract

The persistence of problems such as endemic poverty, rising inequalities, climate change and biodiversity loss demands us to find solutions which are embedded in a highly complex web of interacting social, technological, and ecological processes. Service design (SD), an approach to directly involve citizens in the development and improvement of services and systems, shows promise as a tool to support the design of interventions to address complex development challenges in the Global South. In this paper we describe how service design was used alongside discrete choice experiments (DCEs) to inform the design of a Weather Index Insurance product for small holder farmers in Uganda. As part of the service design process, we used archetypes to capture and articulate the multiple vulnerabilities of farmers and quickly test prototype insurance packages to identify important design features. DCEs tested promising design features in a manner that complemented as well as triangulated the service design phase. The results of both phases were used to inform the design of a WII product that has been taken up by major insurance providers in Uganda.. The approach complements and builds on qualitative work typically done to inform DCEs by opening up space for research participants to question core assumptions, and by involving respondents directly in the process of designing a future service.

Response to Reviewer Comments

EDITOR		
Number	Comment	Actions
1	*As such, we encourage all our authors to be vigilant in attribution of intellectual debt and citations, attending in particular to acknowledging authors, scholarship,* *and literatures often overlooked as a result of above biases. Two, please provide a set of 3-5 highlights that convey the message and findings of your paper succinctly and clearly to the general reader. Finally, please avoid references to gray literature to World Development now asks authors at the "revise and resubmit" stage to make replication data available to reviewers and readers to encourage transparency in research. We also enable authors to interlink the data* *with published articles. Research replication data refers to observational and/or experimental data that validate research findings. To facilitate reproducibility and data reuse, this journal also encourages you to share your software, code, models, algorithms, protocols, methods and other materials relevant to the replication of the research results presented in your paper. the greatest possible extent. You can associate data with your article or include information about availability and access to your data when resubmitting the revised version of your paper. Please refer to the "References" section in author guidelines for more information about data citation. For more information* *on depositing, sharing and using research data and other relevant research materials, visit our research data page under author guidelines.*	We have complied with these requests, and as during the previous submission, have provided the corresponding data files.

REVIEWER 1		
Number	Comment	Actions
1	*Reviewer #1: So from this latest version, what I think I understand about the authors' views on what distinguishes SD from typical qualitative methods used to improve a DCE is:* ** typically (non-SD-based DCEs), the sole purpose of the qualitative methods are to make a better DCE, whereas with SD methods, they provide sometimes unique and complementary insights to those from the resulting DCE (from p.6 "in most cases the function of such qualitative dimensions remains subservient to the requirements of the DCE investigation.")* ** typically, qualitative research leads to iterative improvements of DCEs, but with SD, the actual *purpose* of the qualitative research is to trigger iterations (from p.7 "a design approach will consciously trigger such iterations.")* ** typically, DCEs don't do enough qualitative research, use the findings of any qualitative research as well as they could, or do not write about the qualitative findings and how they informed the DCE as much as they should (from p.10 "many published studies fail to appropriately engage in the qualitative component of the experiment, or little information is provided about how this phase was conducted in practice." About the authors' comment that "typical" qualitative DCE design*	We are glad that the reviewer now recognizes the distinct contribution that SD serves in the study, but to further underline how and where such contribution lies, we explain this concretely in section 4.4 and have additionally provided a new **Figure 2** to increase clarity on this important point. To address the reviewer's general point as to SD's contribution beyond 'survey honing', it should be noted that we make no secret of the fact that the SD and DCE were conducted as stand-alone research phases, but with the stated objective of both were to inform the design of a future insurance product for the same target beneficiaries. Since the SD phase occurred before the experiments, it would be broadly impossible – and unhelpful to our objective - to withhold information gained when constructing the DCE itself. However, as we have made clear, any such information was supplementary (and not subservient) to the requirements of conducting the qualitative preparatory phase of the DCE itself, as an integral part of constructing a well-design experiment. To address the reviewer's question about specific activities we invite attention to Sections 4.2 & 4.4 which lays this out clearly. But for convenience we would point to the example of rapid prototyping of insurance products excercises conducted with farmers - before the DCEs were implemented - where we learned that insurance would not be a suitable solution for all. As a method, rapid prototyping calls for the development of an array of models to trigger creative problem solving allowing for the progression on promising design components. As such, the SD phase led to the early questioning of core research assumptions and a broadening of focus based on the farmers' contexts, and ultimately a protoyped community savings scheme for "Bettys" – or highly vulnerable individuals in our setting – entirely independent of the a priori working assumptions which underpinned the DCE investigation. In summary, whilst the SD phase will certainly have benefited the preparation of the subsequent DCE – given the practical and objective overlap between the phases – its operation and analysis

	serves only to hone the DCE itself, whereas SD can give separate insights: I guess maybe I can see that, but it still does seem to me like the SD work done on this project was primarily used as an input into the DCE design. For example, what specific activities from the SD were implemented to give their own research insights that were in no way related to the DCE design? I understand that some of the DCE findings contradicted the SD findings and vice versa, but that feels a lot to me like what might occur with "typical" qualitative work to hone a DCE. (e.g. cognitive interviews and focus groups made the researchers think x1 was preferred to x2, but the DCE results showed the opposite.) Following from what I'm writing here, I guess I found line 374 to be not too convincing: "Our objective was thus to do more than simply engaging in a qualitative survey honing exercise for the DCE…" Because overall, again, it does seem like the SD was primarily used as an input into the DCE rather than as stand-alone research. But I do acknowledge that it's clear the authors do not feel the same. Also, I know the DCE team did its own qualitative work to inform the DCE design. Let's assume it was excellent by DCE standards - maybe one was to help the reader understand the potential advantages of SD over best-practices for DCE design would be to contrast the SD approach with what was actually done by the DCE team. (Of course, if the measures undertaken by the DCE weren't best practices, that contrasting may not be very helpful.)	were independent, with findings being triangulated to produce the studies final conclusions. **See Lines 408, 760 & 770**

2	*One point of confusion that I apologize for not remarking on in previous iterations: in several places around line 700, the authors conclude that coverage for the whole season is strongly preferred to coverage only for individual growth phases "despite the higher premium". How can that be concluded? The marginal effects relate to the probability of an alternative being chosen holding all else (including the premium) equal, right? Maybe I missed something.*	Insurance premium levels are specified as affordable levels meeting willingness to pay and dependent on coverage phase (see Table 2). Specifically, respondents were asked to imagine that the insurance was offered at a premium that they were happy to pay. If more phases of the growing season were covered, this would imply a higher premium. We now refer back to Table 2 at this point in the text (footnote 8 to line 749 in the current version) to remind the reader of this point. **See Line 751**
REVIEWER 2		
Number	Comment	
1	*Reviewer #2: The paper has improved considerably. It was easier to find the changes made to the text this time. It would have been useful if the authors had explained why their model results were changed in their Response to Reviewers. I am however, not fully satisfied, with some of the responses to my earlier comments. I'm using the same numbers as the authors used in their rebuttal (Reviewer 2).*	We are pleased that the reviewer thinks the paper has improved and apologise for not providing information in our previous response to the reviewers on why the model results have slightly changed. The reason is that trust in VSLAs is added as a control variable, the omission of which was an oversight in the previous version.
2	*Comment 2: Qualitative studies:* *- Line 191: Schaafsma et al. 2017 and Rabkin et al. 2020 do NOT use focus groups as subservient to the DCE investigation.*	We thank the reviewer for drawing our attention to these specific studies. On reflection, we agree that the Schaafsma et al. 2017 study mentioned uses qualitative methods in a balanced way and therefore it should be included in the subsequent list of papers which highlight this combination - which we have now done. The Rabkin et al, 2020 paper mentioned however does clearly state in its methods sections (pg. 3) https://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0228148&type=printable) that "*Qualitative and quantitative methods were used to explore patient preferences for service delivery characteristics associated with Zimbabwe's DART models. In Phase One (July 2018), KIIs with HCW and FGDs with DART-eligible patients* ***were conducted to provide contextual information and feedback on the attributes and images used for the DCE."*** Which is precisely

		the argument we were making - that Qualitative components of the listed studies were there, primarily, as a subservient function to the requirements of the DCE. Nonetheless, the citation mentioned was not essential to our argument, so we have removed it from the paper. **See Lines 225 & 231**
3	- *Line 314: Vass et al. only review the healthcare related DCE literature. For a generic statement as in lines 310-314 you need more references that also cover other domains, or you need to quantify that such a lack of engagement has been observed in healthcare studies.*	We agree that the Vass et al. 2017 should be substantiated and have added the review by Rakotonarivo et al. 2016 to expand the themes covered. This review looked at 107 articles (of which 13 were in LICs) using DCE's to evaluate non-market environmental goods, specifically looking at how mixed-methods approaches can be used to assess such studies' reliability and validity - concluding that whilst the authors *"recommend using qualitative approaches in combination with DCEs to make full use of key concepts in cognitive psychology and decision-making (pg 106)"* this had only been done comprehensively in one of the 107 selected studies. **See Line 350**
4	*Comment 4: Highlights:* - *I would strongly recommend the authors to revise the highlights and turn these (from a summary of what was done) to tell the key messages of the paper*	We thank the reviewer for this suggestion. We do feel that, since our contribution is in substantial part a methodological one, that the original four highlights are essential. However, we have added a fifth highlight that summarises both our findings and what happened as a result: "The study's recommendation to bundle insurance with certified inputs and credit was adopted by Ugandan insurance companies." **See Line 68**
5	*Comment 6:* *- Line 374: What is a survey honing exercise? Please rephrase.*	The phrase 'survey honing exercise' was included in response to a request from Reviewer 1 during the last round of revisions, but since it creates confusion we have paraphrased its meaning in this new sentence construction - which we hope will provide greater clarity. **See Line 411**
6	*Comment 15:* - *The authors state they no longer pursue this line of argument in the response, but still kept the text (albeit in a footnote). This is setting up a strawman argument, suggest deleting the footnote.*	We agree and have deleted the footnote (this was a footnote to line 629 in the current version). **See Line 629**

7	*Comment 20* - *The possibility of participants to interact is listed as one of the key drawbacks of deliberative monetary valuation studies. Can the authors please comment whether this approach was indeed more akin to a market stall approach? The interactions means that choices and therefore individual utility functions may no longer be independent, and that results may therefore not be aggregated to a full population. This is a theoretical concern that should be highlighted more clearly. It may lead to a rejection of the DCE results by at least some reviewers.*	The phrase 'survey honing exercise' was included in response to a request from Reviewer 1 during the last round of revisions, but since it creates confusion we have paraphrased its meaning in this new sentence construction - which we hope will provide greater clarity. **See Lines 557-576**
8	- *The text should also clarify how many sessions were held (line 519) and/or how many workshops were held (line 520), and how long these lasted, who organized them and what the key points were. I read the accompanying methods paper and cannot find the information.*	We have now provided this information in the main text. **See Lines 557-576**

Highlights

- Beyond informing the design of Discrete Choice Experiments, Service Design can provide rich contextual information relevant to the goals of the intervention in question.
- Prototypes and archetypes were useful for identifying important insurance product attributes early in the intervention design process.
- The combined approach allowed research participants to have agency in the process of designing an insurance product.
- The study's recommendation to bundle insurance with certified inputs and credit was adopted by Ugandan insurance companies.

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Highlights

- ~~Service Design and Discrete Choice Experiments were combined to inform the design of weather index insurance product for Ugandan smallholder farmers.~~
- ~~Prototypes and archetypes were used to identify important insurance product attributes early in the intervention design process.~~
- ~~Discrete Choice Experiments were used to quantitatively test promising design features.~~
- ~~The combined approach allowed research participants to have agency in the process of designing an insurance product.~~
- ~~The study's recommendation to bundle insurance with certified inputs and credit was adopted by Ugandan insurance companies.~~
-
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1. Introduction

Transforming specific policy ambitions into practice is a complex and challenging process. This has proven to be particularly problematic for policymakers in the Global South working towards delivery of the multidimensional targets proposed in the Agenda 2030 framework (Fu et al., 2019). Critical reflections on this topic have often largely focused on a somewhat unproductive polemic between the relative strengths and weaknesses of top-down versus bottom-up programming (McCourt, 2012; Pritchett et al., 2013; Viterna & Robertson, 2015; Howlett, 2019). From the 1990s onwards, the drive for greater 'evidence-based policymaking' and the concomitant clamour for demonstrable 'aid effectiveness' led to significant advances in research approaches used to inform both the planning and the evaluation of development programming (Howlett et al., 2015). Nonetheless, and despite such advances, many persistent development challenges remain unresolved and there are growing concerns that programming cycles which rely on often expensive and lengthy learning processes may not be the most appropriate way to address the current and future developmental challenges (Guyadeen & Seasons, 2018; Lucas, 2019).

Indeed, in a rapidly evolving and complex world system, development programming must not only be able to meet new demands, but also requires speed and flexibility in transferring and adapting policy innovations across places and time (Ramalingam, 2013; Ramalingam et al., 2014; Development Studies Association, 2021). Echoing the Senior Vice President of the World Bank, Mahmoud Mohieldin (2019) "the business-as-usual model will not suffice to deliver the aims of 2030"; therefore the development community urgently requires means and methods capable of deploying programme innovations to complex challenges in a nuanced and appropriate, yet rapidly scalable manner.

In this paper, we argue that making an overt shift away from project evaluation and learning *after* deployment, toward a more explicit focus on intervention design *before* deployment, can help to deliver on this objective (Escobar, 2017; Sangiorgi et al., 2017; Maher et al., 2018b). Drawing on advances within the field of Design, we demonstrate how there could be significant benefit to applying a Service Design (SD) approach to deliver this shift in development programming focus, particularly when conducted in conjunction with complementary methodologies such as Discrete Choice Experiments (DCE).

Service design is a human-centred and iterative approach to service innovation (Holmlid et al., 2015; Wetter-Edman et al., 2014) that is gaining ground as a way to create systems and services that are

useful, efficient and desirable to the user (Penin, 2017; Stickdorn & Schneider, 2012). A central tenet in service design is the principle of co-creation, where actors in service systems engage in a creative process to define problems and explore solutions (Jones, 2014).

In the Global North we see an increasing trend of using SD to inform policy delivery and yet today this approach is rarely used when it comes to designing development programming (Howlett, 2011; Bason, 2017; Malmberg, 2017). We will show how the SD approach can be used to absorb a significant amount of nuanced information and translate such data into forms that can allow for the development of viable solutions to multidimensional challenges; and then, to complement and triangulate these insights, they can be used to inform choice experiments prior to deployment. Whilst each methodology can operate as an independent body of work, and each has its own strengths and limitations, as a combined approach, it is cheap, quick and reduces the risk of doing harm whilst providing an opportunity to deliver well-designed projects at scale. In particular though, we feel that it would be most immediately advantageous when it comes to designing programme interventions at a sub-national project level where the degree of complexity and multidimensionality often makes it challenging for traditional alternative approaches to deliver programmes at scale of sufficient nuance and appropriateness (Whitney & Kelkar, 2004; Datta & Mullainathan, 2014; Maher et al., 2018a).

Following this introduction (1), we outline where we see our proposed approach fitting into the broader discourse around development programming in complex settings (2), and then introduce the central concepts and applications of service design and discrete choice experiments (3). Following this description, we provide an illustrative example of where it has been employed to inform a complex financial, climate adaptation and equity programme in Uganda (4). We conclude with a discussion of the methodological approach in combination, its limitations, and its potential to inform future development intervention design (5).

2. The Challenge of Complexity

Historically, and contrary to negative stereotypes, governments and organisations have been quite successful at delivering top-down development programming when such activities have been relatively standardised, routine and in high volume (Andrews et al., 2012; Denizer et al., 2013). This is especially the case when developmental problems are easy to define and where discrete technological or logistical solutions can be found – i.e., the Green Revolution in the 1970s, small-pox eradication in the 1980s, etc. As a leading advocate Jeffrey Sachs describes; *"For decades,*

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interventions in public health and in agriculture, such as Asia's Green Revolution in food production, have shown that the combination of a sound technology, a plan for large-scale implementation, adequate financing, and steadfastness over several years can make huge inroads against disease, poor health, and hunger even in the poorest settings. Bold plans have been part and parcel of those successes…. " (Sachs 2006: 1309).

Nonetheless, "*the conventional assumption that 'scientific' approaches to policy and planning provide the most reliable guidance for practitioners and researchers when working within complex settings,*" has been persuasively critiqued for decades (Head, 2019:180). These arguments have become increasingly compelling as the persistence of such 'wicked problems' as global poverty, rising inequalities, climate change, and biodiversity loss remain unresolved (Head, 2008; Moser et al., 2012; Head & Alford, 2015). These ongoing challenges have led to calls for greater acknowledgement and engagement with the dynamic, multidimensional, and inherently complex nature of such problems (D. Burns & Worsley, 2015; Hämäläinen, 2015; Waddock et al., 2015; Reyers et al., 2015; Salonen & Konkka, 2015; Lambe, Ran, Jürisoo, et al., 2020a).

Correspondingly, ~~we have been encouraged by the~~ there is a growing body of evidence that has shown how SD can be a useful approach to facilitate the design of services and policies that work for citizens in complex settings (C. Burns et al., 2006; Malmberg, 2017; Bason, 2016, 2017; Cottam, 2018). SD shows promise as a method for understanding and situating micro-level needs, preferences and concerns and translating this information into meso and macro-level programme design. For example, SD was used by research teams at the Stockholm Environment Institute (SEI) to inform the design of interventions aimed at boosting the incomes of small-scale mango farmers in Kenya (Lambe, Ran, Jürisoo, et al., 2020b) to improve the design of clean cookstove interventions in Kenya and Zambia (Jürisoo et al., 2018b; Lambe, Ran, Kwamboka, et al., 2020c) and to inform the design of minigrid services for households and businesses in Tanzania and Zambia (Muhoza & Johnson, 2018b; Ogeya et al., 2021). A common feature of these studies is the complexity of the problem in focus (e.g., interventions that seek to change household energy practices require~~s~~ the improved service or technology to satisfy the needs of the targeted users in terms of affordability, convenience, cultural fit, behavioral patterns, etc.), and often the needs of multiple key stakeholders must be met for the intervention to be effective (cookstove user, other family members, service provider, etc.).

More recently, and motivated by policy makers' demands to provide some quantitative validation of the outcomes of a qualitative co-design processes (Voorberg et al., 2015; van Buuren et al., 2020),

the SEI team have sought to triangulate the findings of the SD investigations by combining them with quantitative methods so as to provide more 'evidential robust' findings to support future programme and intervention design (Lambe, Ran, Kwamboka, et al., 2020a). In looking to expand the combination of quantitative approaches that could be combined with SD, the SEI team were keen to collaborate with the researchers from the Norwich Institute for Sustainable Development (NISD) and The Field Lab Uganda who intended to use a series of DCEs to investigate the potential role of insurance in overcoming persistent poverty traps amongst smallholder farmers in Uganda. As an approach, there appeared to be a clear compatibility with the underlying operation and objective of SD: in that such quantitative instruments are used to capture and consolidate a significant degree of complexity and produce data that can be used to inform the future construction and delivery of products or services. (Bennett & Birol, 2010; Terris-Prestholt et al., 2019).

3. Combining Service Design and Choice Experiments

There is of course a rich history of combining ~~different~~ quantitative and qualitative approaches in development research and practice, and the benefits of such triangulated approaches are well recognized. Within DCE studies qualitative components, such as focus groups or interviews, are often included during the preparation of experiments, as well as deployed later to better understand experimental findings (Powe et al., 2005; Kløjgaard et al., 2012). In the Global South, the use of DCEs in combination with qualitative components is growing, however in most cases the function of such qualitative dimensions remains subservient to the requirements of the DCE investigation (Mangham et al., 2009; Van den Broeck et al., 2017; Van Gevelt et al., 2017; Menyeh, 2021; Agarwal et al., 2021) ~~(i.e., Schaafsma et al., 2017; Van den Broeck et al., 2017; Van Gevelt et al., 2017; Rabkin et al., 2020)~~. To our knowledge there are only a handful of published studies from the Global South where DCEs have been combined with participatory investigations in a fully aligned manner, and where their independent findings and outputs are equally relied upon to inform the final conclusions and recommendations of the project (i.e. Duguma et al., 2010; Kenter et al., 2011; Kenter, 2016; Brunie et al., 2016; Indravudh et al., 2017; Schaafsma et al., 2017). This could in part be explained by the challenges of coordinating interdisciplinary research as Rakotonarivo et al., (2016) suggest, nonetheless it is with the view of building upon the foundations of such studies that we see the opportunity for SD and DCEs to provide such a positive contribution in this area.

3.1 Service Design

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Service design is a qualitative approach to understanding people's needs, wider context, motivations and behaviours, which aims to co-create improved services or systems that better meet their needs (Edvardsson et al., 2012; Manzini, 2015; Pfannstiel & Rasche, 2017). Service design provides tools for user engagement in public service design (Parker and Heapy, 2006). In recent years, SD has been increasingly applied in Europe, Australia and North America to improve public services together with users of the services to deliver positive social impact through so-called design labs, or public policy labs (McNabola et al., 2013; Escobar, 2017; Bason, 2017). In these cases, SD proved to be a valuable approach for understanding, representing and designing the interdependencies between actors, system components, and levels in a system (Sangiorgi et al., 2017). It has been applied in a more limited sense in low income countries to inform the design of services and service systems that can reach "Base of the Pyramid" consumers (Jagtap & Larsson, 2013).

How design methods differ from conventional qualitative approaches

Design methods are epistemologically distinct from conventional qualitative methods used within the social sciences. Design is often focused on addressing wicked problems in complex settings (Buchanan, 1992; Head & Alford, 2015), where the information required to produce solutions to a problem depends upon one's idea for solving it (Rylander, 2009). What this means in practice is that a design process is deliberately iterative and emergent, alternating between problem articulation and suggested solutions, and characterized by imagination, prototyping, and empathizing with the user (Conklin, 2006; Lawson, 2010). Although conventional qualitative research will often involve iteration as new information is gathered, a design approach will consciously trigger such iterations by presenting research participants with design ideas. As Cross explains, *"design reasoning is different from conventionally acknowledged forms of inductive and deductive reasoning … Science investigates extant forms; Design initiates novel forms"* (Cross, 2011, p33). As such, the logic of a design approach is often described as being abductive in nature, in the sense that the designer moves between suggesting solutions as interpretations of alternatives to what currently is and gathering data about the setting and the problems, gradually refining the solution and the problem articulation based on new data and insights (Alvesson & Kärreman, 2007).

Thus, in a design process the gathering of contextual information and the process of developing solutions happen concurrently, together with people and communities, often with the participants perspective as an important empirical foundation itself (Čaić et al., 2019).

SD process and tools

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The iterative design process results in a detailed understanding of the problem, the stakeholder, and their needs which in turn informs the subsequent iteration, and so on (Stickdorn & Schneider, 2010). Solutions are developed and problems are (re)defined gradually and in parallel until a feasible and desirable intervention emerges. This process involves quick prototyping of ideas and solutions early in the design process where there is still room to make changes at a relatively low cost (Blomkvist, 2014) .

A key innovation of service design is its capacity to support the creation of new services together with users, where a wide range of actors in a service system are engaged in a creative process to define problems and develop solutions (Patrício et al., 2018). This approach is critical to ensure the inclusion of multiple perspectives early in the design process, so that the inherent complexity in a given system is captured and translated into new services that are feasible and scalable from the perspective of programme implementers (Sangiorgi et al., 2017; Patrício et al., 2018).

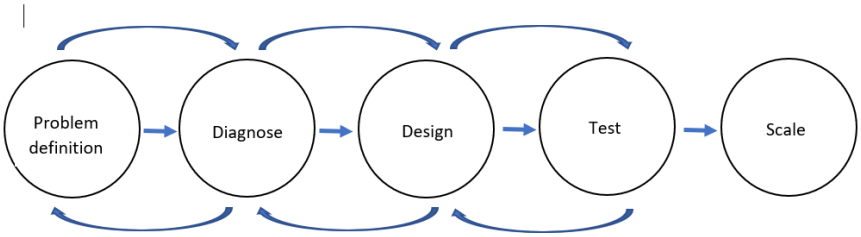

Figure 1. The stages of a service design driven intervention process, adapted from *Tantia, (2017)*

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SD limitations

Despite the potential of SD to improve public policies, it does have several procedural and practical limitations as a methodology. Firstly, the approach does require a degree of expertise, knowledge, and experience to oversee a SD study effectively (Leitch, 2016). However, this constraint can be relatively easily and quickly overcome with appropriate training and involvement in a study with sufficient guidance (i.e. Lambe et al., 2020). Furthermore, the willingness to embrace the inherent complexity of challenges that SD seeks to address can make it difficult for designers to evaluate the limits to which they should set boundaries to the systems they are trying to understand (Polaine et al., 2013). Usually however, this difficulty can be overcome by series of iterative steps where knowledge is consolidated to a point where the designer is confident about limiting the boundaries of the system by applying the principle of 'differences that make a difference' to delineate the boundary edge (Bateson, 1972; Saunders et al., 2018). Such a stepwise approach allows for the

subsequent identification and/or analysis of environmental, institutional, and social boundaries of the particular study, including informing the selection of significant stakeholders.

3.2 Discrete Choice Experiments

DCEs were first developed as a means of understanding consumer demands for particular products or services (Louviere & Woodworth, 1983). They have their origins in the economic theory of demand, and especially in the work of Lancaster, who proposed that the demand for goods was effectively driven by demand for specific combinations of their characteristics (Lancaster, 1966). DCEs are a quantitative method that allows for the systematic elicitation of such individual preferences. Importantly, the approach allows for the thorough evaluation of how different characteristics (or *attributes*) of a proposition - or in this case policy intervention - are valued by a participant: how they balance these attributes, and how they evaluate the relative importance of different attributes against one another (Street & Burgess, 2007; Bennett & Birol, 2010).

The benefits of being able to rigorously 'test' the support and interest that an intended future policy has, in a relatively cheap and timely manner, prior to its deployment is significant. Not only are DCEs able to tell a policymaker whether or not a particular programme or service is valued in a binary sense, but of far greater value is its potential to provide a detailed measurement of how the policy's different constituent components are valued in relation to one-another (Hensher et al., 2005; Landmann et al., 2018).

In comparison to Behavioural Games and Randomised Controlled Trials (RCTs), the distinction that DCEs present hypothetical scenarios of policy design to participants to be considered within their real-life setting allows incorporating contextual SD considerations more easily. Although the number of attributes is limited (DeShazo & Fermo, 2002) and their selection and description need to be handled with care to avoid multicollinearity and omitted variable bias (Mangham et al., 2009; Coast et al., 2012), their design is comparatively flexibly adapted to local context (Abiiro et al., 2014).

DCE limitations

Despite these advantages, the utility of DCEs are however limited by a number of procedural, practical and theoretical challenges (DeShazo & Fermo, 2002; Hoyos, 2010; Lancsar & Savage, 2004; Johnston, Boyle, Adamowicz, et al., 2017). Firstly, whilst the application of the DCEs themselves are relatively straightforward to administer once devised, their construction does require a significant familiarity with advanced notions of choice modelling for the experimental design (Lagarde &

Blaauw, 2009; Johnston, Boyle, Vic Adamowicz, et al., 2017). Secondly, the selection of attributes and levels are crucial for the meaningfulness of the resultant experimental data. Poor or ill-defined attribute selection with imprecise or counter-intuitive weighting of levels will reduce confidence that participants are able to make informed and representative selections from the available choice-sets (Coast & Horrocks, 2007; Kløjgaard et al., 2012).

To avoid this, it is strongly recommended by experts to use qualitative approaches to ensure that choice-sets are meaningful and relevant to experimental participants: *"We cannot overemphasise how important it is to conduct this kind of qualitative, exploratory work to guide subsequent phases of the stated preference study… The study team should endeavour to understand the dimensions… along which the product is evaluated by consumers and how specific levels of these dimensions are expressed…"* (Louviere, Hensher, and Swait 2000: pg 257-8). Despite the recognised importance of the necessity to conduct substantive qualitative research to better select, frame and translate the DCE, in practice many published studies fail to appropriately engage in the qualitative component of the experiment, or little information is provided about how this phase was conducted in practice (Rakotonarivo et al., 2016; Vass et al., 2017) ~~(Vass et al., 2017)~~.

4. Illustrative case study - WII in Uganda

4.1 Case study background

Economists from Norwich Institute for Sustainable Development (NISD) at the University of East Anglia and partnership institutions have studied the risk-taking and risk-sharing habits of smallholder farmers in Bugisu in eastern Uganda since 2001.[1] Working with major insurance companies in the country, agricultural extensionists, farmers' organisations, seed companies and agro-dealers, research findings were translated into recommendations for risk protection measures that would encourage agricultural investment, increase the productivity of farms, and lead to higher incomes and poverty reduction (Balungira et al., 2016; McSherry, 2017). The main recommendation was to bundle Weather Index Insurance (WII) with authenticated agricultural inputs and credit, as well as to offer this to established risk-sharing groups, in particular village savings and loans associations (VSLAs) (Verschoor, Clist, et al., 2016).

[1] Research findings are reported in *inter alia* Humphrey and Verschoor (2004a,b), Harrison et al. (2010), D'Exelle and Verschoor (2015), Verschoor et al. (2016) and Verschoor and D'Exelle (2021).

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However, UEA's economists involved in the research were not confident in this recommendation. It was inferred from research findings obtained in lab-in-the-field experiments, and therefore based on behaviour observed in stylised settings, in which hypotheses are tested about particular factors in isolation by keeping all other relevant factors at bay that determine behaviour in real life. In complex settings, these other factors interplay with the factors tested, which may undo or reinforce (as the case may be) the effect of the factors studied in the experiments. Moreover, it was silent about some of the other factors that previous studies of WII have found to be important in determining its desirability for the purposes of risk protection.[2]

UEA's economists thus faced the challenge of understanding better (than their experiments had allowed them to) the complexity of factors behind risk protection that would interplay with the provision of WII in the context of farmers' livelihoods in Bugisu. In order to meet this challenge, they teamed up with the team of social scientists from the Stockholm Environment Institute (SEI) to implement the study described in this paper.

Our case study was conducted in Bwikhonge, Bulambuli district of eastern Uganda with the objective of understanding the viability of different WII designs from the perspective of local smallholder farmers. The study applied a combined SD and DCE approach whereby each methodology would operate as an independent body of work but conducted in a coordinated fashion to facilitate the triangulation of data and findings.

WII is a financial service innovated specifically for application in low-income rural areas, where traditional insurance schemes have been shown to be too costly for widespread uptake. Based on a verifiable index of weather patterns that correlates with on-farm losses, WII can save otherwise prohibitive transaction and claim verification costs and has enjoyed increasing attention as a promising lever out of rural poverty traps (Barnett & Mahul, 2007). As with other insurances the intention of risk pooling and risk spreading by design aspires to scalable uptake across geo-climatic areas. At the same time, WII design features are highly context dependent. Whilst ecological, climatic and agricultural factors may play a preliminary role to determine an insurance's risk coverage, institutional arrangements (e.g., pay-out channels, bundling options or group insurances)

[2] For instance, a large number of studies have found that illiquidity, i.e. not having sufficient cash at hand when the premium payment is due, is negatively associated with WII uptake (Giné et al., 2008; Cole et al., 2012, 2013; Hill et al., 2013; Akter et al., 2016; Casaburi and Willis, 2018; Belissa et al., 2019). As well as illiquidity, lack of trust in the provider and/or lack of trust in the product has frequently been found to impede WII uptake (Giné et al., 2008; Cole et al., 2012, 2013; Karlan et al., 2014), and the suggestion has been made to use trusted pay-out channels to increase uptake (Giné et al., 2008; Cole et al., 2013)..

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to reduce transaction costs, avoid unforeseen risks, and build trust and demand need to be socio-economically and culturally contextualized (Dercon & Gollin, 2014).

Clearly, WII has great promise as a means of alleviating poverty and preventing food insecurity in low-income countries but to date there has been disappointing uptake of early schemes (Platteau et al., 2017). With notable exceptions (Clarke, 2016), what has so far been generally under-researched is understanding how simple deficiencies in the design of many index insurance products - often related to local, contextual factors - has resulted in limited uptake of these products (Dercon, 2007; Dercon et al., 2008). A promising avenue of research, and a suitable application of our approach, was therefore to try to address these deficiencies and design WII packages that would be more likely to be adopted.

4.2 Service Design Phase

In phase one, SD methodology was applied to gain a contextual understanding of the socio-economic and ecological system and relevant actors' perspectives. Our objective was thus to do more than simply use qualitative methods as a means to improve the DCE survey, ~~engaging in a qualitative survey honing excericse for the DCE~~, but rather it was to engage in an independent co-design process with farmers and other key stakeholders such as agricultural extension workers, district agricultural officers, and a major provider of agricultural insurance in Uganda. With the ~~objective~~ purpose of co-designing prototype of a future WII product which contained features which would be of value to such stakeholder groups[3]

During the SD phase, we conducted 20 participant observations, 48 key informant interviews, 14 field workshops, two larger workshops – a solutions prototyping, and a testing and validation workshop - both with 40 local farmers and stakeholders. Apart from the key informants, participants were randomly sampled household heads and spouses taken from the same population lists that were used in the subsequent DCE phase that had been generated in previous rounds of fieldwork. Participant observation is typically the starting point in a design process, to better understand the users' context. In our case, participant observation allowed us to quickly familiarise ourselves with the farmers' daily practices, and to relate their daily routines to the themes of the interview. Interviews and field workshops were conducted at respondent's homes and/or farms by four research teams each consisting of one research lead and one assistant, using paper and pencil to record responses. Specific activities included detailed mapping of annual farming, income and risk

[3] See Lambe et al. (2020) for the conceptual foundation and examples of this approach in the Global South.

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cycles, risk response journeys, actors and financial flows along crop value chains, and a framework assessment of farmers' risk coping capacity.

The stages and operation of an ideal SD study are outlined in the companion methodological paper see Dehmel et al., (2021), and further examples of SD methodology can be found in similar studies such as see Jürisoo et al., (2018); Muhoza & Johnson, (2018); Lambe et al., (2020). As an explicitly iterative and abductive research approach however, the actual practice of conducting a SD study in the field means that the specific activities will be responsive to the study's contextual demands and constraints, as was the case here.

4.2.1 The emergence of key insights

Whilst the ordering and selection of fieldwork activities broadly followed the SD model of problem co-definition, actor-centred mapping, experience-based problem definition, rapid prototyping and then design and qualitative testing of the insurance prototypes, in practice a significant degree of iteration and repetition of stages occurred as different lines of enquiry developed (Lambe, Ran, Jürisoo, et al., 2020a).

As an abductive process, this is typical of a SD study where the process of learning and doing happen concurrently. We summarise below several strands of such enquiries, and how they led to formalised findings.

Mapping farming and income cycles

An ongoing line of enquiry was to establish with farmers how the annual crop and income cycle interacted in this heavily agriculturally dependent region. It was shown that crops are not grown in isolation, nor is finance linked to individual crops. Rather, each crop is grown as a means to finance future costs and investments for subsequent cultivation periods.

In Bwikhonge the end of the first growing season starts with preparation of the land and planting in January and February, with associated costs incurred for inputs which included (for some) the renting of land, hiring of additional labour, the purchasing of seeds and fertilizers, etc. Major sales of maize – the primary first season crop – occurs during August and September, at which time farmers reported being less income constrained than throughout the rest of the year. The second growing season begins in September with a more diverse range of cash-crops that include cotton, sunflower, tomatoes, etc. which are sold around November and December. Since the majority of farmers subsisted on the maize (primarily) that was produced in the first growing season, the decision about

investment in the subsequent growing season was highly dependent on its relative bounty. Since, with a good harvest and food security assured, they would have greater flexibility about their choices and investments (and potential earnings) going into the second growing season. Conversely, a poor first harvest, restricted choice as the demand to satisfy basic needs outweighed maximising agricultural earnings.

Accordingly, the end of the maize season and the end of the cash crop season were identified as potential promising timings for the insurance premium payment – with the significant qualifier that such premiums may not be within reach of the most vulnerable farmers. Furthermore, the SD phase suggested that insurance that could provide cover to specific crops seasons might be preferable to a comprehensive annual policy.

Mapping diverse risk coping mechanisms

It was apparent that in the absence of formal insurance, farmers in the region had an array of risk management strategies. We found through mapping and comparing risk response journeys from different farmers that there were substantial differences between household risk coping strategies, even in households that were ostensible socio-economically similar. We identified 11 categories of behaviours that farmers engage in when responding (as individuals and households) to risks or shocks – ranging from selling of land or other assets to borrowing money from friends or family, etc. Broadly these could be clustered along four key metrics or categories: social networks, social institutions, agricultural diversity, and economic diversity.

These four categories represent the diverse sources of capacity for farmers to respond to risk. Taken together, the categories are a way to understand overall capacity to respond to shock, rather than risk response based solely on economic wealth. To capture the richness of the risk coping strategies applied, we mapped the risk response capacity of each farmer we interviewed along these four dimensions, and then visualized the overall risk capacity using a simple spider diagram (see supplementary material in Dehmel et al., (2021).

As we began to develop an ever more detailed and substantive understanding of the agricultural system and the users operating within it, in collaboration with our colleagues at The Field Lab Uganda, we were able to develop farmer “archetypes” to describe each category and to devise a narrative history and a name for each one. An archetype can be thought of as a model representing an observed pattern in terms of composite factors or characteristics (Vaillancourt et al., 2014;

Saadat et al., 2018). The purpose of developing the archetypes was to find a way to represent multiple complex characteristics that determine how different types of farmers cope with risk within the context of the system they were operating. We named our characters (A)ndrew (strong capacity to respond to risk), (B)etty (weak capacity to respond to risk) and (C)harles (medium capacity to respond to risk).

From archetypes to prototypes

During the first round of 10 interviews, ideas for prototype insurance products emerged and were discussed and refined during subsequent interviews, and in the field workshops. This abductive mode of testing early "sketches" of an insurance product resulted in deeper insights about the needs of different types of farmers as well as critical insights about the community that would have implications for the design of a WII. For example, when testing different payment models for insurance packages we found that many less well-off farmers could not afford even very low-cost insurance. Another early prototype tested during the interviews involved the local village savings and loan association (VSLA) acting as the agent responsible for handling WII pay outs. Responding to this prototype, we learned from several farmers that levels of trust in the local VSLA were generally very low, with some reporting that they had been "cheated" by the VSLA in the past. However, through these discussions on trust in the community, we learned that most farmers have a high regard for other community organisations including agricultural input stores and other microfinance institutions such a burial savings schemes.

During the solutions prototyping workshop we used storytelling and sketching to describe and visualise the archetypes in detail for the participants. After presenting each archetype, we asked the participants whether they could identify with (A)ndrew, (B)etty and (C)harles and invited them to suggest changes to the details of the archetypes to bring them closer to the reality of the community. Once satisfied with how the archetypes were described, the participants worked in groups to map out the risk response journeys that they imagined each of these characters taking in the event of a sudden shocks (such as severe drought or pest infestation).

Using these archetypes and informed by the SD fieldwork as well as with references to earlier foundational work by the UEA economist team, we then introduced the refined insurance prototypes that had emerged from the interviews during a subsequent design and testing workshop. These protoypes included a 'full coverage', more expensive insurance option, that would cover all losses; a less expensive option that would cover the cost of inputs (seed and fertilizer); and a cheap

'basic coverage' option that would provide a safety net in the event of a disaster to protect farmers from starvation. We chose not to place a price on the insurance products since the point of the exercise was to discuss more generally which sort of model would be appropriate for each farmer archetype, rather than agree on the price level of each. Given the expressed inability of some farmers to pay for even inexpensive insurance, prior to the workshop we sketched a savings scheme as an alternative to an insurance product, that could provide some financial relief at particularly difficult times in the year.

The workshop participants, again working in groups, were then asked to match the appropriate insurance package with each archetype, with the option of not selecting any if none were considered appropriate. This exercise provided an entry point to discuss the prototyped insurance products, but more importantly, to learn more about the needs and constraints of each of the archetypes.

Table 1. Summary of key findings from SD phase

1.	Insurance was seen as an attractive option for some, but not all, farmers
2.	There is significant heterogeneity in how farmers respond to risk, with financial capacity being just one source of risk response capacity. The key categories of risk response capacity identified were: social network; social institutions; agricultural diversity and economic diversity.
3.	Farmers in this area can be considered to have either strong, medium, or weak capacity to respond to shocks. Insurance does not appear to be an appropriate option for farmers with weak risk response capacity.
4.	Trust in the formal VSLAs is generally low, and most farmers responded negatively to the idea of a VSLA being involved in handling insurance pay outs.
5.	Trust in other community organizations (e.g., agricultural input stores and alternative finance organizations) is high.

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4.3 Discrete Choice Experiment Phase

In this section, we describe our discrete choice experiment. At the time of the fieldwork, in the period February – July 2018, no WII was offered in the study area. Our experiment is therefore about hypothetical demand by research participants who, prior to the fieldwork, had little or no understanding of WII. This meant we had to teach the participants about WII before our experiment was implemented, as described in detail in a companion methods paper (Dehmel et al., 2021).

Discrete choice experiments are a quantitative technique for eliciting preferences and have been used previously for understanding determinants of WII uptake (Tadesse et al., 2017; Sibiko et al., 2018; Ward and Makhija, 2018). Individuals state preferences over hypothetical alternatives. The characteristics that describe each alternative, for instance the identity of the policy holder, are called attributes. The values or conditions that an attribute can take are called levels. So, in the example of the attribute 'identity of the policy holder', the levels could be 'an individual' and 'a savings group'.

Our focus in the DCEs is squarely on individual decision making. The discrete choice experiments were conducted in face-to-face interviews with individual respondents that took about 45 minutes. Prior to the interview, each respondent participated in a 1.5h long workshop that ensured they obtained a full and correct understanding of the insurance product and its possible features. The workshops (30 in total) were organised by our fieldwork partner (The Field Lab Uganda) and were exclusively intended to convey the necessary information to allow for meaningful responses to the DCE. Using posters for visual reference, they covered the general concept of WII, that pay-outs may not be equal to experienced costs, that different insurance designs may vary in the period of coverage, timing of premium payment, pay-out channels, and bundling options and finally that WII could be sold to individuals or groups. Respondents were encouraged to ask questions, whilst any discussion of benefits and shortcomings were explicitly dismissed. The workshop followed a set script and was delivered by the same person to ensure consistency.~~The discrete choice experiments were implemented in sessions that were conducted in the afternoons of fieldwork days. During the morning, all participants took part in workshops that ensured they obtained a full and correct understanding of the insurance product and its possible features. These were explained at length to all participants, with helpful illustrations and examples, which had been extensively piloted. While crucial, the workshops have two drawbacks: their heavy demand on respondents' time (for which they were financially compensated) and unobserved influences on their choices (e.g. induced by the delivery style of a particular workshop leader).~~ See the companion methods paper (Dehmel et al., 2021) for further details of the implementation of the DCEs~~ of these workshops~~.

4.3.1 Selection of attributes and levels

Table 2 describes the attributes and levels that we selected. They are rooted in the literature on WII uptake, shaped by the preceding service design phase, and contextualised based on extensive prior qualitative fieldwork, which we have documented separately (Dehmel et al., 2021).

Attribute 1 is the identity of the policy holder. Our interest here is in whether WII offered to savings groups raises demand, as predicted by Trærup (2012), De Janvry et al. (2014) and Mobarak and Rosenzweig (2012, 2013) provided that savings groups are sufficiently limited in the protection they provide against common shocks. VSLAs are the dominant savings groups in our study area: 77 percent of households in our sample have at least one member who belongs to a VSLA, with mean VSLA membership per household being equal to 1.06. We therefore specified two levels for attribute 1: the policy holder can be an individual (level 1) or a VSLA (level 2).

A large number of studies have found that liquidity, income and wealth levels are positively associated with WII uptake (Giné et al., 2008; Cole et al., 2012, 2013; Hill et al., 2013; Akter et al., 2016; Casaburi and Willis, 2018; Belissa et al., 2019). We therefore investigated two potential means of increasing uptake by taking liquidity concerns into account. The first is to reduce the premium buyers need to pay by taking out insurance for a growth phase rather than the whole season (Hazell and Hess, 2010). The service design phase of the research suggested the levels 'germination', 'plant growth', 'flowering' and 'the whole season' for the attribute 'growth phase covered' (Attribute 2).

Table 2
DCE design: Attributes and levels

Generic Attributes		Drought insurance for maize cultivation during the first annual season. Insurance premium levels specified as affordable levels meeting WTP and dependent on coverage phase.			
Alternative specific attributes		**Level 1**	**Level 2**	**Level 3**	**Level 4**
1.	Policy holder	Individual	Savings group	-	-
2.	Coverage phase	Germination	Plant growth	Flowering	Whole season
3.	Timing of premium payment	January-February	August-September	November-December	-
4.	Payout delivery channel	Local Agent	Agro-input shop	Mobile money	-
5.	Bundling	No bundling	Bundling with certified seed	Bundling with seed and pesticide	Bundling with seed, pesticide and an agro-input loan

The second way of tackling illiquidity that we investigated is avoiding liquidity constraints through the timing of the premium payment (Mcintosh et al., 2013). The service design phase suggested that August-September (after the main maize harvest) and November-December (after the harvest of the second season crop) are times of relative cash abundance, whereas the natural period to pay for WII, just before the main growing season, in January-February, is not, because payments need to be made for school fees, agricultural inputs and (sometimes) renting in land. The three periods mentioned are therefore the levels corresponding with the attribute 'timing of premium payment' (Attribute 3).

As well as illiquidity, lack of trust in the provider and/or lack of trust in the product has frequently been found to impede WII uptake (Giné et al., 2008; Cole et al., 2012, 2013; Karlan et al., 2014), and the suggestion has been made to use trusted pay-out channels to increase uptake (Giné et al., 2008; Cole et al., 2013). The service design phase suggested a 'local agent', an 'agro-input shop' and 'mobile money' as levels for the attribute 'pay-out delivery channel' that are worth investigating (Attribute 4).

Finally, in Attribute 5 we consider the effect on demand of combining the provision of WII with products that reduce basis risk, so-called 'bundling' (Awondo et al., 2017; Ward and Makhija, 2018). Prior qualitative research suggested certified seed in order to deal with the risk of counterfeit inputs, and pesticides for combatting crop pests and diseases. Reliable inputs such as seed and pesticides can be hard to get hold off in the study area. To provide them (at the normal commercial price) together with WII would take care of three major risk factors: drought, pests and diseases, and counterfeit seed. We also investigate whether adding an agro-input loan to bundled WII increases the latter's attractiveness. The rationale is that, when fear of bankruptcy is sufficiently low, a loan for paying for agro-inputs can be confidently taken out (cf. Fafchamps, 2003: 151-158). Credit could therefore add value to bundled WII that sufficiently reduces basis risk and increase demand for WII.

We ensured that the combination of levels selected for our 12 pairs of choice alternatives is D-efficient (see Dehmel et al., 2021 for further details).

4.3.2 Specification of the insurance premium

In randomized control trials, demand for WII is found to be pointedly price sensitive (Mobarak and Rosenzweig, 2012, 2013; Cole et al., 2013; Karlan et al., 2014). However, we decided not to introduce variation in the insurance premium in our choice experiment because our interest is in features of an attractively priced insurance product, not in willingness to pay for an as yet unfamiliar and hypothetical product.[4] We therefore specified the insurance premium as an amount that research participants would feel comfortable in paying:

"Suppose a company is offering you Weather Insurance for growing maize during the first season […] ***You are indeed interested, because they want to sell it to you at a premium you can afford and are happy to pay****".*

4.3.3 Sampling and sampling characteristics

From the study area of Bwikhonge, 196 respondents from maize-growing farm households were randomly selected from ten villages in Bwikhonge sub-county[5] purposefully according to perceived exposure to drought, geographical spread (to increase representation), accessibility and availability

[4] ~~Moreover, hypothetical willingness to pay (WTP) is not necessarily a good basis for measuring the price elasticity of demand for WII; see Mcintosh et al. (2013), who find that actual demand for WII, as measured through an RCT, is poorly correlated with stated WTP elicited in a prior research phase.~~

[5] Sub-county is the second-tier administrative unit in Uganda.

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of a research venue. For each selected village a sampling frame of all households and their heads and spouses was then devised, 22 households were selected per village (20 + 2 spare), participants were randomly selected (subject to the constraint of one per household) and if the selected individual was not available then their spouse would be invited (see Dehmel et al., 2021 for details). Table 3 presents characteristics of the respondents in the sample and their households. 64 percent of respondents are female, which reflects the random selection procedure followed: when the household head of a randomly selected household was married, either they or their spouse were randomly selected for participation. If the randomly selected person was not available for participation, then their spouse could participate. Larger unavailability of men would explain why there are more women than men in the sample.

73 percent of respondents have been educated at the primary level or received no education. Even those educated at the primary level have not necessarily completed it; the table presents the highest level of education achieved, whether or not respondents finished school. Only one person in the sample attended a tertiary education institution.

The land that is cultivated in the households of the sample respondents is 2.3 acres on average. This figure includes land rented in by the household and excludes land that is rented out. We report on land ownership, a crucial variable in the analysis, below.

A second crucial variable is VSLA membership, which is common in the study area. On average, there is slightly more than one person per household a member of a VSLA in the sample. These VSLAs typically consist of between 10 and 50 members in our study area, who contribute weekly savings to a common fund. Members may borrow money from this fund for a period of 1-3 months at an interest rate of 10 percent per month. The accumulated savings and interest are distributed among members in proportion to members' savings. This takes place at the end of the annual savings cycle, either in January or in February, which is when cash needs for agricultural inputs and school fees are highest.

Table 3

Descriptive statistics of sample respondent and households' characteristics.

		N (%)	Mean	St. Dev.	Min-Max
Respondent characteristics					
Female		126 (64.29)			
Age		196	42.06	15.12	18-78
Education					
	No education	17 (8.67)			
	Primary	127 (64.80)			
	Secondary	47 (23.98)			
	Tertiary	1 (0.51)			
Relation to household head					
	Self	108 (55.10)			
	Spouse	85 (43.37)			

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	Child	3 (1.53)			
Household characteristics					
Household size		196	6.31	2.82	1-17
Cultivated land (acres)		196	2.34	1.93	0-17
Cultivating maize		196 (100)			
Number of second season crops		196	1.48	0.89	0-4
Number of VSLA memberships		196	1.06	0.79	0-4
Years living in Bwikhonge		196	33.68	18.03	2-76

4.3.4 Regression analysis

The analysis of the responses from the DCEs are often modelled within the Random Utility Theory (RUT) framework developed by McFadden (1974). In RUT, the utility of an alternative presented to the individual is decomposable into two parts: a systematic (observable) component specified as a function of the attributes of the alternatives (function v below), and a random element ε_{ij} representing the unobserved variation in preferences (de Bekker-Grob et al., 2012).

$$U_{ij} = v_{ij}(A) + \varepsilon_{ij}$$

where v_{ij} is the measurable utility of alternative j of attribute A for individual i. The subject will then choose alternative j over k if:

$$v_{ij} + \varepsilon_{ij} > v_{ik} + \varepsilon_{ik} \text{ or } v_{ij} - v_{ik} > \varepsilon_{ik} - \varepsilon_{ij}$$

The probability of choosing alternative j conditional on the attributes and choice set C is:

$$P(j_i|A, C) = P_{ij} = P\left[v_{ij} - v_{ik} > \varepsilon_{ik} - \varepsilon_{ij}\right] \forall\, j \neq k$$

So the probability of choosing alternative j (over k) is given by the probability that the difference in the error term (i.e. random element) is smaller than the difference in the observable utility component (McFadden, 1973; Ryan & Gerard, 2003). A cumulative distribution function is assumed for the difference in the error term, which in our case was a standard normal CDF, as we deploy a random effects probit model (REP) in the analysis.

Our choice is motivated by the long tradition of this method for the study of DCEs, well-documented in successive literature reviews (Ryan & Gerard, 2003; de Bekker-Grob et al., 2012; Clark et al., 2014; Soekhai et al., 2019), and, as we argue next, because it fits our data generation process well. First, the method is suitable for the analysis of binary choices, which is strictly the case in our experiment, where participants were presented with just two choices without the possibility of opting out (De Bekker-Grob et al., 2012). Second, our data possesses a panel structure, as it contains the sets of 12 responses each per participant. In other words, it consists of 12 choices between two insurance options for the 196 respondents that took part in the experiment. Lastly, REP does not require the

stringent Independence of Irrelevant Alternatives (IIA) assumption, which other competing methods must hold and would be violated in our application (McFadden, 1974; De Bekker-Grob et al., 2012).[6]

As described in eq. (1), the latent relationship between the utility of the alterative and its two components is assumed to be linear, specifically in our application it takes the following form:

$$U_{ij}^{*} = \alpha + \boldsymbol{A_j\beta} + \boldsymbol{X_i\delta} + \varepsilon_{ij}$$

where U_{ij}^{*} is the latent utility of alternative j for individual i , which is not directly observed, and instead is represented by bivariate variable Y_{ij} that takes value 1 if an option is chosen (i.e. $U_{ij}^{*} > 0$) and 0 if it is not. $\boldsymbol{A_j}$ is a set of bivariate variables which define the attributes of every alternative j. They include whether insurance is offered to saving groups, whether it is bundled with inputs, the timing of the premium payment and the payout delivery channel (see Table 4 for the full list). Lastly, $\boldsymbol{X_i}$ includes the individual level controls, and ε_{ij} is the error term.[7]

We report in Table 4 two models, one estimating the unconditional effect of insurance being offered to savings groups (model 1), the other with that effect interacted with land ownership and trust in the savings group (model 2).[8] The table reports marginal effects. If these are multiplied by 100, then they can be interpreted as the change in percentage points of the probability of an insurance option being chosen as a result of the change in the attribute under consideration from its base level to the level associated with the marginal effect. The main effects are the following.

First, when insurance is offered to a savings group rather than to an individual, the unconditional probability of the insurance option being chosen goes down by 18 percentage points (model 1). However, when land ownership and trust in the savings group are interacted with the saving group attribute, its effect changes substantially.

Trust in savings groups is measured on a scale from 1 to 5 and land ownership (bar the four largest landowners in the sample) ranges from 0 to 10 acres. Specification (1) of model (2) shows that, for a person with no trust in the savings group and no land, the probability of choosing an insurance option when it is offered to the savings group goes down by almost 40 percentage points when the

[6] While more complex alternative methods exist which could fit our data, like the mixed (or random parameters) logit model, we believe that we lack the necessary priors to decide on the crucial assumptions that the method requires. For instance, we neither know which parameters to specify at random, nor the distribution they could follow. If decisions like these—and several others—are not carefully researched and convincingly settled, they can greatly compromise the internal validity of the analysis and lead to misuse of such advanced method, as documented by some of its exponents (Hensher and Greene, 2003).

[7] Controls include age, sex, level of education, land owned and trust on VSLAs.

[8] All significant effects shown in Table 4 are robust to the inclusion of controls and (where appropriate) the sequential addition of interaction terms.

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alternative features it. By contrast, for a person who fully trusts the savings group and owns 10 acres of land, this decline in the probability of choosing the option is only 6 percentage points and becoming insignificant, as shown by specification (2) of this model. So individual contracts are clearly preferred to group contracts, but the extent to which this is the case largely depends on trust in the group and land ownership.

Table 4:

Influence on Insurance Choice of DCE Attributes (marginal effects in probit models)

Model	(1)	(2)	
Specification	(1)	(1)	(2)
Attributes			
Insurance unit			
Savings group compared to individual contract	-.1776***	-.3983***	-.0585
	(-4.47)	(-4.59)	(-0.389)
Trust in savings group	-.0001	-.0002	-.0002
	(-0.54)	(-1.03)	(-1.03)
Land owned in acres	-.0001***	-.0001***	-.0001***
	(-3.18)	(-3.04)	(-3.04)
Bundling (base: no bundling)			
With certified seed	.1066***	.1078***	.1078***
	(4.25)	(4.27)	(4.27)
With certified seed and pesticides	.0670***	.0669***	.0669***
	(2. 62)	(2.59)	(2.59)
With certified seed and pesticides and an agro-input loan	.1051***	.1054***	.1054***
	(4.76)	(4.73)	(4.73)
Timing of premium payment (base: Jan-Feb)			
August-September	.0035	.0042	.0042
	(0.15)	(0.18)	(0.18)
November-December	.0582***	.0591***	.0591***
	(2.72)	(2.74)	(2.74)
Payout delivery channel (base: local agent)			
Agro-input shop	.0440**	.0436**	.0436**
	(2.32)	(2.28)	(2.28)
Mobile money	.1294***	.1300***	.1300***
	(5.72)	(5.70)	(5.70)
Coverage phase (base: whole season)			
Germination	-.3726***	-.3758***	-.3753***
	(-13.40)	(-13.59)	(-13.62)
Plant growth	-.2863***	-.2885***	-.2883***
	(-11.91)	(-11.99)	(-12.01)
Flowering	-.2094***	-.2105***	-.2104***
	(-7.86)	(-7.86)	(-7.87)
Wald chi2	205.04***	246.04***	246.04***
Observations	4,696	4,696	4,696

Random effects probit estimation. Number of observations = 12 choices per respondent times 196 respondents. Marginal effects reported with z-statistics in parentheses. * indicates statistical significance at the 10%, ** at the 5% and *** at the 1% level. Standard errors estimated are robust to several kinds of misspecification (option vce(robust) for Stata's xtprobit command). Controls included in the models are respondents' age, sex, level of education, -land owned and trust on VSLAs.

Second, compared to no bundling, bundling with certified seed, pesticides and agricultural credit raises the probability of the insurance option being chosen by almost 11 percentage points, but the

same option without the loan is less attractive. One way of interpreting this finding is as follows. Agricultural credit is often avoided in the study area because of the fear of bankruptcy. However, when the major risk factors to crop growing are dealt with through bundled WII (the risk of pests through pesticides, the risk of bad seed through seed certification, the risk of a drought through insurance), then the option of agricultural credit can be confidently chosen. The fact that the WII option that includes both agricultural inputs and credit is most attractive may thus be a matter of risk reduction being large enough for the risk of bankruptcy following the taking out of a loan to be sufficiently low.

Third, the timing of the premium payment has only a small effect on WII becoming more attractive. Allowing payment during periods of greater liquidity, after the first harvest (August-September), or the second (November-December), increases probability that the WII option is chosen only in the latter case, when the payment can be made at the end of the second season. Despite the necessity to pay school fees and for agricultural inputs during the base level period (January-February), it is possible that the advantages of paying for insurance during times when liquidity is high are to some extent counterbalanced by the flexibility of not committing to the insurance until respondents know whether they can afford it, giving rise to the modest effects observed.

Fourth, receiving insurance pay-outs through mobile money raises the probability of choosing an insurance option by 13 percentage points compared to through a local agent, whereas the agro-input shop is only slightly preferred to the agent. This echoes the trust in and convenience of this payment method that informants mentioned during the qualitative phase of the research preceding the experiments.

Fifth, the whole season covered is strongly preferred to individual growth phases, despite the higher premium.[9] The effects are large too: 37 percentage points in the case of the germination phase. This resonates with the bundling result above in that it suggests that comprehensive risk reduction is sought after by farmers in this area.

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In sum, respondents prefer individual to savings group insurance, bundled with certified seed, pesticides and credit, receiving pay-outs through mobile money, and the whole growing season covered despite the higher premium that needs to be paid for that. Even though insurance being offered to savings groups never has a positive effect on the attractiveness of it, the negative effect is much smaller when trust in savings groups is higher and land ownership larger.

[9] Recall that insurance premium levels are specified as affordable levels meeting WTP and dependent on coverage phase (Table 2).

4.4 Analysis and Discussion: Combining Service Design and Discrete Choice Experiments

In total, the combined fieldwork for the study took just four months to implement, and the team were ready to provide recommendations to the Agriculture Insurance Consortium of Uganda (AIC) within six months of the project start date. By concentrating far more directly *a priori* on the design phase of project interventions, the combined approach of SD and DCE methods is comparatively time, cost and impact efficient when compared with current practice: where learnings and improved efficiencies tend to come *a posteriori* in the policy cycle (Lopez-Acevedo & Krause, 2012). Both methods are clearly user-centred tools with an explicit aim of supporting the design of policy interventions (Mangham et al., 2009; Stickdorn & Schneider, 2010; Abiiro et al., 2014; Jürisoo et al., 2018). However, they are methodologically distinct and to our knowledge have not before been combined (see Figure 2.).[10] The case study illustrates the value of the combination, in three distinct ways.

First, the *SD phase informed the DCE design*. Examples are the identification and specification of the attributes 'timing of premium payment' and 'coverage phase', and their levels. Here the SD phase fulfilled a similar function to the qualitative research that normally precedes well-designed DCEs.[11]

Second, the *SD phase triangulated research findings from the DCE phase and vice versa*. At times, a DCE finding validated an SD finding, as when low trust in VSLAs was found to hinder WII uptake provided through them. At other times, they were seemingly at odds, and a synthesis suggested new research insights. An example here is when, contrary to SD-based expectations, insurance for the whole season was strongly preferred in the DCE. This suggested that the importance for our research participants of comprehensive risk reduction outweighed the higher insurance premium that needed to be paid for that.

Third, *each methodology was able to uncover aspects of risk coping and protection that the other was not*. For example, the DCE found strong evidence for the prediction rooted in theory that bundling WII with inputs and credit increases its uptake (Awondo et al., 2017; Ward and Makhija, 2018), which the SD phase had not noticed. By contrast, the SD phase yielded nuanced insights that

[10] Having said that, choice experiments and qualitative methods have been combined in ways that resemble the combination of service design and choice experiments advocated here; see for instance Powe et al. (2005) and Schaafsma et al. (2017). The key distinction is that our choice of qualitative methods is subservient to a design process, which influences their focus and contents as discussed in Section 3.

[11] Note, the DCE conducted its own dedicated qualitative component to refine attribute and level selection and description, see Dehmel et al., (2020).

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a DCE methodology is probably too crude ~~for~~ to find. For instance, SD found that for asset-poor, weakly socially connected individuals, risk protection other than insurance needs to be designed. SD also revealed risk coping to be complex and multi-dimensional; our attempt failed to approximate this by a principal component-based index for use in the DCE analysis, which we think is a limitation of the quantitative method when used on its own. Finally, SD showed that the annual liquidity cycle in the study area affects the uptake of WII. The DCE failed to spot this because it was not able to isolate this factor from countervailing factors.

Based on the combined SD and DCE findings, UEA economists dropped their recommendation to provide WII through VSLAs, while advocating bundling WII with certified inputs and credit. The recommendation was adopted by the Ugandan insurance companies united in the AIC, which industry experts recognise had a considerable impact on the success of its nation-wide WII scheme.[12] Work is ongoing on risk-protection schemes that do justice to the heterogeneity of risk coping that the SD research uncovered (through the archetypes, and so on).

[12] The contribution of UEA economists' recommendations to the provision of bundled WII in Uganda is described in UKRI (2020).

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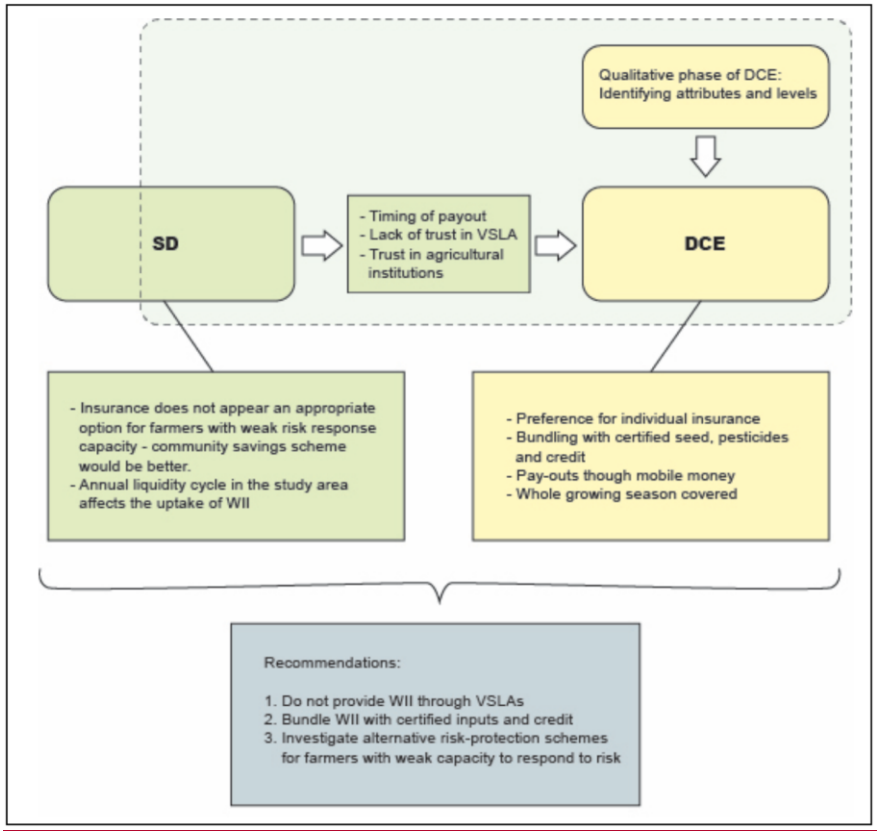

Figure 2. Graphic representation of the discrete and collective contributions of the SD and DCE research phases. The dashed line represents the parameters of the DCE investigation, whilst activities travesing this line are relevant for the wider project objective of informing the design of WII, but not necessarily relevant for the construction of the DCE itself.

Whilst traditional participatory approaches for policy relevant in-depth analysis of local contexts have often struggled to make effective use of the nuanced information in subsequent practical application (Uvin, 1995; Binswanger & Aiyar, 2003), SD when combined with DCEs thus provides a medium in which fine-grained locally informed insights can be transformed and incorporated into scalable and effective solutions. Furthermore, by combining the locally derived insights of SD into the design of subsequent DCE investigations, the research approach is able to effectively bring and transform nuanced qualitative insights into a quantitatively validated form. This delicate but robust transformation provides policymakers *operationally* with the type of data most readily required to build scalable development interventions, but crucially it also provides such

data in a form (more overtly scientific and measurable) that is generally more *politically* palatable amongst planners: where a positivist outlook tends to dominate, meaning that quantitative over qualitative evidence is generally favoured.

Since SD requires the users of a future intervention to be involved in problem definition as well as solution design, the approach provides agency to local actors to question core assumptions underlying a proposed intervention, and to critique proposed design features (Lambe, Ran, Jürisoo, et al., 2020a). For example, in our case study, we demonstrated how prototyping insurance products allowed community members to reject the idea that insurance would be appropriate for all farmers in the area, and to suggest another type of support for the most vulnerable farmers in their community. Such early engagement helps to insure against the potential emergence of negative unintended consequences of interventions (Escobar, 2011; Mills, 2012), and reduces concerns about the programmatic momentum or misplaced 'directionality' driving outcomes after deployment (Brooks et al., 2009).[13]

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On completion of the analysis of findings from the SD and DCE investigations, the outcomes were extensively discussed by the director of The Field Lab Uganda with farmer groups, agricultural extension workers and the district agricultural officer from the study area in about twenty individual meetings that culminated in three workshops. In this way, community members were given the opportunity to comment on the findings before they were taken up by Uganda's insurance providers united in the Agricultural Insurance Consortium (AIC).

5. Conclusion

We have highlighted the growing need to recognise that the world's most persistent development challenges are embedded within a highly complex web of interactive social, technological, and ecological processes. Working with such a degree of complexity is difficult and currently there exists a knowledge practice gap between researchers exploring such dynamics and policymakers and programmers mandated to address them. As shown in our illustrative example from Uganda, we hope that by emphasising the need to refocus on the design phase of programming and providing a

[13] Equally, the SD (and DCE) approach cannot guarantee that the study is not ultimately researcher-driven. Although the necessity of establishing 'users' needs before considering the identification of any potential problems (and certainly before sketching out any solutions) goes some way to protecting against this concern.

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methodological example of how to enable this, our work can contribute to addressing this wider deficit.

As we found in Bwikhonge, the combination of service design approaches and discrete choice experiments are highly compatible in achieving this refocusing on the design of development interventions prior to deployment. Both are explicitly outcome oriented and conceptually coherent in that they seek to gain an understanding of what might work in a given setting, and both recognise that solutions are likely to be multifaceted and complicated. The qualitative service designer sees their essential task as being to translate complexity at the individual and community level and analyse, consolidate, and transform such insights into data usable for decision makers at a higher level of policymaking. Discrete choice experimenters apply a quantitative approach that is tailored to the demands of the context for which they are designed, enabling the systematic testing and evaluation of a range of hypothetical scenarios.

An additional but important benefit of both approaches is the inherent need to work in close collaboration with individuals, communities and stakeholders who represent the target beneficiaries – it is only through such engagement that either approach can produce meaningful data. In so doing, the needs, requirements and constraints of such groups are brought into focus far earlier in the programme lifecycle than is typical. Whilst this doesn't, of course, guarantee that they will influence programme outcomes, it helps at a minimum to mitigate against the potential of negative unforeseen consequences caused by development interventions.

As the Uganda case also demonstrates, both methods have their own methodological limitations and can provide differing perspectives which can be confusing to interpret. Nonetheless, we would argue that accepting a degree of uncertainty in research findings, is on balance, a necessary and realistic consequence of attempt to explore solutions in such complex settings. Clearly therefore, the approach would benefit from the lessons learned from its adoption and application in different studies and settings. Even so, just as SD and DCEs have been useful for informing policymaking in different academic fields and global regions, we see no obvious reason why their application in a Global South setting would be any less beneficial.

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Designing development interventions: The application of service design and discrete choice experiments in complex settings.

Abstract

The persistence of problems such as endemic poverty, rising inequalities, climate change and biodiversity loss demands us to find solutions which are embedded in a highly complex web of interacting social, technological, and ecological processes. Service design (SD), an approach to directly involve citizens in the development and improvement of services and systems, shows promise as a tool to support the design of interventions to address complex development challenges in the Global South. In this paper we describe how service design was used alongside discrete choice experiments (DCEs) to inform the design of a Weather Index Insurance product for small holder farmers in Uganda. As part of the service design process, we used archetypes to capture and articulate the multiple vulnerabilities of farmers and quickly test prototype insurance packages to identify important design features. DCEs tested promising design features in a manner that complemented as well as triangulated the service design phase. *The results of both phases were used to inform the design of a WII product that has been taken up by major insurance providers in Uganda. The approach complements and builds on qualitative work typically done to inform DCEs by opening up space for research participants to question core assumptions, and by involving respondents directly in the process of designing a future service.*

Highlights

- Beyond informing the design of Discrete Choice Experiments, Service Design can provide rich contextual information relevant to the goals of the intervention in question.
- Prototypes and archetypes were useful for identifying important insurance product attributes early in the intervention design process.
- The combined approach allowed research participants to have agency in the process of designing an insurance product.
- The study's recommendation to bundle insurance with certified inputs and credit was adopted by Ugandan insurance companies.

1. Introduction

Transforming specific policy ambitions into practice is a complex and challenging process. This has proven to be particularly problematic for policymakers in the Global South working towards delivery of the multidimensional targets proposed in the Agenda 2030 framework (Fu et al., 2019). Critical reflections on this topic have often largely focused on a somewhat unproductive polemic between the relative strengths and weaknesses of top-down versus bottom-up programming (McCourt, 2012; Pritchett et al., 2013; Viterna & Robertson, 2015; Howlett, 2019). From the 1990s onwards, the drive for greater 'evidence-based policymaking' and the concomitant clamour for demonstrable 'aid effectiveness' led to significant advances in research approaches used to inform both the planning and the evaluation of development programming (Howlett et al., 2015). Nonetheless, and despite such advances, many persistent development challenges remain unresolved and there are growing concerns that programming cycles which rely on often expensive and lengthy learning processes may not be the most appropriate way to address the current and future developmental challenges (Guyadeen & Seasons, 2018; Lucas, 2019).

Indeed, in a rapidly evolving and complex world system, development programming must not only be able to meet new demands, but also requires speed and flexibility in transferring and adapting policy innovations across places and time (Ramalingam, 2013; Ramalingam et al., 2014; Development Studies Association, 2021). Echoing the Senior Vice President of the World Bank, Mahmoud Mohieldin (2019) "the business-as-usual model will not suffice to deliver the aims of 2030"; therefore the development community urgently requires means and methods capable of deploying programme innovations to complex challenges in a nuanced and appropriate, yet rapidly scalable manner.

In this paper, we argue that making an overt shift away from project evaluation and learning *after* deployment, toward a more explicit focus on intervention design *before* deployment, can help to deliver on this objective (Escobar, 2017; Sangiorgi et al., 2017; Maher et al., 2018b). Drawing on advances within the field of Design, we demonstrate how there could be significant benefit to applying a Service Design (SD) approach to deliver this shift in development programming focus, particularly when conducted in conjunction with complementary methodologies such as Discrete Choice Experiments (DCE).

Service design is a human-centred and iterative approach to service innovation (Holmlid et al., 2015; Wetter-Edman et al., 2014) that is gaining ground as a way to create systems and services that are

useful, efficient and desirable to the user (Penin, 2017; Stickdorn & Schneider, 2012). A central tenet in service design is the principle of co-creation, where actors in service systems engage in a creative process to define problems and explore solutions (Jones, 2014).

In the Global North we see an increasing trend of using SD to inform policy delivery and yet today this approach is rarely used when it comes to designing development programming (Howlett, 2011; Bason, 2017; Malmberg, 2017). We will show how the SD approach can be used to absorb a significant amount of nuanced information and translate such data into forms that can allow for the development of viable solutions to multidimensional challenges; and then, to complement and triangulate these insights, they can be used to inform choice experiments prior to deployment. Whilst each methodology can operate as an independent body of work, and each has its own strengths and limitations, as a combined approach, it is cheap, quick and reduces the risk of doing harm whilst providing an opportunity to deliver well-designed projects at scale. In particular though, we feel that it would be most immediately advantageous when it comes to designing programme interventions at a sub-national project level where the degree of complexity and multidimensionality often makes it challenging for traditional alternative approaches to deliver programmes at scale of sufficient nuance and appropriateness (Whitney & Kelkar, 2004; Datta & Mullainathan, 2014; Maher et al., 2018a).

Following this introduction (1), we outline where we see our proposed approach fitting into the broader discourse around development programming in complex settings (2), and then introduce the central concepts and applications of service design and discrete choice experiments (3). Following this description, we provide an illustrative example of where it has been employed to inform a complex financial, climate adaptation and equity programme in Uganda (4). We conclude with a discussion of the methodological approach in combination, its limitations, and its potential to inform future development intervention design (5).

2. The Challenge of Complexity

Historically, and contrary to negative stereotypes, governments and organisations have been quite successful at delivering top-down development programming when such activities have been relatively standardised, routine and in high volume (Andrews et al., 2012; Denizer et al., 2013). This is especially the case when developmental problems are easy to define and where discrete technological or logistical solutions can be found – i.e., the Green Revolution in the 1970s, small-pox eradication in the 1980s, etc. As a leading advocate Jeffrey Sachs describes; *"For decades,*

interventions in public health and in agriculture, such as Asia's Green Revolution in food production, have shown that the combination of a sound technology, a plan for large-scale implementation, adequate financing, and steadfastness over several years can make huge inroads against disease, poor health, and hunger even in the poorest settings. Bold plans have been part and parcel of those successes…. " (Sachs 2006: 1309).

Nonetheless, "*the conventional assumption that 'scientific' approaches to policy and planning provide the most reliable guidance for practitioners and researchers when working within complex settings,*" has been persuasively critiqued for decades (Head, 2019:180). These arguments have become increasingly compelling as the persistence of such 'wicked problems' as global poverty, rising inequalities, climate change, and biodiversity loss remain unresolved (Head, 2008; Moser et al., 2012; Head & Alford, 2015). These ongoing challenges have led to calls for greater acknowledgement and engagement with the dynamic, multidimensional, and inherently complex nature of such problems (D. Burns & Worsley, 2015; Hämäläinen, 2015; Waddock et al., 2015; Reyers et al., 2015; Salonen & Konkka, 2015; Lambe, Ran, Jürisoo, et al., 2020a).

Correspondingly, there is a growing body of evidence that has shown how SD can be a useful approach to facilitate the design of services and policies that work for citizens in complex settings (C. Burns et al., 2006; Malmberg, 2017; Bason, 2016, 2017; Cottam, 2018). SD shows promise as a method for understanding and situating micro-level needs, preferences and concerns and translating this information into meso and macro-level programme design. For example, SD was used by research teams at the Stockholm Environment Institute (SEI) to inform the design of interventions aimed at boosting the incomes of small-scale mango farmers in Kenya (Lambe, Ran, Jürisoo, et al., 2020b) to improve the design of clean cookstove interventions in Kenya and Zambia (Jürisoo et al., 2018b; Lambe, Ran, Kwamboka, et al., 2020c) and to inform the design of minigrid services for households and businesses in Tanzania and Zambia (Muhoza & Johnson, 2018b; Ogeya et al., 2021). A common feature of these studies is the complexity of the problem in focus (e.g., interventions that seek to change household energy practices require the improved service or technology to satisfy the needs of the targeted users in terms of affordability, convenience, cultural fit, behavioral patterns, etc.), and often the needs of multiple key stakeholders must be met for the intervention to be effective (cookstove user, other family members, service provider, etc.).

More recently, and motivated by policy makers' demands to provide some quantitative validation of the outcomes of a qualitative co-design processes (Voorberg et al., 2015; van Buuren et al., 2020), the SEI team have sought to triangulate the findings of the SD investigations by combining them with

quantitative methods so as to provide more 'evidential robust' findings to support future programme and intervention design (Lambe, Ran, Kwamboka, et al., 2020a). In looking to expand the combination of quantitative approaches that could be combined with SD, the SEI team were keen to collaborate with the researchers from the Norwich Institute for Sustainable Development (NISD) and The Field Lab Uganda who intended to use a series of DCEs to investigate the potential role of insurance in overcoming persistent poverty traps amongst smallholder farmers in Uganda. As an approach, there appeared to be a clear compatibility with the underlying operation and objective of SD: in that such quantitative instruments are used to capture and consolidate a significant degree of complexity and produce data that can be used to inform the future construction and delivery of products or services. (Bennett & Birol, 2010; Terris-Prestholt et al., 2019).

3. Combining Service Design and Choice Experiments

There is of course a rich history of combining quantitative and qualitative approaches in development research and practice, and the benefits of such triangulated approaches are well recognized. Within DCE studies qualitative components, such as focus groups or interviews, are often included during the preparation of experiments, as well as deployed later to better understand experimental findings (Powe et al., 2005; Kløjgaard et al., 2012). In the Global South, the use of DCEs in combination with qualitative components is growing, however in most cases the function of such qualitative dimensions remains subservient to the requirements of the DCE investigation (Mangham et al., 2009; Van den Broeck et al., 2017; Van Gevelt et al., 2017; Menyeh, 2021; Agarwal et al., 2021) . To our knowledge there are only a handful of published studies from the Global South where DCEs have been combined with participatory investigations in a fully aligned manner, and where their independent findings and outputs are equally relied upon to inform the final conclusions and recommendations of the project (i.e. Duguma et al., 2010; Kenter et al., 2011; Kenter, 2016; Brunie et al., 2016; Indravudh et al., 2017; Schaafsma et al., 2017). This could in part be explained by the challenges of coordinating interdisciplinary research as Rakotonarivo et al., (2016) suggest, nonetheless it is with the view of building upon the foundations of such studies that we see the opportunity for SD and DCEs to provide such a positive contribution in this area.

3.1 Service Design

Service design is a qualitative approach to understanding people's needs, wider context, motivations and behaviours, which aims to co-create improved services or systems that better meet their needs

(Edvardsson et al., 2012; Manzini, 2015; Pfannstiel & Rasche, 2017). Service design provides tools for user engagement in public service design (Parker and Heapy, 2006). In recent years, SD has been increasingly applied in Europe, Australia and North America to improve public services together with users of the services to deliver positive social impact through so-called design labs, or public policy labs (McNabola et al., 2013; Escobar, 2017; Bason, 2017). In these cases, SD proved to be a valuable approach for understanding, representing and designing the interdependencies between actors, system components, and levels in a system (Sangiorgi et al., 2017). It has been applied in a more limited sense in low income countries to inform the design of services and service systems that can reach "Base of the Pyramid" consumers (Jagtap & Larsson, 2013).

How design methods differ from conventional qualitative approaches

Design methods are epistemologically distinct from conventional qualitative methods used within the social sciences. Design is often focused on addressing wicked problems in complex settings (Buchanan, 1992; Head & Alford, 2015), where the information required to produce solutions to a problem depends upon one's idea for solving it (Rylander, 2009). What this means in practice is that a design process is deliberately iterative and emergent, alternating between problem articulation and suggested solutions, and characterized by imagination, prototyping, and empathizing with the user (Conklin, 2006; Lawson, 2010). Although conventional qualitative research will often involve iteration as new information is gathered, a design approach will consciously trigger such iterations by presenting research participants with design ideas. As Cross explains, *"design reasoning is different from conventionally acknowledged forms of inductive and deductive reasoning … Science investigates extant forms; Design initiates novel forms"* (Cross, 2011, p33). As such, the logic of a design approach is often described as being abductive in nature, in the sense that the designer moves between suggesting solutions as interpretations of alternatives to what currently is and gathering data about the setting and the problems, gradually refining the solution and the problem articulation based on new data and insights (Alvesson & Kärreman, 2007).

Thus, in a design process the gathering of contextual information and the process of developing solutions happen concurrently, together with people and communities, often with the participants perspective as an important empirical foundation itself (Čaić et al., 2019).

SD process and tools

The iterative design process results in a detailed understanding of the problem, the stakeholder, and their needs which in turn informs the subsequent iteration, and so on (Stickdorn & Schneider, 2010).

Solutions are developed and problems are (re)defined gradually and in parallel until a feasible and desirable intervention emerges. This process involves quick prototyping of ideas and solutions early in the design process where there is still room to make changes at a relatively low cost (Blomkvist, 2014) .

A key innovation of service design is its capacity to support the creation of new services together with users, where a wide range of actors in a service system are engaged in a creative process to define problems and develop solutions (Patrício et al., 2018). This approach is critical to ensure the inclusion of multiple perspectives early in the design process, so that the inherent complexity in a given system is captured and translated into new services that are feasible and scalable from the perspective of programme implementers (Sangiorgi et al., 2017; Patrício et al., 2018).

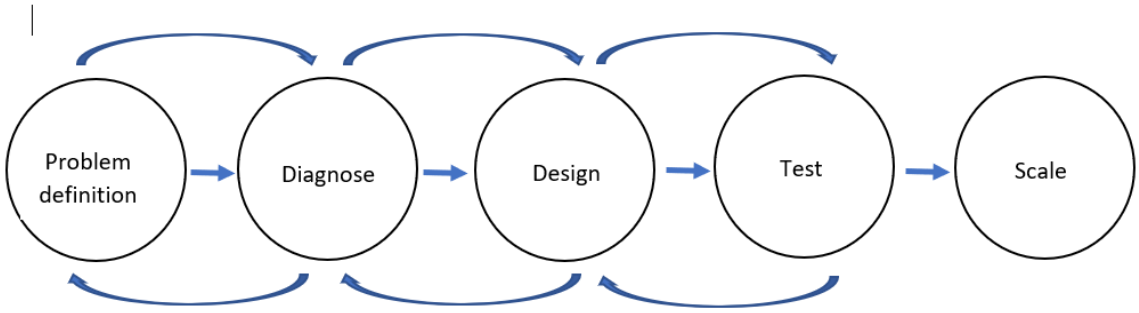

Figure 1. The stages of a service design driven intervention process, adapted from *Tantia, (2017)*

SD limitations

Despite the potential of SD to improve public policies, it does have several procedural and practical limitations as a methodology. Firstly, the approach does require a degree of expertise, knowledge, and experience to oversee a SD study effectively (Leitch, 2016). However, this constraint can be relatively easily and quickly overcome with appropriate training and involvement in a study with sufficient guidance (i.e. Lambe et al., 2020). Furthermore, the willingness to embrace the inherent complexity of challenges that SD seeks to address can make it difficult for designers to evaluate the limits to which they should set boundaries to the systems they are trying to understand (Polaine et al., 2013). Usually however, this difficulty can be overcome by series of iterative steps where knowledge is consolidated to a point where the designer is confident about limiting the boundaries of the system by applying the principle of 'differences that make a difference' to delineate the boundary edge (Bateson, 1972; Saunders et al., 2018). Such a stepwise approach allows for the subsequent identification and/or analysis of environmental, institutional, and social boundaries of the particular study, including informing the selection of significant stakeholders.

3.2 Discrete Choice Experiments

DCEs were first developed as a means of understanding consumer demands for particular products or services (Louviere & Woodworth, 1983). They have their origins in the economic theory of demand, and especially in the work of Lancaster, who proposed that the demand for goods was effectively driven by demand for specific combinations of their characteristics (Lancaster, 1966). DCEs are a quantitative method that allows for the systematic elicitation of such individual preferences. Importantly, the approach allows for the thorough evaluation of how different characteristics (or *attributes*) of a proposition - or in this case policy intervention - are valued by a participant: how they balance these attributes, and how they evaluate the relative importance of different attributes against one another (Street & Burgess, 2007; Bennett & Birol, 2010).

The benefits of being able to rigorously 'test' the support and interest that an intended future policy has, in a relatively cheap and timely manner, prior to its deployment is significant. Not only are DCEs able to tell a policymaker whether or not a particular programme or service is valued in a binary sense, but of far greater value is its potential to provide a detailed measurement of how the policy's different constituent components are valued in relation to one-another (Hensher et al., 2005; Landmann et al., 2018).

In comparison to Behavioural Games and Randomised Controlled Trials (RCTs), the distinction that DCEs present hypothetical scenarios of policy design to participants to be considered within their real-life setting allows incorporating contextual SD considerations more easily. Although the number of attributes is limited (DeShazo & Fermo, 2002) and their selection and description need to be handled with care to avoid multicollinearity and omitted variable bias (Mangham et al., 2009; Coast et al., 2012), their design is comparatively flexibly adapted to local context (Abiiro et al., 2014).

DCE limitations

Despite these advantages, the utility of DCEs are however limited by a number of procedural, practical and theoretical challenges (DeShazo & Fermo, 2002; Hoyos, 2010; Lancsar & Savage, 2004; Johnston, Boyle, Adamowicz, et al., 2017). Firstly, whilst the application of the DCEs themselves are relatively straightforward to administer once devised, their construction does require a significant familiarity with advanced notions of choice modelling for the experimental design (Lagarde & Blaauw, 2009; Johnston, Boyle, Vic Adamowicz, et al., 2017). Secondly, the selection of attributes and levels are crucial for the meaningfulness of the resultant experimental data. Poor or ill-defined

attribute selection with imprecise or counter-intuitive weighting of levels will reduce confidence that participants are able to make informed and representative selections from the available choice-sets (Coast & Horrocks, 2007; Kløjgaard et al., 2012).

To avoid this, it is strongly recommended by experts to use qualitative approaches to ensure that choice-sets are meaningful and relevant to experimental participants: *"We cannot overemphasise how important it is to conduct this kind of qualitative, exploratory work to guide subsequent phases of the stated preference study… The study team should endeavour to understand the dimensions… along which the product is evaluated by consumers and how specific levels of these dimensions are expressed…"* (Louviere, Hensher, and Swait 2000: pg 257-8). Despite the recognised importance of the necessity to conduct substantive qualitative research to better select, frame and translate the DCE, in practice many published studies fail to appropriately engage in the qualitative component of the experiment, or little information is provided about how this phase was conducted in practice (Rakotonarivo et al., 2016; Vass et al., 2017) .

4. Illustrative case study - WII in Uganda

4.1 Case study background

Economists from Norwich Institute for Sustainable Development (NISD) at the University of East Anglia and partnership institutions have studied the risk-taking and risk-sharing habits of smallholder farmers in Bugisu in eastern Uganda since 2001.[1] Working with major insurance companies in the country, agricultural extensionists, farmers' organisations, seed companies and agro-dealers, research findings were translated into recommendations for risk protection measures that would encourage agricultural investment, increase the productivity of farms, and lead to higher incomes and poverty reduction (Balungira et al., 2016; McSherry, 2017). The main recommendation was to bundle Weather Index Insurance (WII) with authenticated agricultural inputs and credit, as well as to offer this to established risk-sharing groups, in particular village savings and loans associations (VSLAs) (Verschoor, Clist, et al., 2016).

However, UEA's economists involved in the research were not confident in this recommendation. It was inferred from research findings obtained in lab-in-the-field experiments, and therefore based on behaviour observed in stylised settings, in which hypotheses are tested about particular factors in

[1] Research findings are reported in *inter alia* Humphrey and Verschoor (2004a,b), Harrison et al. (2010), D'Exelle and Verschoor (2015), Verschoor et al. (2016) and Verschoor and D'Exelle (2021).

isolation by keeping all other relevant factors at bay that determine behaviour in real life. In complex settings, these other factors interplay with the factors tested, which may undo or reinforce (as the case may be) the effect of the factors studied in the experiments. Moreover, it was silent about some of the other factors that previous studies of WII have found to be important in determining its desirability for the purposes of risk protection.[2]

UEA's economists thus faced the challenge of understanding better (than their experiments had allowed them to) the complexity of factors behind risk protection that would interplay with the provision of WII in the context of farmers' livelihoods in Bugisu. In order to meet this challenge, they teamed up with the team of social scientists from the Stockholm Environment Institute (SEI) to implement the study described in this paper.

Our case study was conducted in Bwikhonge, Bulambuli district of eastern Uganda with the objective of understanding the viability of different WII designs from the perspective of local smallholder farmers. The study applied a combined SD and DCE approach whereby each methodology would operate as an independent body of work but conducted in a coordinated fashion to facilitate the triangulation of data and findings.

WII is a financial service innovated specifically for application in low-income rural areas, where traditional insurance schemes have been shown to be too costly for widespread uptake. Based on a verifiable index of weather patterns that correlates with on-farm losses, WII can save otherwise prohibitive transaction and claim verification costs and has enjoyed increasing attention as a promising lever out of rural poverty traps (Barnett & Mahul, 2007). As with other insurances the intention of risk pooling and risk spreading by design aspires to scalable uptake across geo-climatic areas. At the same time, WII design features are highly context dependent. Whilst ecological, climatic and agricultural factors may play a preliminary role to determine an insurance's risk coverage, institutional arrangements (e.g., pay-out channels, bundling options or group insurances) to reduce transaction costs, avoid unforeseen risks, and build trust and demand need to be socio-economically and culturally contextualized (Dercon & Gollin, 2014).

[2] For instance, a large number of studies have found that illiquidity, i.e. not having sufficient cash at hand when the premium payment is due, is negatively associated with WII uptake (Giné et al., 2008; Cole et al., 2012, 2013; Hill et al., 2013; Akter et al., 2016; Casaburi and Willis, 2018; Belissa et al., 2019). As well as illiquidity, lack of trust in the provider and/or lack of trust in the product has frequently been found to impede WII uptake (Giné et al., 2008; Cole et al., 2012, 2013; Karlan et al., 2014), and the suggestion has been made to use trusted pay-out channels to increase uptake (Giné et al., 2008; Cole et al., 2013)..

Clearly, WII has great promise as a means of alleviating poverty and preventing food insecurity in low-income countries but to date there has been disappointing uptake of early schemes (Platteau et al., 2017). With notable exceptions (Clarke, 2016), what has so far been generally under-researched is understanding how simple deficiencies in the design of many index insurance products - often related to local, contextual factors - has resulted in limited uptake of these products (Dercon, 2007; Dercon et al., 2008). A promising avenue of research, and a suitable application of our approach, was therefore to try to address these deficiencies and design WII packages that would be more likely to be adopted.

4.2 Service Design Phase

In phase one, SD methodology was applied to gain a contextual understanding of the socio-economic and ecological system and relevant actors' perspectives. Our objective was thus to do more than simply use qualitative methods as a means to improve the DCE survey, , but rather it was to engage in an independent co-design process with farmers and other key stakeholders such as agricultural extension workers, district agricultural officers, and a major provider of agricultural insurance in Uganda. With the purpose of co-designing prototype of a future WII product which contained features which would be of value to such stakeholder groups[3]

During the SD phase, we conducted 20 participant observations, 48 key informant interviews, 14 field workshops, two larger workshops – a solutions prototyping, and a testing and validation workshop - both with 40 local farmers and stakeholders. Apart from the key informants, participants were randomly sampled household heads and spouses taken from the same population lists that were used in the subsequent DCE phase that had been generated in previous rounds of fieldwork. Participant observation is typically the starting point in a design process, to better understand the users' context. In our case, participant observation allowed us to quickly familiarise ourselves with the farmers' daily practices, and to relate their daily routines to the themes of the interview. Interviews and field workshops were conducted at respondent's homes and/or farms by four research teams each consisting of one research lead and one assistant, using paper and pencil to record responses. Specific activities included detailed mapping of annual farming, income and risk cycles, risk response journeys, actors and financial flows along crop value chains, and a framework assessment of farmers' risk coping capacity.

[3] See Lambe et al. (2020) for the conceptual foundation and examples of this approach in the Global South.

The stages and operation of an ideal SD study are outlined in the companion methodological paper see Dehmel et al., (2021), and further examples of SD methodology can be found in similar studies such as see Jürisoo et al., (2018); Muhoza & Johnson, (2018); Lambe et al., (2020). As an explicitly iterative and abductive research approach however, the actual practice of conducting a SD study in the field means that the specific activities will be responsive to the study's contextual demands and constraints, as was the case here.

4.2.1 The emergence of key insights

Whilst the ordering and selection of fieldwork activities broadly followed the SD model of problem co-definition, actor-centred mapping, experience-based problem definition, rapid prototyping and then design and qualitative testing of the insurance prototypes, in practice a significant degree of iteration and repetition of stages occurred as different lines of enquiry developed (Lambe, Ran, Jürisoo, et al., 2020a).

As an abductive process, this is typical of a SD study where the process of learning and doing happen concurrently. We summarise below several strands of such enquiries, and how they led to formalised findings.

Mapping farming and income cycles

An ongoing line of enquiry was to establish with farmers how the annual crop and income cycle interacted in this heavily agriculturally dependent region. It was shown that crops are not grown in isolation, nor is finance linked to individual crops. Rather, each crop is grown as a means to finance future costs and investments for subsequent cultivation periods.

In Bwikhonge the end of the first growing season starts with preparation of the land and planting in January and February, with associated costs incurred for inputs which included (for some) the renting of land, hiring of additional labour, the purchasing of seeds and fertilizers, etc. Major sales of maize – the primary first season crop – occurs during August and September, at which time farmers reported being less income constrained than throughout the rest of the year. The second growing season begins in September with a more diverse range of cash-crops that include cotton, sunflower, tomatoes, etc. which are sold around November and December. Since the majority of farmers subsisted on the maize (primarily) that was produced in the first growing season, the decision about investment in the subsequent growing season was highly dependent on its relative bounty. Since, with a good harvest and food security assured, they would have greater flexibility about their choices and investments (and potential earnings) going into the second growing season. Conversely,

a poor first harvest, restricted choice as the demand to satisfy basic needs outweighed maximising agricultural earnings.

Accordingly, the end of the maize season and the end of the cash crop season were identified as potential promising timings for the insurance premium payment – with the significant qualifier that such premiums may not be within reach of the most vulnerable farmers. Furthermore, the SD phase suggested that insurance that could provide cover to specific crops seasons might be preferable to a comprehensive annual policy.

Mapping diverse risk coping mechanisms

It was apparent that in the absence of formal insurance, farmers in the region had an array of risk management strategies. We found through mapping and comparing risk response journeys from different farmers that there were substantial differences between household risk coping strategies, even in households that were ostensible socio-economically similar. We identified 11 categories of behaviours that farmers engage in when responding (as individuals and households) to risks or shocks – ranging from selling of land or other assets to borrowing money from friends or family, etc. Broadly these could be clustered along four key metrics or categories: social networks, social institutions, agricultural diversity, and economic diversity.

These four categories represent the diverse sources of capacity for farmers to respond to risk. Taken together, the categories are a way to understand overall capacity to respond to shock, rather than risk response based solely on economic wealth. To capture the richness of the risk coping strategies applied, we mapped the risk response capacity of each farmer we interviewed along these four dimensions, and then visualized the overall risk capacity using a simple spider diagram (see supplementary material in Dehmel et al., (2021).

As we began to develop an ever more detailed and substantive understanding of the agricultural system and the users operating within it, in collaboration with our colleagues at The Field Lab Uganda, we were able to develop farmer "archetypes" to describe each category and to devise a narrative history and a name for each one. An archetype can be thought of as a model representing an observed pattern in terms of composite factors or characteristics (Vaillancourt et al., 2014; Saadat et al., 2018). The purpose of developing the archetypes was to find a way to represent multiple complex characteristics that determine how different types of farmers cope with risk within the context of the system they were operating. We named our characters (A)ndrew (strong capacity

to respond to risk), (B)etty (weak capacity to respond to risk) and (C)harles (medium capacity to respond to risk).

From archetypes to prototypes

During the first round of 10 interviews, ideas for prototype insurance products emerged and were discussed and refined during subsequent interviews, and in the field workshops. This abductive mode of testing early "sketches" of an insurance product resulted in deeper insights about the needs of different types of farmers as well as critical insights about the community that would have implications for the design of a WII. For example, when testing different payment models for insurance packages we found that many less well-off farmers could not afford even very low-cost insurance. Another early prototype tested during the interviews involved the local village savings and loan association (VSLA) acting as the agent responsible for handling WII pay outs. Responding to this prototype, we learned from several farmers that levels of trust in the local VSLA were generally very low, with some reporting that they had been "cheated" by the VSLA in the past. However, through these discussions on trust in the community, we learned that most farmers have a high regard for other community organisations including agricultural input stores and other microfinance institutions such a burial savings schemes.

During the solutions prototyping workshop we used storytelling and sketching to describe and visualise the archetypes in detail for the participants. After presenting each archetype, we asked the participants whether they could identify with (A)ndrew, (B)etty and (C)harles and invited them to suggest changes to the details of the archetypes to bring them closer to the reality of the community. Once satisfied with how the archetypes were described, the participants worked in groups to map out the risk response journeys that they imagined each of these characters taking in the event of a sudden shocks (such as severe drought or pest infestation).

Using these archetypes and informed by the SD fieldwork as well as with references to earlier foundational work by the UEA economist team, we then introduced the refined insurance prototypes that had emerged from the interviews during a subsequent design and testing workshop. These protoypes included a 'full coverage', more expensive insurance option, that would cover all losses; a less expensive option that would cover the cost of inputs (seed and fertilizer); and a cheap 'basic coverage' option that would provide a safety net in the event of a disaster to protect farmers from starvation. We chose not to place a price on the insurance products since the point of the exercise was to discuss more generally which sort of model would be appropriate for each farmer

archetype, rather than agree on the price level of each. Given the expressed inability of some farmers to pay for even inexpensive insurance, prior to the workshop we sketched a savings scheme as an alternative to an insurance product, that could provide some financial relief at particularly difficult times in the year.

The workshop participants, again working in groups, were then asked to match the appropriate insurance package with each archetype, with the option of not selecting any if none were considered appropriate. This exercise provided an entry point to discuss the prototyped insurance products, but more importantly, to learn more about the needs and constraints of each of the archetypes.

Table 1. Summary of key findings from SD phase

1.	Insurance was seen as an attractive option for some, but not all, farmers
2.	There is significant heterogeneity in how farmers respond to risk, with financial capacity being just one source of risk response capacity. The key categories of risk response capacity identified were: social network; social institutions; agricultural diversity and economic diversity.
3.	Farmers in this area can be considered to have either strong, medium, or weak capacity to respond to shocks. Insurance does not appear to be an appropriate option for farmers with weak risk response capacity.
4.	Trust in the formal VSLAs is generally low, and most farmers responded negatively to the idea of a VSLA being involved in handling insurance pay outs.
5.	Trust in other community organizations (e.g., agricultural input stores and alternative finance organizations) is high.

4.3 Discrete Choice Experiment Phase

In this section, we describe our discrete choice experiment. At the time of the fieldwork, in the period February – July 2018, no WII was offered in the study area. Our experiment is therefore about hypothetical demand by research participants who, prior to the fieldwork, had little or no understanding of WII. This meant we had to teach the participants about WII before our experiment was implemented, as described in detail in a companion methods paper (Dehmel et al., 2021).

Discrete choice experiments are a quantitative technique for eliciting preferences and have been used previously for understanding determinants of WII uptake (Tadesse et al., 2017; Sibiko et al., 2018; Ward and Makhija, 2018). Individuals state preferences over hypothetical alternatives. The characteristics that describe each alternative, for instance the identity of the policy holder, are called attributes. The values or conditions that an attribute can take are called levels. So, in the example of the attribute 'identity of the policy holder', the levels could be 'an individual' and 'a savings group'.

Our focus in the DCEs is squarely on individual decision making. The discrete choice experiments were conducted in face-to-face interviews with individual respondents that took about 45 minutes.

Prior to the interview, each respondent participated in a 1.5h long workshop that ensured they obtained a full and correct understanding of the insurance product and its possible features. The workshops (30 in total) were organised by our fieldwork partner (The Field Lab Uganda) and were exclusively intended to convey the necessary information to allow for meaningful responses to the DCE. Using posters for visual reference, they covered the general concept of WII, that pay-outs may not be equal to experienced costs, that different insurance designs may vary in the period of coverage, timing of premium payment, pay-out channels, and bundling options and finally that WII could be sold to individuals or groups. Respondents were encouraged to ask questions, whilst any discussion of benefits and shortcomings were explicitly dismissed. The workshop followed a set script and was delivered by the same person to ensure consistency. See the companion methods paper (Dehmel et al., 2021) for further details of the implementation of the DCEs.

4.3.1 Selection of attributes and levels

Table 2 describes the attributes and levels that we selected. They are rooted in the literature on WII uptake, shaped by the preceding service design phase, and contextualised based on extensive prior qualitative fieldwork, which we have documented separately (Dehmel et al., 2021).

Attribute 1 is the identity of the policy holder. Our interest here is in whether WII offered to savings groups raises demand, as predicted by Trærup (2012), De Janvry et al. (2014) and Mobarak and Rosenzweig (2012, 2013) provided that savings groups are sufficiently limited in the protection they provide against common shocks. VSLAs are the dominant savings groups in our study area: 77 percent of households in our sample have at least one member who belongs to a VSLA, with mean VSLA membership per household being equal to 1.06. We therefore specified two levels for attribute 1: the policy holder can be an individual (level 1) or a VSLA (level 2).

A large number of studies have found that liquidity, income and wealth levels are positively associated with WII uptake (Giné et al., 2008; Cole et al., 2012, 2013; Hill et al., 2013; Akter et al., 2016; Casaburi and Willis, 2018; Belissa et al., 2019). We therefore investigated two potential means of increasing uptake by taking liquidity concerns into account. The first is to reduce the premium buyers need to pay by taking out insurance for a growth phase rather than the whole season (Hazell and Hess, 2010). The service design phase of the research suggested the levels ‘germination’, ‘plant growth’, ‘flowering’ and ‘the whole season’ for the attribute ‘growth phase covered’ (Attribute 2).

Table 2

DCE design: Attributes and levels

Generic Attributes		Drought insurance for maize cultivation during the first annual season. Insurance premium levels specified as affordable levels meeting WTP and dependent on coverage phase.			
Alternative specific attributes		**Level 1**	**Level 2**	**Level 3**	**Level 4**
1.	Policy holder	Individual	Savings group	-	-
2.	Coverage phase	Germination	Plant growth	Flowering	Whole season
3.	Timing of premium payment	January-February	August-September	November-December	-
4.	Payout delivery channel	Local Agent	Agro-input shop	Mobile money	-
5.	Bundling	No bundling	Bundling with certified seed	Bundling with seed and pesticide	Bundling with seed, pesticide and an agro-input loan

The second way of tackling illiquidity that we investigated is avoiding liquidity constraints through the timing of the premium payment (Mcintosh et al., 2013). The service design phase suggested that August-September (after the main maize harvest) and November-December (after the harvest of the second season crop) are times of relative cash abundance, whereas the natural period to pay for WII, just before the main growing season, in January-February, is not, because payments need to be made for school fees, agricultural inputs and (sometimes) renting in land. The three periods mentioned are therefore the levels corresponding with the attribute 'timing of premium payment' (Attribute 3).

As well as illiquidity, lack of trust in the provider and/or lack of trust in the product has frequently been found to impede WII uptake (Giné et al., 2008; Cole et al., 2012, 2013; Karlan et al., 2014), and the suggestion has been made to use trusted pay-out channels to increase uptake (Giné et al., 2008; Cole et al., 2013). The service design phase suggested a 'local agent', an 'agro-input shop' and 'mobile money' as levels for the attribute 'pay-out delivery channel' that are worth investigating (Attribute 4).

Finally, in Attribute 5 we consider the effect on demand of combining the provision of WII with products that reduce basis risk, so-called 'bundling' (Awondo et al., 2017; Ward and Makhija, 2018). Prior qualitative research suggested certified seed in order to deal with the risk of counterfeit inputs, and pesticides for combatting crop pests and diseases. Reliable inputs such as seed and pesticides can be hard to get hold off in the study area. To provide them (at the normal commercial price) together with WII would take care of three major risk factors: drought, pests and diseases, and counterfeit seed. We also investigate whether adding an agro-input loan to bundled WII increases the latter's attractiveness. The rationale is that, when fear of bankruptcy is sufficiently low, a loan

for paying for agro-inputs can be confidently taken out (cf. Fafchamps, 2003: 151-158). Credit could therefore add value to bundled WII that sufficiently reduces basis risk and increase demand for WII.

We ensured that the combination of levels selected for our 12 pairs of choice alternatives is D-efficient (see Dehmel et al., 2021 for further details).

4.3.2 Specification of the insurance premium

In randomized control trials, demand for WII is found to be pointedly price sensitive (Mobarak and Rosenzweig, 2012, 2013; Cole et al., 2013; Karlan et al., 2014). However, we decided not to introduce variation in the insurance premium in our choice experiment because our interest is in features of an attractively priced insurance product, not in willingness to pay for an as yet unfamiliar and hypothetical product. We therefore specified the insurance premium as an amount that research participants would feel comfortable in paying:

"Suppose a company is offering you Weather Insurance for growing maize during the first season […] ***You are indeed interested, because they want to sell it to you at a premium you can afford and are happy to pay****".*

4.3.3 Sampling and sampling characteristics

From the study area of Bwikhonge, 196 respondents from maize-growing farm households were randomly selected from ten villages in Bwikhonge sub-county[4] purposefully according to perceived exposure to drought, geographical spread (to increase representation), accessibility and availability of a research venue. For each selected village a sampling frame of all households and their heads and spouses was then devised, 22 households were selected per village (20 + 2 spare), participants were randomly selected (subject to the constraint of one per household) and if the selected individual was not available then their spouse would be invited (see Dehmel et al., 2021 for details). Table 3 presents characteristics of the respondents in the sample and their households. 64 percent of respondents are female, which reflects the random selection procedure followed: when the household head of a randomly selected household was married, either they or their spouse were randomly selected for participation. If the randomly selected person was not available for participation, then their spouse could participate. Larger unavailability of men would explain why there are more women than men in the sample.

[4] Sub-county is the second-tier administrative unit in Uganda.

73 percent of respondents have been educated at the primary level or received no education. Even those educated at the primary level have not necessarily completed it; the table presents the highest level of education achieved, whether or not respondents finished school. Only one person in the sample attended a tertiary education institution.

The land that is cultivated in the households of the sample respondents is 2.3 acres on average. This figure includes land rented in by the household and excludes land that is rented out. We report on land ownership, a crucial variable in the analysis, below.

A second crucial variable is VSLA membership, which is common in the study area. On average, there is slightly more than one person per household a member of a VSLA in the sample. These VSLAs typically consist of between 10 and 50 members in our study area, who contribute weekly savings to a common fund. Members may borrow money from this fund for a period of 1-3 months at an interest rate of 10 percent per month. The accumulated savings and interest are distributed among members in proportion to members' savings. This takes place at the end of the annual savings cycle, either in January or in February, which is when cash needs for agricultural inputs and school fees are highest.

Table 3
Descriptive statistics of sample respondent and households' characteristics.

		N (%)	Mean	St. Dev.	Min-Max
Respondent characteristics					
Female		126 (64.29)			
Age		196	42.06	15.12	18-78
Education					
	No education	17 (8.67)			
	Primary	127 (64.80)			
	Secondary	47 (23.98)			
	Tertiary	1 (0.51)			
Relation to household head					
	Self	108 (55.10)			
	Spouse	85 (43.37)			
	Child	3 (1.53)			
Household characteristics					
Household size		196	6.31	2.82	1-17
Cultivated land (acres)		196	2.34	1.93	0-17
Cultivating maize		196 (100)			
Number of second season crops		196	1.48	0.89	0-4
Number of VSLA memberships		196	1.06	0.79	0-4
Years living in Bwikhonge		196	33.68	18.03	2-76

4.3.4 Regression analysis

The analysis of the responses from the DCEs are often modelled within the Random Utility Theory (RUT) framework developed by McFadden (1974). In RUT, the utility of an alternative presented to the individual is decomposable into two parts: a systematic (observable) component specified as a

function of the attributes of the alternatives (function v below), and a random element ε_{ij} representing the unobserved variation in preferences (de Bekker-Grob et al., 2012).

$$U_{ij} = v_{ij}(A) + \varepsilon_{ij}$$

where v_{ij} is the measurable utility of alternative j of attribute A for individual i. The subject will then choose alternative j over k if:

$$v_{ij} + \varepsilon_{ij} > v_{ik} + \varepsilon_{ik} \text{ or } v_{ij} - v_{ik} > \varepsilon_{ik} - \varepsilon_{ij}$$

The probability of choosing alternative j conditional on the attributes and choice set C is:

$$P(j_i|A, C) = P_{ij} = P\left[v_{ij} - v_{ik} > \varepsilon_{ik} - \varepsilon_{ij}\right] \forall\, j \neq k$$

So the probability of choosing alternative j (over k) is given by the probability that the difference in the error term (i.e. random element) is smaller than the difference in the observable utility component (McFadden, 1973; Ryan & Gerard, 2003). A cumulative distribution function is assumed for the difference in the error term, which in our case was a standard normal CDF, as we deploy a random effects probit model (REP) in the analysis.

Our choice is motivated by the long tradition of this method for the study of DCEs, well-documented in successive literature reviews (Ryan & Gerard, 2003; de Bekker-Grob et al., 2012; Clark et al., 2014; Soekhai et al., 2019), and, as we argue next, because it fits our data generation process well. First, the method is suitable for the analysis of binary choices, which is strictly the case in our experiment, where participants were presented with just two choices without the possibility of opting out (De Bekker-Grob et al., 2012). Second, our data possesses a panel structure, as it contains the sets of 12 responses each per participant. In other words, it consists of 12 choices between two insurance options for the 196 respondents that took part in the experiment. Lastly, REP does not require the stringent Independence of Irrelevant Alternatives (IIA) assumption, which other competing methods must hold and would be violated in our application (McFadden, 1974; De Bekker-Grob et al., 2012).[5]

As described in eq. (1), the latent relationship between the utility of the alterative and its two components is assumed to be linear, specifically in our application it takes the following form:

$$U_{ij}^{*} = \alpha + \boldsymbol{A_j\beta} + \boldsymbol{X_i\delta} + \varepsilon_{ij}$$

[5] While more complex alternative methods exist which could fit our data, like the mixed (or random parameters) logit model, we believe that we lack the necessary priors to decide on the crucial assumptions that the method requires. For instance, we neither know which parameters to specify at random, nor the distribution they could follow. If decisions like these—and several others—are not carefully researched and convincingly settled, they can greatly compromise the internal validity of the analysis and lead to misuse of such advanced method, as documented by some of its exponents (Hensher and Greene, 2003).

where U_{ij}^{*} is the latent utility of alternative j for individual i, which is not directly observed, and instead is represented by bivariate variable Y_{ij} that takes value 1 if an option is chosen (i.e. $U_{ij}^{*} > 0$) and 0 if it is not. $\boldsymbol{A_j}$ is a set of bivariate variables which define the attributes of every alternative j. They include whether insurance is offered to saving groups, whether it is bundled with inputs, the timing of the premium payment and the payout delivery channel (see Table 4 for the full list). Lastly, $\boldsymbol{X_i}$ includes the individual level controls, and ε_{ij} is the error term.[6]

We report in Table 4 two models, one estimating the unconditional effect of insurance being offered to savings groups (model 1), the other with that effect interacted with land ownership and trust in the savings group (model 2).[7] The table reports marginal effects. If these are multiplied by 100, then they can be interpreted as the change in percentage points of the probability of an insurance option being chosen as a result of the change in the attribute under consideration from its base level to the level associated with the marginal effect. The main effects are the following.

First, when insurance is offered to a savings group rather than to an individual, the unconditional probability of the insurance option being chosen goes down by 18 percentage points (model 1). However, when land ownership and trust in the savings group are interacted with the saving group attribute, its effect changes substantially.

Trust in savings groups is measured on a scale from 1 to 5 and land ownership (bar the four largest landowners in the sample) ranges from 0 to 10 acres. Specification (1) of model (2) shows that, for a person with no trust in the savings group and no land, the probability of choosing an insurance option when it is offered to the savings group goes down by almost 40 percentage points when the alternative features it. By contrast, for a person who fully trusts the savings group and owns 10 acres of land, this decline in the probability of choosing the option is only 6 percentage points and becoming insignificant, as shown by specification (2) of this model. So individual contracts are clearly preferred to group contracts, but the extent to which this is the case largely depends on trust in the group and land ownership.

[6] Controls include age, sex, level of education, land owned and trust on VSLAs.

[7] All significant effects shown in Table 4 are robust to the inclusion of controls and (where appropriate) the sequential addition of interaction terms.

Table 4:

Influence on Insurance Choice of DCE Attributes (marginal effects in probit models)

Model	(1)	(2)	
Specification	(1)	(1)	(2)
Attributes			
Insurance unit			
Savings group compared to individual contract	-.1776***	-.3983***	-.0585
	(-4.47)	(-4.59)	(-0.389)
Trust in savings group	-.0001	-.0002	-.0002
	(-0.54)	(-1.03)	(-1.03)
Land owned in acres	-.0001***	-.0001***	-.0001***
	(-3.18)	(-3.04)	(-3.04)
Bundling (base: no bundling)			
With certified seed	.1066***	.1078***	.1078***
	(4.25)	(4.27)	(4.27)
With certified seed and pesticides	.0670***	.0669***	.0669***
	(2. 62)	(2.59)	(2.59)
With certified seed and pesticides and an agro-input loan	.1051***	.1054***	.1054***
	(4.76)	(4.73)	(4.73)
Timing of premium payment (base: Jan-Feb)			
August-September	.0035	.0042	.0042
	(0.15)	(0.18)	(0.18)
November-December	.0582***	.0591***	.0591***
	(2.72)	(2.74)	(2.74)
Payout delivery channel (base: local agent)			
Agro-input shop	.0440**	.0436**	.0436**
	(2.32)	(2.28)	(2.28)
Mobile money	.1294***	.1300***	.1300***
	(5.72)	(5.70)	(5.70)
Coverage phase (base: whole season)			
Germination	-.3726***	-.3758***	-.3753***
	(-13.40)	(-13.59)	(-13.62)
Plant growth	-.2863***	-.2885***	-.2883***
	(-11.91)	(-11.99)	(-12.01)
Flowering	-.2094***	-.2105***	-.2104***
	(-7.86)	(-7.86)	(-7.87)
Wald chi2	205.04***	246.04***	246.04***
Observations	4,696	4,696	4,696

Random effects probit estimation. Number of observations = 12 choices per respondent times 196 respondents. Marginal effects reported with z-statistics in parentheses. * indicates statistical significance at the 10%, ** at the 5% and *** at the 1% level. Standard errors estimated are robust to several kinds of misspecification (option vce(robust) for Stata's xtprobit command). Controls included in the models are respondents' age, sex, level of education, land owned and trust on VSLAs.

Second, compared to no bundling, bundling with certified seed, pesticides and agricultural credit raises the probability of the insurance option being chosen by almost 11 percentage points, but the same option without the loan is less attractive. One way of interpreting this finding is as follows. Agricultural credit is often avoided in the study area because of the fear of bankruptcy. However, when the major risk factors to crop growing are dealt with through bundled WII (the risk of pests through pesticides, the risk of bad seed through seed certification, the risk of a drought through insurance), then the option of agricultural credit can be confidently chosen. The fact that the WII option that includes both agricultural inputs and credit is most attractive may thus be a matter of

risk reduction being large enough for the risk of bankruptcy following the taking out of a loan to be sufficiently low.

Third, the timing of the premium payment has only a small effect on WII becoming more attractive. Allowing payment during periods of greater liquidity, after the first harvest (August-September), or the second (November-December), increases probability that the WII option is chosen only in the latter case, when the payment can be made at the end of the second season. Despite the necessity to pay school fees and for agricultural inputs during the base level period (January-February), it is possible that the advantages of paying for insurance during times when liquidity is high are to some extent counterbalanced by the flexibility of not committing to the insurance until respondents know whether they can afford it, giving rise to the modest effects observed.

Fourth, receiving insurance pay-outs through mobile money raises the probability of choosing an insurance option by 13 percentage points compared to through a local agent, whereas the agro-input shop is only slightly preferred to the agent. This echoes the trust in and convenience of this payment method that informants mentioned during the qualitative phase of the research preceding the experiments.

Fifth, the whole season covered is strongly preferred to individual growth phases, despite the higher premium.[8] The effects are large too: 37 percentage points in the case of the germination phase. This resonates with the bundling result above in that it suggests that comprehensive risk reduction is sought after by farmers in this area.

In sum, respondents prefer individual to savings group insurance, bundled with certified seed, pesticides and credit, receiving pay-outs through mobile money, and the whole growing season covered despite the higher premium that needs to be paid for that. Even though insurance being offered to savings groups never has a positive effect on the attractiveness of it, the negative effect is much smaller when trust in savings groups is higher and land ownership larger.

4.4 Analysis and Discussion: Combining Service Design and Discrete Choice Experiments

In total, the combined fieldwork for the study took just four months to implement, and the team were ready to provide recommendations to the Agriculture Insurance Consortium of Uganda (AIC) within six months of the project start date. By concentrating far more directly *a priori* on the design phase of project interventions, the combined approach of SD and DCE methods is comparatively

[8] Recall that insurance premium levels are specified as affordable levels meeting WTP and dependent on coverage phase (Table 2).

time, cost and impact efficient when compared with current practice: where learnings and improved efficiencies tend to come *a posteriori* in the policy cycle (Lopez-Acevedo & Krause, 2012). Both methods are clearly user-centred tools with an explicit aim of supporting the design of policy interventions (Mangham et al., 2009; Stickdorn & Schneider, 2010; Abiiro et al., 2014; Jürisoo et al., 2018). However, they are methodologically distinct and to our knowledge have not before been combined (see Figure 2.).[9] The case study illustrates the value of the combination, in three distinct ways.

First, the *SD phase informed the DCE design*. Examples are the identification and specification of the attributes 'timing of premium payment' and 'coverage phase', and their levels. Here the SD phase fulfilled a similar function to the qualitative research that normally precedes well-designed DCEs.[10]

Second, the *SD phase triangulated research findings from the DCE phase and vice versa*. At times, a DCE finding validated an SD finding, as when low trust in VSLAs was found to hinder WII uptake provided through them. At other times, they were seemingly at odds, and a synthesis suggested new research insights. An example here is when, contrary to SD-based expectations, insurance for the whole season was strongly preferred in the DCE. This suggested that the importance for our research participants of comprehensive risk reduction outweighed the higher insurance premium that needed to be paid for that.

Third, *each methodology was able to uncover aspects of risk coping and protection that the other was not*. For example, the DCE found strong evidence for the prediction rooted in theory that bundling WII with inputs and credit increases its uptake (Awondo et al., 2017; Ward and Makhija, 2018), which the SD phase had not noticed. By contrast, the SD phase yielded nuanced insights that a DCE methodology is probably too crude to find. For instance, SD found that for asset-poor, weakly socially connected individuals, risk protection other than insurance needs to be designed. SD also revealed risk coping to be complex and multi-dimensional; our attempt failed to approximate this by a principal component-based index for use in the DCE analysis, which we think is a limitation of the quantitative method when used on its own. Finally, SD showed that the annual liquidity cycle in the

[9] Having said that, choice experiments and qualitative methods have been combined in ways that resemble the combination of service design and choice experiments advocated here; see for instance Powe et al. (2005) and Schaafsma et al. (2017). The key distinction is that our choice of qualitative methods is subservient to a design process, which influences their focus and contents as discussed in Section 3.

[10] Note, the DCE conducted its own dedicated qualitative component to refine attribute and level selection and description, see Dehmel et al., (2020).

study area affects the uptake of WII. The DCE failed to spot this because it was not able to isolate this factor from countervailing factors.

Based on the combined SD and DCE findings, UEA economists dropped their recommendation to provide WII through VSLAs, while advocating bundling WII with certified inputs and credit. The recommendation was adopted by the Ugandan insurance companies united in the AIC, which industry experts recognise had a considerable impact on the success of its nation-wide WII scheme.[11] Work is ongoing on risk-protection schemes that do justice to the heterogeneity of risk coping that the SD research uncovered (through the archetypes, and so on).

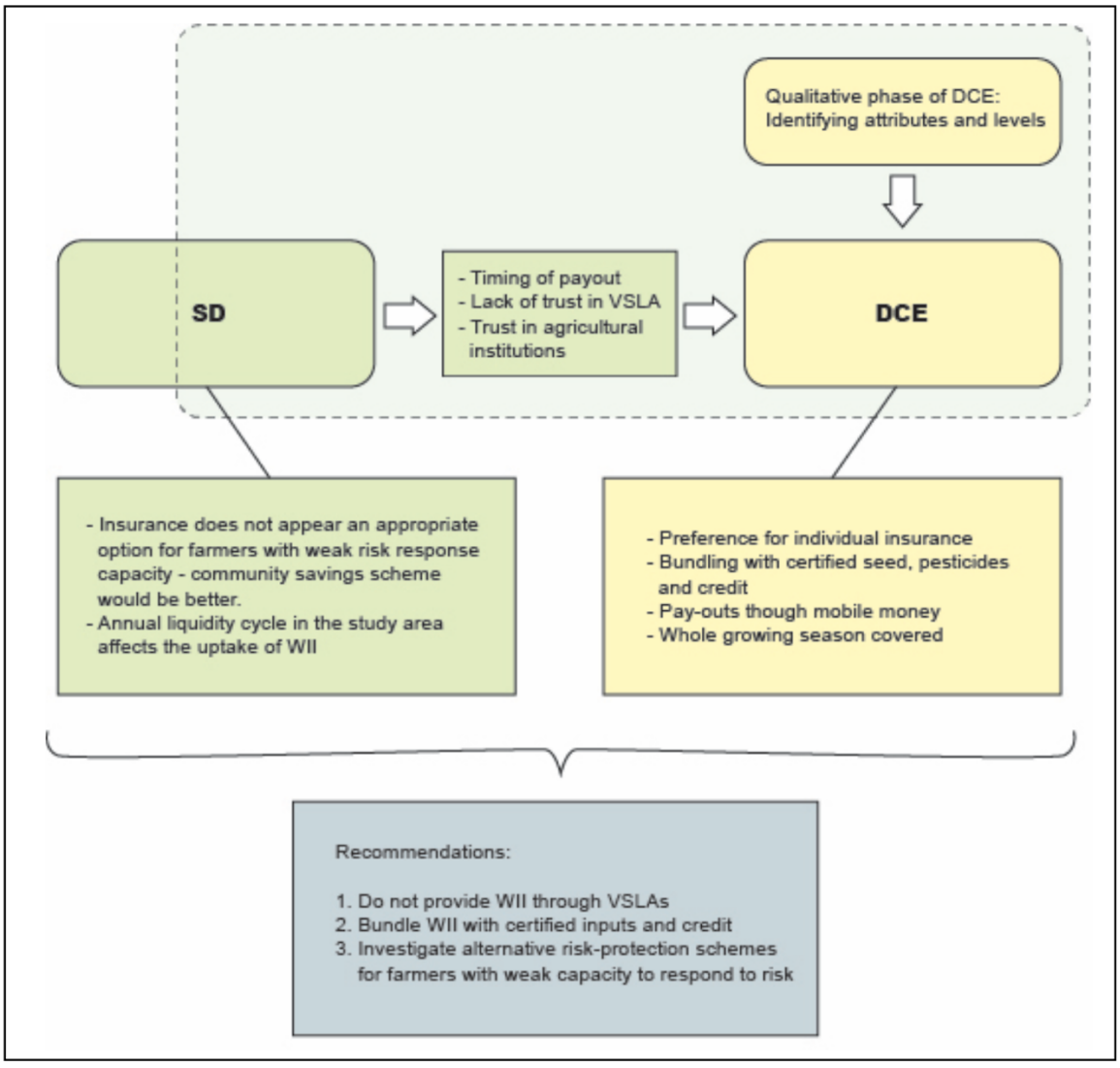

Figure 2. *Graphic representation of the discrete and collective contributions of the SD and DCE*

[11] The contribution of UEA economists' recommendations to the provision of bundled WII in Uganda is described in UKRI (2020).

research phases. The dashed line represents the parameters of the DCE investigation, whilst activities travesing this line are relevant for the wider project objective of informing the design of WII, but not necessarily relevant for the construction of the DCE itself.

Whilst traditional participatory approaches for policy relevant in-depth analysis of local contexts have often struggled to make effective use of the nuanced information in subsequent practical application (Uvin, 1995; Binswanger & Aiyar, 2003), SD when combined with DCEs thus provides a medium in which fine-grained locally informed insights can be transformed and incorporated into scalable and effective solutions. Furthermore, by combining the locally derived insights of SD into the design of subsequent DCE investigations, the research approach is able to effectively bring and transform nuanced qualitative insights into a quantitatively validated form. This delicate but robust transformation provides policymakers *operationally* with the type of data most readily required to build scalable development interventions, but crucially it also provides such data in a form (more overtly scientific and measurable) that is generally more *politically* palatable amongst planners: where a positivist outlook tends to dominate, meaning that quantitative over qualitative evidence is generally favoured.

Since SD requires the users of a future intervention to be involved in problem definition as well as solution design, the approach provides agency to local actors to question core assumptions underlying a proposed intervention, and to critique proposed design features (Lambe, Ran, Jürisoo, et al., 2020a). For example, in our case study, we demonstrated how prototyping insurance products allowed community members to reject the idea that insurance would be appropriate for all farmers in the area, and to suggest another type of support for the most vulnerable farmers in their community. Such early engagement helps to insure against the potential emergence of negative unintended consequences of interventions (Escobar, 2011; Mills, 2012), and reduces concerns about the programmatic momentum or misplaced 'directionality' driving outcomes after deployment (Brooks et al., 2009).[12]

On completion of the analysis of findings from the SD and DCE investigations, the outcomes were extensively discussed by the director of The Field Lab Uganda with farmer groups, agricultural extension workers and the district agricultural officer from the study area in about twenty individual meetings that culminated in three workshops. In this way, community members were given the

[12] Equally, the SD (and DCE) approach cannot guarantee that the study is not ultimately researcher-driven. Although the necessity of establishing 'users' needs before considering the identification of any potential problems (and certainly before sketching out any solutions) goes some way to protecting against this concern.

opportunity to comment on the findings before they were taken up by Uganda's insurance providers united in the Agricultural Insurance Consortium (AIC).

5. Conclusion

We have highlighted the growing need to recognise that the world's most persistent development challenges are embedded within a highly complex web of interactive social, technological, and ecological processes. Working with such a degree of complexity is difficult and currently there exists a knowledge practice gap between researchers exploring such dynamics and policymakers and programmers mandated to address them. As shown in our illustrative example from Uganda, we hope that by emphasising the need to refocus on the design phase of programming and providing a methodological example of how to enable this, our work can contribute to addressing this wider deficit.

As we found in Bwikhonge, the combination of service design approaches and discrete choice experiments are highly compatible in achieving this refocusing on the design of development interventions prior to deployment. Both are explicitly outcome oriented and conceptually coherent in that they seek to gain an understanding of what might work in a given setting, and both recognise that solutions are likely to be multifaceted and complicated. The qualitative service designer sees their essential task as being to translate complexity at the individual and community level and analyse, consolidate, and transform such insights into data usable for decision makers at a higher level of policymaking. Discrete choice experimenters apply a quantitative approach that is tailored to the demands of the context for which they are designed, enabling the systematic testing and evaluation of a range of hypothetical scenarios.

An additional but important benefit of both approaches is the inherent need to work in close collaboration with individuals, communities and stakeholders who represent the target beneficiaries – it is only through such engagement that either approach can produce meaningful data. In so doing, the needs, requirements and constraints of such groups are brought into focus far earlier in the programme lifecycle than is typical. Whilst this doesn't, of course, guarantee that they will influence programme outcomes, it helps at a minimum to mitigate against the potential of negative unforeseen consequences caused by development interventions.

As the Uganda case also demonstrates, both methods have their own methodological limitations and can provide differing perspectives which can be confusing to interpret. Nonetheless, we would argue that accepting a degree of uncertainty in research findings, is on balance, a necessary and realistic consequence of attempt to explore solutions in such complex settings. Clearly therefore, the approach would benefit from the lessons learned from its adoption and application in different studies and settings. Even so, just as SD and DCEs have been useful for informing policymaking in different academic fields and global regions, we see no obvious reason why their application in a Global South setting would be any less beneficial.

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Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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CRediT statement

	Conceptualisation	Methodology	Formal Analysis	Investigation	Data Curation	Writing - Original	Writing - Revision	Funding
Osborne	X	X	X	X	X	X	X	X
Lambe	X	X	X	X	X	X	X	X
Ran	X	X				X	X	X
Dehmel		X	X	X	X	X	X	
Tabacco	X	X	X		X	X	X	
Balungira			X	X	X			
Perez-Viana	X	X	X		X	X	X	
Widmark	X	X						
Holmid	X	X	X					X
Verschoor	X	X	X	X	X	X	X	X