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Article

Conceptualizing the societal impact of research in terms of elements of logic models: a survey of researchers in sub-Saharan Africa

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Abstract

This study addressed the conceptualization of the societal impact of research from the perspective of programme evaluation, by focusing on the three 'result' elements of logic models: outputs, outcomes, and impact. In research evaluation, the distinction could resemble a difference between product, use, and benefit. The study established whether researchers in sub-Saharan Africa (SSA), South Africa excluded, view societal impact as extending across all three elements or as confined to the last element only. A web survey of 485 SSA researchers was conducted, as researchers from this region are not yet bounded by policy definitions of impact. The survey imposed the three elements of logic models onto five hypothetical descriptions of 'impactful' research initiatives. Respondents rated each element in terms of how much it reflects the societal impact of research. For any initiative, use was more likely to be considered a strong example of societal impact compared to a product, but less likely so compared to benefit. Between 23% and 43% of respondents rated all three elements as strong examples of the societal impact of research. Responses were analyzed by SSA region and the research domain and years of research experience of survey participants. An open-ended question about own understandings of societal impact was included as well in the survey. The responses portrayed impact as a (generally) positive effect that contributes to change in the daily life of human kind. The expectation that research should have impact at an almost general level of aggregation could be unique to the SSA context.

Key words: Africa; logic model; research impact; societal impact; survey.

1. Introduction

Governments and funding organizations increasingly expect contributions to society, or impact, in return for investments in research. To assess these contributions, impact evaluations at different organizational levels are on the rise. These levels may range from individual researchers and projects to universities and large-scale programmes. Yet, research impact assessment (RIA) still faces many challenges (Martin 2011). One key challenge is how to conceptualize the societal impact of research.

This study approached the conceptualization of the societal impact of research from the perspective of programme evaluation, by focusing on the three 'result' elements of logic models: outputs, outcomes, and impact. Specifically, the study aimed to establish whether researchers in sub-Saharan Africa (SSA),[1] South Africa excluded,[2] view societal impact as extending across all three elements or as confined to the last element only. In other words, to establish whether SSA scientists and scholars, when reflecting on the societal impact of research, either preserve or abolish the distinction between the three elements. This interest was inspired by recent

developments in the RIA literature, where networked and interactive models of the processes of impact creation (e.g. Meagher, Lyall and Nutley 2008; De Jong et al. 2014; Matt et al. 2017; Boshoff and Sefatsa 2019) are taking central stage. Networked models emphasize contextual understanding of the mechanisms and processes of impact creation. For instance, a focus on research–stakeholder interactions is seen as a logical starting point for understanding and learning about the process of impact creation (Spaapen and Van Drooge 2011). This means that conceptualizations of impact are moving closer to the actual process of doing research and its immediate interactions and immediate effects, thereby also reducing the conceptual distances between output, outcome, and impact.

For this conceptualization study, SSA was chosen as a setting. The reason is threefold. First, the absence of explicit national impact policies in SSA provided us with a context to study how academics that are not yet bounded by policy definitions of impact understand the concept. This complements studies conducted in countries in which academics can hardly escape the impact agenda, such as the UK and the Netherlands and to a lesser extent other countries in the European Union. Second, the SSA region has received little attention in the RIA literature. Some of the few exceptions include an econometric study of the economic impact of agricultural research (Alene and Coulibaly 2009) and a recent application of impact pathway analysis to assess the impact of agricultural research for development (Temple et al. 2018). Yet, research activity in Africa—although unevenly distributed among countries—is taking off with publication numbers at least doubling every 5 years since the year 2000 (Sooryamoorthy 2018). For countries in SSA, especially those with small science systems, the growth in publication numbers is largely the result of increased international research collaboration (Mouton and Blanckenberg 2018), which also implies greater reliance on international funding sources (Kozma, Calero-Medina and Costas 2018). More investments in SSA research, whether from international or national sources, will undoubtedly raise demands for evidence-based demonstrations of research impact, which means that at least some shared understanding is required of what is meant by impact. Finally, societies in SSA face numerous global and regional socio-economic challenges, such as raising living standards (FMST 2011), securing food production in general and in an age of climate change in specific (MINISTR 2006; MSTD 2012), and eradicating disease transmitting insects (MCST 2010). These challenges are intensifying pressures on research to contribute to society, be it directly or indirectly, as is evident in governmental documents about science policy (e.g. MFPED 2012; MHEST 2012; MoST 2012; MESTI 2017).

In order to explore the conceptualization of societal impact of research in SSA, an exploratory survey of SSA researchers was conducted. The survey imposed the 'result' elements of logic models onto five hypothetical descriptions of 'impactful' research initiatives. Respondents rated each element in terms of how much it reflects the societal impact of research in the relevant description. An open-ended question about own understandings of societal impact was included as well. Before presenting the findings (Section 5), a brief overview of conceptualizations of research impact is provided, in addition to a specific focus on the three 'result' elements of logic models in programme evaluation and their adaptations in research evaluation (Section 2). This is followed by a discussion of the context for RIA in the SSA context (Section 3) and an explanation of the study's methodology (Section 4). Sections 6–8 present the concluding remarks together with recommendations for strengthening the research impact agenda in SSA as well as for future research.

2. Conceptualizing impact: a challenge for research evaluation

2.1 Different understandings of impact

Research evaluation increasingly addresses societal impact, whether stand-alone or in combination with scientific quality. Ex ante evaluations of impact, i.e. assessing potential impact before funding, seem to be the most common. The USA (NSF 2017), the UK (RCUK n.d.), Switzerland (Dance 2013), and the Netherlands (NWO 2017) are examples of countries where research councils have included societal impact as a criterion in funding procedures. Foreseen societal impact of proposed projects is assessed before funding at the European level as well (Holbrook and Frodeman 2011; De Jong and Muhonen 2018). Moreover, some countries, such as the UK and the Netherlands, also have adopted the impact criterion in national evaluation frameworks for ex post assessment, i.e. evaluating achieved impacts after funding (VSNU-KNAW-NWO 2014; HEFCE 2017).

However, there is an ongoing debate about the type (e.g. a policy report, an adopted policy or the effects of the policy) and nature (e.g. economic, social, or environmental) of results and their scope (e.g. geographically or numerically) that allow it to be labelled as societal impact of research. Interpretations of what constitutes impact also differ across research domains, as studies in agricultural research (Weißhuhn, Helming and Ferretti 2018) and the social sciences (Reale et al. 2018) have shown. Also within domains consensus is not evident. For instance, Samuel and Derrick (2015) interviewed panelists involved in the Research Excellence Framework (REF) of 2014, in the health domain, and found that, although most of the interviewees defined impact as a result rather than a process, they lacked consensus concerning what constitutes a result. Some academics considered only final impacts in terms of health and economic benefits in their definition, whereas others also included intermediate impacts, such as uptake in policies or patents. In another study, Watermeyer and Hedgecoe (2016) observed the discussions that took place at a British University when it prepared its impact portfolio for REF2014. Dissemination and public engagement were not considered impacts but rather ways to achieve impact. The study also found evidence of impact hierarchies—although impacts on local society were included as relevant, it was considered less important than impacts occurring on a global scale. The definition of impact in REF2014, '*... an effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia*' (REF2014 2011: 26), as well as the announcement that '*reach and significance*' (ibid: 27) would be taken into account, may explain the conceptualization of impact by academics in the UK.

In the Netherlands, De Jong, Smit and Van Drooge (2016) conducted focus groups with academics and support staff from the 13 main Dutch universities, representing a wide variety of fields. The participants defined impact as a process, not as products. For instance, patents were not regarded as examples of impact. It further emerged that impact could be direct or indirect, i.e. facilitated through uptake by other disciplines, and that it is broader than economic impacts only. Yet, economic impacts were least contested to count as impact and some participants did not readily consider their own non-economic impacts as examples of impact. Again, the national context may explain the way academics understand impact. On the Dutch national level, impact is referred to as 'valorisation' and defined as '*The process of creating value from knowledge by*

making it suitable and/or available for economic and/or societal use and translating it into products, services, processes and entrepreneurial activity[3]' (Nederland Ondernemend Innovatieland 2009: 8).

2.2 The three 'result' elements of logic models and their adaptations in research evaluation

A promising way forward in the debate of conceptualizing impact in the context of research evaluation is to look beyond studies focusing on the perspectives of academics and to tap into literature on logic models. Programme evaluators—who evaluate programmatic policy interventions and not research—use a far more articulated understanding of impact. Commonly, they rely on logic models that portray impact (high-level transformations and changes in organizations, systems, or communities) as the long-term results of a programmatic intervention (Wildschut 2014), in addition to outputs (products, goods, and services) as short-term results and outcomes (likely effects for the target groups) as intermediate results (W. K. Kellogg Foundation 1998) (Figure 1). In the context of theory-based and realistic evaluation (Chen and Rossi 1983; Weiss 1997; Pawson and Tilley 2004), logic models reflect a theory of change that serves to unravel the black box of intervention, and clearly separate impacts from the outputs and short- and intermediate-term outcomes of a programme.

This explicit distinction between output, outcome, and impact seems to be compatible with research evaluation. Bornmann (2013: 217) identifies a development from assessing 'societal products (outputs), to societal use (societal references), and societal benefits (changes in society) of research', which serves to indicate the widening scope of research evaluations since the 1990s. De Jong et al. (2014) interpret these elements as representing three strands of definitions of societal impact of research. Accordingly, evidence of societal impact is understood to imply a product (a knowledge output of potential societal value), use (the adoption of knowledge by societal stakeholders), or benefit (the effect of knowledge use, manifesting as positive change for some segment of society). The three strands resemble the three types of results represented in logic models in programme evaluation.

However, an explicit distinction between the three types of results—which is common in the programme evaluation literature—is either preserved or creatively modified, or even ignored by RIA approaches in order to bypass the attribution conundrum. Attribution refers to the establishment of a causal link between the activities and long-term outcomes of a programme (OECD 2010). In RIA, conceptualizations in terms of contribution rather than attribution are favoured because of the often long time-lag between completed research and observed transformations, in addition to the fact that various unknown factors may account equally well for the same transformations (Rymer 2011; Bornmann 2013). To bypass the attribution conundrum, the Social Impact Assessment Methods for research and funding instruments through the study of Productive Interactions between science and society (SIAMPI) approach in RIA has abandoned the distinction between output, outcome and impact (Spaapen and Van Drooge 2011). The 'productive interactions' approach, as SIAMPI is also known as, defines impact as any change that is associated with any research stakeholder, and that change can be either in the short- or long-term. Moreover, typical research outputs, such as articles or policy briefs, are considered conduits for indirect, productive interactions between the research and its stakeholders.

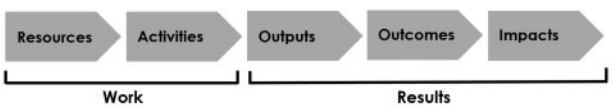

Figure 1. Logic model (authors' adaptation of W. K. Kellogg Foundation 1998).

An example in RIA of creative modification of the elements of logic models is *Analyse des Impacts de la Recherche Publique Agronomique* (ASIRPA) (Joly et al. 2015). The ASIRPA approach is case study oriented and uses a set of analytical tools to capture and standardize relevant aspects of case studies. One such tool is a non-linear impact pathway. The pathway treats two 'result' elements of logic models (outcome and impact) both as instances of impact, by separating them into primary impacts (transformations in the 'first sphere of targeted end-users' [Joly et al. 2015: 446]) and secondary impacts (transformations in 'wider sets of end-users' [ibid: 446]).

In the current study, the objective was not to apply insights from any particular RIA approach to cases of research impact in SSA but rather to investigate conceptualizations of the societal impact of research through the lens of the three 'result' elements of logic models. To this end, the three strands of definitions of the societal impact of research ('product', 'use', and 'benefit'—De Jong et al. 2014) were considered a useful lens for investigating the 'result' elements. However, the above discussed examples from the UK and the Netherlands suggest that conceptualizations of the societal impact of research may root in institutional contexts. A brief overview of the institutional context for research impact in SSA is therefore provided next.

3. The institutional context for research impact in sub-Saharan Africa

SSA is the only region in the world 'where the absolute number of people living below $1.25 per day continues to rise' (Beintema and Stads 2017: 1). Against this background, research and innovation (R&I) are expected to contribute to a number of priority areas, as highlighted in the current Science, Technology and Innovation Strategy for Africa, called STISA-2024, of the African Union (AU 2014). These include the eradication of hunger and the achievement of food security, the prevention and control of diseases, and wealth creation. Although not explicitly labelled as societal impact, such goals can be understood as expectations of research's impact on society.

The reality on the ground is that many universities in SSA—the main research producers in SSA – are still recovering from programmes implemented by the World Bank in the late 1980s (Mamdani 2016: 109). The programmes involved the funding prioritization of primary education over higher education, based on the assumption that the shift would produce larger returns on investment. However, the shift had plunged many public SSA universities in crisis. Universities suddenly had to survive on cost-based fees with little or no supplementary funding from their already cash-strapped governments. In Uganda, for instance, one consequence of the crisis was a sharp increase in staff consultancies at public universities (Mamdani 2016), thereby diverting the attention from academic research (Wight 2008). The public universities also experienced brain drain of their top academics and postgraduate students, whereas the remaining academics had to deal with overcrowded classes and ailing scientific equipment—all conditions detrimental to the conduct of research.

Most SSA countries still strongly rely on development aid and donor funding for research, particularly in health and agriculture. For instance, in agriculture in the period 2009–2014, donors and development banks accounted for 27% of the funding of national agricultural research institutes across SSA (Beintema and Stads 2017). In

SSA, international support organizations are contributing to the establishment of research cultures, through investing in scholars and institutions and in social networks and partnerships (Hydén 2016). Research impact evaluations in SSA therefore often take the form of commissioned work by international organizations into the broader effects of their funding initiatives (e.g. Bautista, Velho and Kaplan 2001; Maselli, Lys and Schmid 2004). However, to our knowledge, no data exists on the extent of SSA researchers' involvement in the evaluation of donor-funded projects. The extent of SSA researchers' experience with evaluating the impact of donor-based programme interventions thus remains unknown.

What is known, though, is that, for years, research in SSA predominantly served the interests of foreign agendas, against a national research landscape characterized by significant under-investment in scientific research. Mouton (2008: 47) rightfully describes past research activities at some of the region's universities as constituting 'de-institutionalized research'. It refers to research conducted in a landscape that is not 'dense (well-populated) with scientific institutions', and where those lacking institutions refer to 'any formal organization or entity which is dedicated to the pursuit of scientific knowledge production, dissemination, and utilization'.

Therefore, for many universities in SSA, the development of a strong research culture is a recent and ongoing phenomenon. However, established pockets of research excellence do exist. South Africa (excluded in this study)—with its different historical trajectory and large number of deep-rooted scientific institutions—is the powerhouse of SSA in terms of published research (AOSTI 2014). Nigeria and Kenya also have significant numbers of research outputs, although at much lower levels (Mouton and Blanckenberg 2018).

The bottom line is that, in SSA, the culture of research production is largely evolving (although some universities and public research institutes do have developed research cultures) and the culture of research impact largely embryonic. Contrastingly, in developed countries, the emerging culture of research impact is underpinned by an already established culture of research activity and production. In light of SSA's immense socio-economic challenges and the need for almost tangible change at the level of the region's inhabitants, the emerging state of both research production and research impact, although to different degrees, could produce a number of scenarios. For instance, the distinction between research and impact might increasingly start to fade, to the extent that mainly applied or 'interventionist' or action kinds of research with clear practical outcomes are preferred. The other extreme is that in order to catch up with established science systems, societal impact may be considered second to scientific excellence in terms of publishing in high-impact international journals and chasing global university rankings. In between is the growing expectation that any research, irrespective of its size (e.g. funding amount) or nature (e.g. student project or internationally led collaborative project) must change society for the better. This can already be seen from a case study of valorization at a Zimbabwean university, where undergraduate students at a science department—when considering a research topic—are encouraged to reflect on their 'next big idea that will help change the world' (Ngwenya and Boshoff 2018: 225). At the individual level, a mounting tension between paybacks to science and paybacks to society is equally realistic.

4. Method

To explore conceptualizations of the societal impact of research in SSA, a survey was conducted that builds upon the distinction between product, use and benefit as extensions of the output, outcome and impact distinction in logic models. In addition to exploring the blurring of boundaries between the three elements, an attempt was made to elicit researchers' own understandings of what is meant by the societal impact of research.

4.1 Data collection

A survey instrument was compiled in English, French, and Portuguese, which are three 'lingua francas' in SSA. The instrument comprised nine questions, of which the first five each described a hypothetical research initiative that successfully contributed to society. The initiatives cover five different but, for practical reasons, not all possible research domains: interdisciplinary social sciences (initiative 1), agricultural sciences (initiative 2), humanities (initiative 3), engineering sciences (initiative 4), and health sciences (initiative 5). The selection of research domains was informed by a desire to include an initiative from each of agriculture sciences and health sciences, which are the two dominant research domains in SSA (Mouton and Blanckenberg 2018), and one each from the natural and engineering sciences and the social sciences and humanities to cover the broad spectrum of research domains. The last domain was reserved for an interdisciplinary science application (see the descriptions in Tables 1–5).

Moreover, three of the five initiatives (1, 4, and 5) were moulded on actual impact cases in the online database of the 2014 REF in the UK (REF2014 2014). Although the structured and idealized nature of the REF impact cases are criticized for not reflecting reality, this is precisely the reason they allowed for the construction of comparable narratives of examples of product, use, and benefit from the rich details provided. However, the relevant cases were not adopted indiscriminately. The text had to be either generic (initiatives 4 and 5) or easily changeable to suit the African context (initiative 1). Following a similar structure, the remaining two initiatives (2 and 3) were specifically compiled for the survey.

For each initiative, a number of 'results', generically referred to as 'outcomes' in the survey, were presented in a fixed order. Three results per initiative are reported in Tables 1–5, which are the three elements of logic modelling. The first represented a product (output), the second use (outcome), and the third benefit (impact). Participants—without knowing the underlying classification, i.e. how the three results mapped unto the three elements of logic modelling—were asked to rate the extent that each could be considered an example of the societal impact of research. A four-point rating scale was used: 'strong example', 'weak example', 'not an example', and 'do not know'. As such, the answers provide insights on the implicit ideas concerning the type of results that are considered to be societal impact by SSA researchers.

The sixth question, which was open-ended, asked participants 'What is your understanding of the societal impact of research?' The answers to this question not only aimed to collect data on implicit ideas concerning the type of results that are considered to be societal impact, but also concerning additional elements of a societal impact definition.

The last three questions were biographical, asking the respondents for their country at the time of the survey, their number of years of research experience, and primary domain of research.

The survey targeted researchers and academics in SSA countries, excluding South Africa. Relevant email addresses were collected from two sources. First, country-specific sets of articles were

Table 1. Hypothetical research initiative 1—University research conducted into the automatic grammatical analysis of English text has led to the development of software that is able to grade essays. A firm that offers smart solutions for the educational sector has refined the software, and the product is now being used in rural areas at adult training centres where there are insufficient trainers for the large numbers of adult learners wanting to improve their English. A recent provincial survey showed that since its implementation at these centres the literacy levels of adults in a number of rural communities have started to improve. Adult learners generally felt that an English course from the teaching centre had increased their prospects of employment. Those who found new or better employment after completing the training were particularly excited about the resultant higher household income. To what extent are the following examples of the societal impact of research?

	1.1 The development of software to grade English essays (PRODUCT)		1.2 The use of the software at rural adult training centres (USE)		1.3 The improvement of the literacy levels of adults in some rural communities (BENEFIT)	
	% Strong example	N	% Strong example	N	% Strong example	N
All respondents	46%	480	62%	481	81%	480
By SSA region						
a. Central and West	51%	154	73%	154	85%	152
b. East	41%	126	56%	126	80%	127
c. South	36%	66	61%	66	86%	66
Significant differences	None		*a>b*		None	
By research domain						
a. AS	56%	36	73%	37	89%	37
b. HS	44%	122	60%	124	86%	123
c. NES	44%	115	68%	115	80%	114
d. SSH	43%	99	60%	97	80%	98
Significant differences	None		None		None	
By research experience						
a. ≤5 years	48%	77	66%	79	87%	79
b. 6–10 years	47%	120	60%	121	83%	119
c. >10 years	42%	187	64%	185	79%	186
Significant differences	None		None		None	

Note: The 'All respondents' category includes respondents who did not specify their region, research domain or years of research experience.

Table 2. Hypothetical research initiative 2—Cultivar trials on maize production have been conducted now for almost two decades and have resulted in practice guidelines for farmers. The aim of the trials is to indicate which cultivars are best suited for various geographic areas. A few years ago, maize farmers started to experiment with the findings of these trials. Some farmers found that their experimental sites delivered better yields compared to production elsewhere on their farms. These farmers have subsequently fully implemented the cultivars across their land with a significant increase in yield per hectare. For others, though, the results of the trials did not result in any significant gain, and they abandoned the experimentation in favour of their preferred methods. To what extent are the following examples of the societal impact of research?

	2.1 The practice guidelines for farmers based on the findings of the trials (PRODUCT)		2.2 The full-scale implementation of the cultivars (recommended in the practice guidelines) by some farmers (USE)		2.3 The better yields reported by some farmers (BENEFIT)	
	% Strong example	N	% Strong example	N	% Strong example	N
All respondents	57%	441	66%	442	80%	441
By SSA region						
a. Central and West	67%	151	66%	152	85%	151
b. East	52%	127	65%	127	76%	126
c. South	43%	67	72%	67	81%	68
Significant differences	*a>b*, *a>c*		None		None	
By research domain						
a. AS	51%	37	78%	37	97%	37
b. HS	56%	124	61%	124	74%	124
c. NES	60%	113	69%	114	80%	113
d. SSH	57%	98	66%	98	85%	98
Significant differences	None		None		*a>b*	
By research experience						
a. ≤5 years	56%	79	66%	79	71%	79
b. 6–10 years	63%	120	73%	120	80%	120
c. >10 years	54%	185	63%	186	85%	185
Significant differences	None		None		*c>a*	

Note: The 'All respondents' category includes respondents who did not specify their region, research domain or years of research experience.

Table 3. Hypothetical research initiative 3—Research undertaken by an academic at a West African university has led to the publication of a biography of an African-born French poet. This biography has since been read by most students and academics in West Africa who have an interest in French literature. In a television interview the researcher claimed that the biography has contributed to a renewed interest in French literature at his university, evidenced by a sudden growth in the number of students enrolling for French modules. Recently, the biography was also prescribed as a textbook for postgraduate study at a number of universities in France. The biography is now starting to earn significant royalties. A common opinion in international book reviews is that the biography has contributed to a greater appreciation of African literature and philosophy in Europe. To what extent are the following examples of the societal impact of research?

	3.1 The publication of the biography of the African-born French poet (PRODUCT)		3.2 The biography being prescribed for courses at postgraduate levels in France (USE)		3.3 The greater appreciation of African literature and philosophy in Europe (BENEFIT)	
	% Strong example	N	% Strong example	N	% Strong example	N
All respondents	35%	415	47%	418	67%	422
By SSA region						
a. Central and West	46%	146	50%	151	75%	153
b. East	28%	127	50%	127	62%	125
c. South	27%	67	41%	66	65%	68
Significant differences	*a>b*, *a>c*		None		None	
By research domain						
a. AS	39%	36	51%	37	66%	38
b. HS	32%	119	45%	123	62%	122
c. NES	35%	114	46%	114	64%	115
d. SSH	38%	98	51%	97	77%	98
Significant differences	None		None		None	
By research experience						
a. ≤5 years	37%	78	46%	78	63%	79
b. 6–10 years	31%	119	46%	120	63%	122
c. >10 years	38%	182	49%	185	71%	184
Significant differences	None		None		None	

Note: The 'All respondents' category includes respondents who did not specify their region, research domain or years of research experience.

Table 4. Hypothetical research initiative 4—Engineering research into very reliable micro-inverters for use in solar power systems led to an invention that was successfully patented by a spin-off company. Following the process of commercialization, the spin-off company has attracted millions in private investment, increased its number of employees from 5 to 50 people across its two offices, and shipped more than 50,000 micro-inverter units to users. It has since been demonstrated that the spin-off company's products, in comparison with traditional inverters, are more reliable, easier, cheaper and safer to install, and able to extract more energy from an array of solar panels. The products are green and clean technologies since they address environmental and sustainability concerns. To what extent are the following examples of the societal impact of research?

	4.1 The development of highly reliable micro-inverters (PRODUCT)		4.2 The shipping of a significant number of products to users (USE)		4.3 The benefit to the environment as the products are green and clean technologies (BENEFIT)	
	% Strong example	N	% Strong example	N	% Strong example	N
All respondents	55%	405	58%	405	86%	408
By SSA region						
a. Central and West	63%	152	64%	151	86%	153
b. East	53%	126	56%	127	84%	127
c. South	45%	67	61%	67	94%	68
Significant differences	*a>c*		None		None	
By research domain						
a. AS	54%	37	68%	37	87%	38
b. HS	55%	122	52%	123	84%	123
c. NES	56%	115	64%	114	86%	115
d. SSH	56%	98	62%	98	90%	99
Significant differences	None		None		None	
By research experience						
a. ≤5 years	53%	79	64%	78	86%	79
b. 6–10 years	56%	120	53%	120	81%	122
c. >10 years	56%	185	62%	186	89%	186
Significant differences	None		None		None	

Note: The 'All respondents' category includes respondents who did not specify their region, research domain or years of research experience.

Table 5. Hypothetical research initiative 5—University research has led to the development of novel high-strength glass-ceramics to prevent fracture and wear of dental ceramic restorations. The material developed was adopted for clinical application, and has been used in over three million dental restorations. It is associated with a substantial reduction in tooth-enamel wear. It has high patient acceptance, as it involves a 100% pain-free, minimally invasive approach, requiring no tooth preparation or anaesthesia. The product has received extensive media coverage worldwide. To what extent are the following examples of the societal impact of research?

	5.1 The development of a material to prevent fracture and wear of dental ceramic restorations (PRODUCT)		5.2 The use of the material in dental restorations (USE)		5.3 The substantial reduction in tooth-enamel wear (BENEFIT)	
	% Strong example	N	% Strong example	N	% Strong example	N
All respondents	55%	404	69%	402	78%	401
By SSA region						
a. Central & West	63%	153	73%	152	83%	151
b. East	50%	127	68%	126	76%	127
c. South	45%	67	70%	67	75%	67
Significant differences	*a>c*		None		None	
By research domain						
a. AS	57%	37	63%	38	87%	37
b. HS	52%	124	70%	123	77%	124
c. NES	54%	114	74%	112	79%	113
d. SSH	56%	99	68%	99	79%	98
Significant differences	None		None		None	
By research experience						
a. ≤5 years	53%	79	68%	79	76%	79
b. 6–10 years	56%	121	69%	121	75%	120
c. >10 years	53%	186	70%	184	80%	185
Significant differences	None		None		None	

Note: The 'All respondents' category includes respondents who did not specify their region, research domain or years of research experience.

downloaded from the online version of the Web of Science (WoS) database, for the years 2013–2015. This allowed for the extraction of the emails of authors with an SSA address, resulting in 12,006 unique addresses. Second, the websites of the major universities in SSA were visited and scrutinized for email addresses of academics either in possession of a doctoral degree or at the rank of senior lecturer or higher. This generated a second set of unique addresses, namely 4,944. The two sets of email addresses combined—after removing the overlap—generated 15,607 unique addresses. As a result, our sample is composed of three types of researchers: (1) academics at university as well as non-university researchers (e.g. in government or science councils) who published research articles included in the WoS, irrespective of whether they had a PhD or not; (2) academics at universities who had no PhD but who occupied the rank of senior lecturer or higher (in the SSA context, such academics will most likely be seen as researchers, given that publications in local or international journals are strong eligibility criteria for promotion to the rank of senior lecturer in the absence of a PhD); and (3) academics in possession of a PhD, who might not have conducted or published any research following completion of their PhD but who (at least) did research as part of their PhD.

A survey invitation was sent to all 15,607 addresses by using mailing list management software, 7% of which came back as undeliverable. However, this does not mean that 15,607 individuals were surveyed, as the average SSA academic often uses two or three email addresses, both university-based and private, for official communication. The survey invitation was distributed in two rounds, with the second wave following three weeks after the first. In the second wave, the recipients were asked to ignore the request should they already had completed the survey.

A total of 738 submissions were recorded in an online platform. After removing all blank submissions and duplicates, 485 valid responses remained. The valid total, although small, is nevertheless fair because of the challenges of conducting large-scale, online surveys of academics and researchers in SSA. Some of the challenges relate to the fact that university email systems are not always operating as they should. Many academics therefore prefer using private emails addresses (e.g. Gmail or Yahoo), which has the added advantage of remaining unchanged should the academic take up an international study or research opportunity. However, some private email accounts automatically direct bulk emails to a 'spam' folder, which might also have been the case in some instances in the current study. In SSA, a much better survey response is obtained by dropping off copies of questionnaires for completion at the individual institutions (Boshoff et al. 2018). However, given the multiple country coverage of the current study, the latter arrangement was not possible at all.

4.2 Data description

As said, responses were received from 485 individuals (88% English, 9% French, and 3% Portuguese). Not all 485 respondents answered all questions. For instance, the response per subquestion of the presented research initiatives (Tables 1 to 5) ranges between 481 (99%) ('result' 1.2) and 401 (83%) ('result' 5.3). The open-ended question was answered by 369 (76%) respondents. The average length of the answers to this question was 18 words.

A total of 381 (79%) respondents specified their country at the time of the survey. This generated a list of 46 countries, 31 (67%) of which in SSA. Twenty-seven SSA researchers were outside the region at the time of the survey and thereby represent the 15 non-SSA

countries. These respondents were retained for analysis as each had a strong link to the SSA research context: all previously had a SSA country address according to the university websites or a SSA country address in the WoS database for the period 2013–2015. Of the 354 respondents that reported a SSA country affiliation in the survey, two thirds were from five countries: Nigeria (29%), Kenya (18%), Ethiopia (10%), Ghana (5%), and Tanzania (5%). The SSA countries were classified into four main geographical regions: central (e.g. Cameroon, Democratic Republic of the Congo, Gabon), east (e.g. Ethiopia, Kenya, Sudan, Tanzania, and Uganda), south (e.g. Botswana, Malawi, Namibia, Zambia, and Zimbabwe), and west (e.g. Burkina Faso, Ghana, Mali, Nigeria, and Senegal). However, the central region (mainly French speaking) comprised 17 respondents only. This region was therefore merged with the west region, given that the latter includes a number of French speaking countries. The assumption was that, in terms of social-cultural aspects, parts of west Africa most closely resemble central Africa.

The question about primary research domain generated 376 open responses. These were classified in four broad and mutually exclusive categories: health sciences (HS) (33%), natural and engineering sciences (NES) (31%), social sciences and humanities (SSH) (26%), and agricultural sciences (AS) (10%). The 109 respondents who failed to specify their research domain were excluded in any domain-disaggregated analyses in the study. In addition, because the responses to the research domain question ranged from being very specific to vague, the primary research domain classification of the respondents could not be fully aligned with the research domains of the hypothetical research initiatives.

A large share of respondents (48%) reported more than 10 years of research experience, followed by 6–10 years (32%) and up to 5 years (20%), respectively.

4.3 Data analysis

Responses to the questions about the research initiatives (Questions 1–5) were analyzed in Microsoft Access and SPSS (v25). Differences between regions, research domains and years of research experience were analyzed using a test of comparison of proportions. Bonferroni was used for this purpose, meaning that the P-values were adjusted for multiple comparisons. Moreover, for any research initiative (Questions 1–5), different combinations of ratings of strong examples of societal impact were possible for product, use and benefit, which represented different response patterns. For instance, respondents could rate benefit as a strong example but not a product or use, whereas others could rate both a product and benefit as strong examples but not the described use. In order to analyze the co-occurrences of ratings of strong examples of societal impact, we created a new variable in the dataset for each research initiative. The variable comprised eight mutually exclusive categories: 'none', 'product only', 'use only', 'benefit only', 'product and use', 'product and benefit', 'use and benefit', and 'product, use and benefit'. The 'none' category represented respondents who rated none of the three 'outcomes' as strong examples of societal impact. Similarly, the category of 'use and benefit' represented respondents who rated both use and benefit (but not a product) as strong examples of societal impact. Next, the new categorical variable (one for each research initiative) was cross-tabulated with the region classification of the respondents.

Responses to the open-ended question were analyzed using text analysis software Atlas.ti (v7.5). Each answer was coded first in correspondence with the domain and country of the respondent that provided the answer. The subsequent analysis consisted of two phases. The first phase entailed semi-closed thematic coding, based on the most advanced type of result in the logic model (output, outcome, and impact) that was included in the answer. For instance, an answer that contained elements referring to all three elements (output, outcome, and impact) was assigned to 'impact'. The second phase consisted of inductive coding, which aimed to identify bottom-up, emerging dimensions of impact understandings. Following Gioia, Corley and Hamilton (2012), we identified first-order concepts in the answers, which were then grouped into second-order themes and subsequently into dimensions. In theory, multiple first-order concepts could have been identified in any answer. However, when an answer included multiple words indicating a reference to, for instance 'health impact', the first-order concept was derived only once from the particular answer. The quoted answers of respondents have not been edited and are reflected verbatim below.

5. Results

5.1 Ratings for five hypothetical research initiatives

Descriptions for the five hypothetical research initiatives appear in Tables 1–5, together with ratings of how well the three 'results' in each case exemplify strong examples of the societal impact of research. Apart from reporting the percentages of respondents who rated each 'result' element as a strong example, the tables also disaggregate the percentages in terms of the three grouping variables (region, research domain, and research experience).

Across all five research initiatives, between 35% ('result' 3.1) and 57% ('result' 2.1) of respondents rated a product as a strong example of the societal impact of research. Benefit, on the other hand, was rated as a strong example by between 67% ('result' 3.3) and 86% ('result' 4.3) of respondents. Ratings for the third element, use, were somewhere between a product and benefit, with values ranging between 47% ('result' 3.2) and 69% ('result' 5.2). Use was thus more likely to be considered a strong example of societal impact compared to a product, but less likely so compared to benefit. The context of research production and application seems to play some role in the understanding of societal impact. The difference in context between the initiatives in Table 2 (example from agricultural sciences) and Table 3 (example from humanities) provides an illustration. When it comes to a product, a practice guideline for farmers was considered a stronger example of societal impact than a biography of an African-born French poet (57% vs. 35%). Similarly, in terms of benefit, the better yield reported by farmers was found to be a stronger example of societal impact than a greater appreciation of African literature in Europe (80% vs. 67%).

Concerning group differences, only nine instances of significance were observed out of 135 possible differences. Seven of the instances of significance relate to region, and one each to the research domain and years of research experience of respondents. Neither research domain nor research experience seems to play a role in how the respondents rated the different elements. The exception was the responses to the agricultural research initiative (Table 2). Respondents from agricultural sciences, compared with those from health sciences, were significantly more likely to rate better yields (benefit) as a strong example of the societal impact of research (97% vs. 74%). For the same initiative, experienced researchers (>10 years, 85%) were also more likely to rate better yields (benefit) as a strong example compared with less experienced researchers (≤5 years, 71%).

In terms of region, respondents from central and west SSA were the most likely to rate a product as a strong example of the societal impact of research. For two types of products, namely practice guidelines (Table 2) and a biography (Table 3), which are both documents, the ratings of the combined central and western regions significantly exceeded those of the eastern and southern regions. For two other types of products, namely micro-inverters (Table 4) and dental material (Table 5), both technology-based, the significant difference was between the central/western and southern regions only. Respondents from central and west SSA, compared with those in the eastern region, were also more inclined to view the use of research-based software as a strong example of the societal impact of research (Table 1).

Table 6 shows, for each research initiative, the co-occurrence of ratings of strong examples of the societal impact of research. A breakdown by SSA region is also provided as region accounts for most of the significant differences in Tables 1–5. There are eight mutually exclusive categories of co-occurrences. The highlighted cells contain at least 20% of all respondents.

As can be seen, all cells in Table 6 are populated albeit to different degrees. This points to differences in opinion as to what constitute strong examples of the societal impact of research in a particular case. Moreover, at least 20% of respondents rated all three 'result' elements ('product, use and benefit') as strong examples of societal impact. The respective figures range from 43% and 42% (for research initiatives 5 and 2) to 23% (for research initiative 3). Research initiative 3 arguably is the most interesting example of all, as three sets of opinions are evident: no element is considered a strong example (23%), all three elements are considered strong examples (23%), and benefit only is a strong example (21%).

Benefit, either alone or in combination with the other 'result' elements, does come very close to being a decisive criterion for the societal impact of research. For instance, in research initiative 4, 87% of respondents included benefit as a criterion. The figure is calculated as the sum of responses in the 'benefit only' (21%), 'product and benefit' (12%), 'use and benefit' (17%), and 'product, use and benefit' (37%) categories. The figure is even as high as 93% for respondents from the southern region. On the other hand, the mentioning of benefit does not seem to be a broad-based criterion for the societal impact of research. For instance, in the case of research initiatives 3 and 5, respectively 34% and 23% of respondents excluded benefit as a criterion. The 34% of respondents (initiative 3) is calculated by summing the responses in the 'none' (23%), 'product only' (4%), 'use only' (4%) and 'product and use' (3%) categories.

In Table 6, only four statistically significant differences with regard to region were observed. Respondents from the combined central and western regions were more inclined to consider all three elements as strong examples of societal impact, compared with those in the eastern (initiative 1; 43% versus 28%) and southern (initiative 5; 52% versus 32%) regions. In the case of initiative 3, significantly less respondents from the central and western regions, compared with those from the eastern region, considered none of the three elements as strong examples of societal impact (15% versus 28%). Although small percentages of respondents rated both a product and benefit as strong examples in the case of initiative 3, a significant regional difference was nevertheless observed: central/western regions (10%) versus the eastern region (2%).

5.2 Own understandings of societal impact

Whereas between 83% and 99% of the respondents answered the closed questions, only 76% answered the open-ended questions. This can be understood either as a first signal that respondents had difficulties expressing societal impact in their own terms or as the result of survey fatigue. In Section 5.2.1, we analyze the answers to the open-ended questions in terms of the elements of logic models to facilitate a comparison with the answers to the closed questions. In Section 5.2.2, we analyze the open-ended answers bottom-up to identify emerging dimensions of the respondents' understandings of societal impact. The data structure for each dimension is visualized, showing how the answers translated into concepts, themes and finally dimensions. As many answers included references that feed into more than one dimension, the relevant reference for the particular dimension are in bold. Due to space restrictions, we have only included the most prominent themes in the visualizations.

5.2.1 *In terms of logic models*

According to Table 7, the majority of the answers (81%) could be categorized as either 'output' (n = 19), 'outcome' (n = 46), or 'impact' (n = 235), which constitute the three types of results in a logic model. The underlying data structure and examples of quotes for each element are visualized in Figure 2. The distribution of answers shows that the vast majority of respondents require research to have an impact for it to be considered a societal impact. Some respondents provided a description of what they did *not* understand to be societal impact. This suggests that defining impact was a challenge for these respondents. Nevertheless, they often implicitly referred to the three types of results in logic models. Examples are: *'Not only having good science for manuscript for the journals'* (NES, Namibia), '*For instance the invention of a cultivar may not be of any impact to a society unless it resolves the problem of cultivar productivity'* (SSH, Kenya) and '[description of specific health benefits] … *not just improved medical services, increased health care facilities, or using high tech medical equipment to diagnose or treat patients'* (HS, Ethiopia).

A total of 69 (19%) answers could not be attributed to one of the closed categories ('other' in Table 7 and Figure 2). One respondent from the SSH from Cameroon understood societal impact of research as *'paving new grounds of conducting research'*, which implies the advancement of science. Nine understood it as the orientation or relevance of research, for instance *'It is a research that aims at ameliorating the present global problems'* (NES, Nigeria), which can also be manifested in the influence of society on research: '[…] *type of research that a given society has influenced the actual result'* (AS, Ghana). Finally, 59 answers could not be assigned to any of the categories as the answers provided too little grounds to do so. An example of such a response is *'impact that research has on society'* (HS, Zambia), as it merely rephrases the question. This again may suggest that a considerable number of respondents found it difficult to define societal impact in their own terms or suffered from survey fatigue. When breaking down the responses by domain (Table 7), it seems that respondents from two domains (AS and HS) had less difficulty defining societal impact in their own terms than respondents from the other two domains (NES and SSH). In addition, respondents from the former two domains seem more likely to include impacts in their answer than respondents from the latter two.

5.2.2 *Bottom-up emerging dimensions*

Nature of societal impact: A third of the respondents included impact on (daily) life and well-being in their definition of societal impact, which is a dominant theme according to Figure 3. Examples of such

Table 6. Co-occurrence of ratings of strong examples of the societal impact of research, per research initiative and by region of respondents

Research initiatives	SSA region of respondents	Eight mutually exclusive categories							
		None of the three elements	Product only	Use only	Benefit only	Product and use	Product and benefit	Use and benefit	Product, use and benefit
Initiative 1 (Interdisciplinary social sciences)	All respondents (n = 475)	10%	4%	3%	18%	3%	6%	23%	34%
	By region								
	a. Central and West (n = 152)	7%	3%	4%	14%	1%	3%	24%	43%
	b. East (n = 125)	11%	5%	2%	21%	2%	6%	25%	28%
	c. South (n = 64)	9%	2%	2%	23%	2%	5%	30%	28%
	Significant differences	None	None	None	None	None	None	None	*a>b*
Initiative 2 (Agricultural sciences)	All respondents (n = 436)	8%	3%	4%	15%	5%	7%	16%	42%
	By region								
	a. Central and West (n = 148)	6%	3%	1%	14%	4%	10%	12%	50%
	b. East (n = 126)	9%	6%	6%	15%	2%	5%	18%	39%
	c. South (n = 67)	5%	2%	8%	21%	6%	2%	24%	34%
	Significant differences	None	None	None	None	None	None	None	None
Initiative 3 (Humanities)	All respondents (n = 408)	23%	4%	4%	21%	3%	6%	16%	23%
	By region								
	a. Central and West (n = 144)	15%	7%	4%	21%	1%	10%	15%	28%
	b. East (n = 125)	28%	2%	6%	19%	2%	2%	21%	21%
	c. South (n = 66)	26%	3%	6%	27%	2%	3%	14%	20%
	Significant differences	*b>a*	None	None	None	None	*a>b*	None	None
Initiative 4 (Engineering sciences)	All respondents (n = 404)	5%	5%	2%	21%	2%	12%	17%	37%
	By region								
	a. Central and West (n = 151)	3%	5%	4%	15%	3%	14%	16%	42%
	b. East (n = 126)	6%	5%	2%	25%	3%	9%	14%	37%
	c. South (n = 67)	3%	2%	2%	22%	0%	12%	28%	31%
	Significant differences	None	None	None	None	None	None	None	None
Initiative 5 (Health sciences)	All respondents (n = 398)	12%	4%	2%	13%	5%	3%	19%	43%
	By region								
	a. Central and West (n = 150)	8%	5%	1%	13%	4%	2%	15%	52%
	b. East (n = 126)	14%	2%	2%	14%	5%	1%	21%	41%
	c. South (n = 66)	11%	5%	6%	12%	5%	3%	27%	32%
	Significant differences	None	None	None	None	None	None	None	*a>c*

Note: The 'All respondents' category includes those who did not specify their country and those who resided outside SSA at the time of the survey.

responses include: *'Is when research impacts or influences the lives, livelihoods, quality of life and well-being of people'* (SSH, Zimbabwe) and *'A research that have a positive impact on the wellbeing of the society either culturally, economically, healthwise etc'* (HS, Sierra Leone).

Many respondents mentioned specific natures of impact, as the last presented quote above shows. Economic impact was mentioned by respondents from all four domains, although slightly less by respondents from the AS. Generally, it is about economic impacts on society as a whole, or on communities and individuals. Economic impact is hardly mentioned in relationship to commercialization or companies. Social impact was mentioned as often as economic impact, has a similar distribution pattern as economic impact and often refers to social dynamics, for instance *'Change in the way people live with and interact with one another including the way of doing things and the values and norms they choose to live by'* (SSH, Kenya). In contrast, although overall as prominent as the two other natures of impact, health impact is predominantly mentioned by respondents from the HS. These responses often include very specific types of impact, for example *'The actual reduction of tuberculosis cases, reduction in the number of HIV infected individuals, improved quality of life of people with HIV* [...]' (HS, Ethiopia) and '*Outcomes and recommendations that drives policy change, positively changes patterns of drug use, introduces new therapeutic options and reduces the disease burden of the general population*' (HS, Nigeria). Other referred to societal impacts are cultural impact, political and educational impact, but these were mentioned far less. Three natures of impacts further specify the improvement of daily life of individuals and families: impacts on nutrition, income and housing. Although the numbers were small, the latter three seem to be rather distinctive for the SSA context.

Scope of impact: Specifications concerning the scope of impact are far less common than nature of impact and include specifications for size of the impact and the geographical area affected (Figure 4). Nearly all size specifications relate to the number of people that should be affected, for instance: '*Resultados que de algum modo afectam a maioria da sociedade*' [Results that somehow affect the majority of society] (SSH, Mozambique). Yet, some respondents emphasized that the number of people affected is irrelevant. Other size specifications concern the significance of the impact. This is exemplified by the following answer: '*Research whose benefits are transferred to the wider community and the benefits are widespread and significant e.g. use of long lasting insecticide treated nets to protect against malaria*' (HS, Kenya). There does not seem to be a pattern concerning specifications for geographical scale. Some respondents referred to global challenges, whereas others specifically mentioned impact on local communities. The national level is also addressed, including *'developing countries'* (SSH) and *'sub-Saharan countries'* (NES, Nigeria).

Beneficiaries: The most often mentioned beneficiaries all relate to 'human kind in general' (Figure 5). Nearly all answers included words that at least referred to one of the following three terms: 'societies', 'people' and 'communities'. Although 'society' was often used in an abstract sense, a number of answers suggested that in fact there might be a more concrete image behind the term: *'How the outcome of the research has been able to influence positively the lifestyle and wellbeing of people that constitute the society'* (NES, Nigeria). The answers that include 'people' and 'communities' further evidence this: *'The general but not totally direct effects on people as they shape or influence day to day livelihood and activities'* (SSH, Nigeria). Some respondents also emphasized the collective in defining impact, as the following quote illustrates: '[...] *of benefit to the general populace and not a group of persons*' (HS, Nigeria). Overall, the majority highlighted societies – and the communities and individuals that societies are composed of – as the most important beneficiaries of their research.

Table 7. Thematic coding of open-ended responses in terms of elements of logic models

Elements	Research domain of respondents				Total
	AS	HS	NES	SSH	
Output	0% (n = 0)	2% (n = 3)	8% (n = 9)	7% (n = 7)	5% (n = 19)
Outcome	11% (n = 4)	13% (n = 16)	9% (n = 10)	15% (n = 15)	12% (n = 46)
Impact	76% (n = 28)	74% (n = 90)	56% (n = 60)	54% (n = 53)	64% (n = 235)
Other/unspecified	14% (n = 5)	10% (n = 12)	27% (n = 29)	23% (n = 23)	19% (n = 69)
Total	100% (n = 37)	100% (n = 121)	100% (n = 108)	100% (n = 98)	100% (n = 369)

Note: The total column includes respondents who did not specify their research domain.

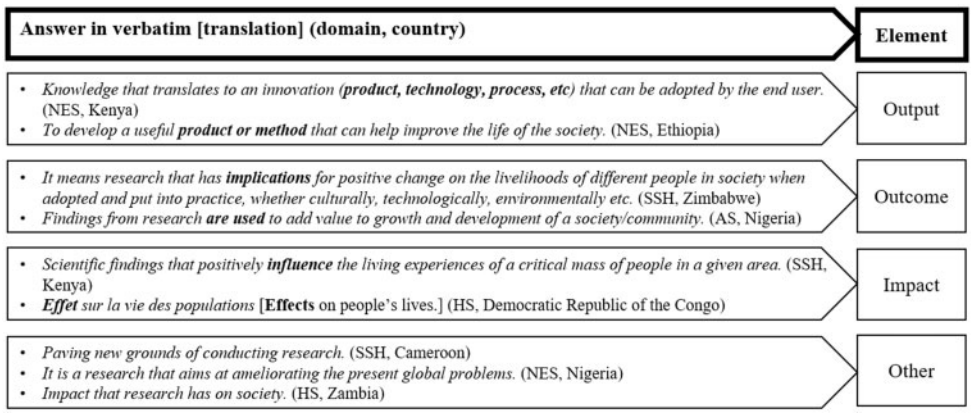

Figure 2. Data structure resulting from thematic coding 'Logic Model'.

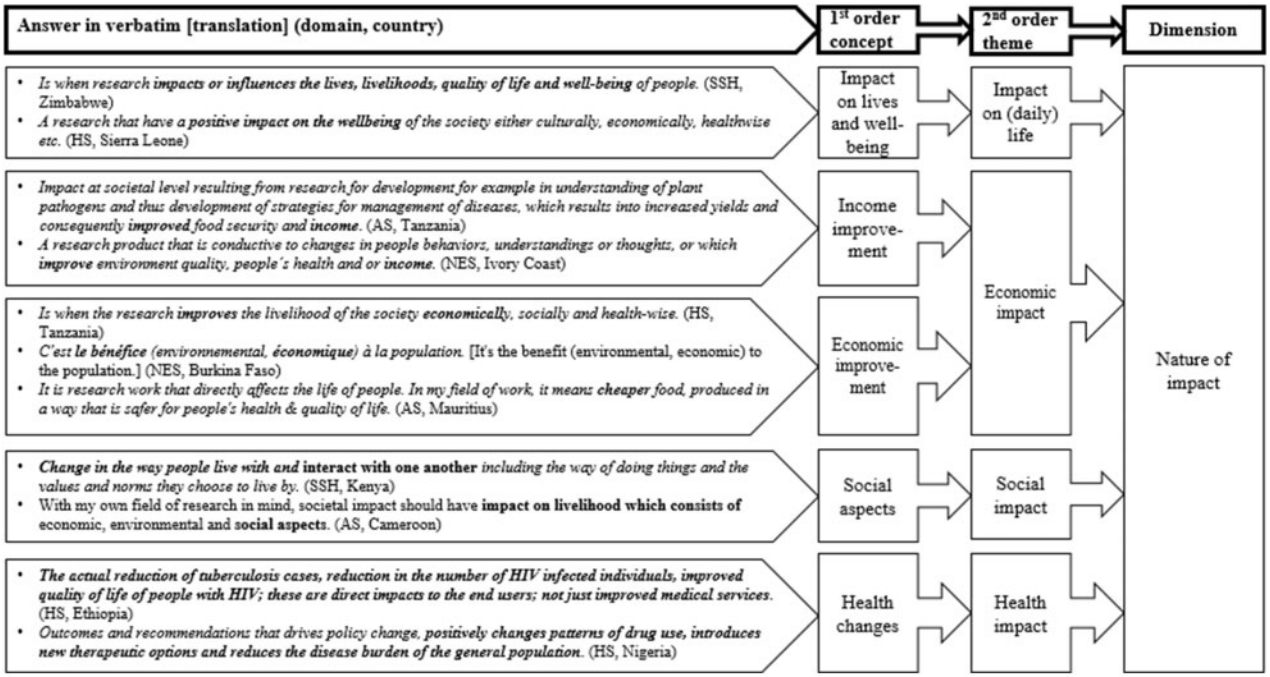

Figure 3. Data structure supporting the 'Nature of Impact' dimension.

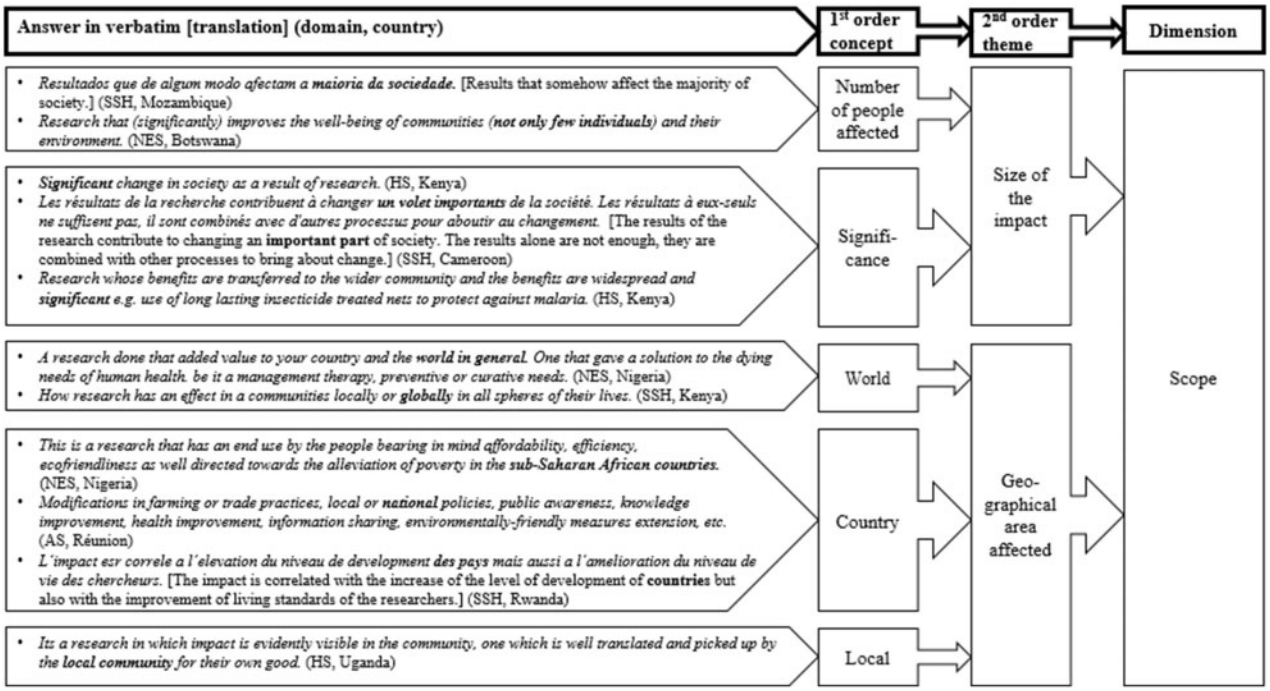

Figure 4. Data structure supporting the 'Scope' dimension.

Other beneficiaries are mentioned far less. '*Policy-makers*' and '*government*' are mentioned in a very limited number of answers. The same holds for '*animals*'. Companies are mentioned sporadically as well, but are never mentioned as the sole beneficiary. Remarkably, they are only mentioned by respondents that at the time of the survey were employed in a western European country. For this reason we have not included companies in the visualization. Finally, farmers and the media both were mentioned only once, the latter as a means to further disseminate results.

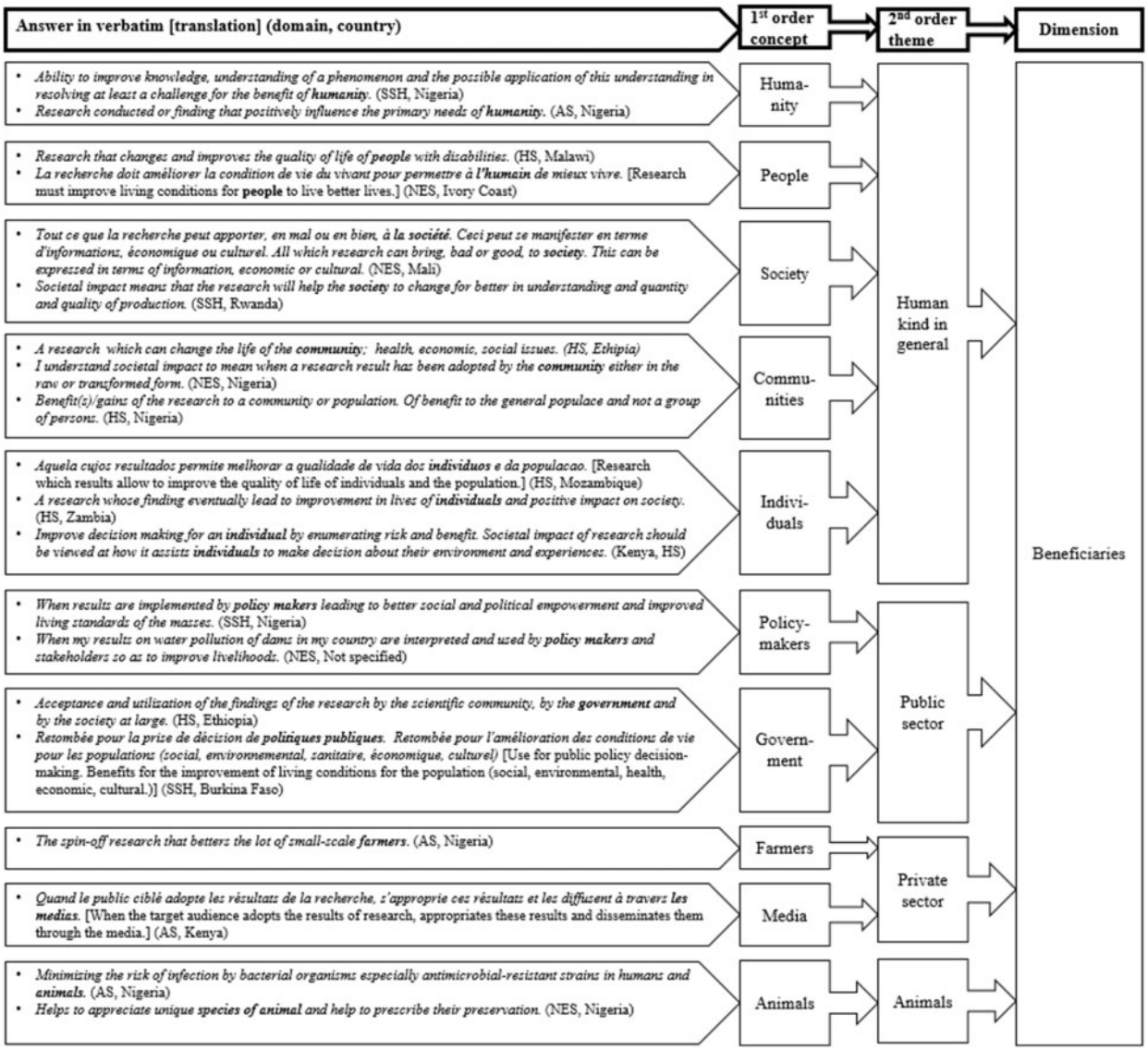

Figure 5. Data structure supporting the 'Beneficiaries' dimension.

Positive change: The responses also contained qualitative specifications for societal impact (Figure 6). Almost half of the responses explicitly mentioned that societal impact concerns positive contributions and that it leads to benefits, for example: '*C'est ce que l'utilisation des résultats de recherche induit comme actions, changement de comportement, adoption d'une technologie pour améliorer une situation existante*' [This is when the use of research results induces actions, behavioural change, adoption of a technology to ameliorate an existing situation] (HS, Benin). Yet, some respondents acknowledged that impact can be either positive or negative: '*What research has done to the society…be it positive or negative…*' (HS, no country specified). A large number of respondents emphasizes change and seem to relate this to positivity and benefits: '*Impact of research that brings positive changes in the life of people in society, be they peasant or well-to-go*' (AS, Ghana) and '*A research the positively transforms the society*' (SSH, Kenya). The same goes for the inclusion of problem solving in the understanding of impact by a smaller number of respondents: '*Investigations aims at solving challenges in the society*' (NES, Kenya).

6. Discussion

The study addressed the challenge of conceptualizing the societal impact of research in SSA, a region that is without explicit national impact policies. It did so by conducting an exploratory web survey of researchers. The guiding question was whether researchers in SSA, when reflecting on societal impact, would follow or ignore the classical distinction between output, outcome, and impact in programme evaluation. It was assumed that in research evaluation the distinction manifests, among others, as a distinction between product, use, and benefit. For all of five hypothetical research initiatives, benefit—compared to a product and use—was the most likely to be rated as a strong example of societal impact (67–86% across all initiatives). This means that a long-term, ultimate 'result' (benefit) is still relevant for conceptualizations of societal impact, thereby suggesting an understanding of impact similar to what is captured by logic models in programme evaluation. The responses to the open-ended question, when analyzed in terms of the elements of logic models, also placed emphasis on impact as the ultimate 'result', as

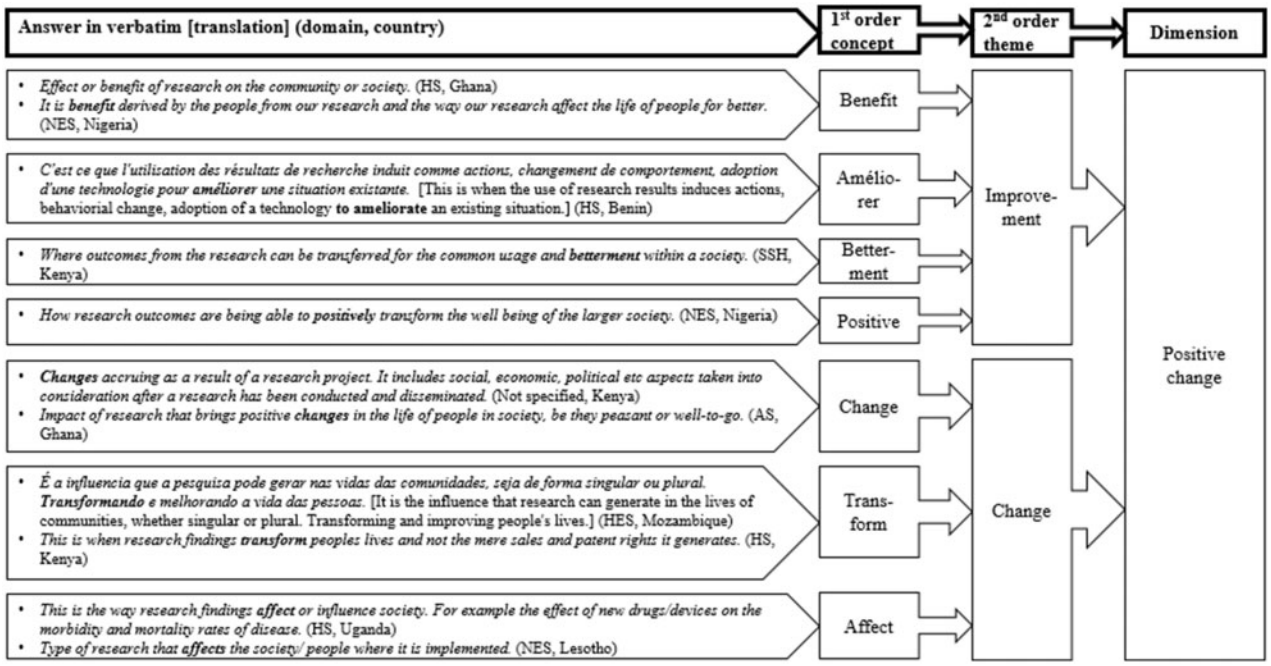

Figure 6. Data structure supporting the 'Positive Change' dimension.

64% of respondents included such a description in their definition of societal impact.

However, across the five initiatives, only 13–21% of respondents rated benefit as the *only* element exemplifying a strong example of the societal impact of research. Markedly larger proportions of respondents (23–43%) rated all three elements as strong examples of the societal impact of research. In other words, not only the ultimate 'result' (benefit) but also the interim 'results' (product and use) constitute relevant examples. In the descriptions of the hypothetical research initiatives, the two interim 'results' function as two sequential steps that build up to the ultimate 'result'. Viewing all three elements as strong examples therefore suggests a process view of societal impact. It needs to be noted that the case descriptions portrayed impact as a linear process and not as a networked or interactive process. The descriptions imposed a linear lens on a non-linear process, as doing so allowed for a set of structured questions to be extracted from the descriptions and presented in a survey.

In only a few instances did the responses to the structured questions differ significantly according to the three grouping variables (region, research domain, and research experience). Occurrences of significance were found mainly for region (central and west SSA combined vs. either east or south SSA) and where a product is concerned. However, the significant regional differences cannot be explained in terms of social-cultural differences between Anglophone and Francophone countries alone. Nigeria, an Anglophone country, dominated the survey responses from west SSA whereas central SSA's responses were exclusively from Francophone countries. Countries within a particular region or, rather, economic block, also share similar networks that cut across language and cultural barriers, such as the West African R&I Management Association for research management staff in west SSA. An alternative explanation for the significant regional differences relates to the involvement of some national science granting agencies in countries in central and west SSA in certain aspects of valorization (Mouton, Gaillard and Van Lill 2014). Mouton and colleagues studied the science granting agencies of 17 SSA countries and identified 12 areas in which agencies in SSA typically operate. Valorization was one such area. It was observed in at least one agency in all seven countries in the central and western regions of their study but less frequently so in the agencies of the study countries in the other regions. The study authors understood valorization as the adding of value to research findings, which the relevant agencies did by supporting the dissemination and uptake of the results of their funded research. However, involvement in some dissemination and uptake activities by no means implies the institutionalization of research impact. The actual point to be made is that a research product is considered part of the uptake process and hence more recognizable as impact by those familiar with valorization.

Moreover, in the current study, not so much the research domain of the respondents but the research domain of a particular initiative determined how the three elements of product, use, and benefit were to be interpreted as examples of societal impact. The research initiative in the humanities presents the clearest example. Respondents from all research domains rated all three elements in the humanities case—relative to the other cases—as *less* indicative of strong examples of the societal impact of research. The fact that almost a quarter (23%) of respondents in the same case rated none of the three elements as strong examples of societal impact points to a broader issue in the appreciation of SSH impacts. SSH impact can be conceptual and without direct use (Brewer 2013), which means that it can also be perceived as having less societal relevance. Olmos-Peñuela, Benneworth and Castro-Martínez (2015) addressed this perception by critically reflecting on and comparing discussions of the value of SSH research in policies. They identify two key but opposing discourses: that SSH is less useful to society than other disciplines, and that SSH is simply different from other disciplines but by no means

less useful. Additional research is required to determine which discourse(s) explain the lower appreciation of the SSH narrative in this study of SSA researchers.

Arguably, in light of the bottom-up definition of societal impact that emerged from the open responses, a greater appreciation of African literature and philosophy in Europe (the humanities example) does not visibly contribute to improving the everyday life of people in SSA. The responses to the open question, viewed together, portrayed impact as '*a (generally) positive effect that contributes to change in the daily life of human kind*'. The expectation that research should have impact at an almost general level of aggregation could be unique to the SSA context. This belief is backed by the few references made to other beneficiaries (in addition to those that broadly relate to 'human kind') in the open question. In European studies, references to companies, government, and media seem to be much more abundant (e.g. HEFCE 2015; De Jong and Muhonen 2018). An African-based study by Boshoff et al. (2018), which focuses on research utilization at three universities in Kenya, Nigeria, and Rwanda, provides further evidence of a relative strong emphasis on the 'general public' as research beneficiary outside academia.

On the other hand, it needs to be remembered that the open question asked about understandings of the societal impact of research, where society is the implied beneficiary. This request could have directed the respondents' attention to the sphere of 'sought-after high-level effects' (Boshoff and Sefatsa 2019: 156), even though the respondents might have been aware of other intermediate impacts (e.g. business or policy impact) that would lead to societal impact that affects the daily life of human kind. Thus, the relative absence of explicit references to business and policy impacts could be because of a focus on the desired end state and not on the various impact points leading towards achieving that state. The sense of community and well-being for all might also have prevailed to such a degree that all survey responses became subject to that. For instance, the idea of what counts as a business might be inextricably linked to community life in the informal sector so that business impact cannot be separated from community impact.

Finally, as in all studies, external factors might have influenced the responses to the survey. One such factor is the extent of international research collaboration between SSA researchers and their European counterparts, specifically collaborators from countries with well-developed national research evaluation systems and institutionalized impact (e.g. the UK and the Netherlands). According to the bibliometric literature, the UK, next to the USA, is a key international collaborator of SSA researchers (Adams et al. 2014). In addition, the strong involvement of external donors in SSA could have informed the understanding of impact in the case of some respondents, given that donors often require the completion of logic models where impact is portrayed as the long-term effect (benefit) of a programmatic intervention.

7. Recommendations for practice

Although the numbers of research publications in SSA overall are rapidly growing, the output is still highly skewed towards South Africa and the result of international research collaboration and other international initiatives (Sooryamoorthy 2018). Against this backdrop, SSA researchers and their affiliating organizations might be at risk of being locked into international definitions and practices of research impact, given the relatively uneven playing field in terms of influences and resources in international collaborations (Boshoff 2009; Owusu-Nimo and Boshoff 2017). However, SSA has its own distinct societal challenges. A first practice recommendation therefore would be that SSA governments and universities take up the task of working towards an understanding of research impact in relation to its own unique context while, at the same time, not lose sight of best practices available elsewhere.

Second, funders and evaluators should also be aware that, without explicit guidelines, a general positive effect is what SSA researchers will most probably describe (ex ante) and assess (ex post) in evaluative contexts. This is probably true for all researchers, not only SSA researchers. However, the survey responses serve to remind that should a funder be interested in additional or specific impacts, for example on business or policy, the latter would need to be stated explicitly in the application and/or evaluation template.

Third, the aggregated understanding of impact that emerged from the open question is rather generic. This raises a question as to how the generic definition would translate into something more specific at the level of fields, institutions, centres and individual researchers. Previous research suggests positive effects of regulations and incentives for knowledge transfer on impact processes (Barjak, Es-Sadki and Arundel 2015). Examples of SSA universities that already formulated policies include Kenyatta University in Kenya, which established a Directorate of Research Dissemination and Uptake. The directorate supports researchers in framing their research questions better, in building relationships with stakeholders and in creating targeted messages to influence stakeholders (KU 2016: 17). The University of Malawi (UNIMA 2014) and the University of Dar es Salaam in Tanzania (UDSM 2015) are two other examples. Both universities aim to facilitate impact learning by establishing feedback mechanisms to obtain stakeholders' input on 'the effectiveness of the research in solving problems' (UNIMA 2014: 17) and 'to foster continued refinement of the research agenda' (UDSM 2015: 14). Such examples could also be of interest to universities elsewhere in the world, as support beyond technology transfer is still in development.

8. Recommendations for future research

Although the survey captured a large set of societal impact understandings, it did not allow for determining their origins. There is thus a need for studies that investigate their roots. What personal assumptions, ideas and experiences can explain the differences among researchers in SSA? In addition, what signals from peer communities and policy contribute to a researcher's thinking about societal impact? Focus groups, observations and interviews have been successfully used to answer similar questions in other parts of the world (e.g. Watermeyer 2014; De Jong, Smit, and Van Drooge 2016; Watermeyer and Hedgecoe 2016), and could also be applied in SSA for the same purpose.

Moreover, the structured component of the survey relied on hypothetical impact cases. In terms of the current study, it is unclear to what extent the various examples of societal impact, presented as a set of 'results' in the structured questions, biased the answers to the open question. Both sets of questions combined allowed for an exploration of impact understandings but did not provide any answers as to how SSA researchers would behave in actual impact evaluations. Two relevant questions are: how would SSA researchers

present their research impact in such evaluations and how would they assess impact? Documentary analyses of funding applications and evaluation reports, as well as interviews with evaluators (e.g. Samuel and Derrick 2015), could provide valuable data sources to answer these questions in future research.

Finally, the key for ensuring that research in SSA would generate beneficial effects for society most probably lies in having a national R&I community that is well informed about matters of research impact. According to Bayley and Phipps (2017), research impact literacy implies knowledge of effects and their measurement (the 'what' component of impact) as well as knowledge of the processes of impact creation and the underlying impact-creating mechanisms (the 'how' component), together with knowledge of the roles of the parties responsible for impact (the 'who' component). The establishment of a culture of research impact awareness among the R&I community of SSA could therefore be instrumental to raising its societal impact capacity, which is 'the ability of academic researchers to realize benefits to society based on academic research' (De Jong and Muhonen 2018).

Notes

1. As a developing region, SSA comprises 48 of the continent's 54 countries which, geographically, lie south of the Sahara desert (World Bank 2018). Normally excluded are six countries in the northern region of Africa (Algeria, Djibouti, Egypt, Libya, Morocco, and Tunisia) that are part of the league of Arab countries.
2. The reason for excluding South Africa in this study was twofold. First, the volume of South Africa's research activities significantly exceeds that of other countries in SSA (Boshoff 2010; Sooryamoorthy 2018), thereby placing South Africa in a category of its own. Second, the research centre that the first author is affiliated with was conducting a number of large-scale surveys among South African researchers at the time of the current study. To prevent any survey fatigue, it was decided to exclude South Africa from the current study.
3. Translation by authors.

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