



Vetenskapsrådet



THE FUTURE OF SWEDISH RESEARCH!

**OVERVIEW 2014
DEVELOPMENT RESEARCH**

THE FUTURE OF SWEDISH RESEARCH

The Swedish Research Council developed a series of overviews and analyses in 2014 which serve as the foundation for the Board's summary conclusions and recommendations on research policy choices to promote Swedish research in the coming 5 to 10 years. This project is designated "The future of research" and will be summarised in a final report in the summer of 2015. As a whole, the material serves as the foundation in the documentation the Swedish Research Council is compiling for the government's upcoming research bill in 2016.

Overviews have been put together for the following seven research domains:

- humanities and social sciences
- natural sciences and engineering sciences
- medicine and health
- educational sciences
- artistic research
- development research
- research infrastructure

THE FUTURE OF SWEDISH RESEARCH! OVERVIEW 2014 DEVELOPMENT RESEARCH

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OVERVIEW 2014

DEVELOPMENT RESEARCH

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PREFACE

This overview of Development research is part of the knowledge base the Swedish Research Council has compiled to contribute decision-making documentation to the government's upcoming research bill and for prioritisation in the scientific councils and committees. It can also be used as reference material in the research sector.

Development research has been its own area at the Swedish Research Council since 2013, when the management of the Swedish Development research was moved from the Swedish International Development Cooperation Agency (Sida) with the aim of integrating Development research with the other areas of Swedish research funded by the Swedish Research Council. The background material to the Overview of Development research include the theme descriptions, which were a first effort to capture relevant research and describe different parts of a very wide field of research. This mapping of research is not a complete compilation of all relevant research and the division into themes used for this exercise will not be used to define future calls or strategic funding.

The background material were developed by over twenty active researchers in Sweden, who were asked to summarise the strengths and weaknesses, describe the trends and tendencies, and to provide recommendations for strengthening the research but also to highlight common challenges and issues to strengthen Development research in general. The researchers met in a workshop where Development research in Sweden and the Overview were discussed, after which the writers had the opportunity to revise their texts.

These texts were then made available in a Web forum for researchers and others to read and comment, and contribute other perspectives to the discussion. The review panels within Development research were also able to discuss and comment on the background material. In October, a seminar where future developments within the Development research area were discussed by the Committee for Development research, active researchers, and other stakeholders, to inform the development of the Overview further, from several perspectives.

We would like to thank everyone who contributed in various ways to the development of the background material and final documents of the Overview of Development research.

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SUMMARY

Introduction

The Swedish Research Council supports high quality Development research in any scientific discipline of particular relevance for low- and middle-income countries (LMICs)¹. The research must be relevant to the overall goals of Sweden's funding for international development that are aligned with global goals for development. This means that such research must contribute to inclusive and sustainable development, help create the conditions that enable poor populations to improve their livelihoods and be undertaken in accordance with the OECD/DAC's definition of development assistance. In 2013 after a government decision, the management of funding applications for Swedish Development research was transferred from Sida to VR, which has a strong tradition and capability for evaluating the scientific quality of research applications. Researchers employed by, or affiliated to, Swedish universities may apply, in certain cases, in collaboration with partners in LMICs. Development research funded through VR may therefore include research across the spectrum from basic to applied, provided its relevance to international development is justified.

Sweden has a strong tradition in several areas of Development research. Peace and conflict, economics, environment, gender, food security, energy and health are all examples of areas in which Sweden has a strong international reputation. At a global level, the impact of Swedish research has been significant and at the cutting edge of innovation. Many leading Development researchers, however, have retired or are close to retirement. Therefore to maintain Sweden's position at the global level, there is an urgent need to attract a new generation of top class researchers to Development research. While research is becoming more global in nature, Development research addresses such complex global challenges through an emphasis on supporting people in resource-constrained settings, where solutions are often specific to local contexts.

Main recommendations

Maintaining Sweden's international position in Development research will require greater investment to attract some of the best young researchers into the area. A continued emphasis on researcher-initiated proposals including some new initiatives, should be balanced with some targeted 'Thematic calls' developed (and funded) jointly with other agencies. The Development research Committee is international in composition and has already discussed opportunities for modifying examples of 'best practice' from other countries to help Sweden raise its profile. Based on the background material and our internal discussions, we have the following three recommendations - all considered equally important.

Researcher-initiated approach

The Development research Committee recommends that support for researcher-initiated proposals (as is currently the main practice at Vetenskapsrådet (Swedish Research Council) (VR)) be continued. This is globally recognized as the best way to stimulate the creation of innovative ideas and novel concepts that are essential for excellent quality research. Calls for proposals should make it clear that both single disciplinary and multi-disciplinary research proposals are welcome, as is research across the spectrum from basic to applied research, provided quality is high and relevance can be justified.

Joint thematic calls with other funding agencies or mechanisms

Given the importance of Development research, there is an expectation for increased financial support from Government. At the same time, the Committee has also identified an opportunity to increase funding through joint thematic calls with other funding agencies and also within VR. Such calls could attract disciplinary as well as multidisciplinary applications. The themes for such calls will need to be decided jointly, but the priorities for the Committee are to support areas where Sweden is already a world research leader or has the

¹ 2013 and 2014 both Project Grants and International Collaboration Grants – Swedish Research Links were aimed at both low and middle income countries. 2015 Project Grants are to be aimed at low income countries, whereas International Collaboration Grants – Swedish Research Links are to be aimed low and lower middle income countries. For more information see appropriation letter for the Swedish Research Council.

potential to be on the cutting edge (e.g. where young researchers show exceptional quality). Joint funding brings two benefits; first it can facilitate the development of a critical mass required for an international profile by increasing the amount of funding available; second, Development research by its nature is often inter-sectoral, and joint funding between sectors offers an entry point for non-traditional Development research sectors to collaborate with those sectors already established in the field. Examples of potential complementary funders could be other research councils or Sida at a national level, while there are also other government and private opportunities at the international level.

Strengthening a new generation of young tenure track researchers

While there was considerable recruitment of Swedish researchers into Development research in the '60s and '70s, many of these researchers have already retired, or are due to retire soon. Since there are great opportunities in Development research for the best scientists to have global impact, the Committee therefore strongly recommends support to young researchers in the field. This is intended to help to maintain Sweden's international position. Such support includes individual projects as well as a research environment that can stimulate or encourage the best researchers to enter, and stay in, the field of Development research. This also includes support for international exchange visits.

Scientific quality and impact of the research

The scientific quality of Swedish Development research is considered world leading in some areas and high overall. Although it was not feasible to undertake bibliometric research in the Development research review due to the wide spread of publications, Development research conducted by Swedish researchers clearly is of equal quality to other high ranking research areas. Sweden also has a strong reputation and a comparative advantage in capacity-building of individual researchers and institutions in LMIC.

The Committee notes that many researchers, as well as undertaking research, are also successful in taking research further through engagement with different communities involved in policy and practice. The impact of Swedish Development research can thus be seen at different levels ranging from the local impact of individual research projects to impact on international policy. Swedish research has contributed at all levels.

Career paths for researchers

Career paths for researchers within Development research can either be within Sweden or internationally. To get onto the career ladder, however, Swedish researchers may need national support to create possibilities for younger researchers to establish themselves as researchers.

Infrastructure needs and utilisation

Infrastructure needs in Development research are similar, but also different compared to other research areas. Examples of similar needs include access to advanced technologies, such as genome sequencing and molecular laboratories, while an example of different needs is access to Health and Demographic Surveillance Sites (HDSS). In this case there is a requirement for comprehensive data collection in contexts where population registries are not available. Accessing infrastructure at an international level may require the signing of agreements at a national level.

National and international collaboration opportunities

National collaboration exists, but could be further strengthened to increase Swedish competitiveness in the area of Development research. Examples include the Research School in Global health, funded by FAS the predecessor of Forte. International collaboration operates at three levels, Nordic, European and global. European collaboration on Development research has been strengthened through EC funding by DG Dev, although it was not possible to quantify this. Examples of international collaboration include links with the CGIAR (for agricultural research) and the African Economic Research Forum.

Internationally there are multiple efforts to foster alignment, e.g. the forthcoming ‘Sustainable Development Goals’². Such initiatives bring increased attention to Development research and present new opportunities for co-funding; however for researchers within a country to engage in such initiatives often requires national investment. A characteristic of current challenges is the increasing recognition of the need for an interdisciplinary approach, whereby scientists in individual disciplines (e.g. humanities and the social sciences, health and medical sciences and natural and engineering sciences) work together to address the complex challenges of the 21st century. Innovations within all these areas are needed and solutions need a global perspective with contextually appropriate implementation of locally suitable interventions like research on the handling of emergencies and on peace processes with or without international involvement. A comparative advantage of Development research, therefore, is that it through its international outreach should be able to use national funding to leverage external funding from international funders.

² Find more information on the Sustainable Development Goals here: <https://sustainabledevelopment.un.org/focussdgs.html>

SVENSK ÖVERSÄTTNING AV ÄMNESÖVERSIKTEN

Den svenska versionen av översikten av utvecklingsforskning kan laddas ner från Vetenskapsrådets webbplats vr.se från och med våren 2015. Orsaken till att denna rapport publiceras på engelska nu är att kommittén för utvecklingsforskning har flera utländska forskare som medlemmar och därmed har engelska som arbetspråk.

Vetenskapsrådet är en myndighet under Utbildningsdepartementet. Inom Vetenskapsrådet finns ämnesråd, råd och kommittéer. De består av aktiva forskare och andra experter inom respektive område.

Vetenskapsrådet har en ledande roll för att utveckla svensk forskning av högsta vetenskapliga kvalitet och bidrar därmed till samhällets utveckling. Utöver finansiering av forskning är myndigheten rådgivare till regeringen i forskningsrelaterade frågor och arbetar för att skapa förståelse för forskningens betydelse, resultat och villkor.

Denna rapport är en av sju översikter av svenska forskningsområden och infrastrukturer genomförda under 2014. Arbetet med översikterna är en del i Vetenskapsrådets verksamhet för att stödja och stärka forskarinitierad grundläggande forskning, initiera forskning inom strategiskt viktiga områden och verka för ett effektivt forskningssystem. Som forskningspolitisk rådgivare förser Vetenskapsrådet regering och riksdag med underlag för framtida vägval som främjar svensk forskning av högsta vetenskapliga kvalitet och som beaktar forskningen som en del av lösningen på samhälleliga utmaningar. Arbetet genomförs återkommande inför varje forskningsproposition.

RECOMMENDATIONS FROM THE COMMITTEE FOR THE AREA AS A WHOLE

Disciplinary/thematic recommendations

Development research is a new area within VR and covers all disciplines. Although the background material do not provide a complete description of Swedish Development research, they do cover the research fields of largest critical mass. While the Development research Committee (which is also multi-disciplinary) has been in operation for less than two years and not yet had the opportunity to study the breadth of Swedish Development research in relation to the global research landscape, nevertheless it is confident to recommend that funding should not be spread too thinly across all topics, if maximum impact (either scientific or in terms of relevance) is to be achieved. Some of the prioritization will happen as a result of the quality of research submitted to researcher-initiated funding streams, although it has not as yet been possible to do this between the three major disciplinary groupings (Global Health, Humanities and Social Sciences and Natural, Engineering and Environmental Sciences). It also recognises that innovation often comes at the interface between disciplines, particularly when addressing the complex challenges in international development. Given the complications associated with objectively assessing inter-disciplinary research, before encouraging too many submissions, the Committee recognises the need to consider new evaluation criteria and special calls.

The Committee also acknowledges that there are areas of research that are strong in Sweden and Europe (e.g. energy research), but that have not as yet been significant operationalized in LMIC. In contrast, other areas are strong both at national and international level. This includes among others food security/agriculture, the environment, peace/conflict and various aspects of public health research. Development research therefore needs to use as the basis those areas where Sweden's international reputation is already strong to identify and support new areas with the potential for future research. Drawing on this initial analysis, the Committee proposes three main recommendations as follows:

Researcher-initiated approach

The Committee strongly recommends that calls for researcher-initiated proposals should continue. This is essential to stimulate innovative ideas and novel concepts beyond existing areas.

However, the methods / modes for identifying high quality researcher-initiated research can be innovative. In addition to current calls for individual grants, one possibility would be to issue calls for dedicated Development research Centres based on researcher-initiated applications. Conventionally Sweden has kept Development researchers within their environment/ discipline, to ensure that disciplinary knowledge and skills are up to date. Increasingly today, however, departments involved in Development research, are recruiting researchers with a range of disciplinary backgrounds.

Therefore, along with the continuation of researcher-initiated proposals, to address major Development challenges, additional new funding is required to ensure that multiple disciplines can collaborate in an integrated way (inter-disciplinarity). A recent evaluation showed that among successful, i.e. funded, Development projects, multidisciplinary projects are rare. The Committee still needs to consider how to attract more such proposals and how to ensure they receive a fair evaluation.

Joint thematic calls with other funding agencies or mechanisms

Alongside researcher-initiated calls, the Committee recommends exploration of the potential for joint calls together with other funding organizations, such as other research councils, Sida or international agencies. Co-funding of thematic areas from more than one funding body could facilitate the development of a critical mass in areas of research strength, to give a higher profile for Swedish research in international contexts. The thematic calls could be both in areas where Swedish research is already strong and in areas where strong Swedish research has not yet been able to capture the opportunities in International Development. This could

potentially increase the potential for international funding by the Swedish research community, but would also require greater Swedish Government investment.

Examples of areas with potential for attracting international funding for interdisciplinary research include those involving collaboration between humanities/social science, health research and researchers from the nature/environment/technology field. Thematic approaches across these areas could lead to more innovative research that could have a transformative impact.

Joint calls could potentially also include support for research environments e.g. in the form of support to Development research Centres. One option would be to support networks within or between universities, where the researchers stay within their discipline but are also part of a formal network embedded in Development research. A critical mass of researchers in the field as a whole and also in different universities/departments is needed.

For thematic calls with joint funding to occur requires collaborative prioritization between funders in developing the themes, as well as evaluation mechanisms and criteria. Joint calls could first be explored with e.g. Sida and Formas during 2015 for potential calls in 2016. This would be a joint responsibility between VR, the committee for Development research and Sida. The duration of thematic support could be a minimum of three years, but preferably five years.

Recommendations on structural issues

Support to a younger generation of researchers

That Swedish Development research is so strong, is probably more a function of individual dedicated researchers and research supervisors than solid commitments from Swedish funding agencies. Research environments in Development research in Sweden are both scattered and isolated; if the Government wishes to keep the profile of Swedish Development research high internationally, it needs to build a strong generation of new researchers, as many in the field have retired or will soon retire. The Committee suggests the following structural approaches to facilitate the building of a new generation of Development researchers to replace the older generation; (i) more opportunities for PhD studentships in Development research, (ii) more funds for postdocs/assistant professorship positions, (iii) ring-fenced funding for grants to post-post-docs including grants to spend time in research environments abroad. To attract really good scientists to enter and stay in the area prestigious fellowships are needed. Another recommendation is the inclusion of Development researchers in the various existing schemes to support excellent younger researchers, i.e. researchers before senior lecturer or professorship level. Here universities must also play an important role.

The Development research Committee sees a range of possibilities for support to a younger generation of researchers. One would be to prioritise funding to support excellent research proposals from young researchers, another to invest in facilitating the recruitment of excellent young researchers, including from abroad. The Committee would like to identify how to demonstrate potential career paths for young researchers interested in Development research. To this end, it suggests that more post-doc and tenure track assistant lectureships should be created within Sweden, which provide support for periods abroad, in LMICs. International recruitment is also essential. To date, recruitment from abroad in other scientific areas has focused on recruiting internationally leading researchers at the highest level, but it might be easier and more efficient to aim for more junior 'rising stars' in Development research. Higher funding levels and funding for longer time-periods will make it easier to create a critical mass. One possibility would be to channel resources to young, successful scholars to build up research groups. Such 'environmental' support should also include funding for doctoral students. This support could be in the form of positions, but could also be in the form of support to PhD students from other countries. Such students might become postdocs later and irrespective of whether they stay in their home country or if they spend time in Sweden after their PhD, they will have the potential to play a key role in facilitating collaboration between Sweden and LMICs.

Infrastructure needs and utilisation

Infrastructure needs are both similar and different in Development research compared to other research areas. Examples of similar needs include access to advanced technologies, such as genome sequencing and molecular laboratories, while an example of different needs is access to Health and Demographic Surveillance Sites (HDSS). In this case there is a requirement for comprehensive data collection in contexts where population registries are not available. The Committee sees it as important for Swedish Development researchers in collaboration with researchers from LMIC to have access to databases which would facilitate their research. The financing of the use by researchers from LMICs of such infrastructures in Sweden (e.g. registries and bio banks) could help to strengthen research quality

The Committee wants to stimulate researchers within Development research to apply for funds for infrastructure support allocated from VR. Furthermore, researchers applying for infrastructure support within other research areas could indicate the value of their research for development, which would have the potential to increase the global impact of their research. Accessing infrastructure at an international level may require the signing of agreements at a national level.

THE IMPACT OF THE RESEARCH WITHIN THE AREA IN AN INTERNATIONAL COMPARISON

The impact of Development research is usually measured in terms of development outcomes e.g. in terms of improved human health, enhanced food security or clean water. These impacts take time to deliver, however, and their delivery is outside the control of researchers. Development researchers should be judged, however, on the degree of interest expressed by development implementers in making use of their research outputs. In addition Development research (as for all research) needs to be judged by the more traditional measures of research impact such as scientific quality measured as publication impact.

Impact can also be measured in terms of research training and capacity building both in Sweden and in collaborating institutions/countries as has been shown by support through Sida for research capacity building in partner countries. Capacity building through research training should have an impact on the research training institutions i.e. universities in LMICs especially when research training is provided in the sandwich model. There is also a link between capacity building of researchers in LMICs through doctoral and post-doctoral training whether it be as full time or sandwich model students and the possibility of impact on society through influencing policy and also politics. There are many examples of former doctoral students ending up in high positions in their home countries who have influenced both policy and politics. However, it is important to also address the issue of critical mass in the collaborating LMIC. Isolated PhDs may not have much impact, so supporting cadres of doctoral students within one institution may be more effective. This is equally important in Sweden.

There is a need for a long term perspective on measuring Sweden's research impact in chosen areas of excellence. Long term impact depends on issues such as some basic institutional financing, career paths, critical mass of researchers, suitable infrastructure and the like. Impact must be measured over one or even a few decades rather than in years. The perspective as to what constitutes positive impact should, further, include a strong involvement of partners in LMICs.

Thus, there is a need to find ways to not only measure 'publication impact' in terms of citations but also other types of impact, including on policy. For example, how can taking 'research to policy' be identified and taken into account in standard measure of impact both for career progression and evaluation by the research councils?

Traditionally Swedish Development research has made a significant global impact in such areas as peace, environment and communicable diseases, where it is perceived to have been world leading (see background material). Examples of specific areas of particular strength in Sweden are, gender and inequality within countries and globally, as well as research on malaria and antibiotic resistance. Individual Swedish researchers have also been members of influential international committees over recent decades and thus have had impact at a global level.

Based on background material analysis, however, is the risk that this important role will decrease or even vanish in some areas, due to pending retirements. It is not easy to judge how big such a risk is, since up until now there has been no systematic long term system for the follow-up on the scientific quality and impact of Swedish Development research. In the future the Committee will need to turn its attention to identifying the relevant combination of quantitative and qualitative measures for future assessment of impact i.e. both the scientific quality and the relevance impact of Swedish Development research

After reviewing the background material, the Committee conclude that the scientific quality of Swedish Development research is rarely questioned (although there is a worry about the future), but there is a considerable amount of critical reasoning about the practical impact of both Swedish and international Development research.

The Committee has noted that the impact of what may be called 'traditional' Swedish niche disciplines is high in research areas as peace and conflict, economics, environment, food security/agriculture, and health. These areas have high quality outputs and the importance of ongoing research appears to be high, and even an increasing priority in some parts of the funding system. Other areas of emerging priority will need strengthening, while the traditional areas of excellence areas will need strengthening targeted at attracting the newer generation of researchers. How this should best be handled will be considered by the Committee.

Other countries have various forms and types of support to Development research and have organized the support in different ways. For example the United Kingdom Government's Department for International Development (DFID) Development research budget includes a number of examples of thematic programmes which are jointly funding with the United Kingdom Research Councils as well as international ones (such as the Canadian International Development research Centre (IRDC)) and which include elements such as programme co-ordinators or knowledge brokers to increase impact.

THE CHALLENGES OF TOMORROW FOR DEVELOPMENT RESEARCH

The background material for this overview strongly highlights the importance of more integrated cross-discipline research, as well as the significance of an even stronger involvement of partners in LMICs as research collaborators. This is essential to understand the specifics of each local context, to create channels for impact and to strengthen local research capacity. Peace, governance, health and environment are broad areas where Swedish research can be considered of high quality. These are also areas where the immediate global implications are visible, with the prevention and solution of conflicts the most obvious example. However, other research areas such as the health consequences of conflicts, gender based violence, are also recognized as important. Environmental and resilience issues, especially water related, as reasons for conflicts connected to future effects of climate change are other rather new research areas, which could be identified as Swedish ‘niches’.

There is a generation shift occurring within a number of institutions which have Development research as one of their specialist areas. Several of these institutions have been centres of excellence for a specific type of research. The background material expresses a strong concern that the developed Swedish research capacity will ‘collapse’, due to lack of replacements (some state that such weakening in fact has already taken place, e.g. in the area of communicable diseases). The research has been built up over a long period - often several decades - based on features such as strong interest among competent individuals, support or at least acceptance from the university in question and availability of Swedish development financing combined with funding from other sources.

Challenges for tomorrow in terms of research areas as identified in the background material include such areas as (i) Short and long term economic and social sustainability relating to environmental- and climate change-induced problems, (ii) Gender issues relating to the roles of both women and men and to approaches which may empower women and promote changes associated with current negative roles, (iii) Institutional development, not exclusively within the public sphere, and other governance issues, (iv) Human development, especially within the fields of education and human health both in a broad sense, and (v) Human resilience connected to the consequences of armed conflicts, natural disasters and other humanitarian disasters, related to decreasing access to resources such as food, water or land and the impacts of climate change and population pressure on the increase in communicable and/or emerging infectious disease related aspects such as malaria, Ebola and antimicrobial including antibiotic resistance.

Challenges in terms of infrastructure include a current lack of infrastructure available for development related research.

Challenges in terms of collaboration between several disciplines includes, (i) How to move from talk to actual funding of projects, (ii) How to highlight multidisciplinary in the evaluation criteria, (iii) How to find suitable reviewers for multidisciplinary applications and how to ensure that they get a fair evaluation, and (iv) How to encourage research proposals which address multiple sectors.

Other challenges include (i) How to put an emphasis on equity, (ii) How to better use existing data, (iii) How to create a larger ‘pool’ of Swedish Development researchers and maintain this, (iv) How to stimulate cooperation within and between already existing networks (academic and non-academic) nationally and internationally

Other challenges identified in the background material are the communication/dissemination of research results, and collaborating researchers’ access to publications, therefore VR recommends that research should be published in open access journals. Other research constraints included communication with researchers when internet connections or electricity are not functioning. In addition, colleagues from LMIC face financial limitations relating to conference participation – as well as those associated with absences from their home institution where they often have key-positions. Low salaries in the university sector often mean LMIC researchers have to have several different income generating activities in parallel to their university work which often delays research related activities. Furthermore in the case of laboratory related research access to reagents, equipment and maintenance of equipment is another challenge that also influences research collaboration. All of these constraints are additional challenges in Development research.

Need for long term perspective

In the background material the importance of a long term perspective on research work is commonly highlighted. Various papers describe the importance in the past of a long term combination of different sources of finance as crucial for the results and global impact of Swedish Development research. Others point to a need for independent Swedish research in LMICs, and in cooperation with LMIC researchers, on issues or questions that do not fit into the development goals, narrowly defined. This requires funding from other sources than the development cooperation budgets. According to some papers this priority is strengthened in a context where the importance of aid is gradually and proportionally decreasing in globally oriented work. Thus capacity-building as a structural aspect is seen as a challenge which needs action e.g. in terms of clearer career opportunities for younger researchers.

It is obvious that the financial issue will, require both increased financing and stronger and more pronounced choices among themes/disciplines and subthemes/sub disciplines, if the quality and impact of Swedish Development research is to be maintained, or even enhanced. A lack, or deterioration, of funding possibilities and career options, makes it difficult for interested younger researchers to move into the area. According to background material, however, there are, positive exceptions to this situation, such as work on 'Human development' at the University of Gothenburg. Some papers, however, suggest that despite Swedish policy for global development (PGU), Swedish universities decreasingly are, prepared to add resources of their own to Development research.

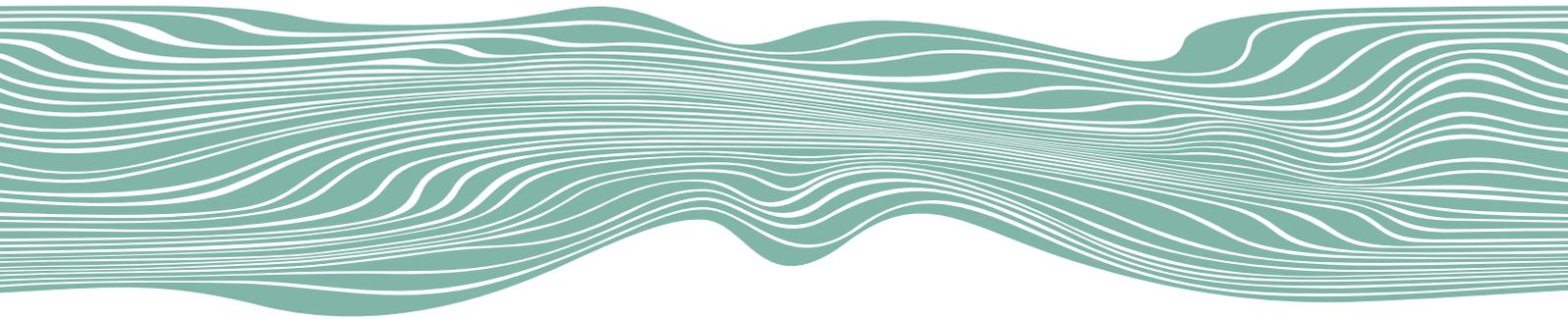
In a globalized world collaborative research between researchers from countries at all income levels and representing a range of contexts and disciplines is needed and to communicate this message is one of the challenges. Today's world will benefit from research focused on local contexts as well as research which is of more general applicability. Other challenges include utilizing existing data as well as existing knowledge both to enhance the utilization of research results and the better definition of research questions

BACKGROUND MATERIAL

The background material for the Development research overview included fifteen theme descriptions, which were a first effort to capture relevant research and to identify strengths, challenges, and trends within Development research areas. Active researchers in Sweden were tasked to describe each theme in a set number of pages, in terms of the following sections; *Description of the research*, *Strengths and weaknesses*, *Trends, tendencies and prognosis for the future* and *Recommendations*. Writers first produced a draft, which they had the possibility to revise after collective discussions at a writers' workshop. All theme descriptions were published in an open web forum for comments on the Swedish Research Council's website during one month. The future of the Development research area was also discussed in a seminar with active researchers and other stakeholders.

This mapping of research within Development research is not a complete compilation of all relevant research. The division into themes used for this exercise will not be used to define future calls or strategic funding. The mapping, using this division of research areas, was part of several exercises attempting to describe the diverse area of Development research and, together with web forum comments and further analysis and dialogue, makes part of the overview of Development research and further discussions. There is a continued need for mapping and analysis of the Development research area.

**OVERVIEW
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APPENDICES**



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INTRODUCTION: THEME DESCRIPTIONS

DEVELOPMENT RESEARCH

The theme descriptions for the Development Research overview were a first effort to capture relevant research and to identify strengths, challenges, and trends within DR areas. Active researchers in Sweden were tasked to describe each theme in a set number of pages, in terms of the following sections; *Description of the research, Strengths and weaknesses, Trends, tendencies and prognosis for the future* and *Recommendations*. Writers first produced a draft, which they had the possibility to revise after collective discussions at a writers' workshop. All theme descriptions were published in an open web forum for comments on the Swedish Research Council's website during one month. The future of the DR area was also discussed in a seminar with active researchers and other stakeholders.

This mapping of research within Development Reserarch is not a complete compilation of all relevant research. The division into themes used for this exercise will not be used to define future calls or strategic funding and should not be seen as recommendations for applicants. The mapping, using this division of research areas, was part of several exercises attempting to describe the diverse area of development research and, together with web forum comments and further analysis and dialogue, makes part of the overview of development research and further discussions. There is a continued need for mapping and analysis of the Development Research area.

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DEMOCRACY AND HUMAN RIGHTS

Keywords

Fragmented, opportunities for collaboration, infrastructures and policy relevance, generational shift, lack of career paths, post-2015 momentum

Description of the research

The task of discussing Swedish research on democracy and associated themes in a development context warrants some initial reflections on how to understand this nexus. In my view, research on development should be evaluated in terms of how it is related to goals for development and to the different ways in which development and development aid is defined at different levels of government.

In the 21st century, it is evident that the millennium development goals (MDGs) have played the dominant role for how development aid has been designed in the form of policies and programs being aimed at reaching the various goals of MDG. Among these goals, poverty reduction has, not least in Sweden, played the dominant role.

Now the international community is engaged in broad reaching discussions about the post-2015 development goals. Even if we do not know if there will be a wide international agreement about the goals, or what exactly they will be about, it is inevitable that the future of Swedish development research somehow has to relate to these goals, or at least to the discourse about them.

This is not to argue that the way in which the goals are defined should be accepted without any further discussion or analysis, quite the contrary: I would argue that development research should be encouraged to get involved in a critical analysis of the ways in which the new development goals are defined, in both normative and positive terms.

This being said, it is natural and perfectly legitimate for the development research to be actively involved in a discussion and analysis of how the development goals could be reached. Hence, the strength and weaknesses, as well as the opportunities and challenges, of Swedish development research should be seen in the light of the priorities expressed in the present and coming development goals.

In brief, this text is about the challenges facing the Swedish resource base in the social sciences, with a specific view on democracy and associated themes, in relation to the development goals. It is only based on a very partial and somewhat impressionistic inquiry of a big field of research. Hence, the format of the report and the resources available makes it difficult to assess the quality and impact of the Swedish research in the area as a whole. The descriptions, the analysis and the recommendations on infrastructure, national and international collaboration, career paths, are therefore preliminary and warrant further deliberations.

I have focused my investigation primarily on the research supported by the Swedish Research Council, and this year's applications for support research in the development oriented call. In addition, I have browsed the webpages of the Swedish universities in an attempt to identify research centres or the equivalent that are of obvious relevance for democracy in a development context. There are of course severe limits to such a method of inquiry and there is a clear risk that I have failed to identify important projects or individuals.

Here it deserves to be mentioned that in the instructions for applicants of project support from the Swedish Research Council, information about the development policy goals of the Swedish government is rather brief: It is stated that the research should contribute to enhance the possibilities of poor people to improve their living conditions and/or contribute to a just and sustainable development. The focus is on low- and middle-income countries and the gender dimension is emphasized. Cooperation with researchers from low- and middle-income countries is encouraged. The text leaves the impression that more could have been done to promote relevance.

Strengths and weaknesses

The strength and weaknesses of Swedish research should be seen in an international context. In the international development literature, the role of democracy figures prominently. Amartya Sen's (1999) work is perhaps the most prominent example, where democracy is seen as an integrated part of development as such. A specific example in Sen's work is that democratic institutions have been identified as strong mechanisms for preventing famines to occur, even in times of declining food production. However, the international development literature also offers a darker picture of the impact of democracy on development, where Paul Collier's (2007) work has been influential in terms of pointing to bad governance as a development trap. In the Swedish research community, Bo Rothstein (2012) has contributed to the debate with 'sceptical observations' by pointing out the 'quality of government' is correlated much stronger to development than 'democracy'. This prompts more research into the multidimensional nature of democratic institutions. This is also related to the importance of institutions, which has been highlighted in the very influential book of Daron Acemoglu and James Robinson (2011) with the title 'Why Nations Fail'. Their distinction between inclusive and extractive growth paradigms formulates a very promising research agenda but is useful also for informing policy makers. Another important book, 'Pillars of Prosperity' by Timothy Besley and Torsten Persson (2011) puts the focus on institutions for making economic development sustainable. Their observation that nations need to reach a certain level of taxation in order to produce conditions for a sustainable growth path is another example of how empirical generalisations invite more specific research on the causal dynamics between institutional design and (economic) development.

What may seem as an alternative understanding of what is changing the conditions for development in the poorest countries of the world is the research on demography and the demographic transition (e.g. David Bloom and David Canning 2003). Often the institutional perspective is pitted against the demographic one. In the Swedish research community, there are however examples of attempts to at least partially integrate demographic analysis with issues around human capital formation and educational systems, which appears to be a fruitful way forward.

In the development discourse, an interesting distinction has been made between approach aimed at universal solutions and country specific ones. Rodrick (2008) has for example criticized the World Bank and IMF for typically promoting 'laundry list' solutions. This laundry list is then more or less forced (as policy prescription) upon a number of countries that are dependent on the support of these organisations. Rodrick argues that this is misguided since individual countries often struggle with specific problems that are not properly prioritised with the laundry list approach. This suggests that there is a natural place for country specific analyses in the development research. But the 'dependent variable' (goals) is sort of the same for broad comparisons and case studies: survival for development.

In this context, the whole issue about the effects of development aid on development should of course figure prominently. Easterley's (2006) book is not the only interpretation of the problems with aid programs and it is not uncontested. However, it is of course important to analyse the potential effects of development programs and evaluating the effects of development aid has to include both intended and unintended consequences. Moreover, in a democratic perspective, democracy cannot only be analysed as a factor contributing to growth, it should be evident that there are intrinsic values with a well-functioning democracy that deserves to be an integrated component of research in this field.

It appears to be a major challenge but also a fantastic opportunity for Swedish development research to find ways to link back to these bigger issues that are being discussed on the international scene. The impact of Swedish research is perhaps limited but carries a great potential and if it is relevant for the international context it should be relevant for Swedish development policy as well. It requires that both those who have already been active find themselves encouraged to continuing and next generation of researchers is provided with favourable resources enough to play a prominent role. This also appears to call for more of integrated approaches: This is about including the different kinds of factors (institutions, demography etc) that appear to favour development within the unified analytical frameworks. It is also about analysing the different ways in which development aid programs can be organized to enhance development. This may be a fruitful way forward in order for research

on development in Sweden to be able to contribute to successful policy implementation of Swedish development cooperation.

However, a weakness of Swedish research on development is that it continues to suffer from a divide between development research and mainstream research. This may have contributed to the fact that few studies address the bigger issues and the bigger picture. Moreover, few studies speak directly to the development goals, which probably have to do with the fact that few studies deal directly with the policy instruments available for promoting development. This counts for both policy instruments within the development aid framework and policy programs that typically belong to the nation states to command over. Relevant case studies could improve on policy relevance and how they are related to the bigger picture(s). However, my admittedly limited investigation leaves the impression that many of the case studies could have been much more integrated with the bigger development issues, or the more specific (but policy relevant) development problems encountered by individual nations for that matter. In brief, many studies help to describe lack of development, for example poverty, but have less to say about alternative anti-poverty strategies.

There are some interesting features in the Swedish research landscape that deserve to be mentioned here because they are by and large under exploited strengths of the Swedish resource base. One such strength has to do with the building up of international infrastructures which are relevant for research on democracy and development. The strength of this kind of research is that it both tends to be related to the bigger picture and speaks to policy issues, even if there is always a lot of room for improvement. The bigger picture here is about the role of constitutions, of corruption, of taxation, of social policy, of gender etc. Broad macro-comparisons can furthermore be used for identifying interesting case study: Countries that diverge from general patterns might be very useful for identifying specific hurdles for development, or alternative development paths!

Focus on failing democratisation stands out as a critical issue. Here the good news and a real potential strength in Swedish research is the participation of the Varieties of Democracy (V-Dem) data base, in Sweden directed by Staffan I Lindberg and Jan Teorell (2013). This database is a large scale international collaboration involving a large number of nations and their teams. In many ways it can be seen as part of mainstream research on democracy but it appears to be particularly important for development issues, not least against the backdrop of the current research and controversies on democracy and development. The Quality of Government (QoG), at the Department of Political Science at Göteborg University, is another Swedish asset with obvious relevance for comparative analysis of development related to a host of issues related to state capacity. When it comes to social protection, the Social Policy Indicator Database (SPIN) project at the Swedish Institute for Social Research at Stockholm University is a very good platform for elaborating an infrastructure on social protection in development contexts and the poverty reducing potential of such policies (Esser et al 2009).

It is of course not enough to analyse the relations between different macro factors. There are good reasons to study the interactions between macro and micro factors concerning the attitudes, values and behaviours of individuals, such tolerance and social trust - or trust in institutions for that matter. A good illustration is the TOLEDO project at the Department of Government at Uppsala University, which studies tolerance and democracy in different national contexts primarily in developing parts of the world. There are of course important global micro-oriented infrastructures that appear vital to sustain in this context, for example the Afrobarometer.

This boils down to an argument about the potentials of new infrastructures. Some of these infrastructures are genuine international collaborations, while other infrastructures have a specific home institution (QoG, SPIN). But also in the latter case they offer excellent platforms for international (and national) cooperation. Since the field shares with the other that it is a major challenge to integrate mainstream research with development oriented research broadly and systematically. There appears to be some movement in this direction, though, at least to judge from the applications to the development related call of the Swedish Research Council.

An additional connection of democracy research that deserves to be mentioned in this context is that with conflict research. The fact that armed conflicts increasingly has become a phenomenon that occurs within countries rather than between them has led to a reorientation of conflict research to focus on the sub-national level. Since armed conflict is a well know destructive factor for development, this suggests that also democracy research should devote increased attention to the sub-national level, and the interaction of national and sub-

national factors. But then we need infrastructures on democracy and various aspects of development that can match the way that the information about conflict is structured. This is another argument for strengthening the critical infrastructures.

Even though I have only briefly discussed the potentials of further integrating research on democracy with that on economic development, health and conflict (as these areas are subject to separate reports), there are good reasons for exploiting such links further. Some of the ongoing research projects are also good examples of such integration could be organised.

While there are fundamental problems with the career opportunities for younger researchers in Sweden, there is a possibility of exploiting this for the advancement of development research. If resources are directed to younger researcher, this could potentially have a lasting effect on their research orientation. The generational shift is hence both a threat and an opportunity for development research in Sweden.

Trends, tendencies and prognosis for the future

For the past decade, Swedish research funding has put a focus on excellence in a number of calls (in addition to the regular project funding, post docs etc). Thus, in 2006 and 2008 the Swedish Research Council selected 40 Centres of Excellence across the board of different sciences. As far as I can judge, no one these centres speak directly to the development agenda, and this appears to be particularly true for the fairly few centres in the social sciences and humanities. After having briefly examined the WebPages of the centres that appeared to be the best candidates for doing development related research, my impression was that this potential was under-exploited (to put it mildly).

When the Swedish Government launched a new programme for support to Strategic Areas of Research, two centres are of relevance for democracy studies at least in the wider development context: The Middle East in the Contemporary World (MECW) and Uppsala Centre for Russia Studies (UCRS). Yet it is clear that these centres are organised around specific geographic regions (as was envisioned in the programme) rather than universal issues such as democracy and human rights.

In the special call on democracy research, there are surprisingly few examples of projects that address development related democracy issue. Exceptions are projects led by Anna Jarstad and Leif Lewin, and in particular the two projects led by Axel Hadenius. Hadenius has also long track record from his time at Uppsala University of doing development oriented studies, including the supervision of a number of doctoral dissertations. His research has an obvious relevance for development with its focus on failing elements of democratic development.

When we look at other forms of 'excellence support' of the Swedish Research Council aimed at funding individuals rather than centres it is also difficult, at least in the social sciences and humanities, to identify researchers with a research profile that is development oriented. This also appears to be, by and large, true for the ERC grants at various levels. Even if researchers that are engaged in development issues, for example Torsten Persson and Bo Rothstein, their ERC grants do not appear have that orientation in particular (at least to judge for the scarce info that I could access).

Over the same past decade, The Bank of Sweden Tercentennial Foundation has supported a fairly large number of programmes with around 35 million SEK. I have not been able to identify any programme with a primary focus on development issue but there are some examples of programmes that have obvious relevance for the development agenda. Sören Holmberg's and Bo Rothstein's programme on Corruption is a clear example. Krister Jönsson's and Jonas Tallberg's on the governance of global organisations is perhaps less directly involved in development issues as such but is of apparent relevance for how the development agenda is formulated and promoted on the international scene.

What about the two most recent attempts to promote excellent research; the 'research professorship' for Swedish researchers and the program for supporting recruitment of international top scholars? In the social sciences and humanities only one 'research professorship' was appointed and not with a profile that is likely to inform the development agenda specifically. However, among the applicants we find several researchers (some of the mentioned above) who clearly have included development issues in their proposals, including issues around democracy, international governance, legacies of colonialism, health and climate change, etc. This

suggests that there is a potential to involve some of the most qualified and ambitious researchers in development related research with relevance for democracy. Among the researchers that so far have been recruited there might be something to build on for the future but the direct links to development policy are somewhat unclear. There is one recruited professor (GU) who has worked on the Arab Spring and democratisation.

The one year guest-professorships (in the names of Kerstin Hesselgren and Olof Palme) offered by the Swedish Research Council are of course more modest in terms of funding but carry the potential of being important for Swedish development research. However, over the past decade or so there are only a few examples of researchers that are important in the development field. The political scientist Anirudh Krishna, US, has written on health and development. The economist Thandika Mkandawire, former director of United Nations Research Institute for Social Development and now at LSE, has focused on development, democracy and inclusion. Naila Kabeer, England, has researched on gender, poverty, empowerment and development. In the future, this kind of funding could be used more extensively for enhancing the international cooperation of the Swedish research community.

It also appears warranted to look at the projects that got support in the first call for development research that the Swedish Research Council opened in 2013. The number of project that have an evident link to the 'democracy' theme is however limited. The relevance of these projects appears to be strong, on the other hand.

One project will study the experience of democracy being imposed 'from above' in different post-conflict countries (also different parts of the world). The opportunities of and threats to democracy in post-conflict countries is studied in another project. Another comparative project is directed to the study of tolerance in low- and middle-income countries and the implications for democracy of anti-democratic values. Yet another project is designed to study the semi-civil society development in Vietnam. There are (at least) two projects that focus on migration and its importance for development. One is studying the role of civil society for the global migration governance, whereas the other is studying the special migration corridor between Angola and Portugal. Within the humanities there is also an interesting project on the importance of language for exclusion which is focused on identity formation for development, which points to the possibility of actually promoting relevant cross disciplinary research.

What can we conclude on the basis of these, admittedly, scattered observations? Nothing firmly perhaps, but I will allow myself to make some tentative suggestions: Very little of what is seen as excellent in the Swedish research community is directly addressing core development issues. Even when excellent researchers get 'excellence support' it is not about their most development oriented research activities. This suggests that there is a fundamental, also normative, challenge to move the development oriented research up on the excellence ladder. This is a responsibility of the research funds as well as of individual applicants.

The international cooperation generates opportunities to build up the new data bases. The project on different dimensions of democracy appears to be one of the strengths of the Swedish research on democracy and development. The researchers that are engaged in this endeavour also appear to be well experienced in this context, given their past work with in the QoG project. The potential impact also appears to be good given their well-established publication profiles. The impact of the research on Swedish policy making is of course not automatic but potentially important given the present state of the art where there are some uncertainties around what aspects of democracy that is of critical importance for development.

There is of course a potential with collaboration with low- middle income-countries. It would however be naive to expect short term returns of such initiatives. In my experience, the greatest return from such collaboration can be expected by integration of PhD students.

One way to get a sense of where development research is going is to examine the most recent round of application for project funding at the Swedish Research Council. Here the applications related to the call on development research are of clearest relevance and in the following I will report my impressions based on the applications within the humanities and social sciences.

There are many applications that more or less directly address the democracy theme but they do that in very different ways. This shows the diversity and potential fragmentation of the field. However, I would argue that the applications demonstrate the potential of the field to make a difference over the coming years. I will briefly outline and discuss the themes of the applications below, rather than focusing on the individual applicants.

There are number of applications that broadly speaking deal with various forms of 'rights'. This ranges from studies that deal with 'social contracts' concerning gender, work and food to studies related to international relations and trade. In between these projects, we find studies that deal with formal as well as informal ways of protecting children in Caucasus and another very different study of security and risk associated with frozen conflicts in the region. Other studies share the comparative perspective but are directed to other regions in the world. One application is about inequality, political conflicts and regime change in South East Asia, whereas another is about work family tensions and social policy in Latin America. These studies are all relevant for the growing discussion and research about social protection as a means for poverty reduction also in a development context.

Corruption is another important 'big' theme and one application is a case study of corruption and cartels in Brazil. In a similar vein but with a comparative approach, another study wants to study different historical paths to a 'good state'. A study on the politics of engineering could be mentioned in this context with its focus on infrastructure investments as stabilisers.

Given the importance of taxation highlighted above in the introduction, there is an interesting project on the colonial legacy in the taxation policy area and its potential effects on institutions and state capacity in developing countries.

There is obviously a lot of activity in the Swedish research community where we find a large number of applications that have obvious relevance for the development. At the same time there appears to be a clear danger that the ongoing generational shift when it comes to research in this area will result in a continued fragmentation and less relevance when it comes to critical development issues. In my view, the lights of hope are the following: Some of the leading social scientists are active in the field and will hopefully continue to be so. In addition, there are a number of really talented younger researchers that are active applicants in the field. There are some common themes around democracy and state capacity, local participation and governance, rights and protection/policy alleviation, migration and development, to give a few examples where national collaboration potentially could generate high quality research. Recent initiatives among economists to form association around the development theme, indicates that it is possible to generate a broader mobilisation of interest in terms of people at different stages in their academic careers.

Recommendations

The recommendations below are guided by the way I have perceived the strengths and weaknesses in this field of research. The overarching principle is that future research funding should be guided by the ambition to remedy the current fragmented nature of Swedish research. The recommendations are also guided by the aim to facilitate integration of different research strands that appear to be missing the opportunity of collaborating around critical development issues. On the international scene, controversies appear to prevail around the importance of democracy, institutions and demography, and they are unlikely to be unresolved unless the perspectives are broadened to include different kinds of factors and the importance of the interaction between different factors becomes part of the analysis. Here the support of research infrastructures could facilitate the integration of different perspectives. There also seem to be good reasons for avoiding a compartmentalisation of development research as such. In most ways development research is not different from research in general. But in one way it is a bit different in the sense that it is obvious that the development issues beg for multi- or cross-disciplinary approaches.

Another overarching objective with the recommendations is about ways in which the Swedish Research Council can facilitate the current generational shift in Swedish research on development. This should preferably be done in a way that contributes to a sustainable production of high quality and policy relevant research.

To promote the quality and long-termism of development oriented research, my recommendation is, first, to use longer periods for supporting projects than the typical three year periods and instead use five year periods, and, second, to move from projects to small scale programmes with fixed sums (2 million SEK per year). This means fewer and longer projects. This kind of smaller programme support is likely to avoid running the risk of

generating the kind of superficial research consortia that the huge level programme support of the Centres of Excellence did.

The issue of ‘financing development’ provides us with an example of the demands on research and policy making. Given that we agree on the desirability of mobilising resources for investing in development and that the sources potentially are of different nature, it appears desirable to integrate economic research with research on public policy of political scientist as well as other disciplines such as sociology. Research on pension systems may be an interesting case in point and research on taxation another. Pension funds in the rich part of the world seek new investment opportunities in the emerging markets but also these poor countries have an increasing part of the population that save in pension plans. Historically as well as now, we find many examples of public pension systems that include elements of funding. How can these funds be used best for promoting development? Taxation is another critical instrument for mobilising resources for investing in development but they tend to be neglected in development research. These issues are related to the whole question about how development can become sustainable by triggering positive interactions, or virtuous circles in other words. This is about what Acemoglu and Robinson have labelled inclusive development. And it is about solving the puzzle identified by Besley and Persson that only when nations reach taxation certain levels in relation to GDP do these virtuous circles stabilise.

The Swedish Research Council may play a critical role in supporting research infrastructures that can facilitate the macro comparative analysis of institutions and their impact on development. This is sometimes about supporting existing infrastructures that already cover developing countries; sometimes it can be about supporting a strategic extension of databases that today only cover richer countries. It is of course important that micro outcomes are covered but this would in most cases require international collaboration and such micro oriented infrastructures exists, for example the Afrobarometer.

The quality of government research (QoG) has contributed with a number of interesting results but has reached a certain level of saturation when it comes to the institutional precision of both the theoretical and empirical analyses. What is warranted appears to be an improved understanding of how different parts of the concepts are related to each other, and how it is related to other macro as well as micro phenomena. An integration with the database on different dimensions of democracy appears to be an interesting option.

There are good reasons for giving attention to migration in relation to the democracy theme in general and in relation to human rights (including social rights) in particular. Here there is an interesting initiative –KNOMAD - taken by the WB and other international organisation aimed at promoting research on the migration and development nexus. This provides an interesting framework also for Swedish research initiatives.

To deal with the thematic compartmentalisation of Swedish research under the broader heading of democracy, it is crucial to find instruments that can foster cross-thematic research. To give one example; can we find ways in which research on human and social rights can become a focus for collaboration? One instrument is to formulate evaluation criteria that favour such projects. Another instrument is to use specific calls that are directed at these kinds of collaborations.

My reading of the state of the art is that there is an unnecessary divide between, on the one hand, large scale comparative studies and, on the other hand, case studies. This is harmful for the analytical depth of comparative studies and reducing the policy relevance of case studies. To break this divide my recommendation is that the Swedish Research Council should explicitly support research projects that apply ‘mixed methods’. This can of course be done in different ways. One alternative is to have this as one of the criteria for evaluating projects in general. Another alternative would be to have specific calls for projects that apply some kind of mix of research methods.

There appears to be good reasons for promoting cross disciplinary work beyond the themes that have been grouped under the heading of ‘Democracy’ in this report. This refers back to what I saw as a weakness in the current research landscape but also as a very clear opportunity for the future. The optimism is based on the kinds of initiatives of cross disciplinary work that were mentioned above. This applies to health, economics, and conflict research alike. There is an additional point that I want to raise here, which has to do with the potential contribution of scientific progress in general: Progress often takes place in what can be call friction zones between different disciplines and the development agenda could presumably be used as a kind of catalytic device to make things happen that otherwise would be difficult to orchestrate. But this is not about

how research can contribute to the development agenda but the other way around. Again, to promote actual collaboration should best be based on a double strategy of introducing new evaluation criteria and to do special calls.

There are some fundamental problems with the career opportunities for younger researchers in the Swedish university system linked to the lack of tenure track positions. The issue cannot be directly tackled by the Swedish Research Council. What can be done however is to provide younger researcher with support over longer time periods than the current practise of three year periods. Over the past 5 years there has also been a strong emphasis on awarding generous funding to excellent researchers. For development research, it appears more fruitful to prioritise support to excellent research projects which would be more forward looking and more relevant for the development agenda. The flexibility of programme support should also be seen as way of strengthening the opportunities of researchers with this kind of profile so that they at the end of the period will have achieved competitive merits to get tenured jobs but also that they might have been able to use some of the programme support for engaging colleagues and PhD-students in their research.

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CONFLICT, PEACE AND SECURITY

Keywords

Peace, security, human security, non-traditional security, conflict, conflict resolution, peace building

Introduction

Peace and conflict research as an academic discipline is by its nature policy-oriented, aimed at promoting and sustaining peace (Aggestam 2010; Gleditsch 2014; Wallensteen 2011). Given the destructive impact of war and large-scale violence on societal development, this type of research is therefore of immediate relevance for the goals of Swedish development assistance. It is well documented, not least due to Swedish research, that violent conflict increases poverty and mortality and hinders health, education and democratization (Brück et al 2011). While progress has been made globally towards poverty reduction, “areas characterized by repeated cycles of political and criminal violence are being left far behind, their economic growth compromised and their human indicators stagnant” (World Bank 2011, 1). World poverty is estimated to be increasingly concentrated to conflict-affected and fragile states in the years to come (OECD 2014). Preventive action and adequately designed policies can contribute not only to reducing the number of casualties, but also to furthering social, economic and political development. Since countries that recently have experienced civil war are particularly vulnerable to renewed conflict, conflict prevention need to remain a top priority on the development agenda.

Description of Swedish Research

Peace and conflict research has existed as a separate research field in Sweden since the early 1970s, and the first professors were appointed in 1985 (at Uppsala University and University of Gothenburg). At its core is research on the causes and dynamics of violent conflict and war, durable conflict resolution, and threats to human and national security from a broad perspective.¹ A fundamental characteristic of peace and conflict research has been its ambition to integrate multiple perspectives to enhance the understanding of violent conflict, and it has in particular found inspiration in sociology, economics, anthropology, psychology, and political science. Research related to peace, conflict and security is conducted under different labels and is related to sub-disciplines such as security studies, war studies, development studies, and international relations. This report concerns peace and conflict research at large, including security studies from a developmental perspective, and recognizes that individual researchers working on issues related to war, peace and security may identify themselves as primarily belonging to a different subject area.

The largest research environments are located at Uppsala University (Department of Peace and Conflict Research), Lund University (Department of Political Science), University of Gothenburg (Peace and Development, School of Global Studies), and Umeå University (Department of Political Science), which offer slightly different research profiles. Research and educational programmes are also conducted at Malmö University and Linnaeus University and the Swedish National Defence College produce research and education on peace, war and security. In addition, there are several more policy-oriented research institutions dealing with these themes, in particular the Stockholm International Peace Research Institute (SIPRI), the Swedish Institute for International Affairs (UI), and the Nordic Africa Institute (NAI). Given the organisation of the research,

¹ The formation of the discipline had a distinct Scandinavian component with the Norwegian academic Johan Galtung being one of the founding fathers. This has probably served to strengthen peace research in Scandinavian context vis-à-vis security studies and related disciplines.

where only the Department of Peace and Conflict Research at Uppsala University forms an independent university department, it is difficult to provide statistics concerning the number of researchers, publications, citations etc.

Research in Sweden broadly covers five different areas, as further discussed below. A notable trend here over time has been a considerable broadening of the field to include new areas and concerns, as a reflection of new realities.

Causes of conflict

Research on inter-state and international armed conflicts is part of the Swedish research, but it is currently focused more on internal armed conflict and civil war, especially when compared to international research. This research concerns issues such as mobilization strategies; forced migration and ethnic cleansing; structural inequalities, poverty and corruption; governance, democracy and democratisation; and conflict prevention. There has been an important shift away from the state as the unit of analysis and a much stronger focus on localised dimensions of conflict, including communal conflict and conflict caused by environmental stress.

Dynamics of conflict, peacekeeping and military intervention

Focusing on the dynamics of armed conflict, Swedish research has addressed the escalation and impact of specific categories of violence during war, such as violence against civilians and gender-based violence during war, and violence against peacekeepers. As such, Swedish research is an active part of an international trend questioning the relevance of the traditional concept of war, focused on conventional warfare. Research also addresses various issues related to international interventions, including economic sanctions, civil-military relations and coordination, and the conditions and impact of military intervention and peacekeeping, including gender and regional dimensions.

Conflict resolution, negotiation and mediation

Swedish peace research has a strong focus on issues related to conflict resolution, negotiation, and provides alternative perspectives on this field which traditionally has been dominated by American scholarship. It explores factors which drive negotiation processes and explain the outcome. Mediation research is concerned with the characteristics, strategies and functions of mediators. Conflict resolution research more generally includes work on ripeness, inclusiveness in peace processes, and the role and impact of violence on these. Part of this research is related to identity formation, linking conflict resolution to broader transformation of society and relationships between antagonists.

Peacebuilding, justice and durable peace

The short-term and long-term predicaments of peace have been studied in relation to peacebuilding and processes which seek to bring about not only the end of violent conflict, but also the conditions for a just and durable peace, reconciliation and development. This field of research includes disarmament, demobilisation and reintegration, the role of transitional justice mechanisms such as tribunals and truth commissions, reconciliation processes including dimensions of gender and psychology, international-local power relations in peacebuilding interventions, civil society and diaspora politics, socioeconomic aspects of peacebuilding, as well as governance, politics and democratization in the wake of war.

New security threats

Security has been approached from several perspectives, ranging from the individual level to the global level. Research within this strand contain studies on crisis management, securitisation of different issue areas (borders, HIV etc.), the security-development nexus, migration, the privatisation of security, security

threats emerging from environmental stress, climate change and natural disasters, and gender dimensions of security. There is also research on regionalism, regional security and connections to global governance and global values.

Impact in Academia and Beyond

Academically, Swedish peace and conflict research as a discipline is internationally oriented and its research is generally well-received and of high quality. In terms of academic productivity, there has been a trend over the past two decades towards more publishing in internationally peer-reviewed articles and books. Compared to other social sciences, and even other disciplines, there is evidence that peace and conflict scores well in academic impact, measured with bibliometric indicators. For instance, in an external quality evaluation of Uppsala University in 2011, the Department of Peace and Conflict had – by far – the highest average impact when comparing the field-normalized citation impact across disciplines at Uppsala University and it is 230% above the global average (KoF 11, 557).² Yet there is reason to believe that academic impact of Swedish peace research could be raised further. Many articles and books are published in outlets of average to very good quality, while publications in the very top and most prominent outlets (journals and university presses) are less frequent. Given that research time is difficult to secure for many Swedish academics, time is probably seen as to be too scarce to invest in the considerable efforts required for reaching the quality that top level publishing demands (see more under the sub-heading Concerns for the future).

In terms of influence on Swedish development goals and broader society, peace research departments provide well-trained graduates in peace and conflict studies. A close connection between up-to-date research and education is a key determinant of high-quality training. This includes training in methodology which is increasingly becoming a necessary competence in order to work with monitoring and evaluating the goals and effects of development aid and support. Graduates in peace and conflict studies work in organizations that are formulating and implementing the development policies of Sweden, including Sida, the Swedish Ministry of Foreign Affairs, various UN agencies, OSCE, European Union, Folke Bernadotte Academy, Swedish Civil Contingency Agency, and the Swedish Armed Forces (including in international peace operations), and major INGOs and NGOs in the field of peace, conflict and security.

The aforementioned proximity to policy relevance, has also made the peace research community active and attractive in debates on and preparation for policy-making in fields such as foreign policy, international aid, refugee reception and migration policies. Information about conflict trends provided by the Uppsala Conflict Data Program, for example, has been a main source in the development of policies by the World Bank, UN and OSCE. Other contexts where peace researchers are prominent are global policy dialogues on international tribunals and interventions, the emerging water crisis, gender and conflict, and peacebuilding practices, to mention a few. Many researchers take an active part in public debates, disseminate research findings in expert workshops and in media, cooperate with civil society organizations in both Sweden, as well as in low-income countries and conflict areas where research has been carried out.

National and International Collaboration

In terms of collaboration, there are few formalised research collaborations nationally, and Swedish peace and conflict research is more oriented towards the international arena. One important forum for exchange and networking is a national conference in peace and conflict research, which has been organised biannually for the last ten years (funded by Folke Bernadotte Academy). In the past there have been other

² The Mean Normalized Citation Score (MNCS) serves as a golden standard for comparing citation impact across disciplines, since it considers the citation traditions in different research fields, and is therefore of relevance in this regard. The report compared academic departments at Uppsala University, 2007–2010.

initiatives, such as the Swedish Network on Peace, Conflict and Development which brought together Swedish scholars (funded primarily by Sida), but the network ran out of funding by 2011, and submitted its last formal report by 2012.

Nationally, there have only been a few funded projects with collaboration across several Swedish research environments. Some of these are *Just and Durable Peace* (2008-2011, EU-funded project headed by Lund University, which brought together national and international expertise), *Not All Good Things Go Together* (2011-2013, funded by Sida, headed by University of Gothenburg in collaboration with Lund University and Uppsala University), *Contested Cities: Challenges to Post-Conflict Peacebuilding and Development* (2013-2015, funded by VR U-forsk, headed by Lund University in collaboration with Uppsala University and Utrikespolitiska Institutet), *Gender-Just Peace and Transitional Justice* (2013-2015, funded by VR U-forsk, headed by Utrikespolitiska Institutet in collaboration with Uppsala University and Lund University), and *Demagogues of Hate or Shepherds of Peace? Why Warlord Democrats (Re)securitize Wartime Identities* (2014-16, funded by VR U-forsk, headed by the Nordic Africa Institute in collaboration with Lund University). Lund University also has two larger cross-disciplinary projects concerning water and peacebuilding, involving researchers from the social sciences, humanities and natural sciences. In addition there are several projects where individuals have cooperated informally across department boundaries, for instance, in the form of co-authoring. However, such cooperation is quite limited.

There are several international networks which serve to institutionalise exchange of ideas and cooperation and in which Swedish research environments partake, such as the European Network for Conflict Research (ENCoRe, EU/COST), Institutions for Sustainable Peace (ISP), and the International Studies Association. There is also extensive collaboration with other Scandinavian institutions, in particular the Peach Research Institute Oslo (PRIO). *Journal of Peace Research*, one of the most prestigious journals within the field, has six Swedish-based members of the editorial board and the editorship of the journal *Cooperation and Conflict* is also based in Sweden. In addition, the Folke Bernadotte Academy organises international Research Working Groups and provides some funding these groups which bring together national and international scholars in five issue areas: peacekeeping operations, conflict prevention, resolution 1325, rule of law, and security sector reform. Funding for these types of working groups, which enable core expertise in a specific issue area to meet and present research on a regular basis, has a strong potential to bring about new research collaboration, and to raise the quality of the research.

Specifically related to collaboration with low- and middle-income countries, the Nordic Africa Institute (NAI) serves as a hub for providing scholarships for students and researchers to do research in Africa, and for guest researchers from Africa and the Nordic countries to visit NAI. The University of Gothenburg has an extensive capacity building project with the University of Rwanda (UR) (funded by Sida) which also involves PhD training, and has in the past had a similar program with partners in Sri Lanka. Uppsala University has had an collaborative project with a South African-based NGO, the African Centre for the Constructive Resolution of Disputes in South Africa (ACCORD), currently focused on training, but which originally encompassed research and staff exchange as well (funded by Sida). Within individual research projects there is also formal or informal collaboration with a vast number of scholars in conflict areas, including Afghanistan, Cambodia, Sri Lanka, Nepal, Burma, Philippines, Thailand, Kenya, Ethiopia, Liberia, Sierra Leone, South Africa, Rwanda, Democratic Republic of Congo, Sudan, Bosnia-Herzegovina, Kosovo, Macedonia, and Israel, Palestine, Iran, Egypt and Jordan.

The value of collaboration with low-and middle-income countries is manifold. First, the exchange of ideas and learning across national contexts is crucial for the advancement of the discipline and the co-construction of knowledge on issues concerning peace, conflict and security. Second, the establishment of networks in conflict zones is crucial for the successful implementation of research projects and ensures the relevance of Swedish research in light of the concerns of low-and middle-income countries. Thirdly, for the long term development of intellectual and academic communities in low-and middle-income countries, contacts with the Swedish peace research community have been fruitful.

Strengths of Swedish Research

Due to the multidisciplinary tradition of peace and conflict research in Sweden, Swedish scholars are well represented and internationally established in most subfields of the discipline. In recent years Swedish research has particularly excelled in four areas, largely due to the development of a critical mass of individuals who are engaged in these respective fields at multiple research departments/institutes.

Research on international interventions and durable peace

Swedish peace research has made a substantial contribution to the study of international interventions by IGOs, regional organisations, individual states, INGOs and NGOs – with the aim to further domestic, as well as international peace. This work covers all the phases of the conflict cycle: conflict prevention, mediation, peacekeeping, peacebuilding and reconstruction. Special emphasis has been on interventions by the UN, the EU and other regional organisations in Africa and Asia. When it comes to preventing armed conflicts, particular focus has, for instance, been on identifying policy tools that can be employed to hinder military escalation and the utility of using international sanctions against aggressors. In the field of mediation and negotiation, Swedish scholars have put focus on and developed concepts such as justice, ripeness, biased versus non-biased mediators, and conflict asymmetries. For example, negotiation research in Sweden (notably at Uppsala, Stockholm and Lund) is the strongest and most extensive in Europe, and provides alternative perspectives on this field which traditionally has been dominated by American scholarship. In recent years, there has been a growing trend towards the study of post-conflict interventions that can prevent the reoccurrence of warfare and address structural conditions that entail widespread human suffering. This includes mechanisms such as deployment of peacekeeping troops; spoiler management; statebuilding; disarmament, demobilization and reintegration of ex-combatants (DDR); security-sector reform (SSR); democratization; gender mainstreaming and equality, transitional justice and reconciliation; and peacebuilding. This academic work has also had a significant impact on policy-making, as it has fed directly into initiatives such as the Stockholm Process (on sanctions); the Stockholm Initiative on Disarmament Demobilization Reintegration (SIDDR); the World Bank 2011 Development Report on Conflict, Security and Development (which to a great extent was founded on UCDP data); European Institute of Peace (EIP); Sida country strategies; the formulation of Sweden's national defense strategy; and various UN and EU strategies in relation to regional organizations.

Trends in organized violence and armaments

One of the areas where Swedish research on peace and conflict has had its largest international impact is the study of trends in organized violence and production and proliferation of armaments (disarmaments). In fact, Sweden hosts two major research programs related to these issues: the Uppsala Conflict Data Program (UCDP) – based at the Department of Peace and Conflict Research, Uppsala University – and Stockholm International Peace Research Institute (SIPRI).

The UCDP's data collection on conflicts is unique in its kind. There is no comparable data source internationally. It is global in its coverage and contains three forms of violence: state-based conflict, non-state conflict and one-sided violence. It thus includes information on armed conflicts between government and organized opposition groups, violence between communal groups, as well as one-sided violence against civilians perpetrated by agents of the state, or other armed actors. Its most recent addition is disaggregated and geo-coded data covering all countries in Sub-Saharan Africa 1989-2010 – this data-collection is now expanded to also include countries in Asia – which opens up novel analysis of spatial, transnational and local dimensions of conflict. The program provides an on-line database and encyclopedia, as well as datasets available for researchers. The UCDP is a major provider of data to policy-makers – such as Department for International Development (DFID), United Nations and the World Bank (including the World Development Report in 2011). It is also a key resource for the national and international research community. For instance, among journals listed in ISI Web of Science, the UCDP is the most frequently employed source for conflict data when it comes to studies on civil wars (Dixon 2009). The resources provided by the UCDP has also been beneficial for the

generation of high-quality and internationally renowned research from Sweden. This is particularly true amongst scholars working with large-N studies.

SIPRI provides data on military spending, nuclear forces, peace keeping operations, arms production and arms transfers, which also are public goods and used in scholarly research and in more practically and policy-oriented work. In its field, SIPRI is regularly ranked among the top five international ‘go-to’ think tanks and is frequently cited in the international media, with substantial coverage in the developing world. Longer SIPRI publications are published through a unique partnership with the Oxford University Press. Shorter pieces are distributed in hard copy and made available for free download on the SIPRI website. Current areas of study include armed conflicts and conflict management; European security; African civil society and peacebuilding; military expenditure and arms production; international arms transfers; conventional, chemical and biological arms control; nuclear non-proliferation; dual-use trade controls; China’s role in global security; small arms and light weapons; and the nexus between security and development. SIPRI currently maintains a presence in Beijing and Washington.

Environmental stress and conflict over water

A third scholarly field where Swedish peace research has had significant international success is in the study of environmental stress and conflict over water. Initially this body of scholarly work focused on how issues such as water scarcity – for instance, as a result of the construction of dams – affected relations between states. Special interest was given to the question of whether there was an increased risk of inter-state war between countries engaged in disputes over water. With the growing realization that global warming affects structural conditions – such as food security, access to water, infrastructure, as well as patterns of migration and urbanization – associated with collective violence, Swedish scholars have increasingly shifted their attention to studying this new form of security threat. Special attention has been given to the effect changes in rainfall due to climate change and variation (resulting in droughts or floods), food production, access to land (for pastoralists and farmers) and institutional capacity have on levels of violence or, more broadly, human security. As a result, UNESCO Category-II Center focusing on international water cooperation is being established in Sweden involving Stockholm International Water Institute, School of Global Studies at University of Gothenburg, and Department of Peace and Conflict Research at Uppsala University and as its research and educational base.

Regional studies on peace and conflict

Based on the observation that zones of armed conflict and peace tend to be clustered in certain geographic areas, Swedish research has been at the forefront of studying war and peace from a regional perspective. Particular attention has been given to how regional integration – for instance in the realm of economics or politics – can foster peace between states with historically conflictual relations. With the growing importance of regional economic communities (RECs) in many parts of the world, there has, in recent years, been a growing interest in investigating the ability of RECs to prevent and manage armed conflicts that erupt within member states.

There has, furthermore, appeared a number of research environments in Sweden devoted to studying the dynamics of war and peace in particular regions. The East Asian Peace (EAP) Program (Department of Peace and Conflict Research, Uppsala University) has, for instance, made significant contributions by addressing the question of why there has been a relatively sharp decline in the number of inter- and intra-state armed conflicts in East Asia in the last few decades, in spite of little institutional integration and few formal peace agreements. This empirical puzzle has been tackled by analysing the importance of factors such as power constellations, growth priority, economic interdependence, repression, democratization, and gender attitudes. The Conflict, Security and Democratic Transformation Cluster (or Conflict Cluster, at Nordic Africa Institute (NAI)), has become internationally renowned for addressing questions relating to peace and security in Africa. Within this context, scholars at the Conflict cluster have addressed topics such as agricultural markets, corruption, democratization, electoral violence, informal military networks, land conflicts, statebuilding, SSR, and violence

against civilians. Regions such as the Horn of Africa, Great Lakes, North Africa, Sahel, and West Africa have been given particular attention.

At another analytical level, the study of the global phenomenon of regionalisation and its impact on regional and global conflicts have been thoroughly studied and published on by Swedish scholars.

Concerns for the Future

Even if Swedish peace research at large has a strong international standing, it is possible to identify a number of concerns primarily relating to the imperative of maintaining a broad empirical expertise and to structural issues which combined undermine long-term planning and ultimately influence creativity and quality (not specific for peace and conflict research).

Maintaining Empirical Breadth and Depth

There is a risk that Swedish peace and conflict research will encounter difficulties in the future to maintain a broad empirical expertise. Swedish scholars have established themselves as experts on large parts of Sub-Saharan Africa, the Balkans, the Middle East, as well as countries in South and East Asia. These are also the regions of the world where the world's conflicts have clustered during the last 25 years (Themnér and Wallensteen 2012). However, we do not know exactly where future crises and armed conflicts will take place and it is therefore problematic to only conduct research in countries where Swedish development assistance is concentrated. Such research may become reactive rather than proactive; only able to inform policy once a crisis has escalated or already been resolved. This dilemma became apparent in the wake of the Arab Spring that erupted in 2010. Historically, Sweden has had limited development co-operation with countries in Northern Africa, which has arguable also affected the ability and willingness of the Swedish research community to conduct research on these countries. It was therefore difficult for peace institutes/departments to satisfy the sudden increase in demand, from policy circles, for high-quality and informed analysis about developments in Egypt, Libya and Tunisia, once these regimes collapsed. Swedish development goals may be important to serve as guidelines for the allocation of research funding to research on countries of specific interest, but it is important that funding of research creates incentives which contribute to a broad empirical expertise, rather than limiting the empirical focus of Swedish peace and conflict research.

Structural Weaknesses

First, research environments in Sweden are heavily dependent on external research funding and individual researchers have difficulties to secure time for quality research.³ This dependence on external funding also generates insecure career paths for Swedish academics. The situation influences the quality of research in several ways: 1) researchers spend a disproportionate amount of time on the drafting of research applications instead of conducting research; 2) some academics have too little time to do research, and have to take up administrative assignments, perform excessive amount of teaching, or leave academia; 3) researchers apply for new funding long before they need it and some (a minority) therefore have too many projects to manage, and less time for high-quality research.

Second, international recruitment is hampered by several features of the Swedish system. One problem is that the basic conditions for lecturers and professors are not very attractive for many foreign scholars, given

³ For instance, in recent years more than 50% of the budget for research was externally generated at PCR at Uppsala University; Peace and Development Research at School of Global studies, GU; and at Umeå University.

that there is limited research time in most positions.⁴ Another key impediment to international recruitment is the protracted recruitment processes.

Third, shifting priorities for research funding and limited faculty funding has also made it difficult to build and sustain strong research environments/groups which create the critical mass needed for impact. For instance, a reorientation of research funding among funding agencies has resulted in fewer options for externally generated doctoral positions. Strong research environments require sustained funding for PhD candidate positions, post-docs and professors alike.

Fourth, it has proven difficult and time-consuming to ensure sufficient core funding for maintenance and updating of major data collections. The main external funders have a strong focus on projects, rather than on the long-term development of basic infrastructure for research, especially the maintenance of databases, which require substantial resources given how labor-intensive it is. While, for instance, the UCDP benefits from being early in the field on innovations such as geographical coding, competition from centers with greater resources constitutes a concern for the future.⁵

Trends, tendencies and prognosis for the future

Several trends in Swedish peace and conflict research can be discerned and we highlight two of them below.

First, Swedish peace and conflict research has seen a shift away from the study of the state as the unit of analysis. This has resulted in three related trends. Theoretically, methodologically and empirically, spatial dimensions and local perspectives are increasingly included, in relation both to analysis of the causes and resolution of conflict. This trend encompasses studies of local governance and peacebuilding, non-violent protest, urban-rural dimensions of peace and war, the use of geo-coded data in large-N studies and theorizing about the microfoundations of civil war or communal conflict. There has, furthermore, been an increasing trend to study the transnational dimensions of conflict, including the impact of globalization. This research also has links to the longstanding tradition of studying regionalism. Finally, Swedish research is in the process of shifting focus from structural explanations of armed conflict, conflict resolution and durable peace to more actor-oriented explanations that stresses practices and procedures of issues such as mediation, diplomacy, local ownership, and civil-military coordination. This has further strengthened the policy relevance of Swedish research.

Second, methodologically there are several notable developments. With social science becoming more methodologically advanced and specialized, Swedish peace research has expanded the type of methods used of data gathering and analysis. The method trend includes application of methods for forecasting and early-warning systems (Swedish-based researchers are pioneering some of this work), field and survey experiments, and the use of survey data from conflict areas. Anthropological methods are also used increasingly by peace scholars in Sweden. Overall there is more rigor in the use of methods and several projects apply a mixed-methods approach. With the introduction of most of these methods, more collaboration between scholars with different competences will be required and there is a need for researchers to cross methodological divides.

Recommendations

We identify two issue areas, which given theoretical and methodological trends, are fields where Swedish research may become very competitive internationally. First, the focus on economic dimensions of war and peace could be strengthened further. One of the main findings in peace research is the connection

⁴ By comparison, Norwegian universities grant most faculty 50% research time.

⁵ Linked to this issue of the sustainability of databases, is the compatibility and access to data sources used in the field. There are some international efforts to facilitate the coordination of datasets to improve comparability and which Sweden is part of.

between economic development and armed violence; not only are eruptions of large-scaled hostilities more likely in less developed societies, peace accords have a lower chance of holding if peace is not followed by economic improvement in the lives of ordinary citizens. While important research on economic dimensions of conflict has been carried out at University of Gothenburg, more focus on these issues is warranted. Given the expertise developed in Sweden on international interventions, governance and the post-war phase, these would be particularly fruitful areas to study in relation to the prospects for growth. Here emphasis could be on aspects such as analyzing informal economies, markets of the poor, natural resources governance, illicit economies, micro-businesses and international trade agreements. Second, more attention could be awarded the economic, political and social geography of war and peace. Theories related to geography have traditionally had a relatively weak standing in Swedish peace and conflict research. This is now becoming a deficiency since a growing trend in the study of peace and conflict, both internationally and in Sweden, is the tendency to disaggregate the level of analysis from the macro national level, to lower levels of analysis, such as provinces, urban spaces, local communities or networks, social groups, and individuals. Swedish researchers are developing more refined methods to collect micro-level data on aspects such as violence, governance, reconciliation, and corruption. However, to truly take advantage of the possibilities that the analysis of such fine-grained data offers, it is necessary to pay greater attention to factors related to economic, political and social geography to explore sub-national variations in war and peace. In contemporary development assistance, such factors are also often employed as indicators for when local communities are susceptible to violence.

A recommendation which flows from our concern with maintaining a broad empirical expertise in the Swedish peace and conflict research community, is to make a regular inventory of empirical expertise in Sweden and if necessary have special calls for research targeting vulnerable regions or countries.

To raise the quality and impact of Swedish research further, we also recommend:

Career paths: As in many other academic disciplines in Sweden, career paths in peace and conflict research are insecure and limited in numbers even for the very best PhDs. This also influences the ability of Swedish research environments to be attractive options for young bright scholars from abroad. For this reason, sufficient funding for more positions at the postdoc and tenure-track assistant lectureship level is needed. As a parallel measure, Swedish junior scholars could be given more guidance and encouragement to take advantage of career and research opportunities abroad. The new International Postdoc grant by the Swedish Research Council is a great improvement compared to the scholarship version that preceded it.

International recruitment: Efforts to increase external recruitment to research-intensive positions at all levels, are needed to increase quality and innovation in peace and conflict research. This has already been acknowledged in the national debate around these issues, and peace and conflict research is no exception. While the issues of recruitment of internationally leading scholars at the senior level has been given much attention, the recruitment of promising researchers at the junior level is equally important.

Efforts to build 'critical mass': A strategy to sustain adequate funding for successful research groups and programs, including core funding to maintain the data bases which have had major international impact, should be developed. More and secure funding, for longer time-periods, will enable better planning of research and recruitment. To develop new and innovative research, funding could to a larger extent be channeled to younger, successful scholars to develop research groups (including doctoral positions).

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ECONOMIC DEVELOPMENT

Keywords

Economic growth, industrial development, employment, international trade, urbanisation, public-private partnership, market development, globalization, agriculture, aquaculture, forestry, migration, economic inclusion, innovation and entrepreneurship, foreign aid, public sector, macroeconomic policy, institutions, investment.

Introduction

This short report looks at Swedish research on “economic development”. This is one of the four identified areas of research on political, social and economic dimensions of development, the others being “Democracy and human rights”, “Conflict peace and security”, and “Social development”. It is not possible to make a precise allocation of development research between these areas, since much of the research relates to more than one of the categories.

Development research is generally broad and includes aspects that normally would have been covered in different disciplines. To explain economic development one often needs to draw on economic, social and political factors and beyond. It is an area that in this respect can be said to be quite interdisciplinary. The research covered in this review is primarily from “economic sciences”, but we seek to cover also research on economic development that is done within other disciplines.

The task given is to identify the major trends within Swedish research on economic development. We give names of some researchers that have made relevant contribution within the field, but we will not be able in this brief review to give a completely “fair” coverage. There are clearly other researchers that also might have been mentioned. Still, hopefully we are able to provide a broad picture, which is relevant enough for the purpose of this review. We will not provide a comprehensive list of papers produced by the cited researchers, but only describe what has been done within their most important contributions.

Description of Swedish research

The research on “political, economic and social development” is (as measured by the VR-Uforsk application pressure in 2013) primarily concentrated to a few large universities. The dominating four are the University of Gothenburg (GU) (30 applications), University of Uppsala (UU) (20), University of Stockholm (SU) (18) and University of Lund (LU) (15). Then there is a drop to the Royal School of Technology (KTH) (6), the Nordic Africa Institute (NAI) (6) and the Swedish University of Agricultural Sciences (SLU) (5), and then there is again a drop to the remaining 20 institutions, among which University of Malmö had three and the remainder one or two applications. So development research within this area is relatively concentrated. Generally it is hard to be successful in research unless it the researcher is located in a supporting environment. Development research does not differ from other areas in this respect.

Looking at publications since 2000 listed in the publication data base ECONLIT, which lists publications in economic sciences in general, we find that Stockholm with several institutions including Stockholm University and Stockholm School of Economics (HHS) is the largest research agglomeration (596 publications), followed by University of Gothenburg (337), University of Lund (286), and University of Uppsala (151). Chalmers Technical University in Gothenburg (103) and University of Umeå (64) are also contributing significantly.

Before describing the Swedish research we will give a brief sketch of where the international research on economic development is moving. Currently the main theme in the research on economic development (as measured by ECONLIT) is “human resources, human development, income contribution, and migration”, reflecting the strong focus on issues of education and health alongside poverty and inequality. The second largest category of research is “financial markets, saving and capital investment, corporate finance and governance”. Here there is a large output of work on micro-finance, while the traditional focus in

development research on savings and investments is less prominent. There is also considerable work on financial markets and their role. The third largest category is “agriculture, natural resources, energy, and environment”. Here agriculture has been a major area of research for a long time, while natural resources, energy and environment have become more prominent in recent years. The fourth category is “industrialization”, which receives surprisingly limited attention given the role that industry has had in virtually all recent economic take-offs. There is furthermore much emphasis on institutional arrangements and international linkages related to all the various areas just discussed.

Macroeconomic and development policy issues are less prominent than in the 1980s and 1990s. There has been a general shift from macroeconomic analysis towards microeconomic analysis of individual or household data, to investigate human resource issues. Generally there is a lot of work using randomized controlled trials (impact evaluation) to study the causal effects of various interventions. Environmental issues have also emerged on a larger scale in recent years. Human capital seems to have replaced physical capital as the core theme of development economics. There are, of course, still discussions about savings, foreign aid, and foreign direct investment, but they are less dominant than they used to be. The key explanatory variable as reflected in current analyses of long-term development is rather institutions.

Development can be defined in many different ways. Amartya Sen (1999) conceives of development as freedom and identifies five components, namely political freedom, economic facilities, social opportunities, transparency guarantees, and protective security. This is just one possible configuration, but human development would always be concerned with a vector of factors. One development measure inspired by these ideas is the UN’s Human Development Index, which combines income, education, and health.

Sen (2009) has also made important contributions with regard to issues of global justice. Here it seems reasonable to argue that one can distinguish between rights to which every person should have equal access, while there are other welfare components which are not allocated as rights. The latter are instead allocated via markets or other institutional arrangements. One could argue that the development research agenda should identify policy areas which are relevant from this perspective, and investigate what improvements of justice can be achieved. The official Swedish policy with regard to development research seeks to strengthen research of relevance to the fight against poverty in developing countries.

Against the background of this quick sketch of changes in the global research landscape, what can we say about Swedish research on economic development? A general observation is that the evolution of Swedish research on economic development generally follows the international trends, both in terms of choice of topics and methodological approaches. So in these respects Swedish research on economic development is close to the international research frontier, which can be seen as a positive aspect. On the other hand, it means that it is hard to discern any specific or original Swedish contributions to the international debate. Still, there are themes where Swedish contributions have had a particular impact. Here we briefly review Swedish research on economic development and seek to indicate where the contributions have been most significant. We group the discussion in accordance with the keywords identified to be relevant for this sub-category.

Economic growth has been extensively analysed, although somewhat less in the last few years. At the turn of the century there was a large focus on growth determinants based on the so called new growth theory, which emphasized the role of the “deeper” determinants of growth, that is institutions which determine what policies are put in place, which in turn determines what happened to the more immediate growth determinants such as investment. To be able to draw causal conclusions researchers used cross country regression and instrumental variable techniques (to deal with endogeneity problems). This made it possible to include a range of international variables that were hard to analyse within a one country setting. However, gradually a feeling has emerged that this approach has run its course and that not so much more could be gained from such cross-country analyses. There was also an increasing concern about the effectiveness of the instrumental variable technique.

In spite of these concerns there is a broad agreement that good institutions are highly correlated with economic development, but at the same time it is clear we know much less about how good institutions emerge or are created. There has been an increasing interest in work on these themes as well in the borderland of economics and political science. There is also a range of new factors which may influence growth that are investigated, such as trust and tolerance. There have also been analyses investigating how corruption affects the growth of firms (Jakob Svensson, SU, and others).

There have been a number of Swedish papers investigating the so called resource curse, i.e. the paradox that countries with an abundance of natural resources seem to grow more slowly than those with less natural resource abundance. It is not completely clear whether this paradox still remains, but the main interpretation of the paradox has been that it is due to political economy (rent-seeking) rather than economic factors (such as Dutch Disease effects)

There has also emerged a new type of literature that focuses on the really long run development of economies, essentially from the stone-age to the present (Ola Olsson, GU). In this literature and in several other contexts there is also analyses of the role and importance of ethnic diversity.

In departments of economic history there has been extensive work on the economic development of the European colonies. The focus in Lund (Christer Gunnarsson and colleagues) has been on long-term growth, structural change and income distribution in LDCs. The role of institutions has been in focus. There has been similar work also in other economic history departments (e.g. Klas Rönnbeck, GU).

Institutions have been at the centre of the stage in development research in the recent decade. The most cited works are those by Acemoglu, Robinson and colleagues, summarized in their book from 2012, *Why Nations Fail*. Their main message is that development requires inclusive institutions, which makes it possible for a broad range of agents to realize their potential. There is a related book considering the big development issues by Torsten Persson (SU) and Tim Besley from 2011, *Pillars of prosperity*. Their focus is on state capacity, which is, of course, related to the debate about institutions. Torsten Persson has furthermore written a series of papers with Guido Tabellini on the relationships between constitutions, democracy, and development. There is also some work by other researchers on issues like taxation efficiency and also about the impact of taxation on institutions such as democracy.

When it comes to institutions there is much work in the borderland between economics and political science and for example the work by Bo Rothstein (GU) on corruption and social capital is relevant also under the heading of economic development. Mats Lundahl (HHS) has over the years made extensive contributions to the analysis of institutional constraints on agriculture and development, particularly on Haiti. Overall, there have been a large number of studies in Sweden looking at the role of institutions, in relation to growth, industrial or agricultural development, as well as a range of other issues. This dimension has thus been very important in recent years.

Employment issues are obviously a fundamental development issue, but there is not that much work (not enough anyway) done on this in Sweden (or internationally for that matter). There are some studies looking at the functioning of labour market, but the old focus in development economics on the transfer of labour from agriculture to industry is not so very visible anymore. The main type of study on this issue is on the impact of education on earnings or incomes (Måns Söderbom, GU, and others). Many of those are done on the basis of firm data, which means that they have a restricted coverage, but there are also some that employ data from household budget surveys or labour force surveys with a broader coverage. There are also studies (Fredrik Sjöholm, LU) investigating links between foreign ownership of firms and employment growth.

There are papers looking specifically at gender issues, such as the empowerment of women in Chinese industry or Indian environments. One has also looked at whether e.g. microfinance can empower women or whether the id discrimination in loan allocation. There has been work on issues such as resource extraction and its impact of women's labour market. Still, almost all studies of employment consider the differential impacts on women and men.

International trade has been considered to be a key determinant of development since Adam Smith. It has also been discussed in the development literature and in particular in the 1980s and 1990s - during the period of Structural Adjustment measures - there was a strong interest in the role of trade, but since then it has been somewhat less in focus. In Sweden there is some work in this area, but surprisingly little. There used to be an emphasis on this type of analysis at the University of Lund (Mats Lundahl, Göte Hansson) and the IIES in Stockholm (Peter Svedberg), but there seems now to be less interest in this issue. There is considerable work of the role of foreign direct investment in development, though. In particular, a lot of work has been done on technology spill-overs from FDI (Magnus Blomström (HHS), Fredrik Sjöholm (LU), and Ari Kokko (currently at Copenhagen Business School). There has also been some related work in economic geography on technology transfer to LDCs via transnational corporations (Claes Alvstam(GU), Inge Ivarsson (GU)). And there has been work on trade and productivity using firm level data (Måns

Söderbom, Arne Bigsten (GU)) as well as work on the international trade dispute settlement system and development (Henrik Horn, SU) as well as trade facilitation interventions.

Globalization relates to several of the listed themes, particularly international trade. As already noted, there is not that much work on trade, and with regard to globalization issues in a broader sense we have some work on global governance and regional collaboration (Jonas Tallberg (SU), Fredrik Söderbaum (GU), Jan Scholte (GU)). There is a lot of work on the functioning and institutions of foreign aid and international economic institutions that could be considered to belong to this category.

Industrial development research has for a long time been quite prominent in Sweden outside development focused research, and the focus has been particularly on manufacturing. This tradition has then carried over to the development arena. Researchers at the University of Gothenburg (Arne Bigsten, Måns Söderbom) were extensively involved in a large World Bank project on enterprise development in Sub-Saharan Africa, which undertook extensive data collection. This led to research on specific countries and major comparative studies across the countries involved within an international network of collaborating researchers. This included analyses of firm productivity and its determinants and constraints. The studies analysed for example how productivity was affected by exports, access to finance etc., and what the constraints on investments and productivity were.

Analyses of firms and productivity have continued to be important with new dimensions being added. In recent work there has for example been a new focus on the effects of agglomeration and networks. An important focus in Sweden as elsewhere in recent years has been on the role of institutions and the importance of the “business environment” for firm development.

Agriculture is a theme that continues to have a high profile in the international research on economic development. It seems generally more prominent in development research at present than work on industry, which may be related to the fact that there is a more direct link between agricultural development and poverty reduction, which has been the key policy focus in recent years.

Agriculture is obviously a very important topic at the Swedish University of Agricultural Sciences in Uppsala. It has a special theme called SLU Global, which includes four sub-themes, namely efficiency in farming systems, restorations of degraded rural landscapes, scale issues in relation to food security and poverty alleviation, and urban and peri-urban farming. SLU also has been given the task to advice the government on how to achieve sustainable and fair global development. There is a group on agriculture for development coordinated by Gert Nyberg.

Much of the Swedish work on agriculture and development has otherwise focused on environmental aspects such as land degradation and how to cope with climate change. Environmental economics is a major theme at the University of Gothenburg, where there is now four full professors in the Department of Economics working within this field - Fredrik Carlsson, Olof Johansson-Stenman, Thomas Sterner, and Peter Martinsson. The environmental group furthermore has established a special research organisation “Environment for development” with extensive funding from Sida and others. This has set up an international network of institutions in Central America, Chile, China, Ethiopia, Kenya, South Africa, and Tanzania.

There has also been substantial work on the Asian green revolution, agrarian change and social mobility and related issues by Göran Djurfeldt and colleagues at the Department of Sociology in Lund. At the School of Global Studies at the University of Gothenburg there is research on global sustainability focusing on land use issues, management of natural resources, and rural development. There has been work on under-nutrition issues at Stockholm University (Peter Svedberg).

Aquaculture in relation to economic development is a smaller category than agriculture, but it is an area where Sweden still does make some contribution. A key issue in this context is how aquaculture can contribute to food security and how it can provide ecosystem services. This is again an area where SLU is active and looks at knowledge, management and the role of communities. There is considerable research on fisheries also in Gothenburg, where the focus is on resource management including ecological concerns and regulations of fisheries.

Forestry research is another area where SLU obviously is active. Within this area there is a Gothenburg-based network called FOCALI (Forest, Climate, and Livelihood research network) coordinating and exchanging information on this theme. It focuses on forest/bio-energy, climate change and poverty issues.

Its purpose is to supply relevant knowledge to Sida and other Swedish authorities for the effective use of forest operations to achieve climate-poverty targets.

Market development is a broad concept, and clearly a lot of economics can be placed under this heading. This can concern development of agricultural markets (Jakob Svensson is for example working on an investigation about why the green revolution has had such a limited impact in Sub-Saharan Africa looking at the role of technology adoption, learning, and market failures) or the work looking at the investment climate particularly related to manufacturing firms (Måns Söderbom). There is also an emerging literature on supply chains, which could be placed in this category. There has also been some work more specifically about market development in economies transitioning to capitalism such as China (Assar Lindbeck). Still, many economists would argue that much of what they do is in some way related to market development. The theme of public-private partnership could probably be placed in this category, but there is not much development related work on this in Sweden.

Migration has always been an important area of research in development. Traditional development models focused on the migration from rural to urban areas, and this was also reflected in the research. In recent years there has been an increased focus on international migration and the impact of this on the sending countries. There is considerable work on the magnitude and the impacts of remittances in the sending countries. At the School of Global studies (Gothenburg) there is work on migration and diversity, refugees and labour migration, transnational mobility and cultural diversity. There is currently a focus on circular migration (Lisa Åkesson).

Urbanization issues are becoming more and more important for developing countries, but there is not that much work on this issue in Sweden (as far as one can judge from journal output).

Economic inclusion issues have been high on the international agenda for a long time, and this is also the case for Swedish research on development. Already in 1994 a paper by Persson and Tabellini investigating the link between inequality and growth received a lot of attention (one of the most cited papers). There has been extensive work on trying to understand poverty. Arne Bigsten and colleagues at GU have worked on household data to identify the correlates of poverty and also to investigate how poverty reduction is related to changes in inequality and growth. There has also been work on seeking to understand the effects of globalization or openness on inequality. Another theme has been to compare different measures of poverty, for example subjective measures with objective economic measures of consumption. Then there is work relating inequality to other social outcomes, such as HIV/AIDS (Dick Durevall, Annika Lindskog).

Innovation and entrepreneurship has been studied in relation to the firm development studies reported earlier. Otherwise this is an area focused on by the technical universities, such as KTH (Pontus Braunerhielm) and Chalmers and to some extent by the Stockholm School of Economics and special institutes such as CRICLE in Lund. There has been research on the links between knowledge creation, entrepreneurship and growth, plus work on innovation policy. At the technical universities there is also a large interest in issues relating to technology, of course. There is also development research related work focusing on energy, telephones, biotech and focus on innovation systems. Still, most of the work in these areas has not focused on developing countries.

Foreign aid has been high on the agenda of development research for half a century, since it is one of the main policy instruments of the developed countries to help the poorer ones and contribute to economic convergence. In recent decades the focus has been on the macroeconomic relationship between aid and growth, and here Swedish researchers have made some contributions. The results of this work based on cross-country regressions have been mixed, and there is not much more to gain from pursuing this line of research. It has been hard to identify effects.

Jakob Svensson has made important contributions to the literature on the role of conditionality in aid contracts as well as elite capture. There have also been several studies on issues such as the fungibility of aid. But most of this research was done a decade ago, and recent work has instead shifted to look at the impact of smaller projects with the help of randomized experiments. There has also been some work on the distributional and poverty reduction consequences of the country allocation of aid.

Macroeconomic policy has always been very important for outcomes in terms of economics development, but research in Sweden on development has in recent years been somewhat marginal. There

are of course exception such as recent work done by Dick Durevall on food prices and inflation policies in Ethiopia.

Public sector issues have also been important. Issues of the efficiency of service delivery have come higher on the agenda in recent years. One of the most influential papers here is about how the transfer of money from central government in Uganda to local school is handled (Jakob Svensson and Ritva Reinikka). Thomas Sterner has worked extensively on how to apply policy instruments to environmental and resource problems (but environment and energy issues relate more to another review).

Finance is another area where there has been a growing interest in recent years. In the development literature there has been a special attention to the role of microfinance for economic development and in particular poverty reduction. There have been some Swedish contributions to this literature (a recent example is Andreas Madestam on informal finance), although this is not one of the main areas of Swedish development research. There is some work on the efficiency of financial markets such as equity markets.

Investment in physical capital has always been a key determinant of economic growth. There has been extensive work on this in relation to manufacturing firms in Africa (Måns Söderbom), but otherwise aggregate investment (or savings for that matter) has not been high on the Swedish research agenda.

Human capital has emerged as the most important theme of research in development economics in the recent decade, and much of the work done with randomized controlled trials is within this area. The theme education is discussed under the heading social development, but the link between investments in human capital and growth could also be discussed here.

There are also some papers looking specifically at gender issues, such as the empowerment of women in different contexts. Anne Boschini (SU) has worked on the economics of gender, but most of this work has not had a development focus. Still, the gender dimension is considered in most of the work on human capital related themes.

There has also been work by Swedish economists on issues such as the gender gap in political participation in Africa and elsewhere, but this work should maybe be placed in the political development category.

Strengths and weaknesses

Swedish research on economic development has a broad coverage and it is very strong in specific areas. The emphasis of Swedish research has broadly followed the shift in emphasis on the international scientific as well as policy arena. The emphasis on poverty in the donor community since the 1990s has meant that also a lot of the research in Sweden has had a focus on this area (although inequality and poverty have always been important themes in development economics). At present this means that there has been a strong emphasis on research on the role of institutions for economic development. And there is currently a strong trend towards the use of impact evaluation to analyse the causal impact of interventions of various types.

The scientific quality of the best work in the field is very high and clearly at the international frontier, and there is also a broad range of interesting work of good quality. There are many highly cited works indicating that there has been a big impact of the research efforts internationally.

The career paths of researchers in the field are similar to those of other areas. There are a considerable number of professors focusing on development in economics, economic history, sociology and other social sciences that have done very well. We cannot see that researcher specialising in development are having a harder time than others, although it may be harder for researchers choosing a very explicit interdisciplinary orientation to get access to jobs. Within the disciplines, interdisciplinary skills is probably regarded as a positive quality, but it does not allow the applicant to be treated any more leniently when it comes to what is required in terms of skills within the discipline itself.

The infrastructure needs are not that different from those in social sciences in general, although there are special needs for research trips and international collaborations because the research focus is on LDCs. It seems, however, that Swedish researchers in development are well connected with partners in LDCs and it is generally an area of research that is very internationally oriented. International conferences are prevalent and a natural part in the scientific life of development researchers.

So generally, this is an area with an unusually high degree of international collaboration. There is, for example, an EU development economics network (EUDN), which has the following Swedish members: Arne Bigsten, Martina Björkman-Nyqvist, Mats Lundahl, Ola Olsson, Måns Söderbom, Peter Svedberg, Jakob Svensson, and associate members are Tessa Bold and Andreas Madestam.

Recommendations

Development economics (and development studies generally) is about understanding the development processes, but also very much to seek to understand how the processes that bring welfare improvements can be and are affected by policy. Development economics research has had a strong impact on how development policy is formulated in poor countries. But papers published in economics journals in recent years may have become less important as a vehicle for communicating ideas about development strategy and policy, and to be more concerned with more limited and well-designed analyses of micro-issues.

The terms and conditions required for researchers on economic development are not fundamentally different than those for other social science researchers. What is different is that the subject of study normally is poor countries, and this requires data collection efforts etc. in far-away places. This means that research trips are necessary and that the costs of doing research may be higher. It often requires collaboration with researchers in the country studied, so it would be desirable to find good ways of incorporating compensation for this participation. Costs have also increased significantly because of the extensive use of Randomized Controlled Trials, which are expensive to implement.

The research system as such does not need to change because it is development research. The current system of funding within the framework of Development Research is useful, although it is a concern that very few applications can be awarded money.

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HUMAN DEVELOPMENT

Keywords

Education, Culture, Religion, Poverty and Inequality, Gender equality and empowerment, Demographic transitions, Welfare systems, Migration, News media, Social media/digital activism, Labor unions and workers' rights, Social integration, Health.

Introduction

This report aims at giving an overview of Swedish research on Human development as this concept is commonly defined and specified. The goal is to identify the major trends within Swedish research on Human development given the sub-headings specified by a set of given “keywords”. In the overview, focus will be laid on research environments and units that can be said to have made significant and to some extent lasting contributions in their respective fields of research. The names of researchers mentioned mostly refer to leaders of research projects or programmes, and a full account of project participants will not be given. Nor is the primary ambition to give a quality assessment of the research in each field. The purpose is rather to identify core areas of ongoing research and to identify research units that have made, or are making, imprints on their respective fields of research. A further aim is to point out possible lacunas, whether in specific fields of research or at identified universities. In the conclusion, lessons are drawn from the evidence presented and a few recommendations of more general character are forwarded.

The concept of Human development

Human development is one of the four identified areas of research on “political, social and economic dimensions of development” (PES). Human development as a concept has been pioneered and popularized by the UNDP global Human Development Reports and the yearly publicized Human Development Index, which is a combined measure of life expectancy, adult literacy, education enrollment ratios and gross domestic product per capita. In broad terms, human development is about processes and conditions that may be enlarging people’s choices, and it is closely linked to concepts such as capabilities and opportunities. Human development can be studied both a process and an outcome. It is concerned with the process, through which choices are, or are not, enlarged, but it also focuses on outcomes as they may be revealed in the form of enhanced, or restrained, capabilities and opportunities.

Human development is sometimes defined as “development of the people, development for the people, and development by the people”, which means that it involves not only measureable outcomes such as those included in the Human Development Index, but also welfare arrangements and public service delivery as well as social mobilization and public and civil action. Development **of** the people means building human capabilities through the development of human resources, for instance by investments in education and health services. Development **for** the people implies that the benefits of growth should be translated into the lives of people, which means that it involves parameters related to poverty and economic and social inequality. Development **by** the people emphasizes peoples’ ability to participate actively in influencing the social processes that shape their lives. So, at the end of the day, Human development is not just one aspect of development among many others. To be sure, Human development defines core issues in development, perhaps even to the extent that it signifies the essence and ultimate meaning of development.

In broad terms the keywords listed should be taken to represent different aspects of Human development either as outcomes or as ongoing processes. So, when identifying ongoing Swedish research a central task is to identify which, if any, components of Human development that are particularly well represented, and which components that may be underrepresented in development research.

Some limitations

Before proceeding to the description of Swedish research a few caveats and comments should be brought to the fore. Our account will essentially be based on the Vetenskapsrådet (VR, Swedish Research Council) and Sida records for project applications between 2003 and 2013. This selection leads to several biases. First, our report is based on records of actually approved projects (by Sida or VR). It has not been practically feasible to go through and follow up on rejected projects. It is, of course, possible that many a rejected project has actually been carried out despite being refuted by Sida or VR.

Second, we have not had access to records over alternative funding, whether from internal university sources or from other funding agencies. We are aware that development research is, at least occasionally, funded from sources such as Riksbankens Jubileumsfond (The Swedish Foundation for Humanities and Social Sciences) and from the general call of Vetenskapsrådet as well as from e.g. Handelsbankens Forskningsstiftelser and Wallenbergstiftelserna (The Wallenberg Foundations). Several divisions of Sida have also been involved in supporting Swedish research. Such support is freestanding from the open calls and generally involves considerably larger amounts of funding than in the open calls. Information on internal university funding of positions held by seniors and doctoral students has been unavailable or difficult to access.

Third, in the records of approved projects no indication is given regarding amounts of funding granted. Nor is there any mention of participants other than the actual applicant. Therefore, it is not automatically given by a project's approval that it has served as a device for creating or strengthening a broader research environment in the specific field of study, or at the research unit in question.

Fourth, the records are obviously not completely accurate. We have identified a few actually funded projects that are in effect missing in the provided records. For instance, one of the Sida funded projects that is absent from the record has been directly instrumental in promoting the careers of two associate professors and one PhD graduate. Another actually approved project is recorded as "rejected". This of course casts some doubts on the accuracy of Sida's handling and administration of research projects.

Finally, when it comes to the concrete identification of research projects in Human development the classification of projects has to be fairly rudimentary. There is no clear borderline between for instance Human development and Economic development (obviously since economic development is a key component of the HDI). So, overlaps and double counting are unavoidable. The classification offered is open to criticism, but we have chosen a broad approach, which means that quite a large number of projects have been defined as falling within the category of Human development. A noticeable problem is that one major component of Human development, namely health interventions and outcomes are essentially studied and classified under Global Health. Therefore, major part of that research is left outside the realm of social and economic sciences.

It should also be said that Human Development covers and bridges over between many academic disciplines, in fact most of the social sciences. Interdisciplinary approaches are often preferred and endorsed by funding agencies. From the available records it is, however, in most cases difficult to detect how much of the research is actually done in interdisciplinary environments.

Description of Human Development research

As can be expected, research activity in the area "political, economic and social development" (PES) is strongly concentrated to the larger universities. The research area Human development is no exception to this rule, although the score for 2013 is somewhat deviating. Of a total amount of 132 applications in 2013, about 35 could be classified as belonging to the field Human development. Of these, 20 represent applications from either Göteborg (12) or Stockholm University (8), whereas the remaining applications are dispersed among several universities and research units. More remarkable is perhaps that only two (2) applications within Human development were actually approved in 2013. Both projects are from Göteborg University representing as diverse topics as migration and linguistic identity.

However, the 2013 sample is far too small to form a basis of any descriptive account of past and/or ongoing research. Therefore, on the basis of the listed keywords, we have gone through all recorded Sida applications from 2003 to 2012 with the aim to identify approved projects that can be said to fall within the

category of Human development. Of a total number of 920 applications in “political, economic and social development” (PES), 189 have been approved and granted funding (given the caution, as mentioned, that some approved projects appear to be missing). Among the approved projects, a broad classification gives an approximate number of 80 to 85 approved projects that can be classified as belonging to the field of Human development. Among these, 68 approved applications originate from the four large universities (Göteborg 22, Stockholm 15, Lund 15, Uppsala 16). It deserves to be mentioned, however, that all PES applications approved by Sida for Linköping (3) and Umeå (5) should be classified as belonging to the field of Human development.

Among the applications approved a rough classification indicates a strong dominance for gender related research. Some 25 projects have an outspoken emphasis on gender related issues. Other important areas are poverty and inequality (ca 15 applications) and culture (13). Health, education, welfare, and migration together represent about 20 approved projects. Social integration, religion, demography, media and workers’ rights issues are clearly underrepresented areas of research. Of course, there are a number of overlapping areas so that several projects can be classified under two or more headings. It is also quite possible that the classification made here is actually more misleading than informative.

The descriptive account in the following section is thematic, i.e. organized by keywords, whereas no direct attempt has been made to assess the state of the art of development research within the academic disciplines involved.

Gender equality and empowerment

Gender studies represent by far the largest research subject area within Swedish research on Human development. This is hardly surprising given Sida’s designation of gender as a prioritized area of research and the stated requirement that, in principle, a relevant gender perspective should be present in all applications. Here, we have only included projects with a direct and identified gender focus in terms of choice of topic or subject matter of research. Of a total of approximately 25 approved projects, 9 have been granted to Göteborg University, notably the School of Global Studies and associated departments such as Peace and Conflict Research and Human Geography. Between 2004 and 2011 the School of Global Studies hosted the Gender and Development Network (GADNET), which was a national network open for researchers based in Sweden with a gender perspective on global development issues. The network was funded by Sida/SAREC between 2004 and 2011. The overarching goal of GADNET was to maintain a national research community of researchers in Sweden with research interests in gender and development issues, connected to each other through the network. From July 2011 GADNET became an informal network rotating between different universities on a yearly basis and administrative responsibility was transferred to the Centre of East and South-East Asian Studies at Lund University.

As Sida funding has been discontinued it appears that GADNET has ceased to be a leading agent and network organization for Swedish gender related research. The spin-off effects of previous GADNET activity may, however, have been considerable, at least at some universities. The gender oriented research at the School of Global Studies appears to have remained active and dynamic, not least in the field of Peace and Development Research where the contributions on gendered violence in war and peace by Maria Stern and Maria Eriksson Baaz can be mentioned. Edme Dominguez’ studies on female workers and global labor standards and Mattias Larsen’s research on vulnerable daughters in India are other notable contributions.

Gender related development research at Stockholm University is conducted by researchers at several departments. A center for gender studies is hosted by the Department of Ethnology, History of Religions and Gender studies. It seems, however, that a gender focus is not dominant in the development research at Stockholm University, not even at a department such as Social Anthropology with its a long tradition of development research.

At Uppsala University (including the Nordic Africa Institute, NAI) the Center for Gender Research has no outspoken development focus, which is reflected in the fact that no project with development focus has been granted funding from VR or Sida. The Department of Cultural Anthropology and Ethnology has a research group in Anthropology and Development, in which several researchers focus on questions related to development and social change in the context of international development cooperation. However, their outspoken interest appears to be on theoretical and epistemological issues, i.e. how for instance

perceptions and imaginations in development cooperation and humanitarian aid shape and influence peoples' opportunities. At the Department of Government Elin Bjarnegård's project *Gender, Informal Institutions and Political Recruitment: Explaining Male Dominance in Parliamentary Representation* (2013) appears to be the major contribution to gender oriented development research.

Lund University has a fairly large Center for Gender Studies with about 12 senior researchers. Two of the prioritized research themes are *Research in/on a Globalized World and Politics of Gendered Exclusion and Inequality*. It is stated that "a global perspective on gender provides a key to understand conflicts, wars and their aftermath, risk, migration, sexualities, masculinities, femininities, identities, employment, exploitation, development, education, health, representation, media, and history". However, the global or development oriented perspective does not appear to a large extent in research projects and publications. The works of Helle Rydström on gender in Asia are prominent. Her research examines the ways in which gender informs violence, security, and vulnerability in social life and in sites of conflict and war, and how gendered power relations impact hierarchies, socialization, sexuality, and education. Since 2006 Rydström alone has been granted three (3) gender oriented projects. No other project with development orientation has been identified from the Sida/VR records.

Poverty and Inequality

Some 15 projects have been approved that can be said to have an orientation towards research on poverty and inequality. A distinction has been made so that only those projects are included that have a declared and direct focus on poverty and inequality in the choice of topic. This is defined as also including projects with a focus on livelihood, vulnerability and pro-poor growth.

Research on poverty and inequality is a prominent part of the research at the Department of Economics at Göteborg University. The pioneering work of Arne Bigsten over the past decades has been crucial for this development. He is also the recipient of two of the approved projects listed. Several of his colleagues have over the years worked on issues related to income distribution, poverty reduction and the growth-inequality nexus. Most of this research can be classified under Economic development, but the link to Human development issues is evident. One project that can be taken to represent both gender oriented and poverty focused research is Måns Söderbom's studies of *Female Non-Farm Entrepreneurs and Rural Diversification in Rural Ethiopia*. Other examples are Sven Tengstam's work on smallholder diversification and income growth in Zambia and Annika Isaksson's doctoral dissertation *Essays on Institutions, Inequality and Development*.

It is perhaps more surprising that none of the research groups at the School of Global Studies seems (Global Gender Studies, Global Heritage Studies, Global Sustainability Studies, Indigenous Studies, Migration and Diversity, Reconstruction and Intervention, Resistance Studies) appears to have poverty and inequality as a prioritized area of research, although poverty is an issue dealt with under Indigenous Studies. Nor do any the regional centers at Göteborg University reveal a strong research orientation towards poverty and inequality matters. The Center for African Studies focuses on conflict management, intervention and post-conflict reconstruction, regionalization, gender issues, international development cooperation and democratization. The Asian Studies Center focuses on democracy, conflict, security, development, religion and politics and gender, and the Latin American Studies Center has a focus on citizenship and civil society (with a special priority to gender issues and social movement), identity and culture (related to indigenous or peasant communities), gender and labor organizing and globalization, and HIV and civil society. In Social anthropology, Maria Eastmod's project on *Human Security and Social Recovery in post-tsunami Sri Lanka* stands out as representing research focusing on vulnerability and livelihood.

Four approved projects related to poverty and inequality issues have been identified for Uppsala University (including the Nordic Africa Institute, NAI). As it appears, there is no defined center for poverty and inequality research at Uppsala University. A recent project at NAI is Kjell Havnevik's *Large scale agro investments in Africa – impacts on small holder land access and food security*, while a completed project at the Department of Economics is Ranjula Bali Swain's study *The Microfinance Impact* (Routledge: 2012).

At Lund University, inequality focused research can be found at the Department of Human Geography. Two important contributions are Agnes Andersson's *The possibilities and challenges for gender neutral pro-poor agricultural growth in Malawi and Zambia* and Magnus Jirström's *Livelihoods and Climate Change Vulnerability in the Lake Victoria Basin*. Both have their research focus on African agricultural development, including poverty reduction and food security, as members of the so-called Afrint project, which is an ongoing interdisciplinary, comparative project based on household level data for some 4000 smallholder farms.

At the Department of Economic History Christer Gunnarsson had led a project on The Role of Equity in Development, which has included colleagues Martin Andersson and Ellen Hillbom. The project, now completed, had a focus in studying the growth-inequality nexus in emerging economies. Equity is here seen not from the outcome side but from the perspective of inclusion, as a fundament for creating capabilities and levelling opportunities. In connection with the project Andersson and Gunnarsson contributed to the preparation of the *World Development Report 2006 – Equity in Development*. At the Center of East and Southeast Asian Studies, Marina Svensson has led a project on legal empowerment of marginal groups in China.

At Stockholm University and the Department of Social Anthropology, Gunilla Bjerén has been doing research on urban livelihoods in Ethiopia and Monica Lindh de Montoya has studied cooperative banking and poverty reduction. However, Bjerén is now retired and Lindh de Montoya has taken up at position at the School of Global Studies in Göteborg. At the Institute of Latin America Studies there have been projects on street children and social inclusion. However, it is difficult to know if this Institute has remained a dynamic research center, not least since the recipients of the Sida grants are no longer affiliated to the Institute.

Culture

Culture studies traditionally represent a strong branch of Swedish development research. The Department of Social Anthropology at Stockholm University has a very long tradition of development oriented research. The department has a stated commitment to global and comparative perspectives on the diversity of social and cultural forms in the contemporary world. Its research encompasses all continents, and the interactions between them. The department is comparatively large, with a sizeable batch of PhD students, and the research exhibits a wide variety of topics. Gudrun Dahl, Bengt Karlsson, Johan Lindqvist are some of the researchers with experience from development focused research. Three (3) projects have received Sida funding. A recent project is Paula Uimonen's *Internet, Culture and National Identity in Tanzania*. Another project dealing with cultural issues is Dolly Kikon's and Bengt Karlsson's project *The Indian Underbelly: Marginalisation, Migration and State Intervention in the Periphery*, which focuses on the prospects associated with the expansion of developmental activities by the Indian state in areas that were traditionally associated with economic backwardness and protracted political conflict. This project is funded by Riksbankens Jubileumsfond.

At Göteborg University three (3) projects at the School of Global Studies have been approved that have a clear focus on cultural studies. The most recent is Mikaela Lundahl's *Frictions, fractures and cultural resilience of Swahili coastal towns*. Kay Århem has led two projects focusing on indigenous peoples. There is also an ongoing *Indigenous Peoples Initiative* that has been operative for a number of years. This is a discussion forum for researchers who are interested in the factors affecting the living conditions of indigenous peoples. Their interests range from animist cosmologies to encounters with the global economy.

At Uppsala University the Department of Cultural Anthropology and Ethnology is an important research unit. The stated profile includes research on among other things ethnicity, politics and the state, the construction of identity, ethno-mobilization and indigenous issues. The department emphasizes its strong links to Sida and the Nordic Africa Institute, and that it has historically held an international reputation for its African research profile. Two recently funded projects are Oscar Jansson's *The Gendered Political Economies of Coca versus Cocaine in Chapare, Bolivia* and Eren Zink's *Agriculture, Health and Scientific Homecomings: A study of internationally-trained scientists that return to Zimbabwe, Uganda and Ghana*. At the Nordic Africa Institute, Ilda Lindell has an ongoing project on *Urban imaginaries and socio-economic exclusion*.

At Lund University, Social Anthropology is a sub-section of the Department of Sociology. The unit describes its activities as having been “the center for the development of global systemic anthropology”. Research has included the study of “the formation and disappearance of particular social and cultural forms, the nature of personhood and social experience, the processes of cultural production, the formation of ontologies and cosmologies”. As far as can be seen from the records for 2003-2012 no project has been granted funding from Sida. The culture oriented projects at Lund University that have been approved are found in Political Science (Winnie Bothe’s *Local Governance in Sikkim and Bhutan: Two models of State Formation- Different Citizenship Roles?*) and Ethnology (Jonas Frykman’s *Cultural heritage for dialogue and development*).

Welfare

Research on welfare systems and public service delivery is surprisingly marginal in the Swedish research community. Only one approved project has been identified from the discipline of Social Work (Sven Trygged’s project *Developing international child care research*). However, this project is completed and no other approved project with development orientation has been identified within the discipline, at any university. When it comes to public service delivery two projects stand out at a national level. One is Malin Hasselskog’s (School of Global Studies, Göteborg University) project *Donor Supported Governance Reform in Rwanda and its impact on Local Service Provision*. A second project is Jakob Svensson’s (Institute for International Economic Studies, Stockholm University) project on health delivery in Uganda.

Health

Research on health issues more generally is conducted at several universities. At Göteborg University, HIV/AIDS has been studied from the perspective of Peace and Development (Maria Eriksson Baaz, *Protecting without protection: Sexuality and HIV/AIDS among soldiers and combatants in the Congo – DR Congo*), Sociology (Håkan Thörn, *Aid and AIDS Governance: Global Influences and Local Strategies in the Context of South African Civil Society*) and economics (Dick Durevall, *Socioeconomic consequences of HIV/AIDS in Malawi*). At Lund University, Kristina Jönsson (political science) has studied health policy and global health governance. Therese Nilsson and colleagues (economics) have been studying health effects of globalization. Attempts at Umeå University to develop health related social science based development research do not seem to have been sustained.

Education

Judging from the Sida/VR records, Swedish research on education in development appears to have been quite limited. Only a couple of approved projects have been identified. At Stockholm University (Human geography) Bo Malmberg has led a project on *Interpreting Expansion of Mass Education in Rural Ethiopia*. At Uppsala University, Bertil Holmlund (economics) has led the project *Village-level governance, teacher contracts and primary schooling in India*. There is little indication, however, that education in developing countries is a strong research area at any Swedish university. This is slightly unexpected for two reasons. One is that education is a prioritized research field by VR, which is signified by the existence of the independent Committee for Educational Sciences (Utbildningsvetenskapliga kommittén). Apparently, the existence of this committee has, so far, not been instrumental in encouraging research on education in a developmental context. The other curiosity is that education is an important research topic in development economics, notably by the importance of the human capital factor for development. Barely any project with such orientation has been funded by Sida. Projects on education funded from other sources can however be identified in economics departments at Uppsala, Stockholm and Göteborg. At Uppsala, Alex Solis in Uppsala has studied credit access and college enrollment in Chile; at Stockholm School of Economics University, Martina Björkman-Nyqvist has studied Income Shocks and Gender Gaps in Education with evidence from Uganda; at Stockholm University, Maria Chang, Andreas Madestam, and Jakob Svensson have studied benefits from free education with evidence from a policy experiment in Cambodia”. At Göteborg, Annika Lindskog has studied effect of siblings’ education on school-entry in the Ethiopian

highlands. As far as can be seen from the available records none of these projects have received funding from Sida.

Other research

The above headings summarize the majority of approved projects within the field of Human development. Only a few projects have been identified for the remaining headings (keywords). Research on religion is virtually absent; demographic studies and media studies concern mainly China; research on workers' rights is almost extinct. Research on migration is somewhat more represented while few projects can be listed under the heading "social integration". Here only a few projects will be mentioned, representing projects that have been recently initiated and that have not been mentioned earlier under some other heading:

Malin Tillmar, (Linköping University), *Gender perspectives on business conflicts in East Africa: Women entrepreneurs in Tanzania, Kenya and Uganda*; Lars Olsson (Linnaeus University) *Grapes of Wrath. The Dop system and structures of paternalism affecting children and women in commercial wine-farming in Western Cape 1950-2010*; Jonas Tallberg (Stockholm University, political science), *Explaining the Origin and Implementation of Children's Rights in EU External Policy*; Johanna Mannergren (Swedish Institute of International Affairs), *Gender-Just Peace and Transitional Justice*; Aina Tollefsen (Umeå University, Social and Economic Geography) *Those Left Behind - Female Migration and the Transnational Family in Latin America*. It is difficult to know, however, if any of these projects are part of or are representing stable and viable research environments.

Strengths and weaknesses

This overview of Swedish development research in Human development has so far had the character of description of past and/or ongoing research. The overview is almost entirely based on the records for approved projects provided by Sida. Although additional information has been gathered from available homepages and publication lists we have no delusion that the account is entirely encompassing, correct, fair or flawless in all detail. Most likely, there are omissions of potentially important contributions and there may be failures to observe trends in ongoing research. Nonetheless, given these shortcomings we should now try to summarize the impressions we have acquired from the information available.

Starting with the three legs of Human development, development of, for, and by the people it is apparent that a large portion of the research has a focus on development **for** the people. This means that the research deals with development outcomes. This is noticeable in all types of research. Research on and poverty related topics are perhaps logically focused on measuring outcome variables, but even the research on gender topics and culture have been largely oriented towards focusing on outcomes. Studies are made of how people and groups are affected by social processes (e.g. globalization, modernity etc.) and how they cope, resist or suffer. On the other hand, it appears that far less work is done on studying the very processes of social change. The most notable detail is how few projects are represented by the discipline of sociology. One would perhaps assume sociology to have taken a dominant position in the research on a subject matter such as Human development. After all, sociology has sometimes been seen as the "mother" discipline for the study of processes of social change. So has not at all been the case in Swedish development research over the past decade.

When Human development **of** the people is the focus of research it appears to be oriented towards productive processes. In the focus then we find studies of men's and women's productivity, female entrepreneurs, micro finance, pro-poor growth processes and equality enhancing policies, institutions and interventions. These are about creating capabilities and about levelling of opportunities. However, a minority among the projects listed have that type of orientation. This type of research appears to be more frequent in disciplines with a focus on studying economic processes, such as economics, economic history, and economic geography. Studies of development **by** the people are represented by research of political activism and other forms of collective action. As it appears, in Sweden this is not a dominant type of research in relation to Human development. Quite possibly, it is more frequent among the research classified under Political development.

Gender oriented research is by far the dominant type of studies. However, also here we find a focus on development of the people. Again, habitually the gender perspective is applied on the outcome side, how women are affected by social and economic processes. Focus is more on studying women in vulnerable positions than on women's empowerment. It is notable that the projects dealing with women's empowerment are significantly fewer than the projects studying aspects of sexuality.

Health is clearly under-represented in the research on Human development. One would have expected more research to be focused on for instance health policy and service delivery. Possibly, such studies appear under Global Health. Although this is understandable, it remains regrettable that such studies are peripheral in or defined away from the social sciences. It is also notable that so little research on educational issues has received funding from Sida/VR. Since school enrollment and literacy make up key components of the HDI one would assume the importance of such factors to have been recognized also in Swedish development research, not least in gender oriented research, given the role of education for women's empowerment. It can be added that research on demographic transition is almost extinct. Perhaps this has to do with the previous observation that processes of socio-economic transition also seem to be under-researched.

Studies of culture and cultural conditions have a long and strong tradition in Swedish development research. As it appears, this position has largely been upheld, in particular at the anthropological and ethnographic departments at the universities of Göteborg, Stockholm and Uppsala. While recognizing the value of anthropological research and the indisputable competence exhibited in much of that research it remains a fact that anthropology is not principally focused on studying process of social change as processes. If there is a deficiency with regard to the latter type of research this should, however, rather be blamed on social sciences other than anthropology.

Lessons/recommendations

The strong research environments are not many. Göteborg University stands out in terms of both volume and diversity. The research has a strong basis at the School of Global Studies and its affiliated disciplines, as well as at the Department of Economics. Of the total of 189 approved projects under "political, social and economic dimensions of development" (PES) Göteborg University accounts for 58, of which the School of Global Studies represents 30 and the Department of Economics 15. Explanations for this dominance are probably best sought for in the long and sustained tradition of development research at departments such as Economics, Social Anthropology and Peace and Development, which have all been hosting scholars who have made pioneering and lasting contributions to research in general but also to the building of sustainable research environments.

At other universities such environments are rare. A few environments can be identified that are hosting a reasonably large number of scholars with development orientation. At Stockholm University, Social Anthropology has upheld its position as a leading environment with regard to development studies. The Institute of International Economics and Stockholm School of Economics are hosting a couple of internationally renowned scholars in development economics, but it is more doubtful if there are any large and sustainable research environments. At Uppsala University, development research has traditionally held a strong position in political science research (this is largely outside Human development and has not only been marginally included here) and in Cultural and Social Anthropology. At Lund University, human geography and economic history are the disciplines where development research has been sustained and growing in terms of number of senior scholars. Previously strong environments for development research such as economics, sociology and research policy seem to have been less sustainable.

One reason behind the difficulty to build sustainable environments is that inter-generational succession has been problematic. The existing environments have been built around one or two scholars and when these have retired or moved it has sometimes proven difficult to maintain standards and volumes of research. Göteborg University represents a notable exception from this rule where succession seems to have been well prepared for. However, perhaps the foremost reason for the dominance of Göteborg University is that, in contrast to other universities, arrangements seem to have been made to encourage cross-disciplinary cooperation and new initiatives. Thus, the School of Global Studies appears to be playing a role as

networking and capacity entity. No other university seems to have developed similar types of arrangements.

Typically, research environments in development are small, scattered and sometimes isolated. Sometimes, development research is located to area centers, such the Nordic Africa Institute at Uppsala, Latin American Institute at Stockholm and the Center of East and Southeast Asian Studies at Lund. All of these centers are represented among the approved projects, which ought to be an indication of sufficiently high standard. However, it is doubtful if these centers can be held up as role models for development research. Often faculty members are visiting scholars on short-term contract and, in addition, the centers sometimes become isolated units with limited interaction with other research units at the home university. This stands in stark contrast to Göteborg, where the School of Global Studies appears to be a tool of intra-university interaction.

A few words should also be said about on research funding. One observation is that transferring of Sida funding to VR has meant that in the field of political, social and economic dimensions of development (PES) the approval rate has come down from circa 20 per cent to around 10 per cent (13 approved projects of a total of 133 applications). A similar reduction can be observed for Nature and Environment (NE) whereas the approval rate for Global Health actually improved to reach 30% after the transfer to VR (45 approved projects of 148 applications). Most likely this means for the social sciences that fewer projects than before will be receiving funding. Whether this reflects a lack of available funding is difficult to judge, and perhaps it is preferable if a few projects of high quality are approved. However, a major problem is recruitment of PhD students given the funding requirement put on all university departments. In the social sciences very little external funding is available for development research and internal university funding is limited. Under these circumstances it is difficult for the research units to recruit and build up a critical mass of doctoral students. This will have serious repercussions in a not too distant future. This is acute problem that needs to be addressed. Not only funding agencies but also, and perhaps primarily, the universities and its faculties will have to take stands and decide on whether they have an ambition to encourage and promote development research.

Finally, I would like to bring up a reflection regarding the definition, organization and overall standing of development research in Sweden. A general impression is that in Sweden research on Political, Economic and Social development (PES) is comparatively downgraded. Possibly, this has to do with the ways in which development research is defined and organized. Sweden has traditionally had no center for development research which is quite unique in the European community (compare for instance with Overseas Development Institute (ODI), Institute of Development Studies (IDS), Institut de recherche pour le développement (IRD), Dansk institut for internationale studier (DIIS), and Deutsches Institut für Entwicklungspolitik (DIE)). In the international community (and by the research units cited), development research is commonly defined from the perspective of political, economic and social conditions. This means that problems of development (whether referring to e.g. health or environment) are fundamentally seen to be caused by political, economic and social conditions or actors and should therefore be studied from the perspective of, and by the tools of, the social sciences. This is also how a leading development organization such as the World Bank or the European Association of Development Research and Training Institute approach and organize its development research.

The Research Council of Norway defines development research as “research which is relevant for understanding the interlinkages and transition processes on global, regional and local levels and which can make an important contribution with this knowledge to poverty reduction, expansion of human rights and sustainable development.” I am not aware of any definition of development research having been adopted by funding organizations, whether by Sida, VR or any other agency. Although it may seem as if the Norwegian definition is in effect applied in Swedish development research this is clearly not the case. Following the Norwegian definition, regular natural or medical research perspectives are not to be included in development research, even when such research may be vital for changing social conditions. The study of how such research (may) change social structures or contribute to development would, however, be defined as development research. Improvements in technology and medicines are thus only regarded as “development research” if they contribute to the understanding of societal processes. Otherwise, the research is called “research for development”.

It appears that the Swedish definition, applied by Sida and Vetenskapsrådet, leans towards “research for development” rather than “development research”, which is indicated by the way in which research funding is made available in three scientific groups (GH, NE and PES). This is a practice that may indeed be preferable for various reasons, but it is unlikely to be an organizational form that will foster knowledge on poverty reduction, expansion of human rights and promotion of political, economic and social development.

HEALTH SYSTEMS

Keywords

Health policy, health systems, systems thinking, policy analysis, implementation research, research uptake, evidence-informed decision making, capacity building, MCH and NCDs, reciprocity

Description of the research

Global inequalities in health must be tackled. Health policies and systems are widely recognized to be vital elements of the social fabric of every society. They are not only critical for the treatment and prevention of ill-health but are central strategies for addressing health inequity and wider social injustice (Commission on the Social Determinants of Health, 2008). Health policies and systems also provide the platform from which to launch dedicated efforts to address major diseases and health conditions that burden low-income populations, such as HIV/AIDS, tuberculosis and malaria and increasingly non-communicable diseases (NCDs). Given these roles, the early 2000s saw a significant expansion of international and national interest in health systems as one component of sustainable development in low and middle income countries (LMICs). Health system strengthening is now seen to be essential for the achievement of the Millennium Development Goals (Travis et al., 2004) and the post-2015 development agenda. However, the knowledge base to support health system strengthening and policy change in LMICs is surprisingly weak (World Health Organization, 2009). The body of available work is quite limited compared to other areas of health research.

A central feature is the “know-do” gap, and efforts to bridge it, that is the difference between what we know and what we do, what actually reaches the persons in need. An example is that we have sufficient knowledge to prevent/avoid 2/3 of the annual 6.5 million under five deaths, if available and even affordable knowledge was implemented at scale (Jones, 2003). This know-do gap exists in all parts of the world, and often has a large (in)equity component to itself within a country setting. The area of implementation research strives to generate generalizable knowledge on how to narrow and close the “know-do” gap, ie to get health systems- both “supply” and “demand” side, to function better. This type of research is relevant in all settings of the world.

Health policy and systems research (HPSR) is defined as a field that seeks to understand and improve how societies organize themselves in achieving collective health goals, and how different actors interact in the policy and implementation processes to contribute to policy outcomes. By nature, it is multidisciplinary, a blend of economics, sociology, anthropology, political science, public health and epidemiology that together draw a comprehensive picture of how health systems respond and adapt to health policies, and how health policies can shape – and be shaped by – health systems and the broader determinants of health (Alliance for Health Policy and Systems Research, 2011.). It includes concern for global as well as national and sub-national issues, as global forces and agencies have important influences; encompasses research on, or of, policy, which means that it is concerned with how policies are developed and implemented, and the influence that policy actors have over policy outcomes – it addresses the politics of health systems and health system strengthening; promotes work that explicitly seeks to influence policy, that is, research for policy. In addition also included is, the implementation of disease control programs (ie HIV, TB, NCDs, SRH), governance, accountability and participation (with a focus on district level), human resources, and financing. HPSR strives to derive its research questions from policy and practice, and formulate them in consultation with policy makers and practitioners, rather than first doing the research and then attempt to get it into policy (Parkhurst). Lately the term ‘Implementation research’ is often used. Some organizations like The Global Fund call this operational research, the strengthening of which that recently was called for by the EU (Quaglio et al. 2014).

One of the main strengths of HPSR is its multidisciplinary approach, recognizing the importance of addressing the complexity of health policy and systems challenges. Hence, HPSR is a field that takes into account a breadth of analytical perspectives and methods (Peters et al. 2013). Health systems encompass not only various elements but also the interactions and interrelationships between those elements and

between the various individuals within the system (Frenk, 1994). These relationships both support service delivery towards universal health coverage and are also central to the wider social value generated by the health system (Gilson, 2003). The interconnections among the health system building blocks (governance; financing; human resources; drugs and other technologies; information; service delivery) are essential. (ANNEX)

There are a number of national examples that serve to demonstrate how HPSR has influenced national policies, strengthened strategies used by priority disease control programme, and changed the terms of international debates. The Thai Universal Health Coverage Scheme is a good example where research played a critical role in: a) getting the issue of financial protection and coverage onto the policy agenda, b) designing the new universal coverage scheme and, c) monitoring and evaluating the implementation of the scheme. (Alliance for Health Policy and Systems Research, 2004). HPSR played a similar role in the case of the major reform of the health system in Mexico, which aimed to provide comprehensive financial risk protection to the poor, the centre-piece of which was the social insurance programme Seguro Popular. The scheme has provided significant financial risk protection with a reported 54% reduction in catastrophic expenditures at the national level. (Galaragga et al, 2011).

Strengths and weaknesses

HPSR in the area of Sexual and Reproductive Health and Rights (SRHR) and its sub-areas has had a strong Swedish profile. Swedish institutions have continued HPSR and capacity building in e.g. Uganda and Vietnam where also demographic surveillance sites (important infra-structure) have been established. The UNICEF/WHO child health policy integrated community case management of febrile children (iCCM) is an example of how Swedish collaborative research influenced national and global policies (Young et al. 2012). The Joint Learning Initiative on Human Resources for Health drew attention to the immense and long-neglected problem of the health workforce focusing national and international attention to this issue (Chen et al, 2004). Also here Swedish researchers have been active experimenting with intervention studies in public and private service in LMICs health systems for improved coverage of good quality services.

HSPR is established to varying degrees at Swedish universities sometimes at different departments. Internationally Swedish researchers have played a key role in the establishment of the Alliance for Health Policy and Systems Research WHO and at present chairs their scientific advisory committee. The Alliance is an international partnership located within WHO, Geneva and a global leader in this field (ANNEX). Sweden has world leading researchers who produce high quality HPSR specifically in the area of maternal & child health, infectious disease control and medicine policy including attempts to contain antibiotic resistance through influencing use of antibiotics through health system interventions. However, the quantity of staff in Sweden working on these topics is low, which makes it difficult to compete with other more established groups outside Sweden. Capacity building with Swedish researchers collaborating with colleagues at LMICs institutions in research training programs using the sandwich model is however a notable strength. A further strength is the "historical" relatively large presence of Swedish human capital in many LICs, which has created large networks and good will and a reasonable Swedish human capital in the area of HPSR. A challenge is to make use of the many trained PhDs at present often having difficulties in pursuing post doc and independent research careers. Sweden also has strong capacity in research utilizing and developing health information systems, which also should be further developed. Here research infrastructure investments in LMICs are important.

Weaknesses and Challenges

HPSR is sometimes described as a "set of overlapping areas with fuzzy boundaries" (Gilson, 2012). Thus, it is sometimes criticized as being unclear in its scope and nature, lacking rigour in the methods it employs and presenting difficulties in generalizing conclusions from one country context to another (Mills, 2012). Review of health policy analysis work, in particular, also shows that research in this area is often weakly contextualized and quite descriptive, and offers relatively limited insights into its

core questions of how and why policies are developed and implemented effectively over time (Gilson & Raphaely, 2008).

The size (both in terms of budget and project length) of the Swedish research funding for HPSR is usually not sufficient to allow for innovation and large scale testing of innovative approaches to health system strengthening. Instead research projects tend to focus more on formative research to establish needs, as well as evaluations of existing programmes. Short duration grants makes it difficult to set up long term research collaborations and projects, and to establish long term effects of interventions. A fundamental weakness is the new funding situation with the lack of a structured approach to build the next generation of Swedish researchers, where previous support mechanisms from e.g. Sida/SAREC have disappeared (Doctorate, Postdoc) and not been replaced by any others. There is also a need for post doc programmes supporting the many LMICs PhD's trained by Swedish universities but with problems with taking the next step in their careers.

Another weakness is the not yet developed linkages and reciprocal learning opportunities for HPSR between countries and settings at different economic levels, including south-north learning. Also that the Swedish support to the health sector in LICs is not linked to capacity development, nor to private sector initiatives in the same countries. This is a missed opportunity. A weakness is the recent successive withdrawal of presence of Swedish technical expertise in LICs, which only partially has been replaced by shifting to capacity building by means of collaboration with Higher Teaching Institutions (HTI) in Sweden. A weakness in funding opportunities is also the focus on national boundaries and national averages when judging the need for collaborative capacity building. I.e. only poor populations in poor countries seem to be of interest for collaborative capacity building efforts, which will miss the majority of poor individuals in the world who are to be found as poor populations in large countries which on the average not are so poor anymore.

Trends, tendencies and prognosis for the future

As the agenda for disease specific programmes, such as malaria, TB and HIV/AIDS moves from investments in measurement of immediate health outcomes, to questions around long term effectiveness and institutionalisation, the need for HPSR is becoming more prominent. This, along with the post-2015 agenda with less focus on disease specific targets, should raise the profile and funding opportunities for HPSR. The EU is one of the world's most prolific funders of both research and development cooperation, but only very few actions relate specifically to HPSR including operational/implementation research in LMICs (Quaglio et al 2014). There is ample opportunity to use the available financial and political power to better meet these ends. A key challenge as mentioned above faced by the global health community is how to take proven interventions and implement them in the real world. Affordable, life-saving interventions exist to confront many of the health challenges we face, but there is little understanding of how best to deliver those interventions across the full range of existing health systems and in the wide diversity of possible settings. Our failure to effectively implement interventions carries a price. Each year more than 287,000 women die from complications related to pregnancy and child birth, for example, while approximately 7.6 million children, including 3.1 million new-borns, die from diseases that are preventable or treatable with existing interventions (Peters et al, 2013). The epidemiological transition with the rapid increase in NCDs challenges already frail health systems. Furthermore if not containing antibiotic resistance modern medicine and systems will no longer work.

Embedded research: The field of HPSR encompasses newer or relatively little-used methods and study approaches that could be further developed. Embedded research is one such approach, whereby research is truly embedded in the programme and policy cycles, and programme managers and people on the front line of health care play a central part in the identification, design and conduct of the research undertaken. WHO's strategy on HPSR entitled "Changing Mindsets" (2012) advocates for greater embedding of research into decision-making and calls for more demand-driven research as an integral part of programme planning and execution. Knowledge generation and uptake into decision-making are inextricably connected. Research embedded in the real world fosters integration of scientific inquiry into the

implementation problem-solving process, along with programmatic improvements in an iterative and continuous manner. Embedded research will also support the scale-up of interventions and their integration into health systems at the national level. Research focused on responsive health systems is of intrinsic value to partners outside academia, and should aim to strengthen health systems in LMIC.

Systems Thinking: Despite strong global consensus on the need to strengthen health systems, there is no established framework for doing so in LMICs, and no formula to apply, or package of interventions to implement. Every intervention, from the simplest to the most complex, has an effect on the overall system, and the overall system has an effect on every intervention. Systems Thinking works to reveal the underlying characteristics and relationships of systems (de Savigny and Adam, 2009). Systems thinking can provide a way forward for operating more successfully and effectively in complex, real-world settings that are non-linear, unpredictable and resistant to change, with seemingly obvious solutions sometimes worsening a problem. Systems' thinking has huge and untapped potential, first in deciphering the complexity of an entire health system, and then in applying this understanding to design and evaluate interventions that improve health and health equity. Development of methodological approaches for systems thinking is an opportunity. The discipline is in some aspects relatively new. While systems thinking in other fields/disciplines/topics have a long tradition, this is not the case within health policy systems research. It is important that we are part of the development of methodological approaches, such as realist evaluations and systems modeling.

Governance, accountability and participation are key areas in HPSR. These are broad issues and focusing on different levels (global, national, district) and programmes/ interventions (being part of implementation research) related to different functions of the system. Such research aims to understand gaps in current practices and also to strengthen processes. Antibiotic resistance has recently been presented by WHO as one of three main challenges to global health. To contain antibiotic resistance multi-level governance is needed. (Laxminarayan et al. 2013). Leadership has given its importance for health systems been surprisingly little studied. However, the next flagship report from the Alliance HPSR will have that as a theme for 2015. More is needed!

Emerging research areas include eHealth/mHealth, and the role it can play in strengthening the effective delivery and efficiency of health care services. While this field is in an early stage, it's likely to grow rapidly in the next decade, as mobile phone usage and network coverage is increasing exponentially each year. While mHealth solutions traditionally have stemmed from technical university research groups who have developed software solutions which have had limited relevance to the health practitioners, for which the solutions were intended, the trend is now changing towards more collaboration between health professions, medical and technical research institutions, and development of solutions that specifically address identified problems. The number of collaborations that have been established between e.g Karolinska Institutet and The Royal School of Technology show examples of such collaboration. NCDs and the health system implications of the epidemic of type 2 diabetes calls for social innovations not least in resource constrained systems developing "smart systems". Task shifting lessons learned from MCH research is an opportunity.

Recommendations

Greater investments in the field of HPSR are needed to address this situation. Global Health problems (and global health inequities) are global challenges, and concerns everyone, and therefore all countries have the obligation to meet those, regardless where we happen to be located on the globe (Global Health Action 2013). The moral responsibility should be shared based on the ability to contribute. Thus, there is a need to develop and maintain capacity for this also in Sweden. This could partially also be viewed in the perspective of a global "market" where we have a great potential to become a major "exporter" of capacity building in Health Systems-related knowledge services, which would benefit the Swedish economy (since the global community should be willing to pay for meeting global challenges if they can't provide the services in a more cost-efficient way) as well as providing needed services for better global health and health equity, and thus contributing to a global sustainable development.

Therefore it would be a great idea to further strengthen the capacity (i.e. human capital and infrastructure) of Swedish higher teaching institutions (HTIs) to provide such services. The EU is one of the world's most prolific funders of both research and development cooperation, but only very few actions relate specifically to HPSR in LMICs. (Quaglio et al. 2014) Sweden should use its political power to influence the agenda. The opportunity for reciprocal learning should not be missed. Inverse innovations include Europe benefiting from LMICs evidence e.g. regarding health care staff task shifting due to resource constraints to handle its own human resource challenges in the increasingly fragmented and costly health systems.

To facilitate the generation of demand for research evidence, efforts should be made to establish LMICs national platforms to identify research needs. Stakeholder consultations, open calls, and similar inclusive processes for priority setting could be used to systematically assess the needs. To increase the efficiency of existing resources, efforts should be made to allocate resources for HPSR as part of Sida programme activities (planning, implementation, and evaluation). Establishing designated line items for knowledge generation activities within programme budgets would ensure adequate funding for relevant research to inform these processes. To facilitate the generation of evidence that responds to complex health system challenges that can only be understood over an extended period of time, efforts should be made to establish flexible funding mechanisms that are not restricted to individual projects. Institutional endowments and/or cooperative agreements could be used by funders of research to support a range of trans-disciplinary research activities to address multi-faceted health system problems.

To strengthening HPSR, efforts should be made to advance methods and to increase peer-to-peer learning establishing linkages between researchers. Today funding opportunities for Swedish based doctoral and post-doctoral positions are few in this field. If we want to see a solid base of HPSR researchers able to collaborate internationally, there is a need to build capacity. Long term funding, ideally un-earmarked, to HPSR groups could help building up the Swedish resource base to deliver evidence for programmes and technical advisory services to countries and global institutions. Also supporting infrastructure for research in LMICs such as demographic surveillance sites is essential in order to strengthen national research. Implementing these recommendations will lead to the creation of a **continuous learning healthcare system**, or a “system that learns, in real time and with new tools, how to better manage problems” (Institutes of Medicine, 2012).

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ANNEX

Health system building blocks (Source: de Savigny & Adam, 2009:32.)



The Alliance for HPSR aims to promote the use of health policy and systems research as a means to strengthen LMIC health systems. The Alliance strives to achieve this goal by undertaking specific programmes to work towards three distinct, though related objectives

The major areas of the Alliance's work include:

Stimulating the generation and synthesis of policy-relevant health systems knowledge;

Promoting the dissemination and use of health policy and systems knowledge to improve the performance of health systems;

Facilitating the development of capacity for the generation, dissemination and use of HPSR knowledge among researchers, policy-makers and other stakeholders.

The Alliance has produced a number of reports and documents that are widely referred to and are regarded as seminal works in the field. Examples of these are given below:

Methodology Reader on HPSR: This publication aims to clarify and provide understanding, ideas and experience to strengthen the quality of HPSR. It includes a collection of peer-reviewed papers demonstrating the application of different HPSR methods. It is available at: <<http://www.who.int/alliance-hpsr/resources/reader/en/>>

Implementation Research Guide: This guide aims to respond to the growing interest in the field of implementation research and boost implementation research capacity, particularly in low-and middle income countries. It can be found at: <http://who.int/alliance-hpsr/alliancehpsr_irpguide.pdf>

WHO Strategy on Health Policy and Systems Research: The World Health Organization strategy on HPSR, the development of which in, the Alliance had a critical role, represents a unique milestone in the evolution of health policy and systems research. It calls for a more prominent role for HPSR at a time when the health systems mandate is evolving towards broader goals of universal health coverage and equity. The strategy is available at :

<http://apps.who.int/iris/bitstream/10665/77942/1/9789241504409_eng.pdf?ua=1>

Systems Thinking for Health Systems Strengthening: The Alliance's 2009 Flagship Report aims at building the capacity of both researchers and policy-makers to apply systems thinking principles in designing and evaluating health systems strengthening interventions. It is available at :

<<http://www.who.int/alliance-hpsr/resources/9789241563895/en/>>

Sound Choices: Enhancing Capacity for Evidence-Informed Health Policy: This publication explores capacity issues underlying different aspects of the relationship between two key groups – policy-makers and researchers – using a new conceptual framework. It is available at: <http://www.who.int/alliance-hpsr/resources/Alliance_BR.pdf>.

COMMUNICABLE DISEASES, VACCINES AND ANTIBIOTIC RESISTANCE

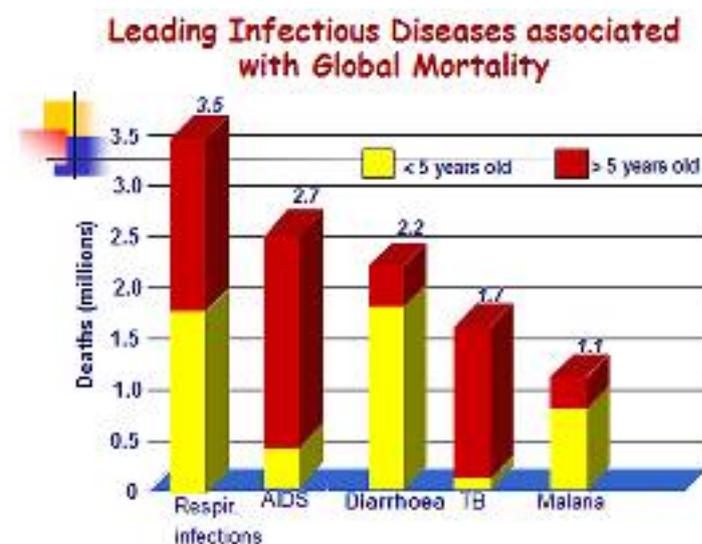
Key words

Malaria, TB, HIV, diarrheal diseases, pneumonia, vaccines, rapid diagnostics, antibiotic resistance (AMR), multidrug resistance, host-parasite interactions

Description of the research

Communicable diseases continue to be major causes of morbidity and mortality, in particular in people living in low and middle income countries (LMIC). Acute respiratory and diarrheal disease infections as well as malaria are major causes of death mainly in children below 5 years whereas other major communicable diseases such as HIV/AIDS and tuberculosis (TB) cause high mortality mainly in older age groups, even though morbidity in most communicable diseases often remains high in all age groups (Figure 1). Repeated or protracted enteric infections during childhood have also been recognized to be a major cause of malnutrition in the developing world. Expanded efforts to control communicable diseases are urgently needed and include needs for development of improved diagnostic tools for rapid identification of causative agents, development of new or improved vaccines, development of improved therapeutic interventions such as new antibiotics, antiviral and anti-parasitic treatments, and novel society-adapted methods for sanitation and vector control. Importantly, there is also a great need to make better use of already existing tools for control of these diseases such as intensified introduction of already available effective vaccines in control programs, better use of available epidemiologic tools, better control of antimicrobial drugs to reduce development of resistance, and expanded use of existing methods for sanitation, vector control etc.

Effective vaccines against most of these diseases are still lacking or not much used in LMIC and therapeutic interventions are progressively negatively affected by increased antibiotic resistance, particularly in the developing world.



Swedish research in communicable diseases

Researchers at most universities in Sweden are active in efforts to control several of the globally important communicable diseases as well as in generic efforts towards new or improved diagnostics, vaccines and therapeutics. Thus, Swedish research has for a long time been in the international forefront in

for example defining pathogenic and immune mechanisms in diarrheal and respiratory infections, malaria and HIV as well as in efforts to develop new or improved vaccines and therapeutic agents.

Research on specific infections

Malaria

Swedish malaria research, mainly at Stockholm University (SU) and the Karolinska Institute (KI), has since several decades been focused on defining immune mechanisms, and based on this vaccine development against different types of malaria, and on epidemiological and treatment studies predominantly in Africa. Recent internationally acclaimed work from KI includes studies of the molecular pathogenesis of malaria with a focus on binding of the parasites to identified surface molecules of the infected red blood cells causing cell clumping (rosetting). These studies form the basis for the ongoing development of an anti-rosetting vaccine as well as receptor based drugs (1; Wahlgren M). A new drug against malaria, Sevuparin, a heparin derivative aimed at inhibiting parasite adhesion to blood cells has been developed by a Swedish biotech company (Dilafor AB) formed jointly by scientists from KI and Uppsala University (UU) and is presently subjected to a large Phase II trial in India. Other important malaria research e.g. at SU and KI includes studies of potential protective immune responses (2; Färnert A), malaria in pregnant women and studies of the genetic diversity of malaria parasites (3; Troye-Blomberg M), development of improved rapid diagnostics and evaluation of different treatment regimens (4; Björkman A). The Swedish malaria research is based on close collaboration with several of the leading malaria research groups in African universities, e.g. in the Makerere university in Uganda and different universities in Mali and Burkina Faso; these collaborations include extensive exchange between Swedish and African scientists and students.

Diarrheal diseases

Swedish researchers at University of Gothenburg (UG) are in the international forefront for their work on pathogens causing diarrhoeal diseases and vaccine development against such pathogens. In early studies they defined the main pathogenic and immune mechanisms in cholera and based on that led the development of an internationally widely licensed, drinkable (oral) cholera vaccine (Holmgren J). Through UG- and Sida-supported technology transfer to different LMICs a modification of this vaccine is now also being locally produced and used in e.g. Vietnam, India and Bangladesh. Work is also in progress to develop a simplified, inexpensive, single strain oral cholera vaccine, potentially also containing a novel mucosal adjuvant, for use both against endemic cholera and in cholera epidemics (5; Holmgren J et al). Further development and clinical testing of this vaccine is underway in collaboration between UG and institutions in India and Bangladesh. Intense efforts have also been made during more than 20 years to develop a vaccine against enterotoxin-producing *E. coli* (ETEC), which is the most common bacterial pathogen causing diarrhoea in children in LMIC as well as in travellers to these regions (6; Svennerholm AM). While a 1st generation oral ETEC vaccine had promising protective activity in travellers it failed to induce adequate protection in the globally primary target group, i.e. young children. A second generation oral Multivalent ETEC vaccine with improved composition has now been developed in collaboration between UG and Swedish vaccine industry (Scandinavian Biopharma), which in clinical studies in Swedish adults has proved to be safe and strongly immunogenic. Studies are now underway to evaluate the vaccine further for safety and immunogenicity in age descending groups in Bangladesh as well as for protective efficacy in travellers. Extensive collaborative studies between researchers at UG, the Sanger Institute in UK and institutions in India and Bangladesh investigate the genetic diversity and spread of particular clones/lineages of cholera and ETEC bacteria globally and over time, and also the genetic basis for individual host susceptibility to infections by these pathogens.

At Linköping University (LiU), in collaboration with UG, exciting research tries to define the mechanisms behind vomiting and diarrhoea caused by rotavirus (RV) and norovirus (calicivirus) with a focus on interactions between the gut and the nervous system (7; Svensson L). These studies have elucidated how RV activates the enteric nervous system resulting in vomiting and form the basis for now

ongoing clinical trials to test if a serotonin (5-HT₃) receptor antagonist can prevent both RV- and norovirus-induced vomiting.

Acute respiratory infections

Swedish research on acute respiratory infections is to a large extent focused on bacterial pathogens causing pneumonia, in particular *S. pneumoniae* and nontype B *H. influenzae*. Internationally strong research at KI and Lund University (LU) is studies on the molecular epidemiology and pathogenesis of such infections, from clinical studies to more basic research focusing on host-pathogen interactions. These studies include identification of pneumococcal serotypes and clones prone to give rise to invasive infections and identification of novel virulence factors and surface structures that may be candidate antigens for new pneumococcal and *Hemophilus* vaccines (8; Henriques-Normark B, 9; Riesbeck C). Other research includes studies of the capacity of type III secretion inhibitors to protect against invasive Group A streptococcal infections with the aim to identify alternatives to antibiotics for treating life-threatening infections.

Tuberculosis

Sweden has a long tradition in internationally highly recognized TB research with development of effective drugs such as PAS against tuberculosis. The for a time less active Swedish TB research has been intensified during recent years based on the alarming increase of multidrug resistant *Mycobacterium tuberculosis* bacteria (MTB), including the extremely resistant, so-called XDR-TB (Världsinfectionsfonden). Thus, intensive efforts are underway to evaluate alternative strategies for the treatment of these bacteria and to identify new treatment approaches (10; Hoffner S; 11; Maeurer M). TB researchers at KI and KTH are also engaged in developing tools for rapid identification of TB in infected individuals through use of new and improved DNA-based (Andersson-Svahn H, KTH) as well as immunological methods (Källenius G, KI, Stendahl O, LiU). Other research aims at identifying protective cell-mediated immune responses against TB as a basis for vaccine development, including the induction and regulation of antimicrobial effector functions in macrophages and T cells at local sites of *M. tuberculosis* infection (12; Brighenti S & Andersson J). Swedish TB researchers collaborate closely with several European as well as African and Chinese TB research groups.

HIV/AIDS

Ever since the identification of HIV and AIDS in the early 1980s Swedish researchers, in particular at KI, have been very active in HIV/AIDS research. The research has been focused on the effect of HIV on the host immune response (13; Broliden K), immunodiagnostic methods (14; Albert, Hinkula J) as well as possibilities of inducing effective mucosal immune responses against the virus (15; Spetz AL, Chiodi F). Vaccine development efforts have in particular been focused on the development of DNA-based vaccines (16; Wahren B, Sandström E), some of which in combination with established HIV treatment (e.g. ART) have been subjected to clinical trials with promising results. Swedish HIV researchers are also active in evaluating different treatment strategies, in studies of transmission of HIV between mother and child (17; Biberfeld G, Ekström A-M), and examining the role of different co-infections on the severity of HIV infections, in particular TB, but also various sexually transmitted genital infections (18; Källenius, Maeurer). Studies at UG have focused on HIV infections in the central nervous system and the diagnosis and treatment of such infections (19; Gisslen M). The Swedish HIV research has close and productive collaboration with leading HIV research centres abroad, both in USA and Europe but also importantly with centres in Africa, in particular in Tanzania but also in several other sub-Saharan countries.

Helicobacter pylori

This is the most common human pathogen in the world with more than 80% of the population being infected in many LMIC, as compared to only 10 -20 % in Sweden and comparable industrialized countries. Infections with *H. pylori* cause peptic ulcers in ca 15 % of all cases and gastric cancer in 1-2 % (the second most common cause of cancer in the world with more than 500,000 cases per year). Since the per se usually effective triple chemotherapy has poor compliance and also is threatened by emerging antibiotic resistance, research groups at especially Umeå university (UmU) (Borén T) and UG (Holmgren J) in Sweden are since long engaged in research to better understand protective and potentially harmful immune mechanisms and, in collaboration with partners in LMIC, in vaccine development.

Research on antibiotics and other antimicrobial agents

WHO and also EU have recently both of them classified antimicrobial resistance (AMR) as one of the major threats to global health both in industrialized countries and in LMICs. Combating AMR at an international scale is also a recognized a high-priority task in Sweden. The international secretariat of “ReACT – Action on Antibiotic Resistance” is hosted by Uppsala University (UU), and recently also 19 EU member states have launched a special initiative (Joint Programming Initiative on AMR) under Swedish chairmanship to integrate relevant scientific fields across national borders and to create a common European research agenda with a shared common vision.

UU researchers have over a long time studied pharmacokinetics and pharmacodynamics of antibiotics, optimal antibiotic dosing regimens, rational use of antibiotics and AMR epidemiology (20; Cars O). Other groups (Andersson D et al), using a combination of genetics, physiology and experimental evolution, have examined factors that influence the evolution of AMR in several bacterial species, e.g. how various types of resistance mechanisms affect bacterial fitness, how bacteria can compensate for these fitness costs, and how AMR affects disease development and bacterial transmission. In Stockholm AMR research is focused *M. tuberculosis*, with a special emphasis on multi-drug resistant *M. tuberculosis* (10; Hoffner S).

Research at UG showing that discharges from pharmaceutical industry into the environment, e.g. in India, and spread of AMR genes from environmental organisms into human pathogens may have profound effects on the emergence of AMR has attracted great international attention (21; Larsson J). Release of large quantities of antibiotics in hospital-waste water in India with similar risks of AMR spread has also been demonstrated by KI researchers (22; Diwan V). Studies conducted at UU have indicated that drug-polluted environments with non-lethal antibiotic concentrations may promote antibiotic resistance (23; Andersson D), and researchers at KI have further shown that the excessive antibiotic treatment of domestic animals is an important contributor to AMR (24; Stålsby-Lundborg C).

UmU has several projects aiming at developing novel antimicrobial as well as antiviral drugs with reduced risk of AMR development. One project, "New strategies to disarm bacteria" (Bergström S), will instead of finding agents that kill bacteria focus on disarming bacteria and prevent them from causing an infection. The aim of this approach is to develop a completely new type of antimicrobial substances which can block the development of resistance based on chemical molecules called 2-pyridones. In earlier preclinical studies it was found that such substances could prevent bacteria from causing urinary tract infection. The team will now study the effect of these molecules on several other types of pathogenic bacteria, both alone and as enhancers of drugs that are already on the market, e.g. earlier results have shown that 2-pyridones can enhance the effects of Isoniazid, an antibiotic used to fight tuberculosis. Another project at UmU, "New drugs against viral infections of the respiratory tract and eyes" (25; Arnberg N, Eloffsson M), focus on identification of natural and synthetic molecules that can specifically inhibit cell-binding of viruses that cause infections in the respiratory tract and eyes, specifically influenza virus, adenovirus and picornavirus. This knowledge may then be used to develop new drugs for the treatment of the virus infections. A similar approach is taken by researchers at UG for identifying receptors and testing receptor blocking in the intervention of norovirus infections causing “winter vomiting disease” (26; Larson G).

Researchers at LU are also taking an unconventional, although different approach to the development of novel antimicrobials. They have found that during an infection the body, through activation of the innate immune system, induces proteolytic cascades involving the complement and coagulation systems that generate a large number of novel host defence peptides (HDP) with antimicrobial and immune-modulatory activities. They will define and synthesize such natural antimicrobial peptides and analogous potentially even more active compounds for treatment of infections. In the long run, such “natural” strategies may be more effective and sustainable than today’s use of antibiotics. Work at KI, in collaboration with researchers in Bangladesh, has been conducted to evaluate the role of different antimicrobial peptides of the innate immune system, e.g. LL-37, for their capacity to inhibit *Shigella* and enteropathogenic *E. coli* (EPEC) experimental infections (27; Agerberth B).

Infrastructural needs

Equipment for molecular studies

Much of current research on communicable diseases make use of the powerful modern molecular tools for “-omics” studies (genomics, transcriptomics, proteomics, metabolomics etc.). Hence there is a need for most research groups in the field for access to state of the art equipment and technical as well as bioinformatics expertise/support for internationally competitive studies on e.g. the genetic diversity and epidemiologic spread of microbes, identification of virulence factors, molecular studies of antibiotic resistance, host genetics etc. Such **platforms for molecular studies** are progressively being built up in several universities in Sweden, most ambitiously represented by the SciLife organisation in Stockholm-Uppsala and with special nodes at other universities. Advanced molecular services are also increasingly being made available through biotech companies. The main needs now may not be in major further investments into the hardware, but rather in increased project funds to make broader use of existing facilities and to get access to local expertise for help with interpretation of data.

Biobanks

Communicable disease research is strongly dependent on biological material from affected areas/populations (microbial strains, clinical specimens, specimens from environment etc.). To facilitate research on such material, and in particular clinical specimens, it would be important to support build-up of relevant biobanks, ideally **national biobanks**, and mechanisms facilitating exchange of material between different universities in Sweden as well as with collaborating institutions in LMICs.

Biostatistics

There is an increased demand of appropriate expertise in biostatistics and system biology for both the design and data management, including publication of research on both epidemiological and laboratory-based research on communicable diseases. Access to state of the art expertise in biostatistics is - or will soon be - compulsory for publications in internationally high ranked journals and the same holds true for bioinformatics and systems biology in especially “-omics”-based molecular research. Hence there is a need to strengthen access to such expertise, preferably by establishing core **facilities for biostatistics, bioinformatics and systems biology** accessible to the different research groups in the field.

Collaboration with LMICs

Internationally competitive research on communicable disease, with particular relevance for LMICs, is conducted at most universities in Sweden and many Swedish groups have extensive and often longstanding collaborations with research groups in different LMICs, particularly in countries in sub-Saharan Africa (e.g. Uganda, Tanzania, Mozambique, Burkina Faso, Mali) and East Asia (e.g. India, Bangladesh, Vietnam, Nepal) but also in Latin America (e.g. Nicaragua, Bolivia, Brazil). These interactions are in most cases extremely valuable for both the Swedish and the international partners allowing **technology transfer in both directions** as well as increased understanding for research opportunities and limitations, including social and religious barriers or sensitivities, in the respective country. Such interactions should be further **extended** - in particular with regard to **student exchange**. Thus, intense efforts should be made to stimulate more PhD students and postdocs from the Swedish groups to study or work for extended periods, at least 6-12 months, at a collaborating institution in an LMIC or at an international centre of excellence in the South where major communicable disease problems are studied (this is already in progress at e.g. KI, UG, UU and LU but should be expanded). Similarly, students and postdocs from collaborating LMIC group(s) should be offered to work for extended periods at the collaborating Swedish universities. Such interactions will be facilitated by establishment of **sandwich programs** that will require specifically allocated funding (for stipends, guest service support etc.). Interactions between Swedish researchers and students in the field of communicable diseases are already facilitated through annual meetings supported by the Swedish Research Council and other sources, e.g. the Planning group for gastrointestinal inflammation and infection, the National doctoral programme in Infection and antibiotics, the Swedish research school for Global health etc. Many of these meeting activities are also attended by researchers and students from collaborative institutions in LMICs. The Swedish Research Link program allows increased interaction between Swedish researchers and their collaborative LMIC partners. However, there would clearly be a need for expansion of such exchange programs, e.g. by **specific calls** for meetings and researcher/student exchange within the field of Global health communicable diseases.

Several groups in the field are also affiliated to Centres of Global health, e.g. IHCAR and Infection biology at KI, the Centre for Global Health and The Laboratory for Molecular Medicine Sweden (MIMS) in Umeå; other universities should be stimulated to establish similar centres and national networks for communicable diseases, vaccine development and antimicrobial research.

Strengths and weaknesses

Examples of Swedish research that for a long time has been in the international forefront of communicable diseases related to LMICs include the research on malaria at KI and SU, the diarrheal pathogen and vaccine research at UG and the HIV vaccine research at KI. However, in all these fields there is clearly a need for “regrowth” of a new generation of younger researchers to ascertain continued excellence, as is also the case in the important TB field. The age problem and need for a new generation is also soon affecting the increasingly excellent research on acute respiratory infections and parts of the now increasingly active and successful Swedish programs on antimicrobial research. Sweden was for a long time a top nation and model for others when it came to bringing many of its best scientists, and then especially in the field of communicable diseases, into addressing diseases and problems of special relevance for LMICs and global health, but this is no longer true to the same extent, most likely due to mainly economic and political reasons. The strong Swedish science in global health which was largely built up in the 1970s and 1980s was heavily negatively affected by the economic crisis in Sweden in the 1990s, and added to this the dismantling of first SAREC and then Sida’s research department as discussed below. The next generation researchers recognized that survival in global health research in Sweden had become precarious and felt forced to go into other fields with better long-term funding opportunities.

Trends, tendencies and prognosis for the future

Regrettably, partly due to the disappearance of SAREC followed by the progressive dismantling of the research department at Sida, much of the Swedish research on LMIC problems, including research on communicable diseases with special relevance for LMIC, has decreased both quantitatively and qualitatively during recent years related to the drastically decreased opportunities for funding. This has also substantially reduced the weight of the Swedish voice in international organs, especially WHO. On the positive side internationally, one can mention the important roles of organisations such as GAVI for helping LMICs to purchase established vaccines and to introduce some of the newer ones (pneumococcal, rotavirus and *Hemophilus* type B vaccines), the Bill and Melinda Gates Foundation (BMGF), US NIH, PATH and EU. However, GAVI does not support research and the other organisations, while having been helpful in financially supporting a few - and in the case of EU several - established Swedish researchers/groups, grants from these organizations have been/are less accessible to young or less well known researchers.

Equally important to avoid the otherwise inevitable risk of a declining and poor development of what has been such a strong Swedish profile in global health research is to overcome the poor regrowth of researchers in the field. Thus, most of the leading Swedish groups today are led by researchers aged 60+ and there are currently not any strong indications that a **new generation** is prepared to take over, at least not in the programs demanding close and long-term collaboration in and with LMICs. Therefore, it is extremely urgent to secure, by means partly discussed below, the **regrowth** of strong, internationally competitive researchers in the field of communicable diseases with special relevance for LMIC.

Recommendations

The probably most important need today to maintain and strengthen Swedish research within the field of communicable diseases including vaccine development and antimicrobial research is to find means to stimulate on a much higher level than seen to-day the **regrowth of researchers/group leaders** interested and capable of conducting internationally competitive research in the field. This will require

possibilities for **career development** through establishing **special positions** for young researchers (fo.ass./assistant prof.), **positions between assistant professor (forskarassistent) and full professorships** (when many young talented researchers disappear from academia or at least go into other fields), and full professorships for the best talents. Previously, when Swedish research in the field was built up to high international competitiveness, this was achieved to a large extent by the fortuitous fact that some of the very best Swedish scientists in microbiology, immunology, epidemiology and pharmacology were stimulated to enter into the field, when already being well established scientifically, and often leading their own institutions where they could foster an infrastructure and promote career positions in LMIC-related communicable disease research. At the time there also existed at least some “institution strengthening” financial support from SAREC to build and maintain successful LMIC-relevant scientific milieus. With a new situation where most of the previous pioneers in the field have already retired or will do so soon, and with the disappearance since long of this kind of support from Sida or elsewhere, the current situation is bleak. The existing good milieus are practically in all cases under severe threat to soon vanish.

It may also be necessary in Sweden, as in many other countries, to **establish physical**, or for the Swedish case arguably better **virtual institutions**, specifically devoted to “**geographic medicine**” or “**global health**” with adequate **basic funding** including positions for keeping Sweden alive in the field; needless to say communicable diseases should be an important subject in such institutions.

Another important activity to strengthen the research on communicable diseases in Sweden would be to implement an **office/organization** with staff knowledgeable in the field and with good connections and knowledge about the opportunities for this type of research. Such an organization should not only be updated on international and Swedish **funding opportunities** but also give **advice** on suitable collaborating partners/universities in LMIC and **assist in** organizing **exchange** between Swedish and LMIC researchers and students. This could include assisting young Swedish researchers to establish collaboration with European and international research groups, e.g. there may be excellent opportunities for Global Health and vaccine research together with Norwegian researchers through the Norwegian research council GLOBVAC program and with different EU groups through participation in a new call within Horizon 2020 on “Personalising health and care” which includes support for breakthrough research and innovation in poverty related and antibiotic resistant infectious diseases (e.g. vaccine platforms for HIV/AIDS and tuberculosis). Other funding opportunities include regular calls from BMGF on Grand challenge projects.

Other important activities include to recruit students to the field of Global Health disease research include intensified **information activities, special courses** during undergraduate education, **master programs, research schools** etc. Several such activities are in progress but clearly need to be expanded and supported.

Planning grants to facilitate establishment of internationally competitive collaborating projects between research groups in Sweden and LMIC as well as other international groups will also be important to stimulate new projects, in particular translational research activities.

Most importantly of all however, is to **substantially increase the Swedish funding** of research on communicable diseases, vaccines and antibiotic resistance with focus on LMICs.

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NON-COMMUNICABLE DISEASES, MENTAL HEALTH AND SUBSTANCE ABUSE

The following questions are designed based on Swedish Research Council's mission and refer in this case only the research areas of chronic diseases (limited to CVD and diabetes), mental health and substance abuse (including alcohol, tobacco, illicit drugs and betel nuts).

Keywords

Social determinants, intervention, implementation research, capacity building, interdependent partnerships

Description of the research

This inventory is based on both scientific publications and on assessments and suggestions from responses from national and international experts and includes the research areas of non-communicable diseases (limited to CVD and diabetes), mental health and substance abuse (including alcohol, tobacco, illicit drugs and betel nuts).

Non-Communicable Diseases (NCD), including cardiovascular disease (largely heart disease and stroke), cancer, chronic respiratory diseases, and diabetes, cause two of every three deaths each year. The massive global toll of NCD deepens poverty, impedes development, threatens health systems, and is a major cause of disability and health inequality. The last two decades have shown a rapid increase in NCD mortality primarily in middle-income countries. It is more difficult to assess if development in low-income countries is showing a corresponding pattern, due to insufficient mortality data. Based on WHO data, it is evident that nearly 80 % of all NCD deaths occur in low-and middle-income countries (LMICs). NCDs affect middle age to a large extent as one third are people younger than 60 years. It is essential to better ascertain the social and individual causes of the drastic increase in CVD, especially among younger individuals (< 60 years) in LMICs where the vast majority of all deaths from stroke and heart attack take place.

Mental, neurological and substance abuse disorders constitute an unmatched burden of disease globally and are the cause of a huge amount of disability and disease throughout the world. To date, these conditions have not been given sufficient attention in development research. In Africa, where mental disorders account for a substantial proportion of the burden of disease, less than 1% of national health budgets are spent on these disorders. In communities in which they live, and even in the health care system, patients, their families and caregivers are frequently stigmatized and discriminated against, and it is often assumed that little can be done to address their conditions. A growing body of scientific evidence shows that much can be done, at moderate cost, and with significant economic benefits to countries, while reducing suffering, and improving or even saving the lives of those who are affected.

There are major Swedish research collaborations with universities in LMIC within the NCD area. Some Swedish research groups have focused their research collaborations on more general NCD primary prevention interventions (mainly focused on lifestyle interventions), while others have collaborated in disease specific programs (secondary prevention) addressing, for example, new approaches for diabetes prevention. Other projects have focused on improving mental health (combating structured violence, suicide prevention among adolescents, or reduced alcohol consumption) or on research collaborations where Swedish universities are partners in multi-center studies in which, inter alia, societal and individual factors behind NCD are identified and compared.

However, this research is not reflected in project applications till SIDA/ SAREC and VR. A review of project applications over the past decade submitted to these councils shows that only a few have addressed development research on NCDs, mental health and substance abuse. One possible explanation could be that the researchers have interpreted the announcements not to be focused NCDs, mental health and drug abuse. Given this, it is less meaningful to separately assess the Swedish development research in the areas of

NCD, mental health and substance abuse, as long as research project on mental health and substance abuse has been so rare.

Development research has in many respects a broad perspective of great importance to academic environments. The different issues it covers enrich our thinking, create opportunities for comparisons between different settings, and can thus help to better understand the significance of cultural and socio-economic conditions for the origin, development and treatment of various disease conditions. Creative and stimulating research collaboration requires a common understanding of problem areas, research questions, methods, etc., which in turn both require time, venues and financial resources.

Sweden and other Western countries have long experience in the prevention and treatment of NCD. These experiences are available for exploitation in the form of research collaborations around the methodological and analytical models for context relevant action. Overall, it is of extreme importance for Swedish universities to build up leading international positions in global health research. The health transition in LMICs is occurring surprisingly fast and Sweden has every reason to pay attention to the strategic importance not to be left behind in this growing and critically important area of research.

The experts consulted for this report warn that development research is linked too strongly to development aid policy, and this could result in a significant limitation on opportunities for research collaborations around both NCD, mental health and substance abuse. If calls for research are formulated quite generically, and are not specifically linked with topical policy formulations, its relevance becomes far greater. The ultimate goal should be to widen VR's responsibility in terms of development research, to apply knowledge building that is generally useful for LMIC needs, and not solely guided by Swedish development aid policy goals.

Capacity building is a key issue for the future. Capacity must be developed in close collaboration with universities in LMIC. The aim should be to develop research infrastructures in LMIC that provide capacity to customize methods that can feasibly be applied in the local context, and to provide guidance on the implementation of relevant methods. This in turn highlights the importance of development research policy also allowing for a matching capacity building within Swedish universities.

Recently, a U.S. analysis concluded that there remains a huge deficit in education and training in chronic diseases in LMICs, especially in the public health sciences such as epidemiology and community health. Contributing to this is the "brain drain" of people who acquire skills only to move to higher income countries. Research in epidemiology/surveillance at the country level constitutes another shortage area, as is the science of the implementation of programs in the local context. The role of individual countries' culture, economy, climate, etc., on chronic disease policy implementation is poorly understood. Capacity building requires partnering for the long term, which in turn entails the development of inter-institutional programs rather than single disease-centered projects.

The needs of new knowledge both regarding NCD, mental health and substance abuse is similar everywhere in the world. Countries have much to learn from each other. Although there are large variations in culture and tradition, a number of countries are committed to finding improved methods and policies, for example, to counteract obesity, to stop the smoking epidemic, and to combat drug abuse. Rather than identifying the specific development aid policy relevance in these issues, national Swedish research policy should highlight the global nature of these issues. All VR calls ought to be opened to applications to meet these challenges, regardless of whether the application is addressing projects in LMIC or Sweden.

Strengths and weaknesses

Both national and international experts prioritize intervention research aiming to implement practices with lasting impact, as a core task, in terms of NCD, mental health and substance abuse. There is a big knowledge gap on which interventions work best and in which contexts. Understanding of local contexts that might influence the effectiveness of an intervention is critical, as it generally not is feasible to import an intervention that was successful in one place into another setting or context, without first adapting it to local wisdom and needs. Formative research in the development of interventions is a fundamental requirement.

A particular challenge is to transfer research results into policy. Health policy research goes beyond medically-oriented epidemiological analyses and studies of social determinants of health, as it also must be

extended via, for example, legislation and social science. Thus it should include cooperation with political science, law, communication research, anthropology, cognitive science and IT.

Swedish universities have extensive research collaborations in NCD research with universities and Ministries of Health in LMIC via the INDEPTH Network, a unique, global association of 49 field sites in 20 countries. Through these systematically developed health and demographic surveillance sites, health data with similar content are collected to illustrate health conditions and development trends in each site, thus providing the basis for comparisons between regions and over time. A relatively large proportion of doctoral dissertations in Swedish universities use NCD-oriented, empirical data from these collaborations.

A number of examples illustrate how Swedish universities over the years, through support from SIDA, have been engaged in efforts to build research capacity in LMICs. These collaborations have resulted in significant added value for the collaborating Swedish researchers. Unlike many other universities in the western world, Swedish universities strive to prevent "brain drain", notably by designing doctoral training that enables the PhD-students to spend most of their time in their home environment for data collection, and after the defense return to the home university and to a more advanced position in teaching, research or other official missions. Thus, graduate education constitutes an important asset in the development cooperation between Sweden and LMIC.

Within a 5-10 year perspective, research into NCD, mental health and substance abuse in LMICs will increase significantly in pace, with a commensurate need to translate research into action. Decisions on actions at all levels of the community must be grounded in evidence from research, and this knowledge has to be translated into action through innovative approaches in the context of low and middle income countries. Swedish universities can support LMICs in building capacity for epidemiological and health system research, including the analytical and operational research required for program implementation and evaluation in the area of NCD.

Trends, tendencies and prognosis for the future

In recent years, SIDA has supported several Partner Driven Cooperation projects in order to utilize research findings to move from words to action. In several LMICs this has supported the development of multi-sectorial collaboration on the prevention and control of NCDs. Through workshops with multi-sectorial actors from governmental institutions, academics, industries, NGOs, and lawyers, this process has been focused on (i) the review of existing evidence on the burden, the risk factors, the management, and the intervention/prevention strategies for NCDs; and (ii) to build networks to increase the policy capacity for evidence-based decision making among policy makers and other stakeholders on NCDs.

The general area of global health, and the role of universities in it, continues to evolve from one of development aid to international cooperation and global solidarity. Swedish Universities can be at the forefront on this new thinking of global health – beyond that of single disease programs to that of interdependence with low and middle income countries. NCDs, mental health, and substance abuse highlight the need for an interdependence model, as chronic disease risk factors are increasingly affected by economics, politics, trade, and media exposure. Therefore, the non-communicable disease agenda for Swedish universities cannot add much using uni-dimensional programs, as compared to the potential that could be attained through interdependent partnerships across sectors of health, economics, etc.

The challenge is to identify what really works, mainly in terms of prevention (in relation to the many strong social determinants of ill-health in LMICs that are the result of powerful globalization forces), but also, within the health system, in terms of ensuring that people have access to proper diagnosis facilities, follow-up and treatment. It is important that the research into these topics is not 'siloe'd', or disease-specific, but rather that it represents real efforts by VR to facilitate broader, cross-cutting research on identifying and addressing the social determinants that cause them (as well as causing wider social problems). Thus efforts should be made to support operational research with innovative community-based organizations that are addressing the conditions that lead to NCDs, mental health and substance abuse.

Research collaborations widen the perspective and understanding of both research and social conditions, as well as of the cultural contexts in the partner countries. Thereby they create the conditions for allowing applicable knowledge in return for Sweden, or so-called "mirror research". They build networks of research

departments that would otherwise have been beyond the reach of most academics, and they increase the capacity of academic scientists to be exposed to and to communicate with policymakers, a skill which is not nurtured sufficiently in many academic settings.

The evolution away from developmental aid toward international cooperation and/or global solidarity requires closer partnerships between high-income countries' universities and their counterpart organizations in low and middle income countries. This includes more integrated research, education, policy, and healthcare services programs. In such a model, there may be umbrella relationships with selected organizations with whom a working relationship has succeeded, rather than a large number of "one-off", transient projects with no follow-up. This would also provide a better long term infrastructure for allowing for student exchanges, clinical services expansion, clinical trial development, etc.

For the future, an obvious need is for surveillance of non-communicable diseases, mental illness and substance abuse. A particular need is to identify geographic, gender, ethnic, age, religion, or other subgroups at especially high risk, and for research into the causes of any disparities identified. Media and health education is usually culturally linked, and much research is needed to evaluate specific interventions to change behaviors in various cultural settings. The provision of essential health services represents a huge area with which implementation science should engage.

Many countries have professional societies, but these mostly fall far short in terms of implementing evidence-based guidelines. Various methods of bringing about evidence-based guidelines have demonstrated good success in high income countries, but rarely in the context of low or middle income countries, or in different healthcare systems. Finally, advocacy and policy change would provide numerous research questions as to model policies which might be exported from one country to the next.

The more basic science research opportunities frequently involve molecular epidemiology studies to understand why a low or middle income population has an exceptionally high or low risk. The basic science infrastructures for the study of molecular mechanisms of disease already present in wealthy countries would be hard to justify in low-income countries in the face of other opportunities for these countries to develop more context-specific knowledge on tackling chronic diseases.

Recommendations

- Concentrate resources on a limited number of research partnering universities in low or middle income countries for long-term development of research, education, and clinical programs.
- Support education and training programs which would discourage the "brain drain".
- Identify unique opportunities for research on the basis of high/low risk populations, unique healthcare or education systems, unusual environmental factors impacting chronic diseases, and policy infrastructure's gaps and opportunities for change.
- Provide incentive to form inter-university teams with funds for pilot studies, graduate student training, core facilities, etc.
- Make core facilities in Swedish Universities available to low and middle income universities as a means to further collaborations.

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MATERNAL, REPRODUCTIVE AND CHILD HEALTH

Keywords

Maternal health, Reproductive health, Stillbirths, Neonatal mortality, Under-five mortality, Child health and development, Maternal and Child Nutrition, Developmental Origins of Health and Diseases, Intervention studies, Implementation research

Description of the research

The overall aim of Swedish support to research and research capability strengthening covered by the developmental budget is to *strengthen and develop research of relevance for poverty alleviation* in low-income countries (Strategy document for Sida support to research 2010-2014). This objective closely links to the Millennium Development Goals (MDG) 1990-2015 that have poverty alleviation as the overarching goal. Several other MDGs address global health issues of importance for poverty alleviation. For maternal, reproductive and child health MDG4 (child survival) and MDG5 (maternal health) are of special relevance.

Maternal, reproductive and child health (research) are partly overlapping concepts. Maternal health refers to the health of women during pregnancy, childbirth and the postpartum period. Reproductive health is broader and implies, in addition to aspects of maternal health, that people (men and women) have a responsible, satisfying and safe sex life and that they have the capability to reproduce and the freedom to decide if, and how often to do so. Universal access to reproductive health was agreed upon in the Population and Development conference in Cairo in 1994 and added, with an initial delay, to the MDGs. Reproductive health often includes aspects of newborn health. Child and adolescent health covers the age interval from birth to 19 years, where newborn health (the first month) has received increasing attention recently but where adolescent health (10-19 years) still may be seen as a neglected age interval in global health. In this review some aspects of global nutrition research will also be included due to its paramount importance for global health, especially for maternal and child health, and its absence from the overall list of reviews.

There has been an accelerated reduction in maternal deaths since the MDGs were formulated, especially evident in Asia (1). Bangladesh is one of the estimated 15 countries that will reach the MDG5, and a recent analysis points at a combination of improvements within and outside the health sector as plausible reasons to this progress, providing a rationale for a broader development agenda along with universal coverage of good-quality reproductive health services(2). Also child survival has shown an accelerating improvement after the millennium shift, with most of the decrease in mortality after the neonatal period (3). The highest maternal, newborn and child death rates and the highest absolute numbers of deaths are found in sub-Saharan Africa and South Asia, with 10 countries having almost two thirds of the global maternal and newborn deaths as well as stillbirths (3). Children before the age of five years constitute less than a tenth of the global population but generate one quarter of the total global burden of diseases. Neonatal conditions alone (first month of life) result in almost a tenth of the global disease burden. Annually there are three million neonatal deaths, most of which occur in low- and middle-income countries. In addition, there is almost the same number of stillbirths, a neglected problem in research as well as in health programs. Undernutrition (consisting of foetal growth restriction, stunting, wasting, deficiencies of vitamin A and zinc and suboptimal breastfeeding) accounts for about 45% of mortality before the age of 5 years(4). In addition, research is accumulating that foetal and young child undernutrition, reflected in a sustained high prevalence of stunting in low- and middle-income countries, is causally linked to the current epidemic of type 2 diabetes and other non-communicable diseases in countries with an ongoing rapid epidemiological and nutrition transition(5,6).

Global health research has suffered from what has been labelled the “10/90 gap”, i.e. that only 10% of global health research resources are used to address the health problems of 90% of the world

population(7). Some progress in resolving these inequities in the fields of maternal, reproductive and child health research has been made in the latest decades(8). The Lancet series analysing magnitude of the problems, potentials for change and research gaps have been of major importance for this positive development, e.g. the series on child survival(9), the repeated series of papers on neonatal survival (10), on maternal mortality(11), on maternal and child nutrition(4) and on child development(12). Another important contribution to global health progress in this area is the *countdown* reports that analyzes the global health situation in relation to the health-related MDGs(13) and the increasing awareness and studies of equity in maternal and child health(14). A common conclusion in most of these publications is that there are a large number of evidence-based and cost-effective interventions that has the potential of substantially reducing mortality and health problems in the field of maternal, reproductive and child health, but there are priority research questions in reducing the *know-do gap*, i.e. how to deliver these interventions. In contrast to these expressed priorities a major part of funding and global health research efforts are still devoted to *discovery*, with less emphasis to *development* of feasible interventions or to issues related to *delivery* of interventions (i.e. implementation research)(15-18).

An analysis based on a consultative process of research priorities in sexual and reproductive health in low- and middle-income countries underlines the need for research that translates evidence into practice, studies that address questions related to scale-up of evidence-based interventions or that deals with issues related to the integration of services, e.g. the linkage of HIV services to other reproductive health services. In line with this a recent analysis of global newborn health research priorities ranks research areas related to delivery of services highest and stresses the importance of allocation of resources to these types of research for further reduction of child mortality(16). In the field of childhood pneumonia research on barriers to care seeking, access and scale up of interventions was getting top priority(19), and research on implementation of evidence-based interventions was also prioritized in the field of childhood diarrhoeal diseases(20). An expert-led process for identifying research priorities in adolescent sexual and reproductive health in low- and middle-income countries ranked research questions related to scale-up of existing interventions high(15).

Sweden through Sida/SAREC has been a pioneer in actions against these disparities in global health research. At the global level it contributed to the establishment of several international bodies that work for a fair distribution of global health research resources, and was a very important voice in global health research policy formation. Within the various bilateral development collaborations ambitious and long-term efforts have been made to build research capacity and infrastructure for research (within this field an example is the build-up and support to health and demographic surveillance systems). The Swedish universities have very actively contributed to this by long-term collaborative research and research training with the unique “sandwich” model (i.e. continued work at the home university interfoliated by shorter or longer periods at the Swedish university). Within the field of maternal, reproductive health and child health there are several examples of the success of these training efforts, where former Sida-trained PhDs have or have had positions such as high-level official at PAHO, head of health at UNICEF, director of a leading public health institute in Ethiopia, dean of a medical faculty in Tanzania and head of maternal and child health at Ministry of health in Vietnam.

The Sida-funded research within global maternal, reproductive and child health (through the U-forsk program at Sida and later Global Health program at *Vetenskapsrådet*) has strongly benefitted from synergies with Sida’s bilateral research capability strengthening programs with institutions in primarily African and Asian countries. Below a few examples are given with an effort to characterize the research, how it position itself in relation to current research priorities and its relative importance.

Research groups at Umeå University and Uppsala University in collaboration with partners in Tanzania and some other African countries have addressed issues related to maternal mortality, maternal health and reproduction by a large number of projects, where several African and Swedish doctoral students have been trained and capacity and research infrastructure have been strengthened at the partner universities in Africa. The topics have to a large extent dealt with “what works when and why” and have consisted of intervention studies (e.g. trials) but also qualitative studies. The Uppsala institution has been a WHO collaborative centre partly related to these achievements. These efforts have been supported by a

combination of bilateral research funding and individual U-forsk grants.

Groups at Karolinska Institutet and Uppsala University with partners in Uganda and India study contraception and abortions with clinical studies, randomized trials and qualitative approaches in order to strengthen delivery of services. WHO has designated the Karolinska group as a collaborating partner in human reproduction.

Research groups at Uppsala University, Karolinska Institutet and Dalarna University have been involved in large projects in Vietnam to improve newborn survival. Currently these efforts are focusing research questions related to scale-up of community-based and hospital-based participatory interventions for perinatal and newborn survival. Even here research students have been trained, with “twinning” of doctoral students from Swedish and partner universities. These efforts have built upon earlier bilateral research funding but are now funded by the Global Health program and other grants.

In different large research projects in Uganda the diagnosis and management of children with fever have been addressed. This has directly contributed to change the WHO/UNICEF and Uganda policy to integrated community case management (iCCM) of Malaria, Pneumonia and Diarrhoea by means of Community Health Workers, which is now expanding through Africa supported by UNICEF and several other organizations. Several Ugandan and Swedish doctoral students have been trained and the efforts have benefitted from strong synergies between bilateral Sida funds, U-forsk and Global Health funding, as well as grants to the Ugandan partners from international funding agencies.

Groups at Karolinska Institutet and Uppsala University together with institutions in South Africa and other international partners have addressed research questions related to the prevention of mother-to-child transmission of HIV, primarily through community-based research. Some of the projects have analyzed the dilemmas related to infant feeding when HIV is prevalent. These projects have contributed to inform policy and programs, primarily in South Africa. PhD students from South Africa and Sweden have been trained, and Swedish as well as European funding programs have provided funding.

Maternal and child malnutrition has been addressed in studies in Bangladesh, where Uppsala University collaborates with the local research institution and several international partner institutions in the US, UK and Japan. Nutrition interventions in early pregnancy resulted in major improvement in infant survival, but also in favourable effects on child growth and metabolic markers in childhood. The current research that has received funding from the Global Health program is related to the DoHAD framework, addressing the question whether the developmental origin of adult chronic diseases can be modified by nutrition interventions in pregnancy. This project has benefitted from bilateral research funding to the Bangladeshi institution and several grants from Sweden as well as from UNICEF and funding agencies in UK, the US and Japan. A large number of research publications have been produced and more than 15 PhD students have been trained.

Strengths and weaknesses

The topics addressed by the Swedish groups active in global maternal, reproductive and child health research to a large extent fall within the research priorities that have been formulated in recent years (16,19,20). Within these projects African, Asian, Latin American and Swedish research students have been trained and capacity has been built in Sweden as well as in the international partner institutions. Research quality has overall been very good and of high relevance, reflected in a large number of publications in high-impact journals as well as in several examples of impact on policy and practice.

Swedish universities have to some extent allocated resources to global health (most larger universities) and Uppsala University has since several decades invested in professorships and associate professorships within maternal, reproductive and child health. These universities offer Masters- as well as PhD programs with a focus on global health, and, as reflected in the examples above, quite frequently collaborate with other Swedish institutions in their global health research programs. An analysis of publications within global maternal, reproductive and child health from Swedish institutions reflect an extensive international network and a large number of publications with partners from (in descending order) Bangladesh, Vietnam, South Africa, Uganda,

India, Tanzania, Ethiopia and several other countries. Many of these collaborations include partners not only in one low- or middle-income country but also other international partners, e.g. in the US, UK and Norway.

During the last 10 years (2004-2013) 41 projects within maternal, reproductive and child health received funding from Sida U-forsk or *Vetenskapsrådet* Global Health program (totally 213 grants were allocated to global health projects), i.e. on average 4 projects per year (range 2-8 projects). The successful grant applicant within this research field was a senior researcher, on average applying when her or his PhD degree had been obtained 15 years before the year of application.

Trends, tendencies and prognosis for the future

Global maternal, reproductive and child health represent a relatively large proportion of the global disease burden, and represent health problems that are highly relevant for the current MDGs and the forthcoming sustainable development goals. A relatively small number of Swedish research groups, mainly found at Uppsala University, Karolinska Institutet and Umeå University have developed research program within these fields during the past 3-4 decades and the universities have also invested in higher positions for global health research. Good collaborative links have been established with institutions in Africa, Asia and to a limited extent Latin America, as well as between the Swedish institutions.

Funding has been very limited to this relatively large and prioritized global health research area, and few grants have been provided to post-doc researchers in recent years. Research within this field often falls within the interest areas of *Forte*, but regrettably that funding agency has not permitted funding of global research, except from an institutional grant to Umeå University.

Successful larger projects have in most cases benefitted from co-funding and synergies between the Sida-funded bilateral research program (capacity strengthening) and the U-forsk or *Vetenskapsrådet* Global Health funding program. To some extent funding has also been obtained from international donors with the African or Asian partner institutions as applicants. Quality assurance and promotion of such synergies were earlier achieved by the SAREC secretariat and later the Research secretariat at Sida. The recent reorganizations of Sida has reduced the research secretariat to approximately twenty percent of its original size, and left the important decisions regarding bilateral research funding to the different embassies. This is a threat to the scientific quality of the bilateral research programs and the earlier synergies are gone or seriously impaired. Further, the voice of Sweden that earlier played such an important role in the global health research discussions is no longer found.

Several of the successful Swedish collaborative research projects within global maternal, reproductive and child health (e.g. among those examples above) had not been possible without a health and demographic surveillance system. Sida has supported the establishment of such systems within the bilateral research programs in a number of countries and by support to the network if such sites (INDEPTH), and the Swedish institutions have got considerable experience of establishing and promoting such important research infrastructure.

With the dismantling of the research secretariat at Sida there is a need to develop new strategies to further strengthen Swedish involvement in global health research and research capability strengthening in low- and middle-income countries. Swedish universities as well as *Vetenskapsrådet* and other Swedish research funding agencies could increase their involvement for the global policy discussion, the strengthening of research capacity building in countries and regions and the quality assurance of the Swedish bilateral investments in research and research training.

Recommendations

- The global research area maternal, reproductive and child health represent a major part of the global burden of diseases and is prioritized in relation to poverty alleviation expressed within the MDGs and the discussed sustainable development goals. In spite of this allocation of U-forsk and later Global Health research funds to this area has been small. Sida should consider whether its

Global Health research funds should be prioritized for research that more closely addresses immediate issues related to poverty alleviation.

- Research within this area as well as global health research overall is done by relatively few research groups at Swedish universities. In order to secure future capacity for this important area networking and synergies between the different Swedish groups and their international partners should be strengthened. There could be several mechanisms for this, such as networking grants, doctoral schools etc.
- Sweden had and could still have an important voice in the global health research and research policy discussion. The role of Sida and its research secretariat has been considerably reduced. Swedish universities and research funding agencies such as *Vetenskapsrådet*, *Forte*, *Vinnova*, *STINT* and others could play an important role in this. A national conference or consultation could maybe analyze the situation, create visions for the future and suggest new roles in Sweden's involvement in global health research.

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INTENTIONAL AND UNINTENTIONAL INJURIES

The text is divided under the following headings:

- Suicide
- Intimate partner violence
- Road traffic accident
- Burn injuries
- Drowning

Suicide

Description of the research

Suicide is a major public health problem worldwide and suicide research activities are therefore imperative. In Sweden, suicide research can be categorized into eight somewhat overlapping research areas: 1, epidemiology and register studies; 2, neurobiology and genetics; 3, suicide risk assessment, 4, treatment and care; 5, public health interventions; 6, suicide bereavement and euthanasia; 7, suicide in low- and middle-income countries (LAMIC); as well as the 8, suicidal experience and process in general. The description below is a short report of the Swedish suicide research produced from the early 1990's, published in international scientific journals. The scope of this review was limited to studies with an exclusive focus on the topic of suicidality. Papers related to, for instance, the determinants of depression, schizophrenia, or other mental health problems without an explicit intent to investigate suicidality were not included. Over of 540 papers were reviewed (see appendix) of which approximately 130 are cited in this document as examples of Swedish suicide research.

Epidemiology and register studies

A large number of studies from Sweden have focused on identifying factors associated with suicide. The aim of this type of research is to identify factors that can be addressed to reduce suicidality and to improve suicide risk assessment. For example, research targeting different aspects of alcohol consumption such as the early studies by the research group of Wasserman et al. (e.g., Wasserman, Värnik, & Eklund, 1994, 1998; Wasserman & Värnik, 1998) and Berglund et al. (e.g., Berglund & Ojehagen, 1998; Berglund, 1984) have increased the knowledge about the association between harmful use of alcohol and the risk of suicide. These studies have had significant international impact. Similarly, a large number of studies have focused on the association of mental disorders to suicidality. These include research by the groups of Runeson et al. (e.g., Tidemalm, Långström, Lichtenstein, & Runeson, 2008), Wasserman et al. (e.g., Balázs et al., 2013; Bertolote, Fleischmann, De Leo, & Wasserman, 2003; 2004), Nordström et al. (e.g., Carlborg, Jokinen, Nordström, Jönsson, & Nordström, 2010; Carlborg, Winnerbäck, Jönsson, Jokinen, & Nordström, 2010) and Berglund et al (e.g., Brådvik & Berglund, 2010, 2011). In addition, research in Sweden has also been focused on understanding and identifying other individual risk factors that relate to suicidal behaviours. These include exposure to adversity (e.g., Söderberg, Kullgren, & Salander Renberg, 2004), personality traits (e.g., Allebeck, Allgulander, & Fisher, 1988; Hirvikoski & Jokinen, 2012), intelligence (e.g., Gunnell, Magnusson, & Rasmussen, 2005), and physical illness and features (e.g., Allebeck, Bolund, & Ringbäck, 1989; Jiang, Rasmussen, & Wasserman, 1999; Magnusson, Rasmussen, Lawlor, Tynelius, & Gunnell, 2006; Sundström et al., 2010), as well as research family, relationship, life-styles and other societal factors (e.g., Carli, Mandelli et al., 2014; Ferrada-Noli & Asberg, 1997; Durkee et al., 2012; Johansson, Sundquist, Johansson, Qvist, & Bergman, 1997; Kuramoto & Runeson, 2013; Magne-Ingvar, Ojehagen, & Träskman-Bendz, 1992; Mittendorfer-Rutz, Rasmussen, & Wasserman, 2004; Moniruzzaman & Andersson, 2004; Sarchiapone et al., 2014; Schmidtke et al., 1996). A number of studies in Sweden have also focused on understanding the prevalence, trends and patterns of suicide in Sweden, Europe and the world through epidemiological studies (e.g., Chotai & Salander Renberg, 2002;

Cullberg, Wasserman, & Stefansson, 1988; Runeson, Tidemalm, Dahlin, Lichtenstein, & Långström, 2010; Schmidtke et al., 1996; Schmidtke et al., 1999; Värnik & Wasserman, 1992; Värnik, Kõlves, & Wasserman, 2005; Wasserman & Värnik, 1998a).

Although some risk factors for suicide are non-modifiable, such as gender, these can be useful in identifying risk groups. Selective suicide-prevention interventions can then target other modifiable risk factors, such as mental disorders, that may be present among a risk group. Research in Sweden concerning high risk groups has mainly focused on understanding suicidal behaviours among young people (e.g., Brunner et al., 2014; Carli, Hoven et al., 2014; Hawton et al., 1998; Hultén et al., 2001; Kosidou et al., 2013; Runeson & Beskow, 1991; Runeson, 1990; Mittendorfer-Rutz & Wasserman, 2004; Wasserman, Cheng, & Jiang, 2005) the elderly (e.g., De Leo et al., 2001; Fässberg et al., 2012; Rubenowitz, Waern, Wilhelmson, & Allebeck, 2001; Waern, Rubenowitz, & Wilhelmson, 2003; Waern, Rubenowitz, et al., 2002; Waern, Runeson, et al., 2002) and among immigrants and adoptees (e.g., Bursztein Lipsicas et al., 2012; Ferrada-Noli, Asberg, Ormstad, & Nordström, 1995; Hjern & Allebeck, 2002; Hjern, Lindblad, & Vinnerljung, 2002; Värnik, Kõlves, & Wasserman, 2005) as well as the unemployed (Garcy & Vågerö, 2012; 2013; Lundin, Lundberg, Allebeck, & Hemmingsson, 2012).

Neurobiology and genetics

The risk of suicide can also be influenced by individual vulnerability or resiliency related to genetic and biological factors. For example, the role of genetics in suicidal behaviours has been investigated extensively by the research group of Wasserman et al. (e.g., Ben-Efraim, Wasserman, Wasserman, & Sokolowski, 2013; Geijer et al., 2000; Sokolowski, Ben-Efraim, Wasserman, & Wasserman, 2013; Sokolowski, Wasserman, & Wasserman, 2010; Wasserman, Terenius, Wasserman, & Sokolowski, 2010), with particular focus on gene-environment interactions regarding serotonergic as well as HPA-axis related genes. The group of Åsberg and Träskman-Bendz et al. has investigated genetic and also neurobiological markers of suicidal behaviour such as specific serotonergic, dopaminergic and HPA activity (e.g., Engström, Alling, Blennow, Regnéll, & Träskman-Bendz, 1999; Jones et al., 1990; Nässberger & Träskman-Bendz, 1993; Träskman, Asberg, Bertilsson, & Sjöstrand, 1981; Träskman et al., 1980), as has the research group of Nordström (e.g., Jokinen, Nordström, & Nordström, 2009; Jokinen & Nordström, 2009; Nordström & Åsberg, 1992) but also others (e.g., Asberg, 1997; Lidberg, Åsberg, & Sundqvist-Stensman, 1984; Lidberg, Tuck, Åsberg, Scalia-Tomba, & Bertilsson, 1985). Suicidality has also been investigated in relation to the biology of mental disorders (Ekström, Lavebratt, & Schalling, 2012; Johansson et al., 2001) as well as inflammatory factors (Hallberg et al., 2010; Janelidze, Mattei, Westrin, Träskman-Bendz, & Brundin, 2011).

Suicide risk assessment

Suicide assessment for identifying individuals at suicide-risk through screening tools has also been studied extensively in Sweden. Focus has been on the development of new psychometric tools, as well as validating existing ones (Jokinen et al., 2010; Stefansson, Nordström, & Jokinen, 2012; Waern, Sjöström, Marlow, & Hetta, 2010). Psychological tests have also been developed for screening, such as those measuring participants reactions to subliminal exposures of clinically specific stimuli (Titelman, Nilsson, Estari, & Wasserman, 2004; Titelman, Nilsson, Svensson, Karlsson, & Bruchfeld, 2011) as well as biochemical/biological tests looking at dexamethasone suppression or skin conductance (Jokinen et al 2008; Thorell et al 2013).

Treatment and care

The research in Sweden regarding the treatment of suicidality has mainly been focused on psychopharmacological treatment with antidepressants (e.g., Brådvik & Berglund, 2011a; Isacson, Holmgren, Wasserman, & Bergman, 1994, 1995; Göran Isacson, Rich, Jureidini, & Raven, 2010). Other studies researched the management, follow-up and care of suicidal people in both Sweden and Europe (e.g., Bursztein Lipsicas et al., 2014; Hultén et al., 2000; Runeson & Wasserman, 1994; Talseth, Lindseth, Jacobsson, & Norberg, 1999).

Public health interventions

A number of large-scale international randomised controlled trials (RCT) of awareness and coping skills increasing programmes among young people have been coordinated by the Swedish research group of Wasserman in collaboration with several EU countries but not in Sweden. These have investigated the effectiveness of suicide prevention programmes aimed at the specific subgroups of the general public, such as adolescents (e.g., Balázs et al., 2013; Brunner et al., 2014; Carli, Hoven et al., 2014; Carli et al., 2013; Hoven, Wasserman, Wasserman, & Mandell, 2009; Kaess et al., 2013; Sarchiapone et al., 2014; C. Wasserman et al., 2012; D. Wasserman et al., 2010). In addition, early work by Rutz has investigated the effectiveness of programmes for training health workers (e.g. GPs) for suicide prevention (e.g., Rutz, von Knorring, & Wålinder, 1989; Rutz, Knorring, Pihlgren, Rihmer, & Wålinder, 1995) with influence to other European countries. Other research in Sweden regarding public health has been focused on understanding attitudes towards suicidal people across different groups (e.g., Renberg & Jacobsson, 2003; Samuelsson, Asberg, & Gustavsson, 1997), investigating the effects of alcohol-related policies for suicide prevention (e.g., Wasserman & Värnik, 1998b; Wasserman, Värnik, Kolves, & Toodling, 2007) and restricting access to common means of suicide (e.g., Beskow, Thorson, & Öström, 1994).

Suicide bereavement and euthanasia

Studies in Sweden have also focused on understanding the impact on friends and family of suicide attempters and completers (e.g., Magne-Ingvar & Öjehagen, 1999; Omerov, Steineck, Nyberg, Runeson, & Nyberg, 2013; Runeson & Beskow, 1991b; C. Wasserman et al., 2012) and euthanasia, (e.g., Wasserman, 1989).

The suicidal experience and process

Studies on the suicidal experience and process are important for increasing the knowledge about suicidality and the improvement of treatment, care and prevention of suicide. Although research focusing on the patients' experience and the process of suicidality is generally limited, a number of Swedish studies have focused on understanding suicidality and provided insight into these issues (e.g., Hjelmeland et al., 2002; Omma, Sandlund, & Jacobsson, 2013; Runeson, Beskow, & Waern, 1996; Wasserman 1990a; 1990b).

LAMIC research

A number of studies in Sweden have carried out research regarding suicide in low-and middle-income countries. These include for example research regarding the prevalence, risk and protective factors, interventions, understanding the suicidal process and expression, and attitudes toward suicide in LAMIC countries (e.g., Ahmadi, 2007; Bertolote et al., 2005, 2010; Burrows & Laflamme, 2008; Fleischmann, 2008; Fleischmann et al., 2005; Mofidi, Ghazinour, Salander-Renberg, & Richter, 2008; Ovuga, Boardman, & Wasserman, 2005; Rodríguez, Caldera, Kullgren, & Renberg, 2006; Sundbom, Jacobsson, Kullgren, & Penayo, 1998; Thanh et al., 2005).

Impact, Strengths and weaknesses

Swedish suicide research using epidemiological, cohort and other designs, aimed at identifying correlates to suicidality has a significant impact on the general understanding of risk and protective factors in suicide. The research carried out using the numerous high quality registries in Sweden and findings have great synergistic potential with other international research. However it's important to note that risk-and protective factors identified in high income countries might not be applicable or even valid predictors of suicide in LAMIC countries (due to contextual differences). Intercultural and international application of the epidemiologic findings can in this way be challenging.

Most epidemiologic, genetic neurobiological research programmes are aimed at identifying correlates to suicidal behaviour. Although this type of information is useful in screening programs, it is difficult to assess what actual role these correlates play in the causal process that precedes a suicide. Specific studies aimed at disentangling the relationship between correlates, causes and effects make up a small proportion of the research in suicide in Sweden and elsewhere.

Swedish research programmes aimed at the rigorous evaluation of suicide prevention activities on universal, selected or indicated populations appear to be high in quality even compared to other international research, but unfortunately low in quantity (perhaps reflecting a lack of research funding).

The National Centre for Suicide Research and Prevention of Mental Ill- Health (NASP), at the Karolinska Institute in Sweden, is unique in being the only in Europe WHO Collaborating Centre for Research, Methods Development and Training in Suicide Prevention, active as an advisor both to the European Regional Office in Copenhagen, as well as the main WHO Office in Geneva, which is responsible for global activities.

NASP, the WHO Collaborating Centre at the Karolinska Institute, has a widely developed research and policy networks on all continents, which resulted in the prestigious publication of *The Oxford Textbook of Suicidology and Suicide Prevention: A Global Perspective* (2009 Oxford University Press) with 193 contributors from all continents.

Recommendations

The Swedish parliament and the Swedish government (Regeringsprop 2007/08:110) approved nine suicide preventive strategies in Sweden. For this reason there is a great need to strengthen implementation of those nine strategies through a systematic research, in collaboration with the global and National networks of suicide researchers, which NASP as the National Centre of Excellence and the WHO Collaborating Centre for Research, Methods Development and Training in Suicide Prevention, has developed since 1993 (www.nasp.se).

There is an excellent opportunity for maintaining and developing the research capacity in Sweden, focussing on Public Health Universal Suicide Preventive Interventions, utilising NASP's capacity developed through the leadership of several European funded studies: SEYLE – Saving and Empowering Young Lives in Europe, WE-STAY - Working in Europe to Stop Truancy Among Youth and SUPREME - Suicide Prevention through Internet and Media Based Mental Health Promotion, and as a contributor to the WHO Office in Geneva's first ever World Suicide Report (2014): "Preventing suicide: a global imperative."

Suicide research conducted in Sweden is of high quality and has a significant International impact. Research leaders have created a strong group of next generation researchers who provide a ground for the continuity and sustainability of future suicide research in Sweden. Current and new research collaborations within suicide prevention, between academic partners in Sweden and on other continents should be supported. A programme for Post-Doc academics from low and middle countries (LAMIC) as well as programmes to support Swedish Senior Researchers to develop research programmes on the five continents, should be developed and sustained.

Support of the following research is highly recommended:

- Intervention studies of universal suicide preventive methods in schools, workplaces and at the community level.
- Qualitative studies on how to improve the implementation of and the adherence to policies and guidelines on suicide prevention in public health and health care sectors.
- Studies regarding the effects of taboo and stigmatization surrounding suicide, in public health and health care sectors.
- Studies focused on anthropological and social aspects of suicidality and suicide prevention in the general population, minorities and in cross-cultural settings.
- Clinical treatment studies of well-defined (phenotype and genotype) psychiatric patient groups.
- Translation of existing evidence-based results in suicide preventive studies to new e-health technologies.
- Longitudinal studies on suicide risk and protective factors, as well as on treatment and preventive effects utilizing the information from high quality registers in Sweden.
- Continued development of research on neurobiological and genetic factors in suicidal behaviour.
- Continued development of research and new theories combining biological, psychiatric/psychological and social factors.

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Intimate Partner Violence

Key words

Gender-based violence, violence against women, intimate partner violence, physical violence, sexual violence/coercion, psychological violence, controlling behavior, gender norms, intervention, prevention, collaborative research

Description of research in the field

Intimate partner violence (IPV) is a major global health problem and a human rights concern (Ellsberg et al., 2008; Garcia-Moreno et al., 2006; Krantz, 2002). IPV is embedded in the imbalance of power between men and women, and thus one form of gender-based violence. IPV is primarily perpetrated against women, and mortality is the most extreme outcome (Campbell et al., 2007). IPV exceeds the prevalence of all other forms of physical and sexual abuse in women's lives, it has been on the research agenda for some time, and it shares many determinants with other forms of gender-based violence in terms of norms and institutional responses. It is an important entry point for interventions aiming to influence future generations attitudes and behaviors (Heise, 2011). Reducing IPV and violence against women in general is high on the political agenda worldwide, being included in the Millennium Development Goals and also in the policy for gender equality for the Swedish Sida 2010-2015 (Government Offices of Sweden, 2010). The Swedish policy puts strong emphasis on increasing women's agency and underlines the need to focus specifically on sexual and reproductive health and rights and tackle all forms of gender-based violence.

Swedish Universities have been involved in research on intimate partner violence in low-income countries since the mid 90's. The research was initially mainly supported by the Sida/SAREC bilateral agreements. Within the Nicaraguan collaboration (Umeå University) Ellsberg and colleagues provided alarming prevalence figures of IPV against women as well as an understanding of the underlying contextual factors. The research group continued with studies of the health consequences of IPV for infant and child mortality as well as studies focusing on the methodological and ethical issues involved in research on violence. Experience from the Nicaraguan studies became crucial in the development of the WHO multi-country study on women's life experiences, since members of the research team became part of its steering- and organizing committees. The multi-country study was a turning point for research on IPV internationally, being performed in 11 countries and the first study to use a standardized methodology allowing for comparisons between different settings (WHO, 2005). Swedish researchers (Umeå University) could together with their Ethiopian counterpart, utilize their long-term collaboration on reproductive health, to become part of the WHO study, which resulted in further studies on the association between IPV, maternal depression and child mortality. In Indonesia the STINT support for developing a demographic surveillance site became an entry point for studies on risk factors of IPV and for qualitative studies on coping with IPV as well as on norms regulating violent behaviour. Within the bilateral collaboration with Vietnam (Gothenburg University, KI, and Lund University) several studies on IPV have been performed with a focus on risk factors and health effects. In Sri Lanka the Sida support for capacity strengthening (Uppsala University) implied addressing risk factors and help seeking for IPV. In Bangladesh collaboration between Swedish researchers (Uppsala University) and ICDDR-B (International Centre for diarrheal disease research -Bangladesh) resulted in studies of IPV in relation to child malnutrition and infant morbidity. Researchers from KI and Lund University have also been involved in research in Bangladesh focusing on magnitude and risk factors as well as the association between IPV and water development. In Pakistan Swedish researchers (Gothenburg University, KI, and Umeå University) have collaborated around studies on gender norms and mental health effects of IPV and the relation to empowerment and contraception use. In Tanzania the bilateral collaboration within reproductive health (Uppsala and Umeå University) includes several studies on the role of health care in IPV response, child sexual abuse and rape. Researchers at KI have been active in utilizing the free access to data from DHS (Demographic health surveys) to make comparisons of exposure to, and risk factors and outcomes of IPV in sub-Saharan Africa. They have focused specifically on IPV in relation to attitudes, disclosure, pregnancy outcomes, and screening in Nigeria and on the connection to social inequalities in Kenya. KI researchers have also been involved in studies on IPV in Mozambique, Zambia, Uganda and South Africa looking at mental health, gendered sexuality norms and

HIV. The collaboration with Nicaragua (Umeå University) has, in the field of violence, been extended to Ecuador focusing on the role of IPV in relation to unintended pregnancies, the health care response, changes in norms and attitudes against violence as well as new forms of masculinities that can reduce IPV. Lund University has in collaboration with Uganda on sexual and reproductive health and rights focused on sexual coercion and mental health in studies among university youth. There are also on-going studies in Rwanda (Gothenburg and Umeå University) and Cambodia (Lund University) focusing on gender-based violence and mental health in previous conflict areas, where the results have not yet been published. So far at least 20 doctoral theses have been defended at Swedish Universities where the focus has been on gender-based violence in low- and middle-income countries. In 2006 Swedish researchers (Linköping, Uppsala, and Umeå Universities) took an initiative to form a network for research collaboration around violence against women, the VAW network. The network, successively inviting researchers from other universities, brought together researchers from the north as well as their counterparts in the south to share research findings and to discuss methodological challenges. The last conference, held in 2013, focused specifically on linking research and practice, and initiated fruitful discussions on the need for contextualized interventions.

Strengths and weaknesses

The long-term bilateral collaborations between strong public health institutions have had great bearing on the research capacity in low- and middle-income countries. But the collaborations have also meant capacity strengthening for the involved Swedish institutions that often also are engaged in studies on IPV and other forms of gender-based violence in their own setting. Over the years we have seen an increase in networking and collaboration between researchers in Sweden (north-north) as well as between researchers in low-income countries (south-south) in this field. The Swedish involvement in the WHO multi-country study paved the way for methodological development and comparative studies. The strong Swedish policies on gender equality have directed research questions towards the role of gender-related attitudes and norms in regulating violent behaviors, on structural, community, and individual levels. The Swedish involvement in disseminating results, collaborating with local health authorities, and non-governmental organizations, has put pressure on policy change and has been important for raising awareness outside the scientific community, both nationally and internationally. The conferences and workshops organized by the VAW network assisted in increasing the visibility and urgency of the global health challenge that violence against women implies.

The overall decrease in funding for global health research is, however, challenging. Not only does it hinder reaching the Swedish development goals, but more importantly it hampers the possibility to continue established collaborations that have the potential to make a difference in developing the overall research area further. In addition, there is a fear, within the global health research community, that violence and gender equality will not be prioritized, and that the gender competence within several of the research council's working groups is limited.

Trends, tendencies and prognosis for the future

While the interest in research on IPV and other forms of gender-based violence has been abundant within the bilateral collaborations, the support for the research field from Swedish research funders has been scarce. Between the years 2004-2013, 24 research applications, focusing on violence against women in a global perspective, were sent to Sida/VR. Apart from the VAW network (given support twice) only two applications, one for comparative IPV research between Nicaragua and Bangladesh, and one on violence and mental health in Cambodia were approved. Even if important research on IPV and gender-based violence has been catered for within the bilateral collaborations this shows that the support for research on gender-based violence, as an overall global health threat, is limited. Making less distinction between global health research and 'health research' would imply more equal access to research funding on urgent global health problems, relevant both in high-income, and low and middle-income countries.

Today, much is known about the magnitude, risk factors and health consequences of men's violence against women (Abramsky et al., 2011; Campbell, 2002; Jewkes, 2002). There is however, more to be learned about the knowledge base and competence of the health care systems to care for patients who have been exposed to violence. We need to develop contextualized studies about how masculinity norms can be influenced to create

increased gender equality in low- and middle-income countries, and how feminist activism can be part of such change on a societal and community level. Thus, interdisciplinary studies involving, to a greater extent, researchers from social science research, are required. On the individual level there is a demand for cohort studies on the process of ending partner violence, as well as on the long-term consequences for children exposed to violence within the family. There is also a need for an increased understanding of violence as part of conflict solving within relationships, among both men and women in different settings. A recent review of non-partner sexual violence indicates the seriousness also of other forms of gender-based violence (Abrahams et al., 2014). We also need to acknowledge that there is limited knowledge, both nationally and globally about the gender asymmetry in violence perpetration, about the risk factors and mechanisms involved in women's violence against men, and violence within same-sex partnerships.

In the coming 5-10 years it is crucial to focus more on intervention research to assess the possibilities for prevention. Heise (2011), in her review of "What works to prevent partner violence", states that the current evidence base is skewed towards high-income countries and that there still is limited knowledge about how different types of interventions work in low- and middle-income settings. Thus, there is need for true collaborative studies comparing how norms and beliefs, social structures as well as individual pre-dispositions interact concerning different types of abuse, and influence intervention outcomes in different social contexts.

Recommendations

- Support long-term collaborations between committed research institutions in Sweden and low- or middle-income countries
- Make special calls for violence research that encourages participation from both health and social science disciplines
- Create twinning PhD and Post Doc opportunities for young researchers from high-, middle-, and low-income countries
- Build on existing links between Swedish research institutions and institutions in low- and middle-income countries, to encourage comparative studies evaluating different types of intervention strategies
- Fund national and global networks that aim to link research and practice in creating an evidence base for interventions

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Road traffic injuries

Keywords

Injury prevention; Injury epidemiology; Surveillance; Road infrastructure; Road user behaviour; Sustainable environment; Urbanisation; Urban planning; Safety legislation; Social inequality; Vulnerable road users; Bicyclist; Motorcyclist; Pedestrian; Systems theory; Mobility; Trauma; Whiplash; PTSD

Description of the research

According to the World Health Organization, approximately 16,000 people die every day worldwide from all types of injuries. Injuries represent about 12% of the global burden of disease, making them the third most important cause of overall mortality. Road traffic injury (RTI) deaths account for 25% of all deaths from injury. The burden of RTIs is disproportionately borne by countries that can least afford to address the related health service, economic, and societal challenges.

Sweden has a very long tradition of RTI research and it is by far one of the countries in the world that has been most successful in identifying and implementing measures that help preventing the occurrence of both road traffic crashes (RTCs) and RTIs. Sweden benefits from research capacity in several disciplines (e.g., technology, medicine and social sciences) at a high academic level, allowing for advanced studies in a vast spectrum of risk and protective factors that include the planning and design of the road traffic environment itself, the design of motor vehicles and other safety devices, and human behaviour and needs, like driver education, the promotion of safe behaviour, and the protection of vulnerable road users (e.g., children and older people). At an early stage, Swedish road traffic safety research has endorsed the Haddon theory/model and adopted a system approach where road users, vehicle and road infrastructure are seen as interrelated risk factors. RTI prevention has also been a cross-sectorial effort.

Swedish RTI research is closely aligned to the Swedish development cooperation plan in at least four main domains. First, child safety and protection is a main focus of Swedish RTI research and development and children's health and well-being is a central element of the goals for development cooperation. Sweden has indeed a lot to offer in intervention and implementation research dealing with the prevention of RTIs among children. Second, in the Swedish approach to RTI prevention, safety and mobility are regarded as each other's prerequisite. Transport and environment issues are also important elements of the goals for development cooperation. Improved road infrastructure is usually seen as a way to improve poor people's living conditions, but if the development of new roads does not consider the need of vulnerable road users, the introduction of rapid transport becomes an additional burden to the life of poor people. Third, Sweden is one of the few countries in the world with a strong research tradition in health equity studies focused on injury, and in particular RTIs. The challenges to country specific development goals posed by the unequal distribution of health between social groups are acknowledged in several key international documents and it is also well reflected in Swedish development cooperation. Fourth, health data quality and accuracy is put forward in the goals for development cooperation and it definitely is an essential element of road safety research, policy, and practice. Reliable data and evidence are essential when describing the burden of RTIs, assessing risk factors and establishing priorities for prevention. RTI registration has come a long way in Sweden. By linking together police and hospital data, the STRADA system (Swedish TRaffic Accident Data Acquisition) provides data that

are more complete for a wider range of injury severity levels and more informative regarding the circumstances of occurrence – and consequences – of those injuries. The STRADA system is internationally seen as an example of best practice.

Sweden has research environments within several traffic safety areas, several with extensive international collaborations and researchers among the world leaders in their areas. The most important ones are listed below.

- Chalmers University (SAFER Vehicle and Traffic Safety Centre)
- Karolinska Institutet; Dept of Public Health Sciences; Rehabilitation/Spinalis; Traffic Medicine Centre)
- Linköping University (Dept of Science and Technology)
- Royal Institute of Technology (Transport research platform)
- Umeå University (Department of Applied Educational Sciences)
- VTI (the Swedish National Road and Transport Research Institute)

Besides the competences into place, there are some additional conceptual and methodological advantages of Swedish RTI research that put Sweden in a competitive position worldwide to deal with RTI prevention in a global perspective and enhance both research quality and its impact.

- It has a vision, the Vision Zero. The vision aims at a future in which no one is killed or seriously injured by traffic and roads should be designed accordingly. The vision is based on the principle that the traffic systems must be designed with the understanding that people make mistakes and that traffic crashes cannot be avoided completely.
- It acknowledges the interrelation between safety and mobility.
- It is inclusive in that it promotes the adoption of safety for all interventions rather than targeted ones.
- It gives priority to passive protection measures, when protection is “built in” the environment (e.g., traffic separation, physical measures for speed reduction) and vehicles (e.g. child restraint measures) – as opposed to imposed on individual (and children) behaviour and practice.
- It benefits from an advanced system for injury registration (STRADA).

Strengths and weaknesses

Swedish RTI research is multi-sectorial and this puts the country in a very good position to make a significant contribution when dealing with major challenges posed by this increasing public and global health problem. Swedish research can contribute with specific competences and also experiences of multidisciplinary work for each of the following challenges.

Rapid urbanization and motorization. Individual mobility often receives low priority in transport development, not least the mobility of children. There is a need for inclusive planning and design of the road traffic environment and Swedish research and development experiences can be a valuable contribution.

Social inequalities in RTIs. Better understanding of those disparities and appropriately responding to them in available evidence and prevention efforts are necessary. Social disparities in road accident arise across categories of road users but the mechanisms behind them can be different.

Safety of unprotected road users. Pedestrians and motorcyclists comprise the majority of road-traffic victims in LMICs, and consequently, the majority of the road-traffic victims globally. It is imperative not only to implement well-established measures to protect those victims but also to conceive additional ones that are contextually relevant (intervention and implementation research).

Know-do gap. Several measures have been put forward that can help preventing road traffic crashes (primary prevention) or reduce their consequences (secondary and tertiary prevention). There is a pressing need to advance the knowledge regarding the implementation of those safety measures in new contexts and improve knowledge on how safety measures used in HICs can be implemented in LMICs.

Incapacitating RTI morbidity. An increasing number of people live with lasting impairments as a result of RTI, with consequences for their everyday life and challenges to their autonomy in society. The research needs in this area is diverse – from the need for tools (e.g., quality-of-life scales) to describe and compare the long-term impact of traffic injury to the need for well-adapted health care services.

Completeness and accuracy of official road accident statistics. Official road traffic accident statistics are incomplete and inaccurate in all countries. The level of reporting for injuries treated in hospitals is, on the average, less than 50%. Injuries are not always correctly classified by severity in police accident reports.

Assessing costs. Costs analyses are surprisingly few in RTI research. There is a need for guidelines regarding the estimation of the costs to society of traffic injury and also the cost-benefit of preventive interventions.

Capacity building. For road traffic injury research and prevention to be successful, it is important to develop local research capacity in LMIC and to establish global research collaborations.

Trends, tendencies and prognosis for the future

Road traffic safety is a global public and global health challenge. Sweden has several research environments with good critical mass of professionals. Several of those have high scientific credibility. International exchanges occur not only through research but also through a number of education programs and consultations in different countries and parts of the world.

Recommendations

Incentives – create incentives to research and research collaborations for global health. At present, there is no financing agency for road safety research that integrates road safety from a global or public health perspective. As a consequence, there is limited stimulation to the creation of short or long-term research collaborations with partners from LMICs.

Positions – create academic positions. Because of the above, and in face of the shift in generation that affects several research environments, a number of key academic positions could be created for specific scientific areas, aligned to the Swedish development collaboration goals (i.e. paediatric RTIs prevention; urbanization, mobility and safety; social inequality and road safety).

Orientation – prioritize program and projects with a public health and cross-sectorial perspective to injury prevention. The generic analytical framework used in public health is helpful in the analysis of risk factors, but also serves as a guide during the whole process, from identifying a problem to the implementation and evaluation of interventions.

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Burn Injuries and drowning

Keywords

Urbanization, social inequality, poverty, home safety, passive safety, education, implementation, child development, morbidity, mental health, family disruption, health system, mHealth, injury diagnostic and care, capacity building, disability

Description of the research

Injuries represent about 12% of the global burden of disease, making them the third most important cause of overall mortality. Burn injury deaths and drowning account for a substantially large proportion of all deaths from injury, in particular among children. As is the case for many other health outcomes and causes of injuries, the burden of burns and drowning is disproportionately borne by countries that can least afford to meet the related health service, economic, and societal challenges. There are also wide socioeconomic differences within countries, to the detriment of the poor.

Swedish research on burn and drowning injury care and prevention is closely aligned to the goals of the Swedish development cooperation plan in several ways, as is described below.

Burn injuries and drowning are a home health and safety issue. Burns and drowning are largely attributable to poor living conditions and occur very often in and around the home, during activities of the daily life. Not only are they a consequence of poverty, but they can also lead to it. Sweden has been successful in developing intervention strategies and means of prevention that promote home safety, in particular flame and scalding injuries and drowning, not least among young children.

Children and women are the most common direct and indirect victims of burn injuries and, to some extent drowning. Children and women are greatly affected by burns, both directly and indirectly. Children are at high risk of burns, in particular when they are very young (in cases of child abuse) and in their early years (as they begin to explore the world). Poor women and girls in particular have high rates of burn injuries, both as victims of domestic violence and due to incidents that occur as a result of the narrow environments in which they perform household chores, those typically falling under their responsibility. Suffering with the lifelong effects of poorly treated burn injuries in themselves or their children adds on to household responsibilities and limits opportunities for educational and economic development.

Social inequality in burn injuries and drowning. The challenges to country specific development goals posed by the unequal distribution of health between social groups are acknowledged in several key international documents and it is also well reflected in Swedish development cooperation.

Acute care is crucial and health care services are ill-prepared. In resource-poor settings where medical expertise is scarce, distance to/from healthcare services and knowledge/competence gaps pose enormous challenges to successful burns treatment. Low cost, timely and inclusive alternatives to burn injury control are, to say the least, a pressing need in many low- and middle-income settings and countries. Sweden has highly competent experts in that area.

Completeness and accuracy of official injury statistics. Official burn and drowning statistics are incomplete and inaccurate in all countries. Official burn mortality data for instance often are restricted to fire-related burns. Drowning on the other hand is underestimated due to the fact that a large number of cases never reach the hospital and therefore are not reported in e.g. health statistics, the most common data sources for injury surveillance.

Assessing costs. Costs analyses are surprisingly few in injury research. There is a need for guidelines regarding the estimation of the costs to society of burn injury and drowning and also the cost-benefit of preventative interventions.

Strengths and weaknesses

Burn injuries

Swedish research puts the country in a very good position to make a significant scientific contribution in face of the various challenges posed by burns. As listed below, there are some universities that educate highly competent professionals and clinicians in burn injury treatment and care so as to achieve a reduction in burn mortality and morbidity through e.g., advanced healing processes like tissue engineering, pain management, or other rehabilitation processes. There are public health researchers with relevant epidemiologic expertise and experience of research in resource poor settings.

- Göteborg University Hospital
- Karolinska Institutet, Department of Public Health Sciences, Injury research group/ISAC
- Linköping University, Faculty of Health Sciences, Department of Clinical and Experimental Medicine, Burn Unit/Center
- Sahlgrenska University Hospital
- Uppsala University, Department of Surgical Sciences, Department of Medical Sciences, Department of Radiology, Oncology and Radiation Science

Drowning

Overall, research on drowning is relatively scarce in Sweden, with studies describing the size of the problem and very little on effective measures to decrease it.

In Sweden, the Swedish Contingency Agency (MSB) is responsible for issues concerning civil protection, public safety, emergency management and civil defence as long as no other authority has responsibility. MSB is a competent authority for, among other things, fire safety and sponsors Swedish but not international research in the injury field.

Trends, tendencies and prognosis for the future

Although Sweden has high-level epidemiological and clinical expertise in burn injury research, but the number of researchers involved in the field is relatively low. In the case of drowning, there is only a handful of academically active researchers.

Social inequalities in injuries. Better understanding those disparities and appropriately tackling them are challenging but imperative.

Know-do gap. Several measures have been put forward that can help to prevent burns and drowning (primary prevention) or reduce their consequences (secondary and tertiary prevention). There is a pressing need to advance the knowledge regarding the implementation of those safety measures in new contexts and improve knowledge on how safety measures used in HICs can be implemented in LMICs.

Incapacitating burn injury morbidity. An increasing number of people live with lasting impairments as a result of burns, with consequent challenges to their autonomy in society. The research needs in that area are diverse – from the need for tools (e.g., quality-of-life scales) to describe and compare the long-term impacts of burn injury to the need to put into place well-prepared health care services.

Low cost, timely and inclusive alternatives to burn injury control are indeed a pressing need in many resource poor settings and countries.

Child safety. Children are most vulnerable to burns and drowning in LMICs. It is imperative not only to implement well-established measures to protect them but also to conceive additional ones that are contextually relevant both in the situations and sources of danger they deal with and the manner in which they do so (intervention and implementation research).

Completeness and accuracy of official injury statistics. Official injury statistics are incomplete and inaccurate in all countries. The level of reporting for injuries treated in hospitals is, on the average, less than 50%.

Assessing costs. Costs analyses are surprisingly few in injury research. There is a need for guidelines regarding the estimation of the costs to society of injuries like burns and drowning and also the cost-benefit of preventative interventions.

Capacity building. For injury research and prevention to be successful, it is important to develop local research capacity in LMIC and to establish global research collaborations.

Recommendations

Incentives. Raise awareness about the added value of international collaborations in the field of burn or drowning injury care and prevention and create economic incentives to international academic partnerships.

Sustain and further develop capacity. Create strategic positions or platforms that have the potential stimulate cross-disciplinary approaches (within Sweden and with other partner countries) and studies dealing with the epidemiology and prevention of drowning and burn injury.

Orientation – prioritize program and projects with a public health and cross-sectorial perspective to injury prevention. The generic analytical framework used in public health is helpful in the analysis of risk factors, but also serves as a guide during the whole process, from identifying a problem to the implementation and evaluation of interventions.

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PHARMACEUTICALS, INNOVATIONS AND TECHNOLOGICAL APPROACHES

Introduction

This research theme is wide covering several areas that often use multidisciplinary approaches. The denominator for the theme is to understand basic mechanisms of action and response of drugs/other technologies or their efficacy, effectiveness, uptake, use and value to prevent, diagnose or treat diseases of importance for resource strained and emerging countries. Based on the instructions by VR, I have found it helpful to classify the theme “Pharmaceuticals, innovations and technological approaches” as seven sub-categories:

1. Technological health systems interventions for prevention, diagnosis and therapy of diseases
2. Pharmacological approaches
3. Traditional medicine
4. Vaccine, antibiotic or resistance research: basic and clinical
5. Laboratory or diagnostic techniques or procedures: basic and clinical
6. ICT (Information Communication Technology)
7. Other technologies or innovations

My task overlaps other assigned themes and has to be considered. However, it is also an advantage to compare the outcomes of overlapping tasks. The report includes an analysis of the type of research within the theme represented in Swedish project grant applications to SIDA between 2000 and 2010 and to VR/SIDA between 2011 and 2013. The applications do not represent all submitted projects within the programs “global health supported research” since data provided by VR lacked information about rejected grant applications for the years 2011 and 2012. In addition, research within the theme “Pharmaceuticals, Innovations and Technological Approaches” may have been granted by VR Medicine & Health Grants, EU-funding (Framework programs and also by EDTCP (European & Developing Countries Clinical Trials Platform)), by Vinnova and by other national and international research grant organizations. To best of my knowledge, I have tried to consider the overall research capacity and impact of the assigned theme.

I have carried out Pubmed searches for all subcategories (See keywords below) of research within the theme “Pharmaceuticals, innovations and technological approaches” to clarify research activity as documented by the number and type of international publications for researchers granted funding by SIDA or VR within the theme between 2000 and 2013. For the period 2010 to end of May 2014, I have also reviewed the number of dissertations (PhDs) of the theme at Karolinska Institutet and at Gothenburg University. My overall assessments of the success of Swedish researchers of the assigned theme build also on my own research in tropical clinical pharmacology, Rational Use of Medicines and on e-health in developing countries. My national, Scandinavian and international contacts and collaborations have helped to assess the international standard of Swedish research within the theme. My participation as either panel member (2010-2011) or as panel chairman (2012-2013) for research applications to VR has provided insights into the activity of the research theme.

Keywords

It is not easy to define relevant keywords for the research theme “Pharmaceuticals, innovations and technological approaches” within global health. A pragmatic approach is to divide the theme into categories and subcategories as defined in Table I. In order to retrieve publications (Pubmed) relevant for resource strained and emerging countries, I have combined each category or subcategory with attributes

describing that publications should cover global health issues or parasitic or infectious or communicable diseases, be focused on resource strained countries or be of relevance for health and healthcare in Africa, Asia and Latinamerica. Thereby, I should have retrieved publications that can be classified as “global health” or “development oriented health research”. The assigned keywords should also ensure retrieval of research publications about non-communicable diseases. Presently the burden of non-communicable diseases increases dramatically in resource strained countries in Africa, Asia and Latinamerica (1).

Table I: Pragmatic definition of categories and subcategories of the theme “Pharmaceuticals, innovations and technological approaches” within global health.

The attribute A is defined as: ((*resource strained or emerging countries*) or (*Africa or Asia or Latinamerica*) or (*parasitic or infectious or communicable diseases*) or (*HIV or malaria or tbc*) or (*global health*))

1. **(Technological health systems interventions for health prevention, diagnosis or therapy of diseases) + A**
2. **Pharmacology**
 - (Pharmacoepidemiology or drug utilization) + A
 - (Pharmacological concepts or drug response or pharmacogenetics or pharmacotherapy) + A
 - (Rational Use of Medicines or Antibiotics) + A
 - (Drug discovery or Development) + A
 - (Clinical trials) + A
3. **(Traditional medicine) + A**
4. **(Vaccine or antibiotic or resistance research)**
 - (Basic vaccine or antibiotic or resistance research) + A
 - (Clinical vaccine or antibiotic or resistance research) +A
5. **(Laboratory or diagnostic techniques or principles)**
 - (Basic laboratory or basic diagnostic techniques or principles) + A
 - (Laboratory or diagnostic techniques or procedures applied in clinical settings/healthcare) + A
6. **ICT (Information and Communication Technology)**
 - (e-health concepts) + A
 - (e-health including mobile phones, ICT-applications or interventions used in clinical practice or adapted by in the healthcare system) +A
7. **(Other technological interventions or innovations) + A**

Description of the research

Table II: Summary of Swedish project research grant applications (n=217 classified into 231 categories/ subcategories.

One application can be assigned to more than one category/ subcategory) to SIDA 2000 to 2010 and to VR 2011 to 2013 for the theme “Pharmaceuticals, Innovations and Technological approaches”. The attribute A is defined above!

1. **(Technological health Systems Interventions) for prevention, diagnosis or therapy of diseases +A: 31**
2. **Pharmacology + A:70**
 - (Pharmacoepidemiology or drug utilization) + A: 6
 - (Pharmacological concepts or response or pharmacogenetics or pharmacotherapy)+ A: 12
 - (Rational Use of Medicines or Antibiotics) + A: 17
 - (Drug discovery or development) + A: 26
 - (Clinical trials) + A: 9
3. **(Traditional medicine) + A: 4**
4. **(Vaccine or antibiotic or resistance research) +A: 87**

- (Basic vaccine or antibiotic or resistance research) + A: 59
- (Clinical vaccine or antibiotic or resistance research) +A: 28

5. (Laboratory or diagnostic techniques or principles) + A: 26

- (Basic laboratory or basic diagnostic techniques or principles) + A: 14
- (Laboratory or diagnostic techniques or procedures applied in clinical settings/healthcare + A: 12

6. ICT (Information Communication Technology) + A: 12

- (e-health concepts) + A: 1
- (e-health including mobile phones or ICT-applications or ICT-based interventions in clinical practice or in healthcare) +A: 11

7. (Other technological interventions or innovations) + A: 1

Table II demonstrates that the theme is dominated by pharmacological and vaccine/antibiotic/resistance research. Both research focusing on a. “laboratory diagnostic methods” and b. “health systems oriented research on technologies for prevention, diagnosis and therapy” are well represented among applications to SIDA and to VR between 2000 and 2013 in the “global health supported program”. In the recent five years 12 ICT-oriented research projects, primarily evaluating the efficacy and effectiveness of SMS- technology for diagnostic and therapeutic purposes have been submitted to SIDA and VR. Few if any comprehensive ICT approaches have, however, been identified among the grant applications. Few applications can be classified as pharmacoepidemiological or as clinical trials. This is in contrast to these research fields become strong in Sweden during the last decade. Few if any applications in the pharmacoepidemiological or drug utilization fields include collaborations with “Demographic Surveillance Sites” in Africa or elsewhere (2-3) in contrast with priorities in other research themes in global health funded by SIDA or VR (4). The 217 grant applications within the theme represented 28% of all global health applications and 35% were funded (n=76). For the period 2000 to 2013, the majority of grant applications came from Karolinska Institutet, Gothenburg University or Uppsala University (Table III). A total of 60.5% of granted applications were to principal investigators at Karolinska Institutet.

Table III: Reported main academic institution for principal investigator of applications for Swedish project grants 2000 to 2013 (n=217) for the theme “Pharmaceuticals, innovations and technological approaches” in global health.

Karolinska Institutet	102
Gothenburg University	36
Uppsala University	23
Swedish Institute for Infectious Disease Control	11
Umea University	9
Dalarna University College	8
Lund University	8
Royal Institute of Technology (KTH)	5
Other universities/institutions	15
Total	217

The 76 granted applications were from 46 researchers. I could retrieve about 2600 listed publications in Pubmed (period 2000 to 2014) for these 46 researchers corresponding to a mean value of 54 international publications within and outside the theme “Pharmaceuticals, Innovations and Technological approaches”. The majority of the publications were in well-respected international journals within specific research areas such as Vaccine, J of Immunology, Clinical Pharmacology & Therapeutics, Malaria Journal, PlosOne. A few

publications were published in top- ranked journals such as the Lancet, The Lancet Infectious Diseases or BMJ. I could not retrieve any publications in the absolutely top ranked journals New England Journal of Medicine, Science or Nature.

For the period 2010 to 2014 (May 31) I have retrieved a total of 41 PhD-dissertations for the theme “Pharmaceuticals, Innovations and Technological approaches” defended at Karolinska Institutet (6, n=34) and at Gothenburg University (7, n=7). As many as 33 were apparently international PhD-students. Most of them were most likely funded by grants from SIDA. As an example, 34 PhD:s from Makerere University have graduated either at Karolinska Institutet, Makerere University or at both institutions between 2002 and 2014. The students have been supported by SIDA within a bilateral development program. The three most frequent research areas for the 41 PhD-theses were: a. laboratory diagnostic approaches (basic and clinical), b. pharmacological and c. health systems focused research on resistance, diagnostic and therapeutic/vaccine aspects of health or healthcare services.

In summary, the research theme “Pharmaceuticals, Innovations and Technological approaches” represents a substantial part of global health project grant applications (28%) to SIDA or VR between 2000 and 2013. Successful and well cited research groups are active in basic and clinical programs for mucosal vaccination of infections (Holmgren, Svennerholm and others, Gothenburg University), on rational drug dosage including pharmacogenetic, population and disease specific factors (Aklillu, Bertilsson and Gustafsson, Karolinska Institutet and Ashton, Gothenburg University) and research on diagnosis, control and treatment of HIV-, tb- and malaria diseases and studies of resistance (Albert, Björkman, Ekström, Färnert, Peterson, Stålsby-Lundholm, Thorson, Tomson and Sönnernborg, Karolinska Institutet). These groups are successful and internationally well recognized in their fields. The theme “Pharmaceuticals, Innovations and Technological approaches” is critical for improving health and performance of health care systems in resource strained countries. The theme has thereby a critical role to eliminate poverty among poor people in Africa, Asia and Latinamerica. For the next 10 years, knowledge and capacity in resource strained and emerging countries are needed to be able to critically evaluate the value and cost-effectiveness of new technologies and to allow reforms providing comprehensive access and affordability of breakthrough technologies. Resource strained and emerging countries will have to integrate funding of new medicines, vaccines and ICT-tools into their healthcare systems. Most likely resource strained countries need to become independent of external foreign funding for medicines, vaccines and other technologies (8,9). In order to cost-effectively introduce and use new technologies, it will be vital to build strong research institutions and well-trained researchers within the theme in Africa, Asia and Latinamerica (10,11). Sweden, can contribute with training of research students and researchers from Africa, Asia and Latinamerica, building on several decades of research collaboration mainly funded by SIDA.

Sweden needs then to ensure that we sustain and develop research capacities in vital fields of the theme. Likewise, for Swedish Development Collaboration and funding, access to excellent competence and international competitive research environments in Sweden are needed also to make cost-effective decisions of funding of development aid for research capacity building in Africa, Asia and Latinamerica. Strong and sustainable research environments in Sweden require access to appropriate funding of investigator initiated longterm research activities. Investigator initiated research projects are proven to be the most cost-effective type of research concerning both breakthrough and impact on health care delivery. It is, however, important to provide funding of appropriate infrastructures and career paths for Swedish researchers. Examples of such funding needs include a. biobanks, laboratory and e-health resources for research collaborations in Sweden/Europe and with scientists in Africa, Asia and Latinamerica, b. support for development and maintenance of collaborations with demographic and clinical trial sites in Africa, Asia and Latinamerica, c. virtual tools for collaboration, data analysis, sharing and storage of data such as science gateways (5) and d. career paths for Swedish researchers and PhD-students. The need of career paths is illustrated by the fact no more than 8 of 41 defended PhDs (2010-May 31, 2014) of the theme were by Swedish students at Karolinska Institutet and Gothenburg University. It is likely that funding of PhD-studies in the area of global health is tougher than for non-global oriented medical research at Swedish universities. Medical students are highly needed for successful global health research but they have plenty of other carrier opportunities to select among in- and outside Sweden. Researchers funded within the theme “Pharmaceuticals, Innovations and Technological

approaches” by SIDA and VR global health programs demonstrate satisfactory research activity documented by the intensity of international publications. Based on my knowledge about participations in collaborative EU-funded research projects, they also are involved in such important international collaboration. It is, however, remarkable that the 34 PhD-theses within the theme “Pharmaceuticals, Innovations and technological approaches” at Karolinska Institutet 2010 to May 31, 2014 only represented 2.2% of all defended theses for this period (n=1546 PhD-theses, 6). Even though Karolinska Institutet has a high percentage of academic activities of the theme in Sweden, the visibility and overall impact academically at Karolinska Institutet and at other Swedish universities could be stronger considering the importance of the theme. It is remarkable that no more than 4 of 41 PhD-theses at Karolinska Institutet and Gothenburg University 2010 to 2014 (May 31) concerned basic vaccine or drug discovery studies. None could be classified in the subcategory clinical trials. In near future, it is likely that the future of “life science industry” in Sweden and globally will be focused on diagnostic, vaccine and drug discovery/development for control and cure of infectious and communicable diseases seen in resource strained and emerging countries.

Strengths and weaknesses

Strengths

The strength of the theme “Pharmaceuticals, Innovations and technological approaches” is demonstrated by a good production of scientific papers in several of the subcategories as documented by a mean publication number of 54 for researchers granted funding by SIDA and VR between 2000 and 2014. It would be of interest to explore how well represented Swedish researchers of the theme among collaborative projects funded by EU-institutions. EDTCP is focusing on applied research and major clinical trials of new diagnostic and treatment approaches with assigned funding equivalent to 372 million Euros so far (12). SIDA provides substantial funding of EDTCP. Swedish researchers seem well represented in diagnostic, drug and vaccine studies of tb (Bertilsson/ Aklillu, Maeurer and others from Karolinska Institutet). Researchers from Karolinska Institutet/ Swedish Institute for Infectious Control have been well represented in HIV-diagnostic, vaccine and therapeutic studies (Sönnberg, Wahren among others). The overall impression is that Swedish researchers could be better represented in other programs including various diagnostic and therapeutic studies in the malaria field.

Sweden has an outstanding track record of both basic and applied studies on mucosa vaccines by the Gothenburg group. This group has also excellent competence in design, planning and completion of clinical trials of new oral vaccines including an established competence centre for vaccine development in Gothenburg. Similar competence and infrastructures linked to universities are not established in any other areas of clinical trials of drugs or other technologies in Sweden focusing on the needs in Africa, Asia and Latinamerica. Most likely, funding of clinical trials of drugs and drug combinations studies for controlling HIV/AIDS, malaria, tbc and other infectious diseases is scarce in Sweden. Such applied may not attract Swedish researchers despite excellent competence and research in pharmacotherapy of malaria, HIV/AIDS and tb. Multicentre trials of new treatment options of malaria has required major public funding by foundations like Wellcome Trust (targeted strictly UK researchers) and Global Fund. Swedish researchers and groups have failed to raise such major funding (13). Interestingly, progress with new diagnostic tools, vaccines and new drug treatment combinations for control and treatment of tb including multiresistant tb is within reach (9). The research and development capacity in Sweden is strong in Sweden (Karolinska Institutet, Linköping, Lund and Uppsala universities among others) (9,14). The potentials for breakthroughs in diagnosis and therapy of tb are summarized by Maeurer et al recently (9).

Other strong research areas include the clinical pharmacology and pharmacogenetics of malaria, HIV/AIDS and tb drugs at Karolinska Institutet (clinical pharmacology; Aklillu, Gustafsson and others; pharmacology; Ingelman-Sundberg and Gil; MTC: Björkman and others). Clinical pharmacology at Karolinska Institutet has excellent laboratory infrastructure for establishing sensitive and field-adapted analytical methods (Beck and others). In addition, good competence in the pharmacological field is established in Gothenburg (Ashton and

others) and at Uppsala with a world leading centre in population kinetic modelling directed by Karlsson et al. The pharmacological, pharmacotherapeutic, modelling knowledge and drug analytical capacity that exist in Swedish universities can be strengthened in the area of global health. Wahlgren and his group has based on understanding on the pathophysiology of cerebral malaria made significant contributions in the development and phase I to phase II tests of new therapeutic approaches. This capacity is an asset in multinational collaborations and can help to establish knowledge centres in resource strained and emerging countries. The field of drug analysis is undergoing a revolution with new automatic systems for multidrug assays using a few microliter of blood only that can be collected as dried blood spots on filter papers. It is likely that these methods will revolutionize drug development and use in future (15). Practically all Swedish universities have excellent resources within the field, in particular in Stockholm including the newly established Toxicological Centre in Södertälje after the closure of the research site of Astra-Zeneca. Clinical pharmacology at Karolinska University Hospital in Stockholm is by far the largest drug analytical laboratory in healthcare in Europe.

My review of the applications for project research funding provided by SIDA and VR within global health demonstrates that Swedish research on ICT-related projects is increasing within the theme (16). The focus is on the use of SMS-technologies to improve adherence to HIV-therapy (Thorson and others) but this field will most likely be of central importance for healthcare and research in Africa, Asia and Latinamerica in future. Sweden is well-positioned in the field but still lack competitive and sustainable infrastructures and career paths and could also gain by joint projects between medical and technical research groups. The possibility to strengthen research in Africa, Asia and Latinamerica by establishing virtual ICT-infrastructures for storage, sharing and analysing data and for communication across distances should be emphasized (17). This will contribute to strengthen collaboration for Swedish researchers with foreign partners in Africa, Asia and Latin America. Karoliska Institutet provides a well-established master program in health informatics recruiting students across the globe (Koch S and others). The funding organization Spider supported by SIDA provide minor grants for foreign students and researchers covering training and research relevant for needs in Africa, Asia and Latinamerica. The fields of ICT and e-health need increased collaboration with institutes of technologies in Sweden and a strengthened focus on contents management and decision support (16-18).

Weaknesses

1. PhD-studies attract few students from Sweden. It is critical to recruit medical students and MDs into the field to ensure that progress in research is implemented also into clinical practice. MD-trained researchers are important for renewal of Swedish undergraduate medical studies since knowledge in global health is required in Sweden and Europe by all physicians in future due to increasing globalization.
2. Concentration of research within the theme to few universities. Research collaboration across university cities in Sweden and in Scandinavia would strengthen the research capacity in Sweden.
3. The theme "*Pharmaceuticals, Innovations and Technological approaches*" is apparently a minor part of medical research in Sweden.
4. The career path for Swedish young researchers active in the theme is weak. It is challenging to acquire sustainable funding since the available funds to project grants for Swedish researchers are not impressive in size. It is important to train Swedish researchers to design and carry out innovative research and write internationally competitive grants for funding.
5. Few outcome studies, in particular researcher initiated, are coordinated by or involving Swedish researchers within the theme. This is in contrast to excellent capacity, training and experience in the area of randomized controlled trials in Sweden.
6. Swedish researchers could be far better represented in major multisite studies and multicentre controlled trials within the theme in Africa, Asia and Latinamerica.
7. Swedish researchers should be better represented in governing and scientific bodies of international funding organizations such as TDR (Tropical Disease Research), EDTCP, malaria and tb-alliances and in other EU-funding organizations of relevance for the theme within global health.

8. The involvement of Swedish researchers in the application process by the bilaterally funded aid for research by SIDA for partner countries in Africa, Asia and Latinamerica (about 1000 million SCr annually) is weak. The procedures for funding of foreign researchers and PhD-students in this program do not adhere to the same models and time schedules developed by SIDA centrally and by VR. It is doubtful if the prioritization of research funding is transparent in those bilateral programs since the evaluation and planning of the research is directed by local officers in charge of research at the local embassies in Africa, Asia and Latinamerica.
9. It is in doubt if laboratory scientists, including bioanalytical experts, pharmacoepidemiologists and epidemiologists, pharmacokinetic modelling experts and e-health scientists are fully aware of the potential to get funding for global health relevant research by VR. These research fields are strong in Sweden and should gain by being involved in global health oriented research since technical breakthroughs within these areas of research will be highly relevant for health related research and healthcare in developing countries in future (2,3,18).

Trends, tendencies and prognosis for the future

The theme will most likely increase in importance in Sweden and in Africa, Asia and Latinamerica.

Systems oriented research on implementation and evaluations of technologies and resistance related research have all potentials to continue to be strong in Sweden. The quality in research would gain from using demographic surveillance sites increasingly in research. The research field is dependent on access to ICT for collection, sharing, storage and analysis of data that is an important area of investment in future (17).

The *pharmacological and clinical pharmacological approaches* are already strong but should gain from better career paths. The area should try to attract interest in pharmacoepidemiological approaches and try to involve the unique and world leading population kinetic/dynamic modelling group in Uppsala. The capacity and knowledge in drug analytical and bioanalytical methods are of high international standard in Sweden. Sweden is well positioned in the area of pharmacogenetics and pharmacogenomics. New innovative biochemical and immunological diagnostic methods and procedures can become a strong research field. The critical role of genomic approaches for African healthcare sciences has just been emphasized by a joint NIH US and Wellcome Trust initiative in building research capacity in Africa (10). Swedish researchers have a long tradition to train and collaborate with African scientists in the field of pharmacogenomics where one graduate of Karolinska Institute, professor Collen Masimirembwa, has established a strong pan-African research network (17) that provides an excellent training opportunity for young Swedish scientists.

The *comprehensive malaria research* integrating pharmacotherapeutic, molecular and interventional approaches has been strong in Sweden since decades. Swedish researchers have helped to define dosage regimens and system like approaches to control malaria in Africa. Several senior clinical researchers have been active in Stockholm, and with close collaborating with basic malaria researchers at Karolinska Institutet and Stockholm University. The research field seems to have decreased in international impact. Young researchers need to be ensured career paths to be able to develop the field.

HIV- research of the theme is well represented and strong in Sweden. A number of groups in Sweden collaborate across institutions and apply various research methods. Swedish researchers have all possibilities to continue to collaborate in molecular, diagnostic and drug trials with institutions in Africa, Asia and Latinamerica. It seems appropriate to stimulate the researchers to develop their research on how ICT-based interventions can assist in clinical care in Africa, Asia and Latinamerica.

Tb-research area is strengthening its position in Sweden due to successful recruitments of scientists, collaborations across institutions and due to good funding opportunities. Sweden should be able to play an important role in the field both concerning basic understanding of the disease and resistance development and in development of new diagnostic procedures, vaccines and drug regimens.

Basic and clinical research on mucosal vaccines is strong and has all possibilities to continue to be so if positions are available for younger researchers in Sweden. The breakthroughs by the Gothenburg group has been of highest international standard. In future, career paths for the young generation is needed.

Research on *mechanisms of action of antibiotics and new targets for antibiotics* and understanding of resistance mechanisms have grown in Sweden the last five years. Major groups including young investigators are active in Sweden, in particular in Uppsala and in Stockholm. Major funding have become available by various initiatives by VR, Vinnova and international institutions. The research field should gain from collaborations with bioanalytical, pharmacological and clinical pharmacological groups.

e-health research will develop and can develop in Sweden. The competence at the medical faculties need to be strengthened with improved contacts with technical faculties. There is a need to get access to reliable and cost-effective e-infrastructures for communication, retrieval and storage of data and e-learning. This area needs to attract MDs if research and clinical applications should be relevant for healthcare in resource strained countries and in Sweden. There are young researchers in the field and an excellent master education in health informatics at Karolinska Institutet. In this area applications for distance diagnosis is developing and seem highly promising with collaborations between Finland and Sweden and resource strained countries (Diwan one of the leaders).

Contacts between life-science industry within the theme and global health research is surprisingly poor developed in Sweden. It should be of benefit for Swedish life-science industry if greater interest was focused on global health research. Several areas of research in global health are related to technologies and drugs/vaccines with strong academic environments and competence in Sweden. Government and Vinnova initiated projects to develop the life-science industry in Sweden should consider the strength of the theme “Pharmaceuticals, innovations and technological approaches” in global health academically in Sweden.

Recommendations

Research funding

1. **Continue and strengthen funding of researcher initiated projects as main route of funding.** The extent of funding within the area of global health should be increased. The research field has gained to be integrated into the VR-system for Swedish researchers.
2. **Explore if the role of Swedish scientists could be strengthened for bilaterally funded projects in research administered by SIDA and increase transparency in the funding process.** Presently bilateral research funds are part of the aid program to specific countries gaining support by SIDA. The administration and priorities are mostly coordinated by research officers at the Swedish Embassy in question. The strength of bilaterally funded research should be strengthened by fully involvement of Swedish researchers (about 1000 million SEK annually) during the application process. The present system to gain support is not transparent, time-lines differ from country to country and the collaboration between scientists in Sweden and in resource strained countries are hampered by administrative burdens. Discussions between VR and SIDA on how Swedish research can strengthen the bilateral SIDA program is a matter of urgency.
3. **Establish funds for researcher initiated “treatment research” in the area of global health.** I have found that Swedish researchers are less than optimally involved in important trials of diagnostic tools, drugs and vaccines. Swedish funds are scarce. Consider if recently established fund (VR handling agency) for “treatment research” could be eligible for research carried out in resource strained countries in Africa, Asia and Latinamerica. Swedish innovation capacity should gain from investment in a fund for “treatment research” for Swedish researchers. VR, SIDA, universities and private donors are recommended to consider establishment of a Swedish or Scandinavian fund for applied global health research similar to Wellcome Trust Fund in UK.
4. **The carrier paths and opportunities for Swedish global health researchers to be improved** The carrier paths have to be improved to attract MD researchers and thereby develop and strengthen knowledge in global health at Swedish universities.

5. **Funding of industrial PhD-/postdoc positions for research of the theme is suggested.** The theme “*Pharmaceuticals, innovations and technological approaches*” is vital for the development of new products to prevent, diagnose, cure or treat important global health diseases. Both for development of diagnostic tools, procedures, drugs, vaccines and e-health applications increased competence in Swedish industry and collaboration with academic institutions are important. This is best achieved by funding of the above type of positions by industries, public funds or private donors jointly. Such a program can help strengthen “Life Science Industry” in Sweden.
6. **The theme of global health should be considered when improving drug development and clinical trial competence in Sweden.** The Swedish government is supporting universities, industries and various government agencies to increase knowledge and drug development capacity at universities and at industries after the break-down of the research site of Astra-Zeneca in Södertälje. This initiative supported by VINNOVA should involve training and capacity building in Sweden within the theme “*Pharmaceuticals, innovations and technological approaches*” of global health.
7. **Establish e-infrastructures for virtual collaboration with scientists in Africa, Asia and Latinamerica.** It is likely that the research capacity in Sweden could be strengthened and also become more sustainable in Africa, Asia and Latinamerica by establishing e-infrastructures for contacts, collaboration, sharing of data, accessibility to research tools and e-learning. This is the responsibility both of VR and SUNET. Infrastructure funds should become available through VR.
8. **Establish longterm funding of infrastructures in resource strained countries: laboratories, ICT-infrastructure and epidemiological centres/surveillance sites.** This should be part of the SIDA program from bilateral funding of research in resource strained countries. SPIDER, supporting ICT-development in developing countries, may get an important role to provide funding and training of relevance for e-infrastructures for research. VR should initiate discussions with SIDA how to strengthen infrastructure for research within the theme and also using Swedish researchers as mentors in Africa, Asia and Latinamerica

Other suggestions

9. **Report biannually what global health oriented research that is supported by VR/SIDA.** The critical role of this research has to be communicated to the scientific community, politicians and the public.
10. **Recruit Swedish scientists in global health to international bodies for research.** Presently the theme of global health have limited representations by Swedish scientists in international bodies for research funding and collaboration.
11. **Establish a national “Research School” in Sweden for PhD-students/postdocs** The collaboration between scientists in Sweden can be strengthened within the theme. In addition, the carrier paths have to be increased. A Research School for the theme “*Pharmaceuticals, innovations and technological approaches*” is needed for students and should be open for Swedish and international students.
12. **Establish guest-research positions at Swedish universities (open for Swedish and foreign scientists) and at selected foreign universities in particular in Africa, Asia and Latinamerica.** This program should vitalize collaboration within Sweden and with other researchers in Europe, USA and in Africa, Asia and Latinamerica.

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SOCIAL DETERMINANTS OF HEALTH

Keywords

Social determinants of health, global health, inequality, life expectancy, healthy life expectancy, morbidity expansion, prevention, capacity-building, measurement, global system

Description of the research

Social determinants of health

These are often defined as “those circumstances in life under which we grow up, study, work, live and age” and which continuously and cumulatively influence an individual’s health during the course of life (Commission on Social Determinants of Health Final Report, 2008). Research focusing on social determinants of health typically has a life course perspective, as is obvious from the definition quoted above. The term “social” is used in the broadest sense and refers to all sorts of external influences, such as nutrition, manmade physical environments or friendships in schools, all of which are believed to have a direct or indirect impact on human health. Such a life course perspective dominates much of epidemiology today. Your life experience determines your long term health chances.

Swedish and Nordic research into social determinants of health largely follows a life course model. In addition there is also a strong focus on contextual influences; for instance of the school class, the neighborhood or the community or the types of welfare policy a country operates. Common to these approaches is that they often try to identify how contextual influences work through social cohesion, social relations and social comparisons, beyond the importance of “downstream” individual risk factors.

Much of this research is done with no particular reference to health problems in low and middle-income countries, but it is in fact generally applicable to all countries, rich or poor. Thus, Swedish and Nordic research represents a very high general scientific competence in social determinants of health, which could benefit low and middle income countries, both in terms of potential research collaborations and perhaps most fruitfully in terms of capacity-building. The Commission on Social Determinants of Health commissioned a network of Nordic researchers, coordinated from Stockholm, to draw lessons for global health from Nordic welfare state policies (Lundberg et al, 2008). Its work led to the recommendation in the final report that governments, rich or poor, should aim for “social protection over the life course” of its populations. The same conclusion was embraced by European WHO, in their report on the “European health divide”.

An exciting recent development of the life course perspective is its extension into the social experience of parental and ancestral generations, which is believed to have a potential impact on the health of present generations. Studies of historical events, from all parts of the world, illustrate this well. For instance, the 1958-61 famine in China has been linked to increased rates of schizophrenia in children conceived during the famine (St Clair et al 2005); the 1933 famine in Ukraine has been linked to excess diabetes mortality (Vaiserman et al 2013) and starvation during the Leningrad siege 1941-44 to elevated blood pressure, cardiovascular disease and breast cancer (Vågerö et al 2013). A study of the Dutch Hunger winter 1944-45 demonstrated that perinatally induced epigenetic changes lasted across life (Heijmans et al 2005) and, hypothetically, could be transmitted to following generations via the germ line. If this is indeed the case, it will probably change our views on public health fundamentally. Historical events, not limited to war and famine, have the capacity to influence population health across a huge time span, sometimes spanning generations. “The long arm of the past” is probably best thought of as acting through several parallel mechanisms, cultural, social and epigenetic, acting simultaneously. The present global system is shaped by history, but its importance for global health is also very direct as can be seen from rapidly changing health situations, for instance after the collapse of the Soviet Union, during the recent economic crisis in Europe or as a consequence of the war in Syria. The WHO regional

office in the Middle East Region considers war and conflict to be the number one health determinant in that region. These are likely to have consequences also in generations not yet born. Examining these should be a part of research for development.

Global health inequalities

The causes behind present life expectancy differences in the world are only partly understood, although some authors do try to advance our theoretical understanding of global health (Kawachi and Kennedy, 2006). A research programme for global health must promote our understanding of global health inequalities.

Moser et al (2005) studied global inequalities in infant mortality and life expectancy at birth by comparing every country in the world with every other country for each year 1950 to 2000. This was summarized into a “dispersion of mortality measure”, taking into account the size of each compared country. They found a pattern of globally converging infant mortality trends for the whole period; thus global inequalities in infant health grow smaller. However, for life expectancy the picture was different. There is convergence of life expectancy trends during 1950-1980, but from approximately 1990 life expectancy trends diverge; thus global health inequalities are growing larger, using this indicator. This divergence was primarily driven by trends in Sub-Saharan Africa and the former Soviet Union, where a number of countries were experiencing falling life expectancies.

The “human development index” includes life expectancy at birth as one of its three components. As the “Sarkozy Commission” has argued, it is a more important component in development than GDP/capita (Stiglitz et al 2010). However, a relevant critique against life expectancy based measures is that they ignore the burden of non-fatal disease and disability. In a recent Lancet paper Salomon et al (2012) use “healthy life expectancy” (the expected number of healthy years) to study trends in 187 countries in the world in the period 1990-2010. Their “healthy life expectancy” measure takes into account 220 distinct health states, as part of a country’s disease burden, apart from its mortality record. Healthy life expectancy increased in general across the globe, but male healthy life expectancy fell in 22 countries and female in 11 countries, during the twenty-year period. Theories that all countries will move forward and more or less follow the same route to improved population health does not stand up to the test; in fact they ignore the fact that national health developments today are part of a closely intertwined global system with extremely skewed distributions of economic resources, political power and public health knowledge (CSDH 2008). Studying this system, and the possibilities to strengthen actors such as UN and WHO, should be part of a research agenda for development.

Expansion of morbidity

Salomon et al (2012) also showed that the increase in global life expectancy, 1990- 2010, was faster than the increase in healthy life expectancy. Therefore the number of year people live with disease or disability is growing on average. This is evidence for the “expansion of morbidity” and a rejection of the theories of “morbidity compression”. The latter theory was based on the insight that cardiovascular disease and respiratory disease could be prevented and postponed to a later stage in life (Fries 1980). This insight is still valid. Most years lost to disability globally, however, are probably caused by problems which have not yet been tackled by credible large scale prevention, sometimes because the knowledge of how to do it is missing, sometimes in spite of the existence of such knowledge.

There are large variations across the globe in this morbidity expansion. Morbidity expansion will inevitably result in demands for more medical resources. Health systems will feel this demand and governments are likely to argue about whether expenditures for medical care are affordable investments or non-affordable costs. In the present discussion of the post 2015 development goals there is a strong push to put “universal health coverage” on the agenda as one of those goals. Prevention is the only way of limiting future costs for medical care. Thus, there is every reason to strengthen research into prevention as well as applying the knowledge that we already

have. The “Lancet Commission on investment in health” concluded that a broad programme of health investments today would result in “a world converging” in 2035 (Jamison et al 2013).

The general public is quite supportive of the idea of financing programmes of disease prevention in poor countries, through international aid, but there are doubts about their effectiveness (Lancet editorial 2010). Evaluations of such programmes must therefore be important.

Focus on determinants vs focus on disease

The consistent social pattern of disease, in rich and poor countries, suggests that by improving living conditions in general, especially for those disadvantaged in society, a variety of health problems will be avoided, prevented or reduced. This has led to a preventive strategy which focuses on social determinants of health rather than on specific diseases with known disease etiology. One can argue both ways and the two approaches are not mutually exclusive. The Commission on Social Determinants of Health highlighted a number of concrete areas for prevention, based on the first strategy. Although these suggestions were based on the best evidence available there are still many questions about what causes the heavy disease burden in some populations and what can be done in the way of prevention.

There is thus a research agenda around all the main recommendations that the Commission suggested, for instance education of mothers, girls and boys to reduce the health burden in a country; improvement of labour market security and work environments; social protection of individuals and families in unemployment, disease or crisis; safe and healthy living environments; inclusive social arrangements to prevent marginalization and social isolation, etc.

These determinants could be seen as “downstream”, since they are closely linked to an individual’s situation and risk profile. They could also be seen as “upstream”, as determinants of individual risk factors such as blood pressure, metabolic profile, obesity or stress. They are studied in many mainstream public health departments around the world. But daily living conditions are embedded in local, national and global political/economic systems, where health is merely a side-issue. Public health needs a much better insight in these systems. There is less research in how these systems influence health. In general, such goals as economic growth, budget control or competitiveness on the global market, score higher in government priorities than do the prevention of health problems, concern for the natural environment or for the climate. Such government priorities are hardly sustainable, not compatible with sustainable development. Under what circumstances can governments in fact change these priorities? That is a different research agenda which will bring together global health researchers and global development researchers.

Strength and weaknesses

All major universities in Sweden are involved in training of Master and/or PhD students in global health, usually provided by university departments with a strong research record. Social determinants of health is a strong research field in Sweden, although it tends to be general rather than focused on low and middle income countries.

There is relatively little interchange between medical and social science faculties in the area of global health. Medical faculties often focus on individual countries and their health systems; sometimes on a specific disease and its distribution across several countries. Social science faculties often have expertise in how the global political and economic systems work, including the UN and WHO. Sometimes this expertise is very high in specific geographical area studies, with their own research institutes. But too often this research is only very loosely, or not at all, concerned with health. Bridging those gaps could be very fruitful.

Sweden has excellent competence in information systems useful for global health research. Swedish demographers have helped build up Census information systems in China, Palestine and other countries. The Swedish Foreign Office helped finance the Russian Longitudinal Monitoring Survey in the 1990s to be able to follow social and health trends there. Mortality studies in many countries without population censuses are based on Demographic and Health Surveys, initiated by the World Bank. Sweden has the same, or higher, capacity

for that kind of work. It would only take a small effort to draw some of these resources together to the benefit of international capacity-building in the monitoring of global social and health trends.

Recommendations

There is a clear opportunity for capacity building in global health in Sweden, focusing on social determinants and the global system as well as on specific problems in individual countries. This could include a program for Swedish academic departments to invite post docs from low and middle income countries as well as programs to support Swedish senior researchers to spend time in academic institutions in low and middle income countries. Research collaborations, around global health issues, between academic partners in Sweden and other countries should be supported.

A program of new professorships, postdocs and doctoral student positions in global health could be created and financed by VR. They could be allocated to a limited number of university departments with a strong research potential after application and peer review, rather than being granted after individual personal application.

Measurement issues and data information systems are two examples of areas where Sweden could take a leading international role if it so wanted. A smaller version of the “Institute for Health Metrics and Evaluation” in Seattle could be a realistic option.

Support for international academic networks that works with global health. There are several examples of these. The “Academic Consortium on Social Determinants of Health”, newly initiated by Michael Marmot, focuses on social determinants and global health inequalities with partner departments from all continents.

Funding for specific research programmes in Sweden: Labour and refugee migration across international borders and continents is a dynamic force that no single country can control on its own. The social and health consequences of this process, both in destination and origin countries, should be studied much more carefully than has been done hitherto.

I suggest that the long term aims could be:

- 1) to get a much better understanding how the global political/economic system influences the global health situation at large and in some detail through the financing of new research and
- 2) to give Sweden a well-integrated global health research community which is able to play its part in building research and monitoring capacity on all continents.
- 3) to “marry” the global health research community in Sweden with the global development research community.

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ENVIRONMENT AND CLIMATE CHANGE

Keywords

Climate change adaptation, biodiversity conservation, ecological design, ecosystem governance, ecosystem services, environmental economy, equity research, institutional capacity, land use sustainability, marine systems, planetary boundaries, resilience science, resource management, social-ecological systems, sustainable agriculture, sustainability science, trans-disciplinary science, transformation, urban ecosystems, urbanisation, vulnerability.

Description of the research

The objective of Swedish development cooperation is to help create conditions that will enable poor people to improve their lives. The Swedish Government have set objectives in their Aid Policy Framework (Regeringskansliet 2013) to meet the needs for development and resilience of current and future populations and core aspects of the Swedish development agency's (Sida) support to environment and climate is: *A better environment, sustainable use of natural resources, stronger resilience to environmental and climate change in developing countries, as well as limited climate impact.*

Environmental and climate aspects are a central basis for all Swedish development cooperation, both within normative and operative work. In order to reach their targets the support to environment and climate change focus on five main goals: 1) *Strengthened resistance to environmental effects, climate change and natural disasters, and reduced impact on the environment and climate;* 2) *Strengthened institutional capacity in environmental management and environmental institutions;* 3) *Sustainable cities;* 4) *Improved access to sustainable energy alternatives;* 5) *Sustainable management of ecosystems and sustainable usage of ecosystem services.*

Globally, interdisciplinary research on environmental and climate change has grown rapidly over the past two decades (ISSC & UNESCO 2013). This is illustrated through international programmes such as the Intergovernmental Panel on Climate Change (IPCC), Millennium Ecosystem Assessment (MA), the International Geosphere-Biosphere Programme (IGBP) and the International Human Dimensions Programme on Global Environmental Change (IHDP), as well as the recently launched Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), and Future Earth. Swedish researchers and research have been strongly involved in many of these initiatives, such as the MA, DIVERSITAS, IGBP, IPBES, and Future Earth.

Future Earth is new international research platform that will provide knowledge and support to accelerate global sustainability (Future Earth 2013). It brings together existing programmes on global environmental change and coordinates new interdisciplinary research within three themes: Dynamic planet (to understand what is happening); Global development (to understand the link between environmental change, human well-being, and development); and Transformations towards sustainability (to understand, implement, and evaluate transformation needed to move towards sustainability). It is also a platform for international engagement and co-production of knowledge, connecting society and users of science. It is open to both natural, and social disciplines, as well as engineering, humanities and law. Swedish researchers, primarily through the Royal Academy of Sciences and Stockholm University, have been closely involved in the framing of the Future Earth, and it was recently acknowledged that one part of the globally distributed secretariat is to be located in Sweden.

Global environmental change has long been addressed in publications from the fields of environmental studies, economics and geography, and since 2005 the number of publications from social sciences within this field has also increased substantially (ISSC & UNESCO 2013). The contribution of European publications to the global total is considerable, most of them originating from North and Western Europe. Swedish environmental research has been concerned with global level dynamics and processes, through e.g. climate and ecosystem dynamics modelling, as well as more case study based empirical research on resource use and governance. There are significant contributions to theoretical development of e.g. biodiversity functions and

social-ecological systems, as well as to knowledge generation for practical implementation of, e.g. ecological design and sustainable land use.

The majority of Swedish environmental research is performed at the universities, while many other nations have research institutes that perform environmental research directed by their respective government. When looking at the division of funding for environmental research from the larger funders (Formas, Mistra, Sida, Swedish EPA, and Swedish Research Council) the Swedish university of Agricultural Sciences (SLU) is the largest recipient, followed by the universities of Lund (LU), Stockholm (SU), Gothenburg (GU), Uppsala (UU) and Umeå (UmU) (Formas 2011). Using the listed keywords a search was performed in Web of Science (WoS) to make a rough analysis of the scope of publications, see the appendix on page 11 for search strings. When looking at the number of scientific publications in WoS within environment and climate, accounting the number of publications per university, according to authorship from Swedish Universities, the list looks similar to the list of funding recipients. However, analysing the assigned topics individually there is a difference of focus between the institutions. *Governance* is larger at SU, LU and Linköping University (LiU); *Resilience* and *marine systems* is largest at SU; *Environmental economy* is shared between GU, SLU and LU; *climate change adaptation* is mainly researched at LU and UmU; SLU have the main research within *sustainable agriculture*, and *biodiversity*; SLU and SU both have *ecological design*.

There is a growing number of research centres at universities in Sweden with environmental focus, some have started through special initiatives from the government, and others at research funders' or universities' initiative. Most of them have cooperation both within and between universities and with stakeholders outside of the academic environment, showing that many of the environmental issues demands this type of trans-disciplinary setting. Especially research at Stockholm Resilience Centre (SRC), and Lund University Centre for Sustainability Studies (LUCSUS), and Linköping University's Unit of Environmental Sciences¹, have strong trans-disciplinary profiles that crosses both the natural and the social sciences. Within their research, there are a number of themes that serve as important platforms for interdisciplinary cooperation, generating novel insights on complex social-ecological systems. There are prominent centres for sustainable development research within most of the universities, either with more of a natural science focus or a more of a social science focus. Examples include Gothenburg Centre of Globalization and Development (GCGD) and Centre for Sustainable Development (CSD) in Uppsala. According to Formas (2011) 65 % of Swedish environmental research is done within thematic research programmes.

Apart from the university research, high-quality scientific environmental research is performed at other institutes, such as *Stockholm Environment Institute (SEI)* (within the themes *Reducing climate risk*, *Managing environmental systems*, *Transforming governance*, and *Rethinking development*), and Beijer Institute of Ecological Economics (within the themes *Aquaculture and sustainable seafood production*, *Behaviour, economics and nature*, *Complex systems*, *Global dynamics and resilience*, and *Urban social-ecological systems*), often in collaboration with established university research groups.

Table 1. Topics addressed within Swedish research and examples of ongoing projects with trans-disciplinary and/or development profile

Topic	Description of research	Examples of research projects
Governance and institutional capacity	<ul style="list-style-type: none"> • Sustainable transformation • Environmental governance and policy 	Urban transformation (LUCSUS); GCGD (GU);
Urbanisation	<ul style="list-style-type: none"> • Urban risks and vulnerability • Green infrastructure • Biodiversity for urban development 	Urban transformation (LUCSUS); URBES (SRC/Era-Net), GreenSurge (SRC/FP7), ARTS (SRC/FP7)

¹ Previously the Unit of Water and Environmental Studies and Centre for Climate Science and Policy Research (CSPR).

		SUPER (Beijer/SRC); SURE (SU); Mistra Urban Futures (GU); CLUE (KTH)
Resilience	<ul style="list-style-type: none"> • Resilience of cities • Increase social-ecological resilience 	PECS (SRC); ResDev (SRC); Global dynamics of resilience (SRC/Beijer)
Biodiversity	<ul style="list-style-type: none"> • Biodiversity for the future • Biodiversity in a changing climate 	BESAFE (SLU); BECC (GU/LU)
Water quality – resource management and productive sanitation	<ul style="list-style-type: none"> • Water stress and adaptation • Right to water • Water management 	DEWD (LiU); WMRG (KTH)
Climate change adaptation – adaptive capacity	<ul style="list-style-type: none"> • Societies adaptive capacities to climate change • Ecosystem-based adaptation • Climate-smart water adaptation strategies • Climate change and environmental objectives 	Ecosystems adaptation (LUCSUS/SLU); Tre små städer (CSPR); CLEO (SLU/GU/SU/LU);
Sustainable land use – ecosystem governance	<ul style="list-style-type: none"> • Land use today and tomorrow 	LUstT (LUCSUS);
Ecosystem services	<ul style="list-style-type: none"> • Tool for climate change adaptation • Ecosystem services for the future • Ecosystem services in a changing climate 	Ecosystems adaptation (LUCSUS/SLU); BESAFE (SLU); BECC (GU/LU); BioSustainability (SRC); ESPA (SRC); SAPECS (SRC), SPACES (SRC).
Environmental economy	<ul style="list-style-type: none"> • Management of natural resources • Sustainable urban development • Green economy 	COMMONS (GU); Green surge (SLU/SU); Economic Assessment for the Environment (KTH)
Agriculture systems – sustainable intensification	<ul style="list-style-type: none"> • Social innovations for food security 	Subsistence agriculture (LUCSUS); Triple Green (SRC)
Marine systems	<ul style="list-style-type: none"> • Sustainable oceans • Seafood production in a changing climate 	NEREUS (SRC); Aquaculture and sustainable seafood production (SRC/Beijer)
Ecological design, restoration	<ul style="list-style-type: none"> • Protected areas to increase social- ecological resilience 	BUFFER (SLU); Urban Form (SRC)

Strengths and weaknesses

Swedish environmental research is generally highly acknowledged internationally and Sweden is one of the leading countries of publishing research on environmental science, especially within the fields of climate change, ecosystem services, marine systems, and trans-disciplinary research. Further, the research produced is an important driver for environmental policies both nationally and internationally, and provides input for many international bodies. As an example there are several of the Swedish research groups that have been active in providing science for the Intergovernmental Panel on Climate Change (IPCC), including lead authors from the Bolin Centre for Climate Research (SU), Centre for Global Health Research (UmU), Lund University Centre for Sustainability Studies (LUCSUS), and the Centre for Climate Science and Policy Research (LiU).

Furthermore there are several international research initiatives with clear development agendas, where Swedish researchers are involved, such as Ecosystem Services for Poverty Alleviation (ESPA). ESPA is a research programme based in UK, where the focus is on performing research that aims to improve understanding of the way ecosystems function and their relationship with the political economy and sustainable growth. The programme has an impact strategy where its success will be measured by how their research generates new knowledge that can benefit poor people. To give one example, Sustainable Poverty Alleviation from Coastal Ecosystem Services (SPACES) is an ESPA funded project in which Swedish researchers are involved, aiming to empirically test and understand the complex relationship between ecosystem services and the wellbeing of the poor in coastal Kenya and Mozambique.

In response to biodiversity and ecosystem services declining at an unprecedented rate, and in order to address this challenge, the international community established The Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) in 2012. It is an independent intergovernmental body open to all member countries of the United Nations and aims to strengthen capacity for the effective use of science in decision-making at all levels. IPBES gives strong arguments for many of the research topics being pursued within Swedish research on biodiversity, ecosystems, and the essential services they provide to society that underpin development and human well-being. Several Swedish researchers have been selected for engagement in different IPBES bodies. One of the current programmes providing scientific knowledge to IPBES is the research programme on Ecosystem Change and Society (PECS) led by the International Council for Science (ICSU) and hosted by Stockholm Resilience Centre (SU), which integrates studies of the relationships among natural capital, human wellbeing, livelihoods, inequality and poverty. Swedish research on ecosystem services and trans-disciplinary approaches to food and environmental aspects have also greatly contributed to e.g. the Consultative Group on International Agricultural Research's (CGIAR) different research programs (including the CRP's on Water, Land and Ecosystems and Forest, Trees and Agroforestry), and to research centres such as the International Water Management Institute (IWMI), the World Agroforestry Centre (ICRAF), the International Livestock Research Institute (ILRI), and World Fish.

Examples of strengths within the approach used by several of the Swedish research groups include systems approaches to research relating to developmental issues. A complex system science approach to understand the interactions between the social- and ecological systems is key in a world of increasing uncertainties and where environmental issues, such as climate change, are closely related to development and the opportunities of people to grow out of poverty. Resilience thinking is therefore an important contribution to the holistic understanding of the different developmental trends, scenarios and desired futures. It has been pointed out numerous times that research on the dynamics of the Earth system and development may greatly benefit from learning and monitoring activities emerging in multiple knowledge systems, including local and traditional ecological knowledge. Sweden has a strong position in resilience research that embraces collaborative processes and multiple knowledge systems.

Among weaknesses it is important to stress the need to better understand the multifaceted relationships between the economy especially macro-economy and the planetary restrictions imposed on the biosphere for improving human well-being and social equity, while at the same time reducing environmental risks, ecological scarcities and vulnerabilities (UNEP 2011). In a global comparison Swedish research is at the forefront here, however there are multiple weaknesses apparent and links between poverty, development, and the capacity of the biosphere are in early stages of exploration. It has been repeatedly pointed out that development economics largely ignores resource and ecological issues, see for instance Dasgupta (2014).

The Swedish Government considers that access to scientifically based knowledge is crucial to development. The majority of poor countries have insufficient production of their own research-based knowledge, including research related to needs and problems specific to that country. By looking at the amount of resources a country allocates to research, the uneven distribution between rich and poor parts of the world becomes even more pronounced. Scarcely 2 % of the world's researchers are found in Africa, and they are responsible for less than 1 % of the world's total production of scientific articles (Regeringskansliet 2010). Many research groups in Sweden have developed strong collaborations with researchers in the South, for example around coastal systems in the Western Indian Ocean within the Sida-funded Wiomsa-programme.

Strengths worth acknowledging are that a lot of the environmental and climate change research performed at Swedish universities today have international researchers in their teams and collaborations and implementation in a low-resource settings is not uncommon. A large constraint has been allocating funding for local researchers within international projects since this has not been part of research grants. With the new possibility to apply for research funding from VR for external researchers based in low-middle income countries this will most probably facilitate the collaborations, and increase equity within the research groups. Support for high-quality research in low resource settings can promote the development of innovation systems in which collaboration between researchers, the business sector and society in general is reinforced (Sida 2014), thereby increasing the opportunities to use research as a means of and a catalyst for development.

Another weakness within several of the research projects is the lack of researchers with different educational background. The research centres are generally better at incorporating different disciplines, however many programmes/projects that deal with trans-disciplinary issues still often lack a fully trans-disciplinary research group. To give an example, the medical proficiencies such as public health or environmental medicine are often left out (the issue is also evident the other way around where environmental scientists are excluded from health research). If these research fields could be better integrated they would not only serve each other with strong political and economic arguments, but also increase the probability of having a larger impact and value for society. This is particularly true when talking about climate change adaptation and resilience where the connection between environment and human health is evident.

Trends, tendencies and prognosis for the future

Traditionally environmental science has tended to mainly provide understanding of complex issues but not provided solutions. Integrating global environmental and climate change with development and sustainability issues involves many complexities and must consider the concurrent changes in e.g. economy, population and acknowledge societal norms and values. The current trend in trans-disciplinary research and creating centres evolving around a larger theme, such as climate adaptation or urbanization, rather than a single discipline, is most probably going to continue. Diagnostics, or impact research will still be vital and an important component for the knowledge base. However, action-oriented research focusing on solutions will increase, in line with the already established platforms such as Future Earth.

One of the most innovative aspects of Future Earth is the idea of trans-disciplinarily in the shape of co-design and co-production of relevant knowledge, building and connecting global knowledge to intensify the impact of research at all levels. While researchers are responsible for the science, and methodology, the definition of research questions and dissemination is done jointly with stakeholders. It further recognises that information and models are based within different organisations and highlights research collaboration between researchers, NGOs and the private sector. This trend has a strong base in Sweden; see for example Cornell *et al.* 2013 and Tengö *et al.* 2014. Within SRC the framework The Multiple Evidence Base (MEB), has been developed in which different knowledge systems are viewed as generating valid and complementary evidence for interpreting change, trajectories, and causal relationships in social-ecological studies (Tengö *et al.* 2014). A peer-review process for a MEB approach takes into account that different criterion of validation should be applied to data and information originating from different knowledge systems (Duraiappah *et al.* 2012). Placing insights from knowledge systems side by side will enable an enriched understanding of the social-ecological system or the issues at hand (Berkes 2007; Moller *et al.* 2004). To secure the legitimacy, credibility, and salience the approach is developed as a dialogue process in partnership between researchers, representatives of indigenous peoples and local communities and their networks and organizations, practitioners, and governmental, international and intergovernmental institutions (Tengö *et al.* 2014).

Swedish research on ecosystem services has increased substantially the past years and to a large degree also been successfully communicated to policymakers and the public. Sweden has often been active in the process from the beginning, not the least with the Millennium Ecosystem Assessment (MA 2005) and The Economics of Ecosystem Services (TEEB 2008). We have strength within the fields that has great potential for constructive co-production and co-design with other stakeholders. Linking global sustainability and local

ecosystem services and resilience is urgent, and examples of research to be developed corresponding to the aid policy *Strengthened resistance to environmental effects, climate change and natural disasters, and reduced impact on the environment and climate* and *Sustainable cities* are:

- Ecosystem-based adaptation is receiving increasing interest worldwide. Whilst its importance is increasingly recognised there is a lack of related research and a need for systematic reviews and collation of concrete examples, as highlighted in a United Nations Framework Convention on Climate Change report on ecosystem-based approaches for adaptation to climate change (UN 2013). Research that would examine how the ecosystem services approach relates to current adaptation planning, and evaluate the conditions for using ecosystem services as a tool for designing local adaptation strategies is needed, in particular in the context of poverty prevention and reduction.
- Despite the growing interest in the concept of conserving or extracting ecosystem services for development, there remain important knowledge gaps regarding how ecosystems actually contribute to wellbeing, and thus poverty alleviation. Further research is needed on how ecological dynamics affects the potentially useful services, and how human inputs turn these into benefits for society.
- In light of expanding urban areas more research is needed on sustainable cities and urban ecosystem services, including urban ecosystem based adaptation to climate change. Environmental scientists could collaborate with public health professionals and urban planners to design programmes that promote healthy environments. It would be of interest, and also necessary, to investigate these issues in different populations, environments and within diverse cultural and social contexts. There is a lack of research on the value of urban green space from low-middle income settings that is relevant to acknowledge, especially since their challenges with creating sustainable societies are on a different level than the high-income nations producing most of the current research.

Closing in on the deadline of the Millennium Development Goals (MDG) in 2015, negotiations on the Sustainable Development Goals (SDG) are underway. The goals and their targets are set to be global in nature and universally applicable to all countries while taking into account different national realities, capacities and levels of development and respecting national policies and priorities. Within the proposed 18 goals there are several of relevance to environment and climate research. Swedish research should contribute to the follow-up of the UN Rio+20 process of transforming these goals. The goals could further be used as a baseline for research needed to support the achievement and could be developed using the framework of co-production and co-design.

Table 2. Proposed Sustainable Development Goals with environmental focus (UN 2014)

Goal 6.	Ensure availability and sustainable management of water and sanitation for all
Goal 8.	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
Goal 9.	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
Goal 11.	Make cities and human settlements inclusive, safe, resilient and sustainable
Goal 12.	Ensure sustainable consumption and production patterns
Goal 13.	Take urgent action to combat climate change and its impacts
Goal 14.	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
Goal 15.	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Another important area for the future will focus on sustainable development and potential pathways to meet economic development goals within a safe operating space of a stable planet. As an example, a research project at the SRC is planning to use economic analyses to compare the sustainable development pathways (for different sectors/areas, e.g., energy, agriculture, and at multiple spatial/temporal scales) with business as usual

scenarios. The aim of the research would be to develop a modelling capacity and scenarios analysis in support of all topics of the SDGs.

Recommendations

The possible solutions to the complex future scenarios demand a stronger investment in inter- and trans-disciplinary research with a systems perspective. Environmental research cannot only be seen as a combination of natural sciences and technological disciplines, but must be more interdisciplinary and also include to a larger extent social sciences such as behavioural economics, political science, sociology, ecology, history, and to some extent also medical research. In general, there is need for more aspects on equity, governance, solving global development issues with social-ecological approaches, and systems approach. Research on solutions and response to our changing planet should be emphasised. Giving two examples:

- There is a need for environmental research to highlight and better understand transformative processes, not only a cost-benefit analysis of action or inaction.
- Measures directed towards underlying causes of climate change vulnerability should be broadly integrated into development actions, and not solely confined to climate change adaptation strategies (Costello *et al.* 2009; Keim 2008).

Specifically, a deeper understanding of what really does contribute to sustainable human wellbeing and resilient social-ecological systems is required, an understanding that goes beyond viewing poverty as merely the condition of having a low income, recognizing the substantial contributions of natural and social capital, which in many countries already are important limiting factors for improving human wellbeing (Griggs *et al.* 2013). A deeper understanding of these issues is at the heart of future research within development and is going to require a number of interlocking developments within ecology and economics and other disciplines. Based on the coming SDG targets, there will be a change in what type of research is needed to achieve these. Three suggested main tracks to follow are: 1) Co-production and co-design of research; 2) Cross-scale dynamics; and 3) Transformation and change of regimes.

Recognising how global processes affects local vulnerability and resilience, within the surrounding social and economic regimes is vital. Research on water, for instance, should not simply be the domain of biologists and hydrologists but also embrace important social, economic, health-related and political knowledge dimensions that need to be considered in disciplinary terms. If performing research on water in e.g. Burkina Faso, it should only be supported with the prerequisite that it is done within the context of what is happening in their surroundings. There are several examples of how this is applied at institutions such as LUCSUS, SRC and Environmental economics at Gothenburg University. A MEB approach can serve as a learning platform for generating insights and triangulation across knowledge systems, as well as a basis for further co-production of knowledge. There are knowledge and experience across institutions in Sweden that could be brought together and developed further.

The research must also be trans-disciplinary in bridging between research and public society. There is a need for better tools of communication to the public, as well as to ensure that knowledge is brought to every level of governance in order to ensure that the knowledge is put into practice. The need for governance research and management of complex systems needs to be highlighted since it often is considered crucial to the implementation of new solutions. An example to learn from is the Sustainable Development Solutions Network (SDSN), launched in August 2012, which mobilizes scientific and technical expertise from academia, civil society, and the private sector in support of sustainable development problem solving at local, national, and global scales, encouraging those who use social-ecological research to become more involved in the overall processes of research design, implementation, and evaluation. Further support to the Swedish node of the SDSN would be desirable. There is as always a need for more integration between different researchers and research themes, particularly with international groups. Both research and society would benefit from more interdisciplinary and international collaborations. In some countries, although not yet in Sweden, special cooperation networks have been created between financiers and users to make sure that the research performed

is what the society needs, can be used in practice, and after finalising then transferred back in to the organisations.

On a structural level there is a need for a trans-disciplinary strategy from both the financiers and universities' part. When it comes to financing this type of research, more often the call for applications are now written with a good intent on being innovative and with a trans-disciplinary framing. However, reviewers of applications may not have the capacity to evaluate the quality of trans-disciplinary research, even though the financiers might have announced a multi-disciplinary application. This may result in rejection of what actually is needed due to a gap in knowledge and understanding. Strategies also need to consider how to promote trans-disciplinarity and handle the applicability and feasibility of such research. While researchers are frequently included in environmental and climate decision-making via formal and informal channels, their engagement with the media is less active. Academic literature is still the dominant form of dissemination for research findings, although it can be inaccessible to the general public.

At university level there are also challenges. More students are being educated within trans-disciplinary fields, both at undergraduate and post-graduate levels dealing with global environmental challenges and sustainability. The scientific community in Sweden is getting better at involving systems thinking and trans-disciplinary issues, the centres created are a sign of this. However, the research is often constrained by rigid university structures and there is a need for supporting the development of new research and educational competences for young students. Incentives for researchers to stay within the field and career pathways are also needed. Fostering new forms of collaboration in science and education, organised around common needs and practices related to environmental change and sustainability is proposed by SDSN. It regards both how to handle formal structures at higher levels when the infrastructure for multi/trans-disciplinary research is not there, as well as a more stable foundation for funding.

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Appendix: Search in Web of Science

Search strings

Research area (SU)

Biodiversity & Conservation OR Environmental Sciences & Ecology OR Geography OR Public, Environmental & Occupational Health OR Meteorology & Atmospheric Sciences OR Oceanography OR Science & Technology Other Topics OR Social Sciences Other Topics OR Urban Studies OR Water Resources

Web of Science Category (WC)

Biodiversity Conservation OR Environmental Sciences OR Environmental Studies OR Engineering, Environmental OR Ecology OR Geography OR Public, Environmental & Occupational Health OR Meteorology & Atmospheric Sciences OR Oceanography OR Multidisciplinary Sciences OR Planning Development OR Geosciences Multidisciplinary OR Agriculture Multidisciplinary OR Urban Studies OR Water Resources

Organisation – Enhanced (OG)

Karolinska Institute OR Royal Institute of Technology OR Stockholm University OR Lund University OR Umea University OR University of Gothenburg OR Swedish University of Agricultural Sciences OR Linkoping University OR Chalmers University of Technology

Topics (TS)

(Governance OR Institutional Capacity) OR Urbanisation OR Resilience OR Biodiversity OR (Climate Change AND (Adaptation OR Adaptive Capacity)) OR (Land Use AND (Sustainability OR Ecosystem Management)) OR (Water Quality AND (Basic Sanitation OR Resource Management OR Productive Sanitation)) OR Ecosystem Services OR Environmental Economy OR (Agriculture System AND (Sustainable Intensification OR Ecosystem)) OR (Marine AND Social-Ecological System) OR (Ecological Design OR Ecological Restoration)

Limitations

Language: English; Document types: Article; Time span: Last 5 years

Individual topic search combining SU, WC, OG, and given TS

SU AND WC AND OG AND TS=(Governance OR Institutional Capacity):
Hits 99 (SU 36; LU 22; LTH 18; UmU 15; KTH 6, UU: 4, GU: 4, CTH: 2)

SU AND WC AND OG AND TS=(Urbanisation AND (Climate OR Environment))
Hits: 23 (UmU: 6, LU: 5, SLU: 4, SU: 4, KTH: 4, GU: 2, UU: 1)

SU AND WC AND OG AND TS=(Resilience AND (Climate OR Environment))
Hits: 83 (SU: 44, SLU: 14, LU: 13, UmU: 17, UU: 5, GU: 4, CTH: 2)

SU AND WC AND OG AND TS=(Biodiversity AND (Climate OR Environment))
Hits: 174 (SLU: 75, LU: 42, SU: 31, UmU: 23, GU: 19, LIU: 8, KTH: 7, CTH: 5, UU: 5)

SU AND WC AND OG AND TS=((Climate Change) AND (Adaptation OR Adaptive Capacity))
Hits: 147 (LU: 38, UmU: 35, SU: 29, SLU: 22, LIU: 17, GU: 12, KTH: 3, CTH: 3)

SU AND WC AND OG AND TS=(Land Use AND (Sustainability OR Ecosystem Management))

Hits: 94 (SLU: 46, SU: 23, LU: 19, GU: 9, KTH: 8, UmU: 5, CTH: 5, UU: 4, LiU: 4)

SU AND WC AND OG AND TS=(Water Quality AND (Basic Sanitation OR Resource Management OR Productive Sanitation))

Hits: 13 (LU: 5, SU: 4, SLU: 2, KTH: 1)

SU AND WC AND OG AND TS=(Ecosystem Services AND (Climate OR Environment))

Hits: 69 (SLU: 26, SU: 22, LU: 20, UmU: 5, CTH: 3, GU: 2, LiU: 2, KTH: 2)

SU AND WC AND OG AND TS=(Environmental Economy)

Hits: 35 (SLU: 8, LU: 7, GU: 5, SU: 5, KTH: 3)

SU AND WC AND OG AND TS=(Agriculture System AND (Sustainable Intensification OR Ecosystem))

Hits: 27 (SLU: 14, SU: 11, LU: 6, UU: 2, GU: 2, KTH: 2, CTH: 1)

SU AND WC AND OG AND TS=(Marine AND Social-Ecological System)

Hits: 17 (SU: 16, GU: 1)

SU AND WC AND OG AND TS=(Ecological Design OR Ecological Restoration)

Hits: 73 (SLU: 22, SU: 20, UmU: 17, GU: 7, LU: 7, UU: 4, KI: 3, LiU: 2, KTH: 2)

Combining all the individual topics in one search

Hits: 613: (SLU: 179, LU: 144, SU: 144, UU: 87, GU: 57, LiU: 43, KTH: 29, UU: 24, CTH: 18, KI: 6)

AND *TS=Poverty*

Hits: 20 (LU: 6, SLU: 5, SU: 4, LiU: 2, GU: 1, KI: 1, KTH: 1)

AND *TS=Equity OR Equality*

Hits: 7 (SU: 5, GU: 1, UmU: 1, SLU: 1, LU:1, KI:1)

AND *TS=Sustainable Development*

Hits: 49 (LU: 17, SLU: 11, GU: 6, SU: 7, KTH: 5, LU: 4, UmU: 3, CTH: 1)

AND *TS=Development Aid*

Hits: 3 (SU: 2, GU: 1, SLU: 1, LU: 1)

ENERGY

Keywords

Energy and development, energy poverty, sustainable development, climate change

Summary

This paper discusses the Swedish research agenda for energy and development aimed at supporting the development of sustainable energy systems in developing regions. Sweden has made significant progress in shifting its national energy systems towards renewable technologies. However, the strong body of knowledge and experiences accumulated are not completely reflected in the work on energy and development. What type of research can contribute to addressing the challenges of energy access and sustainability in the context of developing needs? What contribution can Sweden make? We conclude that a system approach is needed to better integrate energy-related research with other research and actions in developing regions so as to extract most benefits from energy investments beyond infrastructure development and towards sustainable development. Both qualitative and quantitative research is needed to create knowledge to promote clean technologies and deal with system shifts. Top-down and bottom-up approaches will serve to address immediate questions as well as mid-term and long-term systems innovation. In addition, it is necessary to link research and innovation, and plan for actions that can reduce the vulnerability of human systems while also promoting sustainable development. The established global agenda to promote energy access in developing regions has been a major improvement in the international development discourse of the past decade. In this context, the creation of a Swedish *energy and development* network and research agenda can pave the way for stronger impacts of Swedish research in international cooperation for sustainable development.

Theme – setting the global agenda for energy and development

This paper focuses on the emergence of the global *energy and development* agenda, and the role of the Swedish development research in creating knowledge in this topic. The objective is to provide new insights and explore ideas for improving energy research that can promote development in poor and medium income countries.

Swedish development cooperation aims at enabling poor people to improve their lives, and scientific research is an integral part of the actions designed to reach this goal. The research supported shall have scientific quality and serve to strengthen the fight against poverty in developing countries. This will be achieved by building capacity in developing countries, creating knowledge in relevant topics, and enhancing Swedish research on pertinent issues. Relevance for development is important when deciding which research projects to support, though scientific quality should be the leading factor (Government Offices of Sweden, 2010). Any assessment to evaluate the role and impact achieved by development research needs to take these objectives into consideration.

Energy deployment and use has resulted in enormous impacts on the environment since the industrial revolution. This relates directly to the fact that the socio-economic development of the last centuries has largely relied on the use of fossil fuels. The impacts include resource depletion, pollution, emission of greenhouse gases and environmental degradation. It is estimated that approximately three fourths of the global CO₂ emissions are energy related. In addition, the environmental impacts of energy systems have led to health,

social and political problems. Thus the transformation of energy systems towards renewable sources and increased efficiency are essential when trying to improve the sustainability of human activities.

While energy is considered essential infrastructure for industrialization, provision of services and comfort in general, nearly 1.3 billion people in developing countries still lack access to electricity and at least some 2.6 billion people rely on traditional fuels for cooking (IEA, 2013). The large majority in this group lives in developing regions of Asia and Africa, particularly in rural areas. Thus 20 to 35% of the world population lack energy services that the rest of the world considers essential to welfare. IEA estimates that one billion people will still lack electricity and 2.6 billion will lack clean cooking fuels by 2030! If poverty is to be eradicated and sustainable development achieved, access to modern, clean and efficient energy services needs to receive greater attention.

The global development agenda evolved in the second half of the twentieth century, initially anchored on theories of regional development but gradually merging with the environmental movement, and resulting in the agenda for sustainability (Adams, 2001; Silveira, 1993; UN, 1992). Today, the depletion of natural resources and the risk of climate change are recognized as main threats not only to the future prospects of poor countries, but also to the stability of the global economy and the quality of life of the world population as a whole. As a result, previous development strategies, policies and production methods, as well as patterns of consumption and life styles, are being scrutinized according to sustainability criteria in both rich and poor countries. Likewise, in-depth reviews of the role that development aid can play are necessary. In face of remaining widespread poverty, it is essential to coordinate actions and devise ways for leveraging on the financial resources available to promote sustainable development.

The United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992 was a landmark when it comes to defining the global sustainability agenda. In particular, the Agenda 21 and the UNFCCC, which were signed at this occasion, have triggered international processes that are gradually transforming the global economy, albeit at lower pace than desirable. Agenda 21 is a consensus around the need to improve production systems, enhance social inclusion and reduce the impacts of human activities on the environment. The ultimate goal of the UNFCCC is to reduce anthropogenic greenhouse gas emissions in the atmosphere to mitigate climate change, though it also recognizes the need to simultaneously promote sustainable development. Since energy harnessing and utilization impose large impacts on the environment and comprise the majority of greenhouse gas emissions, the transformation of energy systems is at the core of climate change mitigation actions. In addition, addressing energy access is central to improving health, gender equality and poverty alleviation.

Surprisingly, neither Agenda 21 nor the Millennium Development Goals aimed at ending poverty (www.un.org/millenniumgoals/) set targets for reducing *energy poverty* or building *sustainable energy systems*. Nevertheless, in line with efforts to address climate change and define sustainability criteria for development, a global *energy and development agenda* has gradually evolved. The World Summit on Sustainable Development held in Johannesburg in 2002 highlighted the shortcomings of the global agenda to address poverty and environmental degradation, and pushed for more action. In this context, *energy poverty* was recognized, and the need to promote energy access emerged as an underlying factor in the global development agenda. Although no consensus was reached around a global agenda to promote sustainable energy in Johannesburg, energy has received increasing attention since then.

By 2010, the UN was systematically evaluating measures to address energy poverty, and later designated the year 2012 as the International Year of Sustainable Energy for All. This was an important year for raising awareness about energy poverty, as well as the role of energy in health, education, food and water security, and development at large. This initiative aimed at engaging multiple stakeholders to ensure universal access to modern energy services by 2030, reduce global energy intensity by 40%, and increase renewable energy use

globally to 30%¹. Though no binding agreement was achieved in Rio+20 either, the *Sustainable Energy for All* initiative was recently launched by the UN and the World Bank aimed at concerted actions to deliver universal access to modern energy services in developing countries (<http://www.se4all.org/>). This initiative indicates that joint efforts are now in place to allocate funds and define actions towards ambitious energy goals for 2030.

Thus, the energy topic has been rather invisible, and it has been neglected in processes and key documents of the sustainable development agenda for decades. Only recently has energy emerged as a central issue in the development debate. It is with that background in mind that I address the question whether the energy research topics supported in Sweden have been relevant and/or contributed to advance the global *energy and development* agenda that has evolved in the past decade. My focus is on developing countries and the goals of addressing energy poverty and promoting sustainable development.

Energy research in Sweden and its relevance for development

In the aftermath of the oil price shocks of 1973-74, Sweden like most industrialized countries started a significant government-financed energy research program to improve energy efficiency and find alternative energy sources to substitute fossil fuels. In fact, the program launched in 1975 was the second largest sectorial R&D program in the country, only second to defense (Haegermark, 2005). Since then, Sweden has become one of the most prominent industrialized countries when it comes to the transformation of the energy sector. Half of the Swedish system relies today on renewable sources of energy such as biomass, hydro power and wind. This contrasts with the situation back in the 1970s, when two thirds of the Swedish energy matrix relied on fossil fuels.

While transformations in the energy sector are often referred to as technological shifts, the accomplishments achieved in Sweden can hardly be explained as solely the result of technological improvements. Although technological shifts and improvements have been pursued, the rapid transformation of the Swedish energy sector was the result of a combination of factors (Silveira, 2001). These include ambitious political goals to improve the security of supply, privatization of the energy sector, creation of different markets for energy services (e.g. heat, electricity and cooling), incentives and policies to promote renewables (e.g. subsidies, information campaigns), taxation of emissions, development of synergy across sectors (e.g. heating markets and forestry), establishment of platforms for innovation, etc. Energy research has supported technology development and efficiency improvements (e.g. clean tech) at the supply level (e.g. energy conversion), system level (e.g. development of district heating systems) and demand side (e.g. energy intensive industries). There has been close cooperation with the industry to deploy new technologies and develop new systems for efficient delivery of energy services, and plenty of room for learning by doing. In addition, energy and climate policy research has provided support for market promotion and analysis, technology improvements, as well as design and evaluation of policies. How much of that is reflected in the energy research done to promote development and address poverty?

Energy has not been a prioritized topic among projects funded by the Swedish development research programs. The projects funded were few and mainly focused on the feasibility of deploying solar and residue-based technologies to generate energy in developing regions. The topics are certainly relevant but the research is punctual. Thus it can only generate impact if linked with other actions, for example, deployment efforts, policy changes or complementary research in related topics. Swedish development assistance has, in fact, supported various projects for electrification and energy access but there is little relation between the energy infrastructure provided through these projects and the research done in the topic of *energy and development*.

¹ www.un.org/en/events/sustainableenergyforall/

Apparently, not enough effort has been made to capture the research results and use them in other development aid activities.

The Stockholm Environment Institute has worked with *energy and development* issues since its inception in the late 1980s, linking research to policy and collaborating with multiple stakeholders. More and more, this agenda has been linked to the climate agenda and also to other important development topics such as water and sanitation. SEI has been ranked as the second most influential environment think tank in the world in 2013, and has also been praised for its transparency, a sign of ideological independence when addressing global issues. SEI is supported by Sida but is not funded through the research programs listed for consideration in this evaluation. Nevertheless, it has been most through SEI that the Swedish efforts in the area of energy, climate and development have been made visible to the world. SEI's global organization and approach is advantageous when dealing with multiple interests of stakeholders in various development contexts. On the other hand, when it comes to pulling together knowledge and research into global agendas for change, SEI has perhaps relied more on the research done internally or in other countries rather than on Swedish universities. Hopefully, this will improve as SEI is now establishing more close cooperation with Swedish universities.

For most of the researchers involved in *energy and development* projects in the Swedish universities, the development dimension is at the margin of their research area. The project tends to coincide with a PhD project but not with the development of a strong research profile or a group particularly focused on the challenges related to *energy and development*. This is evidenced by the publication lists of the researchers leading the projects funded, or the program of their respective institutions where research usually focuses on Sweden and the EU. It is difficult to identify academic groups doing *energy and development* research among Swedish universities. This means also that carrier opportunities in this field are very limited and uncertain. My own group, established in 2007, is unique in this respect as it has *energy and development* as a focal area of research interest (www.ecs.kth.se). An evaluation commissioned by the Swedish Energy Agency indicated that the program has been "effectively established" and is described as "unique at KTH and in Sweden" (Technopolis Group, 2012). In fact, our research results have found their way into discussions of the Rio+20, IEA work on electrification in developing countries, UNCTAD platform for biofuels in Africa, and policy debates in Nepal, Bolivia and Brazil. We are working with both low-income and middle-income countries. These studies have been further expanded with systems analysis developed at a sister division at the Department of Energy Technology at KTH, which is providing scenarios for IRENA, IEA, World Bank and UN organizations.

Capacity is certainly being built as PhD candidates are being trained, and knowledge is being created in Swedish universities in topics that are relevant to developing countries. The cooperation established with a few universities in developing countries contributes to PhD exchange and joint research which most probably brings value to the universities in developing countries. In this way, it can be said that the objectives of the development research are being met to a certain extent. However, there is certainly a more prominent role that *energy and development* research can play if it takes advantage of the body of knowledge available in Sweden. To influence energy and climate policies and actions, and ultimately help improve energy access and reduce poverty, the knowledge created has to be incorporated in development assistance performed by Sida and other agencies, multi-lateral organizations, and national and local governments in developing countries. A defined agenda for *energy and development* research could be the starting point for an orchestrated process in this direction. Before addressing key questions and approaches that should be considered for composing such a research agenda, I briefly look at the collective experiences that provide the basis for an *energy and development* research agenda in Sweden.

Strengths and weaknesses in energy and development research

In the past decades, the Swedish energy system has experienced profound changes, and gone from over two thirds to one third fossil fuel dependency (Swedish Energy Agency, 2012). Efficiency improvements have

been also significant. Energy demand has remained the same for approximately four decades, while the Swedish economy has grown constantly. When it comes to energy research, the country has been able to develop and deploy a number of technologies and systems that have proved efficient in delivering energy services. Since the late 1970s, Sweden has supported a great amount of research aimed at finding solutions to energy and environmental challenges. Close cooperation between government, energy technology providers, energy service providers and researchers has been essential in the efforts to transform the national energy system. Although many challenges remain (e.g. to address the energy demand embedded in imported products and services), Sweden stands as a very good example of innovation in the energy sector when it comes to technologies, policies, and institutional and regulatory frameworks.

One of the most successful segments in the energy sector in Sweden is related to biomass-based solutions. In particular, a close integration of the forestry sector with the expansion of district heating systems throughout the country has had significant impact in reducing greenhouse gas emissions while also providing quality services at competitive prices. While this experience has been valuable when doing work in Baltic and East European countries, it has hardly been used in doing research or assisting developing countries to address their energy challenges. More recently, a new cooperation program is exploring the application of Swedish know-how in the development of bioenergy in Indonesia. Truly, some applications such as heating are not highly demanded in tropical developing countries. But it is here that research comes in, that is, to evaluate the use of existing knowledge in a new context, and translate it into deployment models that address the local patterns of resource availability and energy service demand. Bioenergy has proved efficient for production of all kinds of modern energy services, and developing countries are blessed with a large biomass potential. Exploring ways to realize that potential is an important item in a basket of options. Research can help unveil that potential in various ways (Silveira, 2005).

Traditional biomass utilization remains the basis for energy provision among the poor. How can the available resources be used in a more efficient way to provide clean and modern energy services at low cost? This is a very important question since most of the energy content in the biomass used in traditional ways is actually being lost (REN21, 2014). However, this question is much broader than the issue of efficient cooking stoves that has attracted significant amount of attention internationally. Certainly, improved cooking stoves have better combustion, save many hours of work in biomass collection, and reduce indoor air pollution, often benefitting women. While important, this is only a very first step when considering the potential for modernization of the bioenergy segment in developing countries. Enhancing the biomass potential, linking energy to agricultural, forestry and waste management sectors in rural and urban areas, using a system approach to devise solutions along the supply chain, and improving logistics are some of the issues that have to be addressed within the specific context of developing regions so that local biomass resources can be better used to simultaneously address (i) energy poverty and (ii) socio-economic development. Broad expertise exists in Sweden for addressing these types of questions.

Thus the problems to be addressed do not simply revolve around energy conversion, or technology transfer and adaptation. Finding sustainable solutions to implement energy systems is much more than creating new knowledge or simply identifying answers to well-framed technical problems. Certainly, technological development remains important, as well as the need to continue filling knowledge gaps to improve resource efficiency, and minimize risks and impacts. However, understanding energy challenges from the point of view of local energy needs is central to making a difference in development aid. The greatest challenge today is the implementation of energy solutions that can operate realistically and efficiently in the context of dynamic energy markets, stringent environmental and social requirements, and limited resource availability. Often, institutional building is needed to design and monitor policy and regulatory frameworks. Bringing together stakeholders takes time – this has transaction costs and requires leadership. Investments need to be allocated, supply and demand have to be matched, delivery models need to be devised for disseminating solutions. Also here, applied research has a role to play and, if research questions are properly formulated, the results can bring

immediate input to development assistance. What solutions can be pursued globally and regionally, which will lead to sustainable development? What are the solutions that will help mitigate and adapt to climate change while also promoting sustainable development?

Until only a decade or two ago, the adoption of new technologies in developing countries had traditionally taken place in close relation with price reductions for the technology. Once the technologies had been extensively tested and deployed in industrialized countries, they were disseminated globally to capture new markets. However, this model for technology dissemination does not match present developments in the energy sector, nor fits the goal to mitigate climate change. We want to see a process in which best practices and best technologies are readily incorporated into the development process, thus *leapfrogging* towards the cleanest options. Therefore, the global character of the climate agenda provides an important framework for promoting and motivating the investments needed in low-carbon technologies. Mechanisms are being created under the UNFCCC which can be used for this purpose. But much more is needed to scale up project experiences such as those of the Clean Development Mechanism (<http://cdm.unfccc.int/index.html>).

Sweden has traditionally had a prominent and pro-active role in the international development agenda. Efforts to improve conditions in health, education and social participation, as well as to reduce gender inequality have been particularly emphasized. Sweden has acted through different channels such as Sida, multi-lateral organizations such as UNDP, UNEP and FAO, and trust funds of development banks. The PGU², policy for global development, approved by the Riksdagen in 2003, made development an issue for the whole society. This meant engaging various organizations to serve the purpose of global development. PGU invites universities, companies and different government agencies to use their knowledge for the purpose of promoting sustainable development. A long presence in the international debate, large resource commitments, and broad experience with development aid give Sweden great authority when it comes to development policy. The institutional framework is in place for resource allocation, research and development collaboration both on a bi-lateral as well as multi-lateral basis. But there is certainly room for doing more to contribute to the *energy and development* agenda.

Energy systems are part of the basic infrastructure necessary for development and this is now broadly recognized. At the same time, finding solutions to the energy challenge is at the core of climate mitigation efforts. This means that low-carbon and efficient energy systems are an important component of any strategy for sustainable development. Linking these multiple objectives will help leverage on efforts and resources, addressing energy poverty as well as enhancing the role of developing countries in implementing global agreements such as the climate convention. The climate agenda can be used for promoting transformations in the energy sector and, in this context, research is needed to explore the best ways of reaching multiple goals. This means, for example, prioritizing energy access and development needs in low income areas, while being more stringent on the climate agenda of rapidly growing economies.

Trends, tendencies and prognosis for the future

The global energy research agenda has been changing rapidly as a result of technological, geo-political and market changes, and along with the global environmental agenda. In this session, I briefly address coming challenges in the energy sector linked to technology shifts, restructuring of markets and implementation of the global sustainable development agenda, particularly climate change. In addition, I exemplify how the agenda of developing countries may differ from that of industrialized countries, justifying a research agenda not simply to address technology feasibility but also new approaches to energy provision in the context of development.

² <http://www.government.se/sb/d/2355>

As previously highlighted, energy poverty has been given low priority in the global development agenda for a long time. In Sweden, the scope and amount of research focused on *energy and development* contrasts with the challenge of energy access in developing countries, and also the strong emphasis put on transformation of national energy systems. It has taken decades for the message about *energy poverty* to reach policy makers and influence research and development agendas, even if development workers have been engaged in this topic for many years. There is certainly a gender dimension to it since energy provision is a task performed by women in poor regions of the developing world, and their voices were not being heard.

One other reason for this slow process could be inherent to the organization of the energy sector. Energy technologies and markets have been traditionally separated in segments. For example, the transport sector was strictly linked to oil markets and multi-national companies. Due to the geographic concentration of oil resources, this market has been subject to global geo-political dynamics. More recently, the transport sector is engaged in developing new transport fuels such as gas and biofuels, while also testing new energy carriers in individual transport such as electricity. In Europe, significant efforts are being made to develop the technology and infrastructure for electrical vehicles. In this way, electricity is now becoming an integral part of the urban transportation systems.

A few decades ago, electricity provision was traditionally organized under single national utilities. Their planning for service provision was supply oriented and based on centralized systems with large-scale generation, long distance transmission, and integrated distribution. Not only was the electricity segment national, but it was mainly treated as a technical issue. Lack of energy infrastructure was a bottle-neck that needed to be dealt with at a cost. Once in place, it would promote industrialization and generate welfare. With low paying capacity and inhibited energy demand, it was difficult to allocate the necessary investments, and thus the process was slow in developing countries, and electricity hardly reached the poor. Since the costs for electrification were high, national governments were engaged in large loans for mega-projects, and often subsidized electricity as a way of creating demand. Today, the electricity markets are undergoing deep transformations. In many countries, utilities have been privatized and unbundled, new supply technologies have become competitive (e.g. wind and solar power) and distribution is becoming a two-way activity between providers and consumers. A new dynamic has emerged in the sector and many new stakeholders have entered the market. The regulatory frameworks are changing but systems are still expected to guarantee supply and reliability as they are shifted towards low-carbon solutions.

An important change when it comes to energy provision in developing countries is that the sector is now viewed as a vector to promote development (Gomez and Silveira, 2010). The process of developing energy markets, implementing and disseminating technologies is seen as a way to promote synergies between existing resources and activities and developing local economies, thus contributing to generate jobs and income. Understanding how the relationship between *energy and development* can be created is very important for developing regions as it will help indicate ways to leverage on the limited resources available to promote sustainable development. This type of research has interdisciplinary character including technical, institutional, financial and social issues. The view of energy as a cross-cutting issue changes the way in which energy provision is to be planned in developing regions so as to reach as many people as possible within the coming decades while also serving as a pillar for development.

The technological challenge implies moving away from fossil fuels. This requires the deployment of new technologies to generate and distribute energy services, improve efficiency in both generation and utilization, and reduce greenhouse gas emissions. However, it is important that the technological challenge be addressed from a systems perspective. On the one hand, renewable technologies are becoming more competitive not least in developing countries where markets for decentralized systems are growing. In some places, renewable alternatives are already the most cost efficient (Mainali and Silveira, 2013). Likewise, it is important that energy harnessing and use is made more efficient. To achieve the levels of efficiency that are actually required, it is important to address energy provision and use in synergy with other sectors. This is related to resource

efficiency (e.g. use of residues to generate energy and multiple services), and energy intensive industrial processes (e.g. steel and cement), for example. It also requires integrated energy planning (e.g. in urban areas) (Tessema et al, 2014).

In addition, it is important to address the opportunities emerging from technological convergence, for example, for smart grid solutions. Using the development of grid systems in industrialized countries as the main reference could be misleading. The models for smart grids may evolve differently in developing countries as large grids are not always available in poor regions. Devising new systems solutions to combine the short-term evolution of decentralized systems with the long-term needs for larger base loads for promoting industrialization should be considered an important topic for research. One can draw a parallel to what has been seen in the area of telecommunications where developing countries leap-frogged to wireless systems. How will developing countries leap-frog as they build sustainable energy systems? Since access to clean energy and electrification in particular remains a major challenge in many countries, and is already internationally recognized as a key area for development assistance, it would be wise to explore this research area as a way of leveraging as much as possible on the efforts being made. Adequacy, reliability and quality of the services are related to affordability, a major preoccupation in the context of development. It is, therefore, a challenge to establish replicable systems that are affordable, efficient and sustainable.

To achieve broad penetration of clean technologies as energy access is improved, business models and regulatory frameworks need to be devised and put in place to attract business. Also triple-helix³ models should be considered for promoting cooperation between public and private stakeholders and academia, inspired by models developed in Sweden and Europe. Attention should be given to both top-down and bottom-up analytical tools as a way to reconcile the broad framework models for funding and technology provision with actions of multiple actors on the ground, including NGOs, small business and local communities.

The challenge of sustainable development has social, economic and environmental dimensions. It includes the pressing need to create welfare. Here, energy has a clear role to play providing essential means to development. Significant improvements can be achieved in the human development index (HDI) in the early stages of development as energy infrastructure is developed and electricity access is improved (Gomez and Silveira, 2010). Sustainable development requires a sustainable energy path which, in turn, requires broad use of renewable resources, improved efficiency of energy systems, structural changes for reducing the energy factor in production, and low environmental impacts.

The UNFCCC is an important platform for international collaboration towards sustainable development, but its implementation has to be kept in line with pressing social realities. The need to address energy is at the core of the climate agenda. Various mechanisms under the UNFCCC can be used to promote low carbon technologies and energy efficiency, reducing costs and risks and channeling investments to developing countries. Climate change mitigation and adaptation is likely to affect major sectors such as energy, transportation, agriculture and forestry. Mitigation measures imply technical and institutional interventions, as well as modification of established production systems. Given the interconnection of natural and societal systems, sustainable development requires balanced use of resources as well as stable socio-economic structures. Inaction could lead to a collapse of natural and human systems. Thus it would be reasonable to consider how development and welfare can be further pursued in a context of climate change adaptation, reducing the vulnerability of the poor.

The challenge of restructuring energy markets is related to the immediate need to provide energy services, the investments needed to provide such services and the necessity to guarantee the sustainability of energy systems in the context of competitive markets. For countries that still have limited access to electricity,

³ <http://lnu.se/research-groups/eseg-the-environmental-science-and-engineering-group/industrial-wastewater-and-stormwater/collaboration-on-industrial-water-conservation/triple-helix?!=en>

public and private partnerships will be essential to reduce investment risks and accelerate the provision of services. In addition to competition, energy companies will need to respond to stiffening environmental regulations, increasing consumer awareness, changing service demands, and new technological choices. The deregulation of electricity markets is modifying investment patterns and favoring more distributed generation as opposed to large-scale centralized systems. While privatization, deregulation of electricity markets and expansion of low-carbon technologies has taken place in conditions of over-capacity in many industrialized countries, the energy infrastructure of developing countries is under rapid expansion to meet growth demands and foster development. This brings opportunities but requires long-term planning. Research can help improve the planning capacity of developing countries.

Globalization means highly interconnected markets where developing countries are already important players. In addition, middle-income countries represent the fastest growing and most dynamic portions of global markets. Many new technologies already find fertile ground for dissemination in developing countries, for example in telecommunications, energy, transport, biotechnology, etc. Thus these countries are no longer peripheral to the global development of human society. In the past few years, for example, African countries have presented the highest levels of economic development and this has had significant macro-economic implications.

The policies, research efforts and strategies chosen to disseminate technologies and build energy infrastructure in the coming decades will be decisive if we are to shift towards renewable systems in the long run. Since energy generation and utilization have been major sources of greenhouse gases, failing to move in this direction may also mean that we will not be able to effectively mitigate climate change. Thus, global co-operation is essential to accelerate the shift towards renewable energy systems and promote sustainable development. Developing countries will have to improve their policies and regulatory frameworks to attract investments in the energy sector and leverage on those to promote industrialization.

Development entails broad transformations in the social fabric of a country. As long as large portions of populations are extremely poor they cannot afford to engage in much more than the improvement of their livelihoods. Sweden has supported community participation and democratization as a way of empowering the poor to improve their lives. However, it may be difficult to achieve mobilization, participation and democratization in the dark. Therefore, there is room for taking a system approach on the issue of democratization too, linking it to infrastructure provision for energy generation and the welfare that it can contribute to create. In fact, properly applied to the benefit of development, the energy and climate agenda can contribute to development of productive activities and employment generation. Proper methodologies are needed to analyse and monitor sustainable development impacts.

There is consensus regarding many of the goals of a sustainable energy agenda but a lot remains to be done when it comes to defining long-term strategies for their achievement. The same goes for linking energy agendas and transforming them into vectors of development to generate jobs and income as well as provide access to clean energy services. The institutional capacity has to be strengthened as well as the research capacity in developing countries to deal with the energy challenges ahead. Thus we should continue providing support for building research capacity in developing countries in this field. The number of energy-related research projects funded by Sida, and more recently VR, has been small so far. Since there is now a global agenda for energy access in addition to the climate agenda, it would be useful to build upon the broad energy expertise available in Sweden to contribute with more research in this field.

Sweden is a strong reference when it comes to efforts to promote efficient low-carbon energy solutions. Thus Swedish experiences can be very valuable when addressing challenges in developing countries and transition economies. When it comes to the research component, we can enhance the Swedish contributions in the *energy and development* research and their impact on international cooperation. The next section brings some recommendations in this direction.

Recommendations

According to the objectives stated by the Swedish government, the research for development shall have scientific quality and serve to strengthen the fight against poverty (Government Offices of Sweden, 2010). This is a very broad definition and, judging by the variety of projects funded, it encompasses almost everything. More specifically, the research shall help build capacity in developing countries, create knowledge in relevant topics, and enhance Swedish research on development. These are quite ambitious and important goals, and perhaps the first goal is likely to have most impact on the developing countries. Yet it is the least observed since most of the research is done in Sweden and links with local universities are often quite weak. Finally, scientific quality is the leading factor followed by relevance for development. Applications are accepted in all areas at the same time and there is very hard competition for the funds, resulting in few small projects. With this criterion, there is risk that a very theoretical project in a niche area at the margin of a strong research group will be funded, while a project with high relevance for development and well anchored on local institutions, but somewhat less stringency in the scientific methods, is not funded. Yet the latter may contribute to train local researchers in applied topics of high relevance for local development. For that reason, **I propose that scientific quality and development relevance should be judged as equally important.** This is not to compromise on scientific quality but rather to acknowledge that the ultimate objective is actually to fight poverty and promote development.

Comparing different types of research in different disciplines is difficult in the evaluation process. To deal with this problem, **I recommend organizing calls in thematic areas with defined focus, allowing larger budgets and longer research periods.** This will facilitate attracting good proposals from various groups, and evaluating their merits according to multiple criteria. With longer projects, organizations can dedicate more effort to building capacity in the organizations involved. Carrier opportunities in the *energy and development* topic will help attract dedicated researchers. Close cooperation with universities in developing countries should be one important criterion for long-term projects. Not all topics need to be included in calls every year. Thematic calls can be preceded by planning grants for meeting collaborating partners in developing countries. The calls can go in cycles for the different thematic areas, particularly if projects are more comprehensive. In addition to strong links and outputs with developing countries' partners (e.g. including sandwich PhD and/or faculty mobility), **the projects should also have a communication plan so that the findings are incorporated in other development assistance work** (e.g. in cooperation with multi-lateral organizations, companies and NGOs).

I propose the creation of a research agenda for energy and development. Today, the energy research is listed under the area of Nature and Environment, and energy research is narrowly focused on technology issues. A new definition for *energy and development* research should be interdisciplinary and include topics that go beyond technology and feasibility studies as per discussed in this paper. This implies filling knowledge gaps, and providing a bridge between different perspectives and disciplines with qualitative and quantitative research. Both top-down and bottom-up approaches should be considered. Top-down analyses include evaluation of resource availability/scarcity, climate impact, investment needs and macro-economic dimensions. Bottom-up approaches promote testing ground for technologies and service solutions as well as multi-stakeholder actions for system shifts. Thus the new agenda should support short and mid-term applied projects as well as long term projects.

Applied research shall focus on feasibility assessments and applications of technologies in the different contexts of developing regions, both rural and urban. This type of research should aim at impact within 3-5 years and aim at promoting access to clean and efficient energy to promote sustainable development. It will not only include technology but rather encompass issues related to resource availability, costs, affordability, business models, institutional issues and regulatory frameworks, paving the way to implementation projects that promote development. There should be incentive for cooperation between researchers, companies and local

organizations in developing countries to develop this type of projects together according to a triple-helix model of operation. **Successful projects could move towards an implementation phase**, which would be an ideal scenario. This obviously requires institutional support for new project phases (e.g. not necessarily VR but maybe VINNOVA). Finally, if projects are designed as interdisciplinary projects as proposed, they could also explore dimensions considered central to Swedish development assistance such as gender equality, community participation, governance and impact on democracy.

Mid-term to long-term research projects, with expected impact of 5-10 years, can take up system oriented issues specifically applied to different developing contexts, including transformation of sectors and scenarios for sustainable development, as well as development of indicators and models for innovation and technology dissemination, synergy with other sectors of the economy, among other topics. This type of research can be done from different perspectives, including topics such as security of energy supply, technology innovation, system shifts, etc. Most of all, the research issues should evaluate long-term energy system shifts in developing countries, for example, in relation to urbanization as well as regional planning needs. Also methodological development aimed at analysis and monitoring of sustainable development, simulations and road maps for technological leap-frogging fit in a mid-term to long-term research agenda.

Another goal for the research should be to **develop strong research networks between Sweden, Europe and developing countries**. These networks should have a role to insert the research results into project implementation through the different channels used by Swedish cooperation assistance. Technical issues should be linked to applied research on policy and implementation of solutions in the developing country context. These research environments can then become an important source of knowledge for multi-lateral agencies. Sweden's broad engagement on aid should be backed up by a strong research network to help devise solutions for implementation on the ground in cooperation with multiple stakeholders. Both short and long term research should be linked to the agreed global agendas for promoting energy access, and mitigating and adapting to climate change.

Final considerations

In development assistance, Sweden dedicates approximately 1% of its GNI to development aid compared to the average of 0.42 % among the OECD countries as a whole⁴. In 2011, Sweden had the largest level of ODA among OECD countries. However, the budget for research on development is only 4% of the total Swedish contribution. Of that, less than one percent goes for energy related research⁵. In face of a global agenda to promote energy access, this budget allocation should perhaps be revised. In particular, **energy can be made part of a multi-sectoral research agenda, cutting across various actions pursued through development assistance**.

Swedish contributions to *energy and development* research have greater potential than what has been achieved to this day. Internationally, energy projects developed through multi-lateral organizations are primarily influenced by Anglo-Saxon based research. There is room for channelling the Swedish research contributions much more to support the work of both national and international organizations. But this will require a better formulation of the research problems, and better use of organizations that are poised internationally such as SEI and IIASA⁶, as well as the most international Swedish universities and development

⁴ <http://www.oecd.org/newsroom/developmentaidtodevelopingcountriesfallsbecauseofglobalrecession.htm>

⁵ <http://www.openaid.se/en/sectors/Research?year=2013>

⁶ Sweden has been an active member of IIASA – Institute of Applied Systems Analysis since its creation in 1972. IIASA conducts interdisciplinary scientific research addressing major global challenges. IIASA's energy models have

institutions such as Sida. Since most research groups doing *energy and development* research are relatively small today, it would be advantageous to **form a network among universities to generate a debate on these topics, and advance the research agenda** in cooperation with researchers of developing countries, and achieve a larger impact internationally. This can also offer opportunities for promoting technology niches, opening new investment areas, expanding markets, thus bringing other benefits to both Sweden and beneficiary countries.

Poor nations still have to work for the industrialization of their economies in order to improve the social condition of their populations. They need better infrastructure in major sectors such as energy, transportation, housing, water and sanitation; they need basic services of education and health; and they need strong policies to support industrialization, technological development, institutional building and employment generation. But the signs of structural change in the world economy, parallel to the recognition of the environmental threats caused by production models pursued over a long time have put development under new light. **Devising ways to promote a green economy will be essential.** In parallel to the mobilization around a global agenda for promoting energy access, UNEP has contributed a working definition to promote the green economy: the *Green Economy* shall be low-carbon, resource-efficient and socially inclusive. The OECD (2011) is also working on the idea of building a green economy – an agenda that links the efforts of developed, emerging and developing economies.

The global agenda for *energy and development* has been shaped and actions to promote energy access are likely to be intensified in the coming decades. Meanwhile, the energy sector is undergoing enormous changes. Thus a review of the energy research agenda is timely. Integrating accumulated knowledge and experiences from Sweden into development aid can potentially improve the quality and impact of international cooperation in the area of energy, climate and development. We need to use our knowledge base to devise new models for providing energy services in a sustainable way in both industrialized and developing countries. We need to understand the ways in which infrastructure systems are evolving in a context of new technologies and solutions that were only dreamt of two decades ago. The final combination of solutions is likely to vary among country contexts entailing studies to better understand such system evolution and the new types of socio-economic relationships likely to emerge.

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been largely used for policy discussions under the climate agenda. The institute is considered to be among the top five think tankers in the world (www.iiasa.ac.at/).

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FOOD SECURITY

Keywords

Agriculture, Commercialization, Diversification, Empowerment, Gender, Intensification, Land tenure, Land use, Market, Nutrition, Production, Productivity, Trade, Value chain

General overview of food security research

Food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (World Food Summit; FAO, 1996). This definition includes four dimensions; *availability*, *access*, *utilization* and *stability* that must be fulfilled simultaneously for food security to be realized (FAO, 2008). The physical availability of food addresses the supply side including the agricultural production and productivity, what is being produced and where, food stocks and aspects of trade. Availability of food does not guarantee economic and physical access to food at international, national or household levels. In order to address concerns about insufficient food, access focuses on incomes market prices for inputs and products, and policies being required. Food utilization has to do with food preparation, intake and the way the body makes the most of energy and various nutrients in the food. This also includes diversity of the diet and aspects of equity such as the distribution of food in the household. Stability in food availability, access and utilization over time is essential for food security, and can be jeopardized by biophysical, social and economic factors at different levels.

Globally, food security research has evolved during the last decades from using a mainly global or national level perspective focusing on increasing the production and productivity to a local level, consumer and individual perspective including aspects of products quality, value chain development, natural resource management, income, food prices, markets, political stability, and policies focusing on and supporting food security. Food and nutrition security are today seen as integrated parts. Among the current Millennium Development Goals (UN, 2000) eradication of extreme poverty and hunger are given the highest priority. Other goals, e.g. on child health and gender, are, however, closely related to food security. When we now are preparing for taking the next step 2015 towards the realization of the Sustainable Development Goals (SDG; UN, 2014) reduction of hunger and malnutrition is carried forward from the MDGs and stands out as a smart investment in the Post-2015 agenda. Sustainable development will be the core of the new global agenda together with economic transformation, building peace and effective, open and accountable institutions for all. The Post-2015 agenda will be underpinned by foraging a new global partnership towards a spirit of cooperation and mutual accountability.

The first International Conference on Global Food Security held in 2013 (<http://www.globalfoodsecurityconference.com>) highlighted the need of interdisciplinary research and the opportunity to ensure that the best science is garnered to support the emergence of the Sustainable Development Goals. Achieving global food security for a growing global population, whilst reconciling demands on the environment is a great challenge for mankind (Refer to the Chapter on NRM). The urgency has led to big investments in agricultural research for development globally, e.g. the CGIAR Research Programs, Bill and Melinda Gates investments, etc. This has helped advance the scientific and technological development but it has also called for more emphasis on systems research across disciplines and to strengthen the socio-economic research components, e.g. to understand behavioural change, development of socio-technical regimes for innovation, policy formation and implementation. Agricultural research is needed to better understand economic, social, biophysical, technological and institutional drivers of current and future global food security and is also required to come up with scalable solutions that can show impact and provide poor people a pathway out of poverty.

Swedish researchers have a long tradition of carrying out food security relevant research, some of which is undertaken together with international research groups or organizations, but a major part is done jointly with

national partner institutions in low income countries as part of research for development and capacity development programs and projects. The Swedish research for development and resource base in the area of food security will be described and assessed within four sub-themes; (i) agricultural production, (ii) nutrition, value chains and the food system, (iii) food prices, market development and trade, and (iv) equity, empowerment and land tenure. In the final section, we present our recommendations.

Agricultural production

Description of the research

Sweden has a long and strong tradition in research on agricultural production in a development context and the contributions are acknowledged by the international scientific and development communities. The work has mainly been taken place in humid and sub-humid areas but also in drier climatic zones. The focus for the last decade has been Sub-Saharan Africa but also Southeast Asia, South Asia, and Central America, following the regional and country priorities of Sida. Agricultural production is here used in a broad sense, including crop, livestock and tree products from fields, farms, pasture land and forests. The different land use systems are interrelated. A higher population pressure and food demand has led to that forested areas have been cleared for crop and livestock production and, where possible, pastoralists have been moving into agro-pastoralism. Overall more land has been going into agricultural production sometime resulting in land degradation through erosion and/or loss in soil fertility (reduced organic matter, nutrient depletion) and the point has been reached where reclaiming new land for agriculture is no longer the way to increase food production. The main focus ahead is on enhancing the productivity (the produce per invested input) of crops and livestock through improved management practices, disease and pest control, breeding programs, etc., and to integrate that with better natural resource management of water, soils and genetic resources within the concept of 'sustainable intensification'. Sustainable intensification of the production system is taking into account environmental (ecological), social and economic perspectives (WCED, 1987). Climate change adaptation and mitigation are aspects of sustainable intensification and FAO has launched the term 'climate smart agriculture'. In addition to the focus on rural farming systems, some of the recent research is targeting peri-urban and urban farming which is of growing importance as a result of urbanisation, increased population density, lack of infrastructure to transport food from rural to urban areas, pressure of resources and in some circumstances a result of conflicts and unrest.

The 'agricultural production' research is dominated by the Swedish University of Agricultural Sciences (SLU) involving scientists from a number of disciplines and departments. However, research teams or individual scientists from several Swedish universities are involved in the research funded through 'u-forsk', e.g. Gothenburg, KTH, Linköping, Lund, Skövde, Stockholm, and Örebro. The research area can be divided into the topic areas; (i) management practices for improved agricultural production and productivity of crops, trees and livestock systems, (ii) genetic resources and breeding of crops and livestock, (iii) combating and controlling animal and plant pests and diseases.

Strengths and weaknesses

Overall the area of agricultural production and productivity is one of the strengths of the Swedish research community both in relation to crops, trees, livestock and fish. Research on peri-urban and urban farming has become more prominent and in rural areas agricultural production research is broadening the perspective to include livelihood and rural development. Many projects are working on resilient production systems being able to adapt to climate change (irregular rainfall patterns and extreme weather events) and to produce multiple ecosystem services including food.

Research on *management practices for improved agricultural production and productivity* deals with a range of farming systems producing staple crops, vegetables, fruits and livestock such as cattle for meat and dairy and pigs, and how to develop productive and sustainable production contributing to food security and improved

livelihood for small-holder farmers. Alternatives to slash-and-burn practices are still the key priority in certain areas, e.g. in Southern Africa and South America. The soil and agronomy related research include restoring soil fertility (soil organic carbon, nutrient status), increasing biological nitrogen fixation, nutrient cycling and use efficiency, finding options for improving water infiltration and water use, controlling weeds (e.g. the parasitic Striga weed) and produce traditional and novel crops/trees for food and fodder. The livestock management research is integrated in regional or bilateral capacity development programmes in SSA and SE Asia (Mekong). This research focuses mainly on developing suitable feeds and feeding strategies for cattle and pigs on small-scale farms, e.g. in sustainable urban and peri-urban production, or in rural areas with different access to pasture areas.

Trees on farms and in agricultural landscapes (agroforestry) contribute to a sustainable production of food and fuel in areas with harsh climate and degraded soils, e.g. the Sahel region. Agroforestry is one way to adapt to a changing climate since perennial shrubs/trees are more resistant to irregular rainfall and can contribute to supply the farmers with fruits and nuts, fodder, fuel, timber, green manure and mulch (soil moisture and fertility). Studies assessing multi-functionality of trees across multiple scales in agricultural landscapes have been carried out in drier parkland areas of West African Sahel as well in the East Africa highlands. Commercial large scale forestry and plantation research is carried out (e.g. in SE Asia) together with the private sector but can rarely be found among the u-forsk projects.

Genetic resources and breeding of crops and livestock is a very strong area of the Swedish research for development. Modern biotechnological as well as traditional methods and tools are used. Within this area Sida's regional program in SSA has invested in technology platforms and capacity development through the BioEarn and BioInnovate programs and the Becahub (located at ILRI in Nairobi). Rapid sequencing of genomes (e.g. plants, animals, pests and diseases) has created a large potential for modern biotechnology and by using bioinformatic and biotechnological tools we can now identify specific genes of interest and determine their function very fast. This is a field where Swedish scientists are very advanced and in the international forefront, which is utilized also in the development oriented research. The research on genetic resources includes studies on the potential of the diversity of underutilized species and staple crops and tubers, e.g. on the Ethiopian highlands, and their oil quality, draught, salt and pest tolerance. Cassava plays a critical role in food security and improved livelihoods in rural communities. Several projects in SSA and SE Asia are working on cassava breeding to increase yield and quality by utilizing the high genetic diversity in wild relatives of cassava for improvement of varieties. Also within the area of animal genetics and breeding Swedish researchers have had a long-term and strong involvement in research and capacity development activities in several countries (mainly through other Sida funding channels than u-forsk).

Controlling and reducing the spread of plant and livestock pests and disease are other very strong research areas. Management practices as well as breeding programs are aiming at healthier and more productive plants. Diagnostic tools, treatment and control programs are being developed, e.g. for potato (*Solanum tuberosum*, L.). Urban agriculture where people and livestock live very close together deserves special attention, policies and regulations due to the risks of transmission of infectious diseases from livestock to humans. State of the art diagnostic tools for animal diseases has been developed in these projects and several projects have a clear interdisciplinary character: advanced infection epidemiology methodology are combined with socioeconomic household analyses All in order to contribute to better disease prevention and better productivity by healthy animals.

Re-use of water and nutrient sources from waste in sustainable agricultural production have a great potential and also many challenges being addressed in a number of projects exploring different techniques of reuse of storm water and sewage water for production of food (fish and vegetables) and fibres.

Social science research on agricultural production in developing countries is particularly visible in research groups in Gothenburg and Lund. An important research area for social science is to understand and address the situation that agricultural productivity has been stagnant in SSA since the 1960's and that the adoption has been very low of new technologies that could make agriculture more productive and more sustainable. This includes research on yield gaps, profitability of sustainable land management and, increasingly, analysis of adaptation strategies to climate change in African agriculture. An efficient interface between Swedish research capacity

and researchers in developing countries has been established through the Sida-funded Environment for Development initiative.

There is an on-going generation shift among researchers/lecturers with long-term and hands-on 'research for development' experience at the Swedish universities/research institutions. At the same time we have had a number of years with 'uncertain/dynamic' conditions for the Sida research support to the Swedish resource base. There is need for more stable and long-term investments/funding opportunities for Swedish universities/research institutions to apply for PhD student projects, post-docs and long-term support of lecturers/senior scientist engaging in food security research. There is also a need to create mechanism for secondments to international research organizations, e.g. within the UN and CGIAR systems, for senior and junior researchers. This could contribute substantially to strengthen the Swedish resource base, and further develop opportunities for collaboration between universities in the south and Sweden beyond the investments through the bilateral university collaborations (presently with e.g. Bolivia, Mozambique, Rwanda, Tanzania and Uganda).

Nutrition, value chains and food systems

Description of the research

Agriculture can do more for improving nutrition and health than has been envisaged in the past when the main focus has been on meeting calorie requirements at relatively low prices. Food and nutrition security is more often seen interlinked and there is a strong emphasis on product quality (not only quantity) and the essentiality of food diversity and access to nutritious food all parts of the year. This can be achieved through combining staple crop production with legumes, vegetables and trees for fruits and nuts (very valuable nutrient sources during the dry season), and integration of milk, meat and/or fish production. In addition to diversification of diets and promoting systems delivering nutritious food the major part of the year, substantial research investments have been done in bio-fortified staple crops delivering the three most important micro-nutrients, vitamin A, iron and zinc, aiming at reaching out to millions of poor households in Africa and Asia (HarvestPlus, 2014).

Many governmental, private sector and development funded programs are investing in value chain projects to contribute to achieve goals related to poverty reduction and economic growth. The underlying assumption is that smallholder farmers "will climb out of poverty when they organize into rural enterprises, when these enterprises link them to business partners committed to win-win relationships, and when the chain actors have access to the right mix of technical, business and financial services" (Sheck et al, 2013). According to Sheck et al, (2013) there is however a poor understanding of if these assumptions hold true, and this is one of the urgent themes to be addressed by researchers using different models and tools. So far more emphasis has been on studying individual value chains.

Post-harvest losses is an area still providing real challenges for food security that need to be addressed in a food systems perspective. The food systems research is addressing and assessing food systems using tools and metrics relevant to the agriculture, nutrition, and health sectors (IFPRI, 2013). When considering gender and equity aspects it can greatly advance food and nutrition security contributing to tackle hunger and malnutrition. Food safety is an integrated part of the food systems research and it is also cutting across to issues related to sanitary and hygienic aspects of wastewater use and nutrient cycling through utilizing waste and by-products in crop and livestock production.

Related to the value chain and food systems research is work dealing with access to energy/fuel for cooking and food processing. Energy efficient and healthy (e.g. in relation to smoke) cooking facilities (stoves) is another priority area engaging Swedish researchers. In many developing countries, in particular in Sub-Saharan Africa, wood fuel, or charcoal made from wood and other biomass, is the dominating fuel for cooking, in both rural and urban areas and research is carried out on technology development as well as policy aspects.

Swedish universities and research institutions being involved in the research described above include Karolinska Institute, KTH, Lund, SLU, Göteborg, Stockholm, Uppsala and Örebro. Several CGIAR Research

Programs include Swedish research collaboration, such as Agriculture for Nutrition and Health (A4NH), Policy, Institutions and Markets (PIM), Livestock and Fish, and Humidtropics, and they all have nutrition, value chains and food systems as part of their research agendas.

Strengths and weaknesses

Swedish research on nutrition, value chains and food systems cover a range of topics from traditional knowledge on food diversity based on indigenous species and traditional management practices to bio-fortification of staple crops for improved nutritional value using biotechnological methods. Diversification of the food production and dietary intake is the focus of several studies. For example, development of growing and management techniques for traditional or novel nutritious crops or fruit trees (e.g., *Momordica cochinchinensis* L.), and studies aiming at improved livestock production contributing to improved quality of dietary intake through milk, egg and meat.

Micronutrient deficiency, in particular of zinc (Zn), in soils and food crops is a major nutritional issue in many parts of the world (together with Fe deficiency) and due to diffuse symptoms called 'the hidden hunger'. Studies are undertaken by Swedish research teams in different parts of the world, and the issue is addressed by a number of disciplines. The portfolio includes for example, studies of effects of breast feeding and micronutrient supplementation of pregnant women on micronutrient status of infants in areas where low birth weight is prevalent. Toxic elements exposure (e.g. Hg from fish) and micro-nutritional status are investigated in different exposed communities. Micronutrient deficiency (i.e. Fe, Zn) is also researched from food safety perspective since it can lead to higher accumulation of toxic elements such as cadmium (Cd).

Food science and food processing research include, e.g., methods for preserving and utilizing fruit (using hygienic solar concentration). Studies on secure and sustainable cereal storage for small-holder farmers based on bio-preservation and nutritional improvement by microorganisms, is another example.

Technologies for sustainable fuels (solar, biofuels, etc.) for food preparation are studied in several environments, and also methods for disinfection of drinking water. Production and use of charcoal (biochar), and alternatives to that, are studied from different angles such as energy efficiency, carbon sink/source, soil amender, conservation aspects. It is also an area where Swedish researchers can make a contribution by addressing the gender dimension.

Trends, tendencies and prognosis for the future

Combined research and development efforts on food systems including agriculture, nutrition and health aspects are needed to address food security and malnutrition with special emphasis on vulnerable groups such as children and mothers. This is a cross-cutting research area between researchers in agriculture, nutrition and health sciences in need to be stimulated and further developed. Here the Swedish research community has a great potential to contribute, and such an investment is well in line with the development prioritise on gender and empowerment.

Although a very active research area internationally with a lot of interest from governments, private sector and development actors, value chain research is underrepresented in the Swedish research portfolio. This is also the case when it comes to understanding the role, potential and challenges of entrepreneurship and innovation systems.

Efficient and sustainable systems for producing energy for cooking and development of efficient and healthy cooking systems are areas of research that will deserve continued attention. This is a research area engaging several Swedish research themes and where there is a comparative advantage due to the research tradition on wood and other biofuels.

Food safety is becoming an emerging issue with rapid urbanisation since sanitation is often lagging behind and livestock are kept integrated in housing areas in urban and peri-urban settlements. Here Swedish research can contribute globally and locally both in relation to policy, technology and disease prevention.

Food prices, market development and trade

Description of the research

Swedish food security research on food prices, market development and trade has addressed a broad range of topics within multiple disciplines. This research area has been growing during the past decade as a result of the accelerated globalization of the world economy and the prioritisation of global hunger reduction under the UN MDG's. Furthermore, the negative impacts of the global food price crisis in 2007/08 have triggered growing interest in food security research. From an international perspective, Swedish research in this field is still somewhat limited and, although growing, the number of research groups and environments are far from abundant. Despite this, due to the embedded nature of markets within the globalised world economy food security research has a broad yet tangible impact globally. The growing contributions of Swedish food security research is therefore important in that it fulfils the Swedish development cooperation's 'people first' mission by enabling individuals to obtain a better life by improving conditions for the poor, who are among the most vulnerable to food insecurity. In this way this research capacity supports the Swedish development cooperation's mission to reduce poverty in the world.

A number of Swedish research groups have focused their attention on food security, market development and smallholder agriculture. Regionally, sub-Saharan Africa (SSA) has increasingly come to receive the most attention during the past decade. Together with researchers in the Food Security Group at Michigan State University, US, Swedish researchers have studied food security and the commercialization of cassava in southern Africa using a value chain perspective. Partly linked to this line of research, a newly started Swedish project carried out in cooperation with researchers from the International Food Policy Research Institute; Washington DC, (IFPRI) focuses on gendered production and distribution dynamics in transforming cassava value chains in Tanzania. Another Swedish research group has drawn from SSA smallholder household panel data to analyse determinants of household food crop production. Commercialization was found to be the strongest driver for increases in production, thereby reducing food insecurity through increases in income and self-provisioning.

A related Swedish research project that frames social science perspectives at the centre of analysis has sought to understand subsistence agriculture by investigating the research question: How can subsistence farmers in SSA overcome local food insecurity for the sake of contributing to global food security? In addition, urban agriculture has also been the subject of Swedish research into food security. A collaborative multidisciplinary project has investigated the role of farming in cities in Ghana and Kenya as a source of food, income and trade. On a related theme, research into African urban consumers' differing food preferences has been pursued for several years. Meanwhile, a further branch of related research interest has been concerned with global patterns of sustainable production and consumption, especially with regard to the role of food within commodity chains.

Considering market investment an emerging body of Swedish research has examined the general impacts of large-scale agro investments, with particular focus awarded to the influence of biofuels upon food prices and food security. Furthermore, additional research has considered the challenges and opportunities bound to the markets of food and fuel. Attention has also been directed towards the economic implications of traditional transfer mechanisms on agricultural production and marketing. Further still, Swedish research has addressed changing market dynamics and infrastructural development in low and middle-income nations, including the introduction of supermarkets and the implications of this phenomenon for food security. Similarly, the marketplace has also been studied as a hub within the food security chain in developing countries.

The research described above is taking place at several Swedish universities and research institutions including Lund, Uppsala, Stockholm, Göteborg, Örebro, Chalmers, SLU, and the Nordic Institute of African Studies.

Strengths and weaknesses

With regard to food prices, market development and trade, Swedish research strengths revolve around political, economic, and social dimensions. Swedish research in this field has been successful in designing international collaborative and multidisciplinary research projects that probe these issues. A feature of much of the Swedish research in this field is the focus on the micro dimensions – i.e. household and household member levels. Swedish access to one of few existing relatively large longitudinal smallholder household databases (panel) covering several SSA countries offers a comparative advantage by enabling analysis of changes in food security over time, especially in relation to food prices, levels of commercialization, and trade.

The prominence of research concerning micro level food security issues is however mirrored in the relatively weaker attention given to macro dimensions. This includes the impacts of factors such as macroeconomic stability, economic growth and its distribution, and public policies on and investments in food security. On the whole a weakness within Swedish food security research is that food prices, market development and trade are rarely the main focus of investigation. These aspects are often addressed implicitly within research as part of a wider set of issues relating to food security. This often allows for other issues to take precedence over these problems.

Trends, tendencies and prognosis for the future

One emerging trend in Swedish food security research within these fields is the investigation of changing patterns of production and consumption under dynamic processes of population growth, urbanisation, and climate change. Urban poverty and food security can be expected to gain more attention in Swedish as well as international research. Shifting dietary patterns in rapidly urbanizing countries, especially in SSA and South Asia, leads to fundamental consequences for agriculture as demand patterns change. A number of challenges in terms of access to and utilization of nutritious and safe food in the growing urban areas are being observed internationally and these issues can be assumed to attract the attention of Swedish development researchers including those from the social sciences. Malnutrition and under-nutrition are aspects of food security research that are rapidly becoming fields in which boundaries between high and low-income countries become less distinct. Given that these prominent issues are difficult if not impossible to address on a short-term basis, research within this area can be expected to continue in the long term.

A further area of contemporary research that has been gaining ground concerns the investigation of bio-fuel production and its influence and competition with food production. This research reflects both the need to develop and implement more sustainable fuel production and consumption as well as the need for sustenance of the increasing global population. This body of research can be expected to continue growing given the prognosis of increasing pressure on global resources.

Equity, empowerment and land tenure

Description of the research

International research approaching food security from equity, empowerment and land tenure perspectives has grown as a consequence of the gradual understanding that international and national food production capacity and availability of food does not guarantee food security at the individual and household levels. Amartya Sen's theory of famine (Sen 1981), which explains the importance of personal entitlements on food access and the multidimensional and complex nature of food security, laid the foundation for a broadening of the definition of the concept. Subsequently, in the 1990s, it was expanded further to include food utilization and stability. In view of this development, it could be claimed that over time the social and economic dimensions of food security have gained prominence in policy as well as in research attention. Having a generally strong orientation towards poverty and poverty reduction, much of the equity,

empowerment and land tenure perspectives on food security only implicitly address food insecurity problems. In this respect Swedish research reflects the international situation. The Swedish contribution to the field is gaining strength but cannot yet, on the whole, be considered internationally prominent.

One stream of Swedish research linked to these themes has focused on government policies and investments in relation to smallholder agriculture and food security in Asia and sub-Saharan Africa. As the approximately 430 million small-scale farm households in the developing world, home to an estimated two billion people (Wiggins and Keats 2013), also contain the majority of the world's absolutely poor as well as half of its undernourished, this line of research remains internationally prioritized. An improved understanding of the ways in which food security can be reached for smallholders is relevant also in relation to Swedish development goals as it implicitly would contribute to the goals of inclusive or broad based economic growth. Swedish contributions in this line of research have been internationally recognized and it is presently integrated in internationally important research networks.

Similarly, different Swedish research groups with an international outreach have engaged in local level impacts on livelihoods and food security of large scale agro investment in sub-Sahara generally and in the case of Tanzania on agro investments in bio-fuel specifically. Insecure conditions surrounding land tenure is a central theme in this line of research. For local population in areas where so called 'land-grabbing' takes place, livelihoods and thereby food security are threatened.

Swedish research has also focused on the impacts of women's access to secure land tenure on household incomes and food security, on the importance of educating women farmers for food security as well as the gendered impacts of new agricultural technology. The impact of local cooperation and empowerment related to new techniques of soil fertility management is yet another example of related research where food security and food sovereignty is discussed from a local perspective.

An important area of impact research has been to evaluate the many policies and projects that have led to increased tenure security and devolution of rights. Applications include large land reforms such as in Ethiopia and Rwanda but also the welfare implications of e.g. forest reforms as in Tanzania, Kenya, Ethiopia, India, China and Vietnam. Such Swedish research has also focused specifically on the impacts of women's access to secure land tenure on household incomes and food security, on the importance of educating women farmers for food security as well as the gendered impacts of new agricultural technology. The impact of local cooperation and empowerment related to new techniques of soil fertility management is yet another example of related research where food security and food sovereignty is discussed from a local perspective.

Strengths and weaknesses

Swedish development research linking questions of food security to those of poverty, equity and income distribution has a long tradition. The centre of attention has usually been on poverty broadly and as a part of that food security problems have been analysed. A number of Swedish social science researchers and research groups, in the past as well as in the present, address these issues departing from a rural and agricultural perspective. This has been highly relevant and remains so but needs to be complemented by more research focusing on urban growth and development and rural-urban linkages in relation to food security, a growing research field internationally not least if the focus is on SSA.

One of the strong points of Swedish research in this field has been its reliance on fieldwork and primary data collection, qualitative and quantitative. The conduct of much of the research in developing countries has created opportunities for cooperation with partners locally and this has in its turn contributed to strong research networks with research institutions in developing countries. The question is whether this tradition will continue? Judging from past few years project applications to Sida u-forsk, now VR-u-forsk, the tendency for those approved seem to imply less fieldwork and more either 'desk-studies' or studies relying on secondary data sources usually macro level data. Refraining from evaluating this possible tendency, a change in this direction should nevertheless be analysed.

Another feature of and an area for potential improvement, is that relatively few researchers in these fields seem to be cooperating with some of the very influential research environments such as the CGIAR centres

including for example, IFPRI, the World Bank research sections, Institute of Development Studies, and other high quality research environments.

Trends, tendencies and prognosis for the future

Research related to food security is rapidly growing internationally something which is reflected by the number of new scientific journals having the words 'food security' in their title. Swedish related research, including that conducted in the social sciences, can draw on an existing resource base of researchers within the field or in closely related research areas. The food security complex is however particularly in need of collaborative initiatives where experts from different scientific backgrounds come together.

It can also be expected that sub-Saharan Africa and South Asia will be the regions receiving most of the research attention and Swedish researchers and research groups do have an advantage in drawing on long-standing experience and networks of research cooperation, not least in SSA. Research using equity, empowerment, and land tenure perspectives on food security will certainly be of relevance also in the future. The ongoing formulation of the post 2015 development goals (SDGs), will continue to place food security goals high on the development agenda. As pointed out in the previous section, urban food security issues seem likely to become growing societal and scientific challenges and there are relatively few Swedish researchers studying urban development in, for example, SSA and still fewer focusing on food security.

In food security research related to agriculture there is currently some emerging platforms for both increased cross-disciplinary research cooperation among researchers in Sweden and for an increase in the interaction with researchers from the regions under study as well as other international researchers. In the following section on recommendations, references to these emerging platforms are made.

Recommendations

The Swedish support to research in the area of food security, including agricultural production, is handled by Sida within the global (e.g. CGIAR), regional (e.g. BioInnovate, Becahub, MekarnIII, ANAFE, AFF, if we include aquaculture, coastal regions and fisheries there are more) and bilateral programmes. Even if the major part of the Sida funding goes to the regional and national partner institutions, the funds allocated to the Swedish partners for capacity development cooperation, including supervision, joint research and publications of PhD students' and postdocs' work, is of a much higher economic value than what an institution or a research team can get from VR u-forsk. This means that it also needs to be considered when assessing the quality and direction of food security research. *It is recommended to develop mechanisms for linking the Swedish VR u-forsk (and Formas) funded research to the global and regional institutions, initiatives/programmes funded by Sida, other Swedish agencies and EU.* Past experiences of capacity building programmes and research collaborations have shown that Swedish academic institutions can play an instrumental role in building relevant and sustainable capacity in developing countries. There are good conditions that this could be the case also in the area of food security. The present system makes it difficult for new actors to enter the scene, in particular young scientists or 'new' groups/institutions would like to get into development oriented research.

The Sida Research Unit (previously Sarec) used to initiate/arrange biannual conferences inviting all researchers and research institutions funded through the Sida 'u-forsk' (now VR u-forsk), the latest held in Uppsala 2008 (Karlsson & Röing de Nowina, 2009). These events gave an up to date overview of the recent and ongoing research carried out and gave room for discussions on results and research directions ahead. The research teams and individual researchers forming the Swedish resource base were getting together with each other, with the Sida research staff and other stakeholder. The conference included all thematic areas funded through u-forsk. *We recommend re-initiating a biannual forum (conference) bringing together researchers and PhD students from Swedish universities and the collaborating research institutions, Sida staff and other stakeholders and development actors.*

The Agricultural Research for Development (Agri4D) network (Gothenburg Univ., Lund Univ., SLU), funded by Sida (2009-2013), has to some extent filled that need within the Food Security area. The Agri4D

Conferences (held 2010 at Stockholm Univ., 2011, 2012, 2013 at SLU) have brought together international invited speakers, the Swedish research community and other stakeholders and development actors. The continuation of these successful network and conferences is uncertain since the funding source has come to an end. The network has resulted in a number of joint proposals and ongoing student and research initiatives. However, for the long-term development of the network and the inclusion of the Swedish universities/institutions beyond the three in Agri4D *the creation of a Swedish hub for Food Security research would be a good mechanism, e.g. to be hosted by SLU Global.*

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