

World Development

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

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Abstract:	<p>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.</p>

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

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

Matthew Osborne¹, Fiona Lambe¹, Ylva Ran¹, Naira Dehmel², Giovanni Alberto Tabacco³, Joshua Balungira⁴, Borja Perez-Viana⁵, Erik Widmark⁶, Stefan Holmlid⁷, Arjan Verschoor⁸

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Abstract

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

EDITOR		
Number	Comment	Actions
1	<i>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.</i>	We have complied with these requests, and as during the previous submission, have provided the corresponding data files.

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REVIEWER 1		
Number	Comment	Actions
1	<p><i>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:</i></p> <ul style="list-style-type: none"> <i>* 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.")</i> <i>* 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.")</i> <i>* 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</i> 	<p>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.</p> <p>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.</p> <p>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.</p> <p>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</p>

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22 *serves only to hone the DCE itself, whereas SD*
23 *can give separate insights: I guess maybe I can*
24 *see that, but it still does seem to me like the SD*
25 *work done on this project was primarily used as*
26 *an input into the DCE design. For example, what*
27 *specific activities from the SD were implemented*
28 *to give their own research insights that were in*
29 *no way related to the DCE design? I understand*
30 *that some of the DCE findings contradicted the*
31 *SD findings and vice versa, but that feels a lot to*
32 *me like what might occur with "typical"*
33 *qualitative work to hone a DCE. (e.g. cognitive*
34 *interviews and focus groups made the*
35 *researchers think x1 was preferred to x2, but the*
36 *DCE results showed the opposite.) Following*
37 *from what I'm writing here, I guess I found line*
38 *374 to be not too convincing: "Our objective was*
39 *thus to do more than simply engaging in a*
40 *qualitative survey honing exercise for the DCE..."*
41 *Because overall, again, it does seem like the SD*
42 *was primarily used as an input into the DCE*
43 *rather than as stand-alone research. But I do*
44 *acknowledge that it's clear the authors do not*
45 *feel the same. Also, I know the DCE team did its*
46 *own qualitative work to inform the DCE design.*
47 *Let's assume it was excellent by DCE standards -*
48 *maybe one was to help the reader understand*
49 *the potential advantages of SD over best-*
50 *practices for DCE design would be to contrast the*
51 *SD approach with what was actually done by the*
52 *DCE team. (Of course, if the measures*
53 *undertaken by the DCE weren't best practices,*
54 *that contrasting may not be very helpful.)*
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were independent, with findings being triangulated to produce the studies final conclusions.

See Lines 408, 760 & 770

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2	<p><i>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.</i></p>	<p>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.</p> <p>See Line 751</p>
REVIEWER 2		
Number	Comment	
1	<p><i>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).</i></p>	<p>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.</p>
2	<p><i>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.</i></p>	<p>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 "<i>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.</i>" Which is precisely</p>

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		<p>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.</p> <p>See Lines 225 & 231</p>
3	<p>- <i>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.</i></p>	<p>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 "<i>recommend using qualitative approaches in combination with DCEs to make full use of key concepts in cognitive psychology and decision-making (pg 106)</i>" this had only been done comprehensively in one of the 107 selected studies.</p> <p>See Line 350</p>
4	<p><i>Comment 4: Highlights:</i></p> <p>- <i>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</i></p>	<p>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."</p> <p>See Line 68</p>
5	<p><i>Comment 6:</i></p> <p>- <i>Line 374: What is a survey honing exercise? Please rephrase.</i></p>	<p>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.</p> <p>See Line 411</p>
6	<p><i>Comment 15:</i></p> <p>- <i>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.</i></p>	<p>We agree and have deleted the footnote (this was a footnote to line 629 in the current version).</p> <p>See Line 629</p>

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7	<p><i>Comment 20</i></p> <p>- <i>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.</i></p>	<p>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.</p> <p>See Lines 557-576</p>
8	<p>- <i>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.</i></p>	<p>We have now provided this information in the main text.</p> <p>See Lines 557-576</p>

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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1 *Designing development interventions: The application of service*
2 *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.

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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.
- 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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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

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7 136 useful, efficient and desirable to the user (Penin, 2017; Stickdorn & Schneider, 2012). A central tenet
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9 137 in service design is the principle of co-creation, where actors in service systems engage in a creative
10 138 process to define problems and explore solutions (Jones, 2014).

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12 140 In the Global North we see an increasing trend of using SD to inform policy delivery and yet today
13 141 this approach is rarely used when it comes to designing development programming (Howlett, 2011;
14 142 Bason, 2017; Malmberg, 2017). We will show how the SD approach can be used to absorb a
15 143 significant amount of nuanced information and translate such data into forms that can allow for the
16 144 development of viable solutions to multidimensional challenges; and then, to complement and
17 145 triangulate these insights, they can be used to inform choice experiments prior to deployment.
18 146 Whilst each methodology can operate as an independent body of work, and each has its own
19 147 strengths and limitations, as a combined approach, it is cheap, quick and reduces the risk of doing
20 148 harm whilst providing an opportunity to deliver well-designed projects at scale. In particular though,
21 149 we feel that it would be most immediately advantageous when it comes to designing programme
22 150 interventions at a sub-national project level where the degree of complexity and multidimensionality
23 151 often makes it challenging for traditional alternative approaches to deliver programmes at scale of
24 152 sufficient nuance and appropriateness (Whitney & Kelkar, 2004; Datta & Mullainathan, 2014; Maher
25 153 et al., 2018a).

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27 155 Following this introduction (1), we outline where we see our proposed approach fitting into the
28 156 broader discourse around development programming in complex settings (2), and then introduce
29 157 the central concepts and applications of service design and discrete choice experiments (3).
30 158 Following this description, we provide an illustrative example of where it has been employed to
31 159 inform a complex financial, climate adaptation and equity programme in Uganda (4). We conclude
32 160 with a discussion of the methodological approach in combination, its limitations, and its potential to
33 161 inform future development intervention design (5).

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36 164 **2. The Challenge of Complexity**
37 165 Historically, and contrary to negative stereotypes, governments and organisations have been quite
38 166 successful at delivering top-down development programming when such activities have been
39 167 relatively standardised, routine and in high volume (Andrews et al., 2012; Denizer et al., 2013). This
40 168 is especially the case when developmental problems are easy to define and where discrete
41 169 technological or logistical solutions can be found – i.e., the Green Revolution in the 1970s, small-pox
42 170 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 requires 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),

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7 205 the SEI team have sought to triangulate the findings of the SD investigations by combining them with
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9 206 quantitative methods so as to provide more 'evidential robust' findings to support future
10 207 programme and intervention design (Lambe, Ran, Kwamboka, et al., 2020a). In looking to expand
11 208 the combination of quantitative approaches that could be combined with SD, the SEI team were
12 209 keen to collaborate with the researchers from the Norwich Institute for Sustainable Development
13 210 (NISD) and The Field Lab Uganda who intended to use a series of DCEs to investigate the potential
14 211 role of insurance in overcoming persistent poverty traps amongst smallholder farmers in Uganda. As
15 212 an approach, there appeared to be a clear compatibility with the underlying operation and objective
16 213 of SD: in that such quantitative instruments are used to capture and consolidate a significant degree
17 214 of complexity and produce data that can be used to inform the future construction and delivery of
18 215 products or services. (Bennett & Birol, 2010; Terris-Prestholt et al., 2019).

26 218 3. Combining Service Design and Choice Experiments

27 219 There is of course a rich history of combining ~~different~~ quantitative and qualitative approaches in
28 220 development research and practice, and the benefits of such triangulated approaches are well
29 221 recognized. Within DCE studies qualitative components, such as focus groups or interviews, are
30 222 often included during the preparation of experiments, as well as deployed later to better understand
31 223 experimental findings (Powe et al., 2005; Kløjgaard et al., 2012). In the Global South, the use of DCEs
32 224 in combination with qualitative components is growing, however in most cases the function of such
33 225 qualitative dimensions remains subservient to the requirements of the DCE investigation (Mangham
34 226 et al., 2009; Van den Broeck et al., 2017; Van Gevelt et al., 2017; Menyeh, 2021; Agarwal et al.,
35 227 2021), ~~i.e., Schaafsma et al., 2017; Van den Broeck et al., 2017; Van Gevelt et al., 2017; Rabkin et al.,~~
36 228 ~~2020~~. To our knowledge there are only a handful of published studies from the Global South where
37 229 DCEs have been combined with participatory investigations in a fully aligned manner, and where
38 230 their independent findings and outputs are equally relied upon to inform the final conclusions and
39 231 recommendations of the project (i.e. Duguma et al., 2010; Kenter et al., 2011; Kenter, 2016; Brunie
40 232 et al., 2016; Indravudh et al., 2017; Schaafsma et al., 2017). This could in part be explained by the
41 233 challenges of coordinating interdisciplinary research as Rakotonarivo et al., (2016) suggest,
42 234 nonetheless it is with the view of building upon the foundations of such studies that we see the
43 235 opportunity for SD and DCEs to provide such a positive contribution in this area.

52 237 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).

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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).

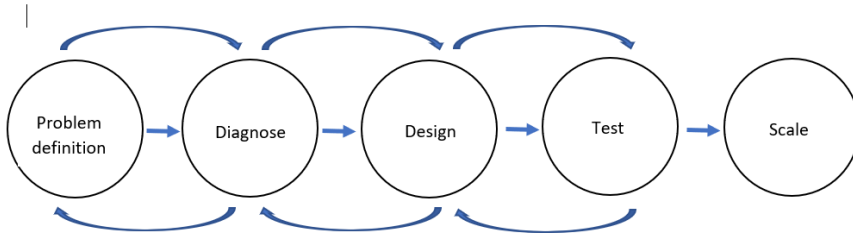


Figure 1. The stages of a service design driven intervention process, adapted from Tania, (2017)

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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

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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 (Abihiro 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 &

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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 exercise 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 groups³

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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7 429 cycles, risk response journeys, actors and financial flows along crop value chains, and a framework
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9 430 assessment of farmers' risk coping capacity.

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12 432 The stages and operation of an ideal SD study are outlined in the companion methodological paper
13 433 see Dehmel et al., (2021), and further examples of SD methodology can be found in similar studies
14 434 such as see Jürisoo et al., (2018); Muhoza & Johnson, (2018); Lambe et al., (2020). As an explicitly
15 435 iterative and abductive research approach however, the actual practice of conducting a SD study in
16 436 the field means that the specific activities will be responsive to the study's contextual demands and
17 437 constraints, as was the case here.

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21 438 **4.2.1 The emergence of key insights**

22 439 Whilst the ordering and selection of fieldwork activities broadly followed the SD model of problem
23 440 co-definition, actor-centred mapping, experience-based problem definition, rapid prototyping and
24 441 then design and qualitative testing of the insurance prototypes, in practice a significant degree of
25 442 iteration and repetition of stages occurred as different lines of enquiry developed (Lambe, Ran,
26 443 Jürisoo, et al., 2020a).

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30 444 As an abductive process, this is typical of a SD study where the process of learning and doing happen
31 445 concurrently. We summarise below several strands of such enquiries, and how they led to
32 446 formalised findings.

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35 448 *Mapping farming and income cycles*

36 449 An ongoing line of enquiry was to establish with farmers how the annual crop and income cycle
37 450 interacted in this heavily agriculturally dependent region. It was shown that crops are not grown in
38 451 isolation, nor is finance linked to individual crops. Rather, each crop is grown as a means to finance
39 452 future costs and investments for subsequent cultivation periods.

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41 454 In Bwikhonge the end of the first growing season starts with preparation of the land and planting in
42 455 January and February, with associated costs incurred for inputs which included (for some) the
43 456 renting of land, hiring of additional labour, the purchasing of seeds and fertilizers, etc. Major sales of
44 457 maize – the primary first season crop – occurs during August and September, at which time farmers
45 458 reported being less income constrained than throughout the rest of the year. The second growing
46 459 season begins in September with a more diverse range of cash-crops that include cotton, sunflower,
47 460 tomatoes, etc. which are sold around November and December. Since the majority of farmers
48 461 subsisted on the maize (primarily) that was produced in the first growing season, the decision about

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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;

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7 496 Saadat et al., 2018). The purpose of developing the archetypes was to find a way to represent
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9 497 multiple complex characteristics that determine how different types of farmers cope with risk within
10 498 the context of the system they were operating. We named our characters (A)ndrew (strong capacity
11 499 to respond to risk), (B)etty (weak capacity to respond to risk) and (C)harles (medium capacity to
12 500 respond to risk).
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14 501
15 502 *From archetypes to prototypes*
16
17 503 During the first round of 10 interviews, ideas for prototype insurance products emerged and were
18 504 discussed and refined during subsequent interviews, and in the field workshops. This abductive
19 505 mode of testing early “sketches” of an insurance product resulted in deeper insights about the needs
20 506 of different types of farmers as well as critical insights about the community that would have
21 507 implications for the design of a WII. For example, when testing different payment models for
22 508 insurance packages we found that many less well-off farmers could not afford even very low-cost
23 509 insurance. Another early prototype tested during the interviews involved the local village savings
24 510 and loan association (VSLA) acting as the agent responsible for handling WII pay outs. Responding to
25 511 this prototype, we learned from several farmers that levels of trust in the local VSLA were generally
26 512 very low, with some reporting that they had been “cheated” by the VSLA in the past. However,
27 513 through these discussions on trust in the community, we learned that most farmers have a high
28 514 regard for other community organisations including agricultural input stores and other microfinance
29 515 institutions such a burial savings schemes.
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31 516
32 517 During the solutions prototyping workshop we used storytelling and sketching to describe and
33 518 visualise the archetypes in detail for the participants. After presenting each archetype, we asked
34 519 the participants whether they could identify with (A)ndrew, (B)etty and (C)harles and invited them
35 520 to suggest changes to the details of the archetypes to bring them closer to the reality of the
36 521 community. Once satisfied with how the archetypes were described, the participants worked in
37 522 groups to map out the risk response journeys that they imagined each of these characters taking in
38 523 the event of a sudden shocks (such as severe drought or pest infestation).
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40 524
41 525 Using these archetypes and informed by the SD fieldwork as well as with references to earlier
42 526 foundational work by the UEA economist team, we then introduced the refined insurance
43 527 prototypes that had emerged from the interviews during a subsequent design and testing workshop.
44 528 These protoypes included a ‘full coverage’, more expensive insurance option, that would cover all
45 529 losses; a less expensive option that would cover the cost of inputs (seed and fertilizer); and a cheap
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'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'.

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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).

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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).

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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-county⁵ 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. (2012), 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:

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

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

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7 690 stringent Independence of Irrelevant Alternatives (IIA) assumption, which other competing methods
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9 691 must hold and would be violated in our application (McFadden, 1974; De Bekker-Grob et al., 2012).⁶

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11 692 As described in eq. (1), the latent relationship between the utility of the alternative and its two
12 693 components is assumed to be linear, specifically in our application it takes the following form:

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

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16 695 where U_{ij}^* is the latent utility of alternative j for individual i , which is not directly observed, and
17 696 instead is represented by bivariate variable Y_{ij} that takes value 1 if an option is chosen (i.e. $U_{ij}^* > 0$)
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19 697 and 0 if it is not. A_j is a set of bivariate variables which define the attributes of every alternative j .
20 698 They include whether insurance is offered to saving groups, whether it is bundled with inputs, the
21 699 timing of the premium payment and the payout delivery channel (see Table 4 for the full list). Lastly,
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23 700 X_i includes the individual level controls, and ε_{ij} is the error term.⁷

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25 701 We report in Table 4 two models, one estimating the unconditional effect of insurance being offered
26 702 to savings groups (model 1), the other with that effect interacted with land ownership and trust in
27 703 the savings group (model 2).⁸ The table reports marginal effects. If these are multiplied by 100, then
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29 704 they can be interpreted as the change in percentage points of the probability of an insurance option
30 705 being chosen as a result of the change in the attribute under consideration from its base level to the
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32 706 level associated with the marginal effect. The main effects are the following.

33 707 First, when insurance is offered to a savings group rather than to an individual, the unconditional
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35 708 probability of the insurance option being chosen goes down by 18 percentage points (model 1).
36 709 However, when land ownership and trust in the savings group are interacted with the saving group
37 710 attribute, its effect changes substantially.
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39 711 Trust in savings groups is measured on a scale from 1 to 5 and land ownership (bar the four largest
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41 712 landowners in the sample) ranges from 0 to 10 acres. Specification (1) of model (2) shows that, for a
42 713 person with no trust in the savings group and no land, the probability of choosing an insurance
43 714 option when it is offered to the savings group goes down by almost 40 percentage points when the
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47 ⁶ While more complex alternative methods exist which could fit our data, like the mixed (or random parameters) logit
48 model, we believe that we lack the necessary priors to decide on the crucial assumptions that the method requires. For
49 instance, we neither know which parameters to specify at random, nor the distribution they could follow. If decisions like
50 these—and several others—are not carefully researched and convincingly settled, they can greatly compromise the
51 internal validity of the analysis and lead to misuse of such advanced method, as documented by some of its exponents
(Hensher and Greene, 2003).

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

53 ⁸ All significant effects shown in Table 4 are robust to the inclusion of controls and (where appropriate) the sequential
54 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			
<i>Insurance unit</i>			
Savings group compared to individual contract	-0.1776*** (-4.47)	-0.3983*** (-4.59)	-0.0585 (-0.389)
Trust in savings group	-0.0001 (-0.54)	-0.0002 (-1.03)	-0.0002 (-1.03)
Land owned in acres	-0.0001*** (-3.18)	-0.0001*** (-3.04)	-0.0001*** (-3.04)
<i>Bundling (base: no bundling)</i>			
With certified seed	.1066*** (4.25)	.1078*** (4.27)	.1078*** (4.27)
With certified seed and pesticides	.0670*** (2.62)	.0669*** (2.59)	.0669*** (2.59)
With certified seed and pesticides and an agro-input loan	.1051*** (4.76)	.1054*** (4.73)	.1054*** (4.73)
<i>Timing of premium payment (base: Jan-Feb)</i>			
August-September	.0035 (0.15)	.0042 (0.18)	.0042 (0.18)
November-December	.0582*** (2.72)	.0591*** (2.74)	.0591*** (2.74)
<i>Payout delivery channel (base: local agent)</i>			
Agro-input shop	.0440** (2.32)	.0436** (2.28)	.0436** (2.28)
Mobile money	.1294*** (5.72)	.1300*** (5.70)	.1300*** (5.70)
<i>Coverage phase (base: whole season)</i>			
Germination	-.3726*** (-13.40)	-.3758*** (-13.59)	-.3753*** (-13.62)
Plant growth	-.2863*** (-11.91)	-.2885*** (-11.99)	-.2883*** (-12.01)
Flowering	-.2094*** (-7.86)	-.2105*** (-7.86)	-.2104*** (-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

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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.

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).

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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; Abiuro 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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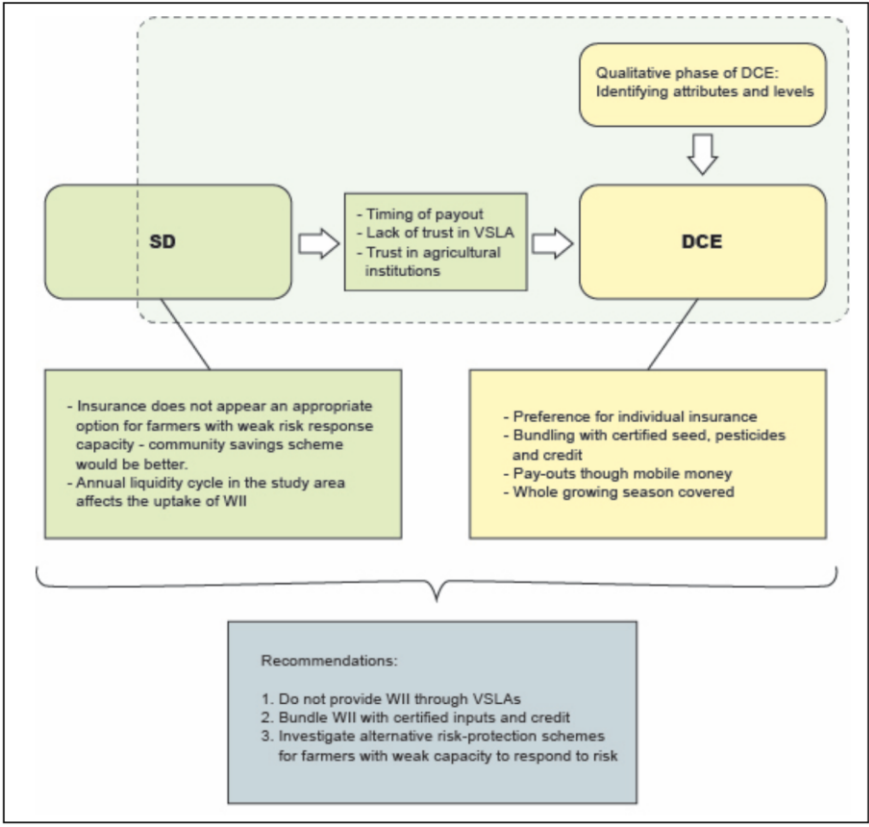


Figure 2. Graphic representation of the discrete and collective contributions of the SD and DCE research phases. The dashed line represents the parameters of the DCE investigation, whilst activities traversing this line are relevant for the wider project objective of informing the design of WII, but 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

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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

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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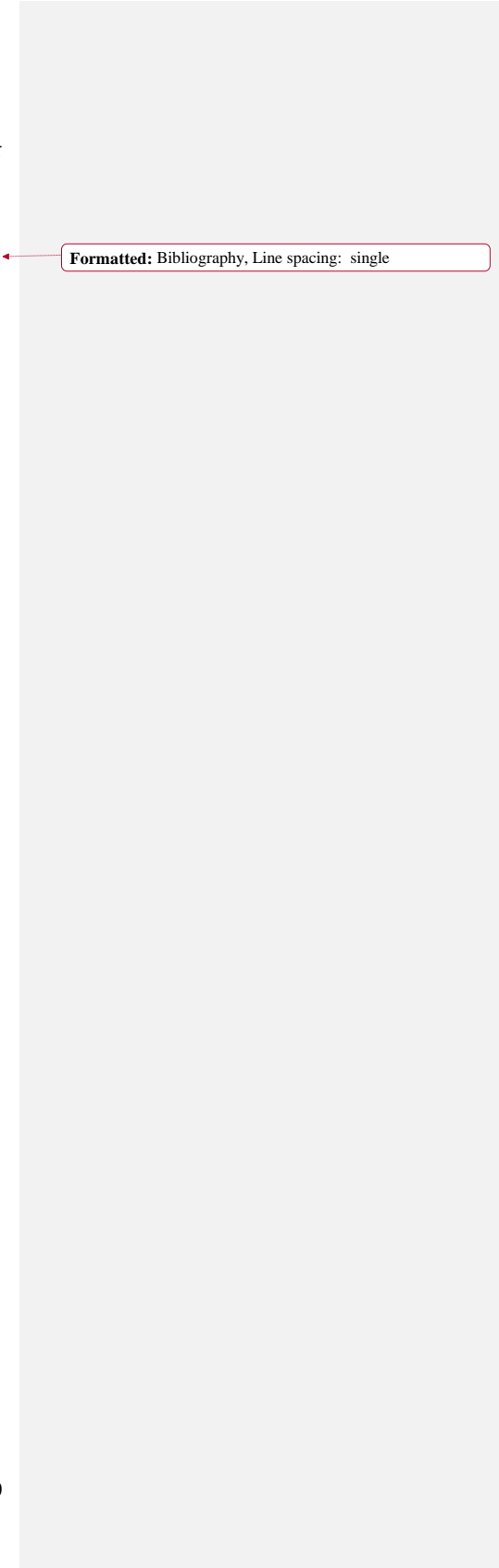
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3 2 ***design and discrete choice experiments in complex settings.***
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34 Abstract

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

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68 **Highlights**

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

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102 1. Introduction

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

116

117 Indeed, in a rapidly evolving and complex world system, development programming must not only
118 be able to meet new demands, but also requires speed and flexibility in transferring and adapting
119 policy innovations across places and time (Ramalingam, 2013; Ramalingam et al., 2014;
120 Development Studies Association, 2021). Echoing the Senior Vice President of the World Bank,
121 Mahmoud Mohieldin (2019) “the business-as-usual model will not suffice to deliver the aims of
122 2030”; therefore the development community urgently requires means and methods capable of
123 deploying programme innovations to complex challenges in a nuanced and appropriate, yet rapidly
124 scalable manner.

125

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

133

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

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

139
140 In the Global North we see an increasing trend of using SD to inform policy delivery and yet today
141 this approach is rarely used when it comes to designing development programming (Howlett, 2011;
142 Bason, 2017; Malmberg, 2017). We will show how the SD approach can be used to absorb a
143 significant amount of nuanced information and translate such data into forms that can allow for the
144 development of viable solutions to multidimensional challenges; and then, to complement and
145 triangulate these insights, they can be used to inform choice experiments prior to deployment.
146 Whilst each methodology can operate as an independent body of work, and each has its own
147 strengths and limitations, as a combined approach, it is cheap, quick and reduces the risk of doing
148 harm whilst providing an opportunity to deliver well-designed projects at scale. In particular though,
149 we feel that it would be most immediately advantageous when it comes to designing programme
150 interventions at a sub-national project level where the degree of complexity and multidimensionality
151 often makes it challenging for traditional alternative approaches to deliver programmes at scale of
152 sufficient nuance and appropriateness (Whitney & Kelkar, 2004; Datta & Mullainathan, 2014; Maher
153 et al., 2018a).

154
155 Following this introduction (1), we outline where we see our proposed approach fitting into the
156 broader discourse around development programming in complex settings (2), and then introduce
157 the central concepts and applications of service design and discrete choice experiments (3).
158 Following this description, we provide an illustrative example of where it has been employed to
159 inform a complex financial, climate adaptation and equity programme in Uganda (4). We conclude
160 with a discussion of the methodological approach in combination, its limitations, and its potential to
161 inform future development intervention design (5).

162
163

2. The Challenge of Complexity

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

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

176
177 Nonetheless, “*the conventional assumption that ‘scientific’ approaches to policy and planning*
178 *provide the most reliable guidance for practitioners and researchers when working within complex*
179 *settings,”* has been persuasively critiqued for decades (Head, 2019:180). These arguments have
180 become increasingly compelling as the persistence of such ‘wicked problems’ as global poverty,
181 rising inequalities, climate change, and biodiversity loss remain unresolved (Head, 2008; Moser et
182 al., 2012; Head & Alford, 2015). These ongoing challenges have led to calls for greater
183 acknowledgement and engagement with the dynamic, multidimensional, and inherently complex
184 nature of such problems (D. Burns & Worsley, 2015; Hämäläinen, 2015; Waddock et al., 2015;
185 Reyers et al., 2015; Salonen & Konkka, 2015; Lambe, Ran, Jürisoo, et al., 2020a).

186
187 Correspondingly, there is a growing body of evidence that has shown how SD can be a useful
188 approach to facilitate the design of services and policies that work for citizens in complex settings (C.
189 Burns et al., 2006; Malmberg, 2017; Bason, 2016, 2017; Cottam, 2018). SD shows promise as a
190 method for understanding and situating micro-level needs, preferences and concerns and translating
191 this information into meso and macro-level programme design. For example, SD was used by
192 research teams at the Stockholm Environment Institute (SEI) to inform the design of interventions
193 aimed at boosting the incomes of small-scale mango farmers in Kenya (Lambe, Ran, Jürisoo, et al.,
194 2020b) to improve the design of clean cookstove interventions in Kenya and Zambia (Jürisoo et al.,
195 2018b; Lambe, Ran, Kwamboka, et al., 2020c) and to inform the design of minigrid services for
196 households and businesses in Tanzania and Zambia (Muhoza & Johnson, 2018b; Ogeya et al., 2021).
197 A common feature of these studies is the complexity of the problem in focus (e.g., interventions that
198 seek to change household energy practices require the improved service or technology to satisfy the
199 needs of the targeted users in terms of affordability, convenience, cultural fit, behavioral patterns,
200 etc.), and often the needs of multiple key stakeholders must be met for the intervention to be
201 effective (cookstove user, other family members, service provider, etc.).

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

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

215

216

217 **3. Combining Service Design and Choice Experiments**

218 There is of course a rich history of combining quantitative and qualitative approaches in
219 development research and practice, and the benefits of such triangulated approaches are well
220 recognized. Within DCE studies qualitative components, such as focus groups or interviews, are
221 often included during the preparation of experiments, as well as deployed later to better understand
222 experimental findings (Powe et al., 2005; Kløjgaard et al., 2012). In the Global South, the use of DCEs
223 in combination with qualitative components is growing, however in most cases the function of such
224 qualitative dimensions remains subservient to the requirements of the DCE investigation (Mangham
225 et al., 2009; Van den Broeck et al., 2017; Van Gevelt et al., 2017; Menyeh, 2021; Agarwal et al.,
226 2021) . To our knowledge there are only a handful of published studies from the Global South where
227 DCEs have been combined with participatory investigations in a fully aligned manner, and where
228 their independent findings and outputs are equally relied upon to inform the final conclusions and
229 recommendations of the project (i.e. Duguma et al., 2010; Kenter et al., 2011; Kenter, 2016; Brunie
230 et al., 2016; Indravudh et al., 2017; Schaafsma et al., 2017). This could in part be explained by the
231 challenges of coordinating interdisciplinary research as Rakotonarivo et al., (2016) suggest,
232 nonetheless it is with the view of building upon the foundations of such studies that we see the
233 opportunity for SD and DCEs to provide such a positive contribution in this area.

234

235 **3.1 Service Design**

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

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

247

248 *How design methods differ from conventional qualitative approaches*

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

264

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

268

269 *SD process and tools*

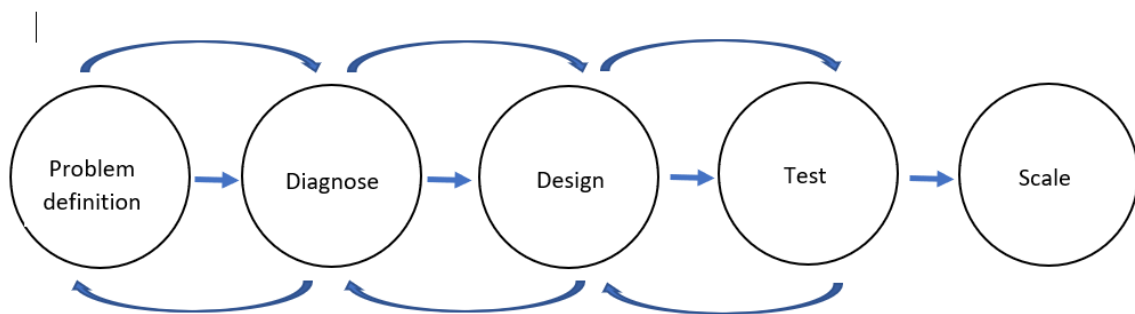
270 The iterative design process results in a detailed understanding of the problem, the stakeholder, and
271 their needs which in turn informs the subsequent iteration, and so on (Stickdorn & Schneider, 2010).

272 Solutions are developed and problems are (re)defined gradually and in parallel until a feasible and
273 desirable intervention emerges. This process involves quick prototyping of ideas and solutions early
274 in the design process where there is still room to make changes at a relatively low cost (Blomkvist,
275 2014) .

276

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

283



284

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

286

287 *SD limitations*

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

301

302 **3.2 Discrete Choice Experiments**

303 DCEs were first developed as a means of understanding consumer demands for particular products
304 or services (Louviere & Woodworth, 1983). They have their origins in the economic theory of
305 demand, and especially in the work of Lancaster, who proposed that the demand for goods was
306 effectively driven by demand for specific combinations of their characteristics (Lancaster, 1966).

307 DCEs are a quantitative method that allows for the systematic elicitation of such individual
308 preferences. Importantly, the approach allows for the thorough evaluation of how different
309 characteristics (or *attributes*) of a proposition - or in this case policy intervention - are valued by a
310 participant: how they balance these attributes, and how they evaluate the relative importance of
311 different attributes against one another (Street & Burgess, 2007; Bennett & Birol, 2010).

312

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

319

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

326

327 *DCE limitations*

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

335 attribute selection with imprecise or counter-intuitive weighting of levels will reduce confidence that
1 336 participants are able to make informed and representative selections from the available choice-sets
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3 337 (Coast & Horrocks, 2007; Kløjgaard et al., 2012).
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5 338
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7 339 To avoid this, it is strongly recommended by experts to use qualitative approaches to ensure that
8
9 340 choice-sets are meaningful and relevant to experimental participants: *“We cannot overemphasise
10 341 how important it is to conduct this kind of qualitative, exploratory work to guide subsequent phases
11 342 of the stated preference study... The study team should endeavour to understand the dimensions...
12 343 along which the product is evaluated by consumers and how specific levels of these dimensions are
13 344 expressed...”* (Louviere, Hensher, and Swait 2000: pg 257-8). Despite the recognised importance of
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15
16 345 the necessity to conduct substantive qualitative research to better select, frame and translate the
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19 346 DCE, in practice many published studies fail to appropriately engage in the qualitative component of
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21 347 the experiment, or little information is provided about how this phase was conducted in practice
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23 348 (Rakotonarivo et al., 2016; Vass et al., 2017) .
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28 351 **4. Illustrative case study - WII in Uganda**

30 352 **4.1 Case study background**

32 353 Economists from Norwich Institute for Sustainable Development (NISD) at the University of East
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34 354 Anglia and partnership institutions have studied the risk-taking and risk-sharing habits of smallholder
35
36 355 farmers in Bugisu in eastern Uganda since 2001.¹ Working with major insurance companies in the
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38 356 country, agricultural extensionists, farmers’ organisations, seed companies and agro-dealers,
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40 357 research findings were translated into recommendations for risk protection measures that would
41
42 358 encourage agricultural investment, increase the productivity of farms, and lead to higher incomes
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44 359 and poverty reduction (Balungira et al., 2016; McSherry, 2017). The main recommendation was to
45
46 360 bundle Weather Index Insurance (WII) with authenticated agricultural inputs and credit, as well as to
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48 361 offer this to established risk-sharing groups, in particular village savings and loans associations
49
50 362 (VSLAs) (Verschoor, Clist, et al., 2016).
51

52 363

53 364 However, UEA’s economists involved in the research were not confident in this recommendation. It
54
55 365 was inferred from research findings obtained in lab-in-the-field experiments, and therefore based on
56
57 366 behaviour observed in stylised settings, in which hypotheses are tested about particular factors in
58

59 ¹ Research findings are reported in *inter alia* Humphrey and Verschoor (2004a,b), Harrison et al. (2010), D’Exelle and
60 Verschoor (2015), Verschoor et al. (2016) and Verschoor and D’Exelle (2021).
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367 isolation by keeping all other relevant factors at bay that determine behaviour in real life. In complex
1 368 settings, these other factors interplay with the factors tested, which may undo or reinforce (as the
2 case may be) the effect of the factors studied in the experiments. Moreover, it was silent about
3 369 some of the other factors that previous studies of WII have found to be important in determining its
4 370 desirability for the purposes of risk protection.²
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10 373 UEA's economists thus faced the challenge of understanding better (than their experiments had
11 374 allowed them to) the complexity of factors behind risk protection that would interplay with the
12 375 provision of WII in the context of farmers' livelihoods in Bugisu. In order to meet this challenge, they
13 376 teamed up with the team of social scientists from the Stockholm Environment Institute (SEI) to
14 377 implement the study described in this paper.
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20 378
21 379 Our case study was conducted in Bwikhonge, Bulambuli district of eastern Uganda with the objective
22 380 of understanding the viability of different WII designs from the perspective of local smallholder
23 381 farmers. The study applied a combined SD and DCE approach whereby each methodology would
24 382 operate as an independent body of work but conducted in a coordinated fashion to facilitate the
25 383 triangulation of data and findings.
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30 384
31 385 WII is a financial service innovated specifically for application in low-income rural areas, where
32 386 traditional insurance schemes have been shown to be too costly for widespread uptake. Based on a
33 387 verifiable index of weather patterns that correlates with on-farm losses, WII can save otherwise
34 388 prohibitive transaction and claim verification costs and has enjoyed increasing attention as a
35 389 promising lever out of rural poverty traps (Barnett & Mahul, 2007). As with other insurances the
36 390 intention of risk pooling and risk spreading by design aspires to scalable uptake across geo-climatic
37 391 areas. At the same time, WII design features are highly context dependent. Whilst ecological,
38 392 climatic and agricultural factors may play a preliminary role to determine an insurance's risk
39 393 coverage, institutional arrangements (e.g., pay-out channels, bundling options or group insurances)
40 394 to reduce transaction costs, avoid unforeseen risks, and build trust and demand need to be socio-
41 395 economically and culturally contextualized (Dercon & Gollin, 2014).
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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)..

397 Clearly, WII has great promise as a means of alleviating poverty and preventing food insecurity in
1 398 low-income countries but to date there has been disappointing uptake of early schemes (Platteau et
2 al., 2017). With notable exceptions (Clarke, 2016), what has so far been generally under-researched
3 399 is understanding how simple deficiencies in the design of many index insurance products - often
4 400 related to local, contextual factors - has resulted in limited uptake of these products (Dercon, 2007;
5 401 Dercon et al., 2008). A promising avenue of research, and a suitable application of our approach,
6 402 was therefore to try to address these deficiencies and design WII packages that would be more likely
7 403 to be adopted.
8 404

14 405

16 406 4.2 Service Design Phase

17 407 In phase one, SD methodology was applied to gain a contextual understanding of the socio-
18 408 economic and ecological system and relevant actors' perspectives. Our objective was thus to do
19 409 more than simply use qualitative methods as a means to improve the DCE survey, , but rather it was
20 410 to engage in an independent co-design process with farmers and other key stakeholders such as
21 411 agricultural extension workers, district agricultural officers, and a major provider of agricultural
22 412 insurance in Uganda. With the purpose of co-designing prototype of a future WII product which
23 413 contained features which would be of value to such stakeholder groups³

30 414

31 415 During the SD phase, we conducted 20 participant observations, 48 key informant interviews, 14
32 416 field workshops, two larger workshops – a solutions prototyping, and a testing and validation
33 417 workshop - both with 40 local farmers and stakeholders. Apart from the key informants, participants
34 418 were randomly sampled household heads and spouses taken from the same population lists that
35 419 were used in the subsequent DCE phase that had been generated in previous rounds of fieldwork.
36 420 Participant observation is typically the starting point in a design process, to better understand the
37 421 users' context. In our case, participant observation allowed us to quickly familiarise ourselves with
38 422 the farmers' daily practices, and to relate their daily routines to the themes of the interview.
39 423 Interviews and field workshops were conducted at respondent's homes and/or farms by four
40 424 research teams each consisting of one research lead and one assistant, using paper and pencil to
41 425 record responses. Specific activities included detailed mapping of annual farming, income and risk
42 426 cycles, risk response journeys, actors and financial flows along crop value chains, and a framework
43 427 assessment of farmers' risk coping capacity.

56 428

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

429 The stages and operation of an ideal SD study are outlined in the companion methodological paper
1 see Dehmel et al., (2021), and further examples of SD methodology can be found in similar studies
2
3 431 such as see Jürisoo et al., (2018); Muhoza & Johnson, (2018); Lambe et al., (2020). As an explicitly
4
5 432 iterative and abductive research approach however, the actual practice of conducting a SD study in
6
7 433 the field means that the specific activities will be responsive to the study's contextual demands and
8
9 434 constraints, as was the case here.

11 435 **4.2.1 The emergence of key insights**

13 436 Whilst the ordering and selection of fieldwork activities broadly followed the SD model of problem
14
15 437 co-definition, actor-centred mapping, experience-based problem definition, rapid prototyping and
16
17 438 then design and qualitative testing of the insurance prototypes, in practice a significant degree of
18
19 439 iteration and repetition of stages occurred as different lines of enquiry developed (Lambe, Ran,
20
21 440 Jürisoo, et al., 2020a).

23 441 As an abductive process, this is typical of a SD study where the process of learning and doing happen
24
25 442 concurrently. We summarise below several strands of such enquiries, and how they led to
26
27 443 formalised findings.

28 444 29 30 445 *Mapping farming and income cycles*

32 446 An ongoing line of enquiry was to establish with farmers how the annual crop and income cycle
33
34 447 interacted in this heavily agriculturally dependent region. It was shown that crops are not grown in
35
36 448 isolation, nor is finance linked to individual crops. Rather, each crop is grown as a means to finance
37
38 449 future costs and investments for subsequent cultivation periods.

39 450
40
41 451 In Bwikhonge the end of the first growing season starts with preparation of the land and planting in
42
43 452 January and February, with associated costs incurred for inputs which included (for some) the
44
45 453 renting of land, hiring of additional labour, the purchasing of seeds and fertilizers, etc. Major sales of
46
47 454 maize – the primary first season crop – occurs during August and September, at which time farmers
48
49 455 reported being less income constrained than throughout the rest of the year. The second growing
50
51 456 season begins in September with a more diverse range of cash-crops that include cotton, sunflower,
52
53 457 tomatoes, etc. which are sold around November and December. Since the majority of farmers
54
55 458 subsisted on the maize (primarily) that was produced in the first growing season, the decision about
56
57 459 investment in the subsequent growing season was highly dependent on its relative bounty. Since,
58
59 460 with a good harvest and food security assured, they would have greater flexibility about their
60
61 461 choices and investments (and potential earnings) going into the second growing season. Conversely,

1 462 a poor first harvest, restricted choice as the demand to satisfy basic needs outweighed maximising
2 463 agricultural earnings.

3 464

4
5 465 Accordingly, the end of the maize season and the end of the cash crop season were identified as
6
7 466 potential promising timings for the insurance premium payment – with the significant qualifier that
8
9 467 such premiums may not be within reach of the most vulnerable farmers. Furthermore, the SD phase
10
11 468 suggested that insurance that could provide cover to specific crops seasons might be preferable to a
12
13 469 comprehensive annual policy.

14 470

15 16 471 *Mapping diverse risk coping mechanisms*

17
18 472 It was apparent that in the absence of formal insurance, farmers in the region had an array of risk
19
20 473 management strategies. We found through mapping and comparing risk response journeys from
21
22 474 different farmers that there were substantial differences between household risk coping strategies,
23
24 475 even in households that were ostensible socio-economically similar. We identified 11 categories of
25
26 476 behaviours that farmers engage in when responding (as individuals and households) to risks or
27
28 477 shocks – ranging from selling of land or other assets to borrowing money from friends or family, etc.
29
30 478 Broadly these could be clustered along four key metrics or categories: social
31
32 479 networks, social institutions, agricultural diversity, and economic diversity.

32 480

33
34 481 These four categories represent the diverse sources of capacity for farmers to respond to risk. Taken
35
36 482 together, the categories are a way to understand overall capacity to respond to shock, rather than
37
38 483 risk response based solely on economic wealth. To capture the richness of the risk coping strategies
39
40 484 applied, we mapped the risk response capacity of each farmer we interviewed along these four
41
42 485 dimensions, and then visualized the overall risk capacity using a simple spider diagram (see
43
44 486 supplementary material in Dehmel et al., (2021).

44 487

45
46 488 As we began to develop an ever more detailed and substantive understanding of the agricultural
47
48 489 system and the users operating within it, in collaboration with our colleagues at The Field Lab
49
50 490 Uganda, we were able to develop farmer “archetypes” to describe each category and to devise a
51
52 491 narrative history and a name for each one. An archetype can be thought of as a model representing
53
54 492 an observed pattern in terms of composite factors or characteristics (Vaillancourt et al., 2014;
55
56 493 Saadat et al., 2018). The purpose of developing the archetypes was to find a way to represent
57
58 494 multiple complex characteristics that determine how different types of farmers cope with risk within
59
60 495 the context of the system they were operating. We named our characters (A)ndrew (strong capacity

496 to respond to risk), (B)etty (weak capacity to respond to risk) and (C)harles (medium capacity to
1
2 497 respond to risk).

3
4 498

5 499 *From archetypes to prototypes*

6
7 500 During the first round of 10 interviews, ideas for prototype insurance products emerged and were
8
9 501 discussed and refined during subsequent interviews, and in the field workshops. This abductive
10
11 502 mode of testing early “sketches” of an insurance product resulted in deeper insights about the needs
12
13 503 of different types of farmers as well as critical insights about the community that would have
14
15 504 implications for the design of a WII. For example, when testing different payment models for
16
17 505 insurance packages we found that many less well-off farmers could not afford even very low-cost
18
19 506 insurance. Another early prototype tested during the interviews involved the local village savings
20
21 507 and loan association (VSLA) acting as the agent responsible for handling WII pay outs. Responding to
22
23 508 this prototype, we learned from several farmers that levels of trust in the local VSLA were generally
24
25 509 very low, with some reporting that they had been “cheated” by the VSLA in the past. However,
26
27 510 through these discussions on trust in the community, we learned that most farmers have a high
28
29 511 regard for other community organisations including agricultural input stores and other microfinance
30
31 512 institutions such a burial savings schemes.

30 513

31
32 514 During the solutions prototyping workshop we used storytelling and sketching to describe and
33
34 515 visualise the archetypes in detail for the participants. After presenting each archetype, we asked
35
36 516 the participants whether they could identify with (A)ndrew, (B)etty and (C)harles and invited them
37
38 517 to suggest changes to the details of the archetypes to bring them closer to the reality of the
39
40 518 community. Once satisfied with how the archetypes were described, the participants worked in
41
42 519 groups to map out the risk response journeys that they imagined each of these characters taking in
43
44 520 the event of a sudden shocks (such as severe drought or pest infestation).

44 521

45
46 522 Using these archetypes and informed by the SD fieldwork as well as with references to earlier
47
48 523 foundational work by the UEA economist team, we then introduced the refined insurance
49
50 524 prototypes that had emerged from the interviews during a subsequent design and testing workshop.
51
52 525 These protoypes included a ‘full coverage’, more expensive insurance option, that would cover all
53
54 526 losses; a less expensive option that would cover the cost of inputs (seed and fertilizer); and a cheap
55
56 527 ‘basic coverage’ option that would provide a safety net in the event of a disaster to protect farmers
57
58 528 from starvation. We chose not to place a price on the insurance products since the point of the
59
60 529 exercise was to discuss more generally which sort of model would be appropriate for each farmer

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

534
 535 The workshop participants, again working in groups, were then asked to match the appropriate
 536 insurance package with each archetype, with the option of not selecting any if none were considered
 537 appropriate. This exercise provided an entry point to discuss the prototyped insurance products, but
 538 more importantly, to learn more about the needs and constraints of each of the archetypes.

539

540 **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.

541

542 **4.3 Discrete Choice Experiment Phase**

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

548 Discrete choice experiments are a quantitative technique for eliciting preferences and have been
 549 used previously for understanding determinants of WII uptake (Tadesse et al., 2017; Sibiko et al.,
 550 2018; Ward and Makhija, 2018). Individuals state preferences over hypothetical alternatives. The
 551 characteristics that describe each alternative, for instance the identity of the policy holder, are called
 552 attributes. The values or conditions that an attribute can take are called levels. So, in the example of
 553 the attribute ‘identity of the policy holder’, the levels could be ‘an individual’ and ‘a savings group’.

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

556 Prior to the interview, each respondent participated in a 1.5h long workshop that ensured they
1 557 obtained a full and correct understanding of the insurance product and its possible features. The
2
3 558 workshops (30 in total) were organised by our fieldwork partner (The Field Lab Uganda) and were
4
5 559 exclusively intended to convey the necessary information to allow for meaningful responses to the
6
7 560 DCE. Using posters for visual reference, they covered the general concept of WII, that pay-outs may
8
9 561 not be equal to experienced costs, that different insurance designs may vary in the period of
10
11 562 coverage, timing of premium payment, pay-out channels, and bundling options and finally that WII
12
13 563 could be sold to individuals or groups. Respondents were encouraged to ask questions, whilst any
14
15 564 discussion of benefits and shortcomings were explicitly dismissed. The workshop followed a set
16
17 565 script and was delivered by the same person to ensure consistency. See the companion methods
18
19 566 paper (Dehmel et al., 2021) for further details of the implementation of the DCEs.

20 567 21 568 **4.3.1 Selection of attributes and levels**

22
23
24 569 Table 2 describes the attributes and levels that we selected. They are rooted in the literature on WII
25
26 570 uptake, shaped by the preceding service design phase, and contextualised based on extensive prior
27
28 571 qualitative fieldwork, which we have documented separately (Dehmel et al., 2021).

29
30 572 Attribute 1 is the identity of the policy holder. Our interest here is in whether WII offered to savings
31
32 573 groups raises demand, as predicted by Trærup (2012), De Janvry et al. (2014) and Mobarak and
33
34 574 Rosenzweig (2012, 2013) provided that savings groups are sufficiently limited in the protection they
35
36 575 provide against common shocks. VSLAs are the dominant savings groups in our study area: 77
37
38 576 percent of households in our sample have at least one member who belongs to a VSLA, with mean
39
40 577 VSLA membership per household being equal to 1.06. We therefore specified two levels for attribute
41
42 578 1: the policy holder can be an individual (level 1) or a VSLA (level 2).

43 579 A large number of studies have found that liquidity, income and wealth levels are positively
44
45 580 associated with WII uptake (Giné et al., 2008; Cole et al., 2012, 2013; Hill et al., 2013; Akter et al.,
46
47 581 2016; Casaburi and Willis, 2018; Belissa et al., 2019). We therefore investigated two potential means
48
49 582 of increasing uptake by taking liquidity concerns into account. The first is to reduce the premium
50
51 583 buyers need to pay by taking out insurance for a growth phase rather than the whole season (Hazell
52
53 584 and Hess, 2010). The service design phase of the research suggested the levels 'germination', 'plant
54
55 585 growth', 'flowering' and 'the whole season' for the attribute 'growth phase covered' (Attribute 2).

56 586
57
58
59 587

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

588

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

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

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

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

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

615

616 4.3.2 Specification of the insurance premium

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

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

626

627 4.3.3 Sampling and sampling characteristics

628 From the study area of Bwikhonge, 196 respondents from maize-growing farm households were
629 randomly selected from ten villages in Bwikhonge sub-county⁴ purposefully according to perceived
630 exposure to drought, geographical spread (to increase representation), accessibility and availability
631 of a research venue. For each selected village a sampling frame of all households and their heads
632 and spouses was then devised, 22 households were selected per village (20 + 2 spare), participants
633 were randomly selected (subject to the constraint of one per household) and if the selected
634 individual was not available then their spouse would be invited (see Dehmel et al., 2021 for details).
635 Table 3 presents characteristics of the respondents in the sample and their households. 64 percent
636 of respondents are female, which reflects the random selection procedure followed: when the
637 household head of a randomly selected household was married, either they or their spouse were
638 randomly selected for participation. If the randomly selected person was not available for
639 participation, then their spouse could participate. Larger unavailability of men would explain why
640 there are more women than men in the sample.

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

641 73 percent of respondents have been educated at the primary level or received no education. Even
 642 those educated at the primary level have not necessarily completed it; the table presents the
 643 highest level of education achieved, whether or not respondents finished school. Only one person in
 644 the sample attended a tertiary education institution.

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

648 A second crucial variable is VSLA membership, which is common in the study area. On average, there
 649 is slightly more than one person per household a member of a VSLA in the sample. These VSLAs
 650 typically consist of between 10 and 50 members in our study area, who contribute weekly savings to
 651 a common fund. Members may borrow money from this fund for a period of 1-3 months at an
 652 interest rate of 10 percent per month. The accumulated savings and interest are distributed among
 653 members in proportion to members' savings. This takes place at the end of the annual savings cycle,
 654 either in January or in February, which is when cash needs for agricultural inputs and school fees are
 655 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

656

657 4.3.4 Regression analysis

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

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

$$663 \quad U_{ij} = v_{ij}(A) + \varepsilon_{ij}$$

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

$$666 \quad v_{ij} + \varepsilon_{ij} > v_{ik} + \varepsilon_{ik} \text{ or } v_{ij} - v_{ik} > \varepsilon_{ik} - \varepsilon_{ij}$$

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

$$668 \quad P(j_i|A, C) = P_{ij} = P[v_{ij} - v_{ik} > \varepsilon_{ik} - \varepsilon_{ij}] \forall j \neq k$$

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

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

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

$$686 \quad U_{ij}^* = \alpha + A_j\beta + X_i\delta + \varepsilon_{ij}$$

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).

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

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

699 First, when insurance is offered to a savings group rather than to an individual, the unconditional
700 probability of the insurance option being chosen goes down by 18 percentage points (model 1).

701 However, when land ownership and trust in the savings group are interacted with the saving group
702 attribute, its effect changes substantially.

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

712

713

714

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.

715 **Table 4:**

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

	<i>Model</i>		
	(1)	(1)	(2)
	<i>Specification</i>	(1)	(2)
Attributes			
<i>Insurance unit</i>			
Savings group compared to individual contract	-.1776*** (-4.47)	-.3983*** (-4.59)	-.0585 (-0.389)
Trust in savings group	-.0001 (-0.54)	-.0002 (-1.03)	-.0002 (-1.03)
Land owned in acres	-.0001*** (-3.18)	-.0001*** (-3.04)	-.0001*** (-3.04)
<i>Bundling (base: no bundling)</i>			
With certified seed	.1066*** (4.25)	.1078*** (4.27)	.1078*** (4.27)
With certified seed and pesticides	.0670*** (2.62)	.0669*** (2.59)	.0669*** (2.59)
With certified seed and pesticides and an agro-input loan	.1051*** (4.76)	.1054*** (4.73)	.1054*** (4.73)
<i>Timing of premium payment (base: Jan-Feb)</i>			
August-September	.0035 (0.15)	.0042 (0.18)	.0042 (0.18)
November-December	.0582*** (2.72)	.0591*** (2.74)	.0591*** (2.74)
<i>Payout delivery channel (base: local agent)</i>			
Agro-input shop	.0440** (2.32)	.0436** (2.28)	.0436** (2.28)
Mobile money	.1294*** (5.72)	.1300*** (5.70)	.1300*** (5.70)
<i>Coverage phase (base: whole season)</i>			
Germination	-.3726*** (-13.40)	-.3758*** (-13.59)	-.3753*** (-13.62)
Plant growth	-.2863*** (-11.91)	-.2885*** (-11.99)	-.2883*** (-12.01)
Flowering	-.2094*** (-7.86)	-.2105*** (-7.86)	-.2104*** (-7.87)
Wald chi2	205.04***	246.04***	246.04***
Observations	4,696	4,696	4,696

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

721

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

1 730 risk reduction being large enough for the risk of bankruptcy following the taking out of a loan to be
2 731 sufficiently low.

3
4 732 Third, the timing of the premium payment has only a small effect on WII becoming more attractive.
5
6 733 Allowing payment during periods of greater liquidity, after the first harvest (August-September), or
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8 734 the second (November-December), increases probability that the WII option is chosen only in the
9
10 735 latter case, when the payment can be made at the end of the second season. Despite the necessity
11
12 736 to pay school fees and for agricultural inputs during the base level period (January-February), it is
13
14 737 possible that the advantages of paying for insurance during times when liquidity is high are to some
15
16 738 extent counterbalanced by the flexibility of not committing to the insurance until respondents know
17
18 739 whether they can afford it, giving rise to the modest effects observed.

19 740 Fourth, receiving insurance pay-outs through mobile money raises the probability of choosing an
20
21 741 insurance option by 13 percentage points compared to through a local agent, whereas the agro-
22
23 742 input shop is only slightly preferred to the agent. This echoes the trust in and convenience of this
24
25 743 payment method that informants mentioned during the qualitative phase of the research preceding
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27 744 the experiments.

28
29 745 Fifth, the whole season covered is strongly preferred to individual growth phases, despite the higher
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31 746 premium.⁸ The effects are large too: 37 percentage points in the case of the germination phase. This
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33 747 resonates with the bundling result above in that it suggests that comprehensive risk reduction is
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35 748 sought after by farmers in this area.

36
37 749 In sum, respondents prefer individual to savings group insurance, bundled with certified seed,
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39 750 pesticides and credit, receiving pay-outs through mobile money, and the whole growing season
40
41 751 covered despite the higher premium that needs to be paid for that. Even though insurance being
42
43 752 offered to savings groups never has a positive effect on the attractiveness of it, the negative effect is
44
45 753 much smaller when trust in savings groups is higher and land ownership larger.

46 754

47 755 **4.4 Analysis and Discussion: Combining Service Design and Discrete Choice Experiments**

48
49 756 In total, the combined fieldwork for the study took just four months to implement, and the team
50
51 757 were ready to provide recommendations to the Agriculture Insurance Consortium of Uganda (AIC)
52
53 758 within six months of the project start date. By concentrating far more directly *a priori* on the design
54
55 759 phase of project interventions, the combined approach of SD and DCE methods is comparatively
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58
59 ⁸ Recall that insurance premium levels are specified as affordable levels meeting WTP and dependent on
60 coverage phase (Table 2).
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760 time, cost and impact efficient when compared with current practice: where learnings and improved
761 efficiencies tend to come *a posteriori* in the policy cycle (Lopez-Acevedo & Krause, 2012). Both
762 methods are clearly user-centred tools with an explicit aim of supporting the design of policy
763 interventions (Mangham et al., 2009; Stickdorn & Schneider, 2010; Abihiro et al., 2014; Jürisoo et al.,
764 2018). However, they are methodologically distinct and to our knowledge have not before been
765 combined (see Figure 2.).⁹ The case study illustrates the value of the combination, in three distinct
766 ways.

767

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

771

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

779

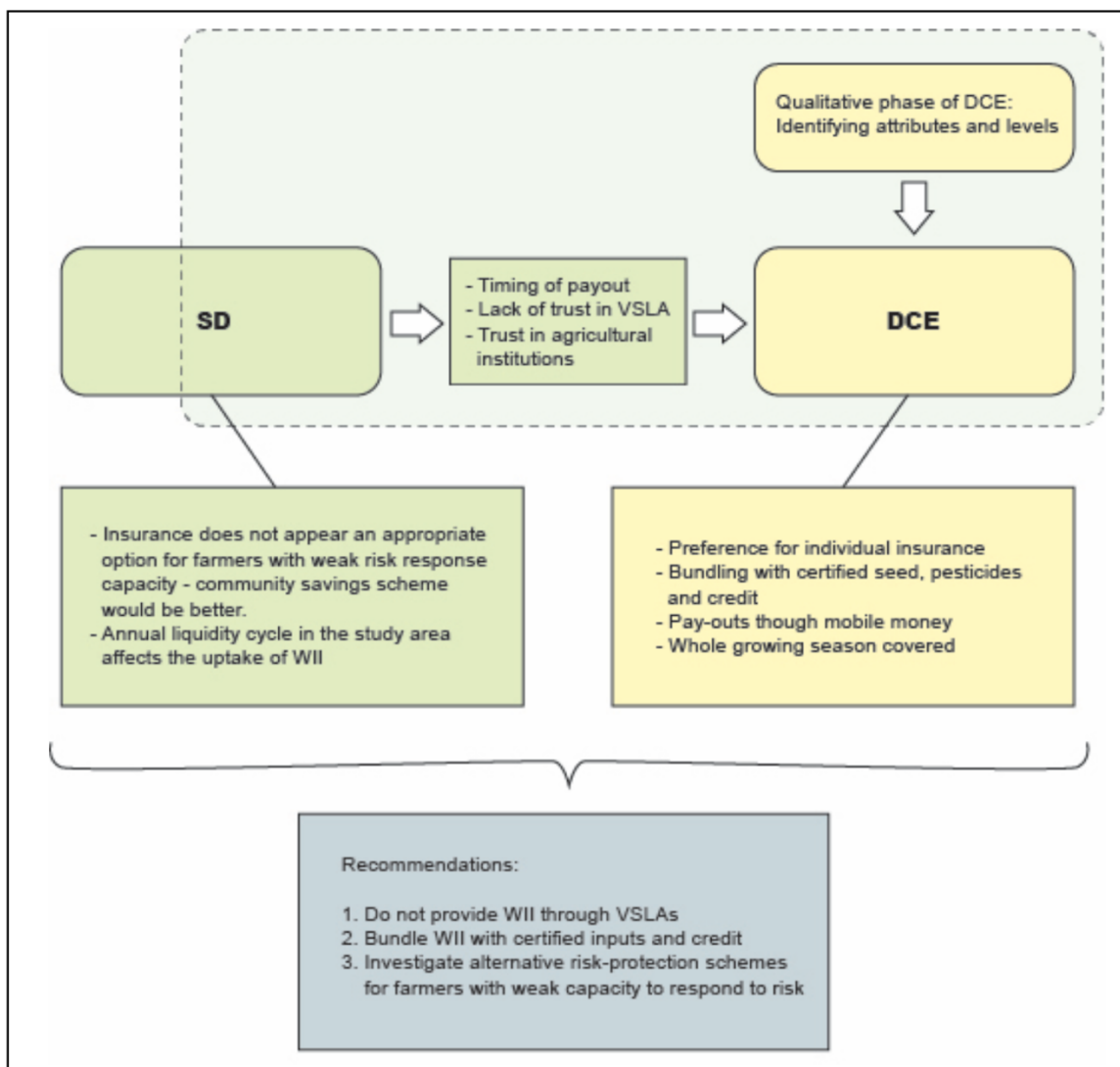
780 Third, *each methodology was able to uncover aspects of risk coping and protection that the other*
781 *was not*. For example, the DCE found strong evidence for the prediction rooted in theory that
782 bundling WII with inputs and credit increases its uptake (Awondo et al., 2017; Ward and Makhija,
783 2018), which the SD phase had not noticed. By contrast, the SD phase yielded nuanced insights that
784 a DCE methodology is probably too crude to find. For instance, SD found that for asset-poor, weakly
785 socially connected individuals, risk protection other than insurance needs to be designed. SD also
786 revealed risk coping to be complex and multi-dimensional; our attempt failed to approximate this by
787 a principal component-based index for use in the DCE analysis, which we think is a limitation of the
788 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).

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

791
 792 Based on the combined SD and DCE findings, UEA economists dropped their recommendation to
 793 provide WII through VSLAs, while advocating bundling WII with certified inputs and credit. The
 794 recommendation was adopted by the Ugandan insurance companies united in the AIC, which
 795 industry experts recognise had a considerable impact on the success of its nation-wide WII
 796 scheme.¹¹ Work is ongoing on risk-protection schemes that do justice to the heterogeneity of risk
 797 coping that the SD research uncovered (through the archetypes, and so on).



799
 800 **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).

1 801 *research phases. The dashed line represents the parameters of the DCE investigation, whilst activities*
2 802 *travelling this line are relevant for the wider project objective of informing the design of WII, but not*
3 803 *necessarily relevant for the construction of the DCE itself.*

4
5 804

6
7 805 Whilst traditional participatory approaches for policy relevant in-depth analysis of local
8
9 806 contexts have often struggled to make effective use of the nuanced information in subsequent
10
11 807 practical application (Uvin, 1995; Binswanger & Aiyar, 2003), SD when combined with DCEs thus
12
13 808 provides a medium in which fine-grained locally informed insights can be transformed and
14
15 809 incorporated into scalable and effective solutions. Furthermore, by combining the locally derived
16
17 810 insights of SD into the design of subsequent DCE investigations, the research approach is able to
18
19 811 effectively bring and transform nuanced qualitative insights into a quantitatively validated form.
20
21 812 This delicate but robust transformation provides policymakers *operationally* with the type of data
22
23 813 most readily required to build scalable development interventions, but crucially it also provides such
24
25 814 data in a form (more overtly scientific and measurable) that is generally more *politically* palatable
26
27 815 amongst planners: where a positivist outlook tends to dominate, meaning that quantitative over
28
29 816 qualitative evidence is generally favoured.

30 817

31
32 818 Since SD requires the users of a future intervention to be involved in problem definition as well as
33
34 819 solution design, the approach provides agency to local actors to question core assumptions
35
36 820 underlying a proposed intervention, and to critique proposed design features (Lambe, Ran, Jürisoo,
37
38 821 et al., 2020a). For example, in our case study, we demonstrated how prototyping insurance
39
40 822 products allowed community members to reject the idea that insurance would be appropriate for all
41
42 823 farmers in the area, and to suggest another type of support for the most vulnerable farmers in their
43
44 824 community. Such early engagement helps to insure against the potential emergence of negative
45
46 825 unintended consequences of interventions (Escobar, 2011; Mills, 2012), and reduces concerns about
47
48 826 the programmatic momentum or misplaced ‘directionality’ driving outcomes after deployment
49
50 827 (Brooks et al., 2009).¹²

51 828

52
53 829 On completion of the analysis of findings from the SD and DCE investigations, the outcomes were
54
55 830 extensively discussed by the director of The Field Lab Uganda with farmer groups, agricultural
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57 831 extension workers and the district agricultural officer from the study area in about twenty individual
58
59 832 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.

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

835

836

837 5. Conclusion

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

846

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

857

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

865

1 866 As the Uganda case also demonstrates, both methods have their own methodological limitations
2 867 and can provide differing perspectives which can be confusing to interpret. Nonetheless, we would
3 868 argue that accepting a degree of uncertainty in research findings, is on balance, a necessary and
4 869 realistic consequence of attempt to explore solutions in such complex settings. Clearly therefore, the
5 870 approach would benefit from the lessons learned from its adoption and application in different
6 871 studies and settings. Even so, just as SD and DCEs have been useful for informing policymaking in
7 872 different academic fields and global regions, we see no obvious reason why their application in a
8 873 Global South setting would be any less beneficial.

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