Innovation, TH & Clusters: Evidence from East Africa

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Introduction

- My own interests in this topic begins with:
- How is poverty reduced? It appears to rely on growth as the most important factor. Increased growth is supported through innovations among other factors.
- Hence, there is increased attention to innovations and the systems that support or hinder innovation. There is also increased attention to the role of knowledge.

- Here we focus on some results from an evaluation of an implementation of Triple Helix and Clustering ideas to promote innovation and growth in East Africa.

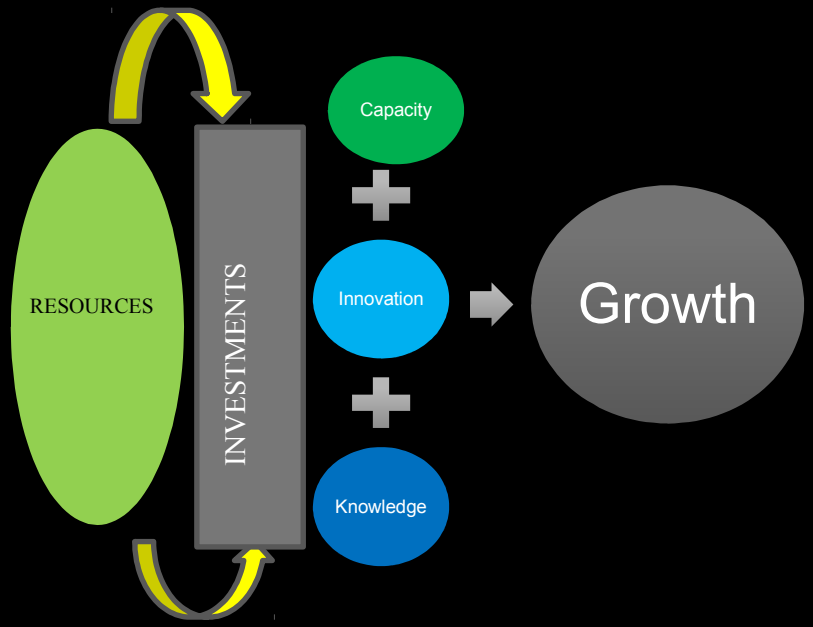
- The presentation is based on the findings from an evaluation of support provided by Sida, focused on an audience of researchers, policy makers and a University audience.

A Diagram

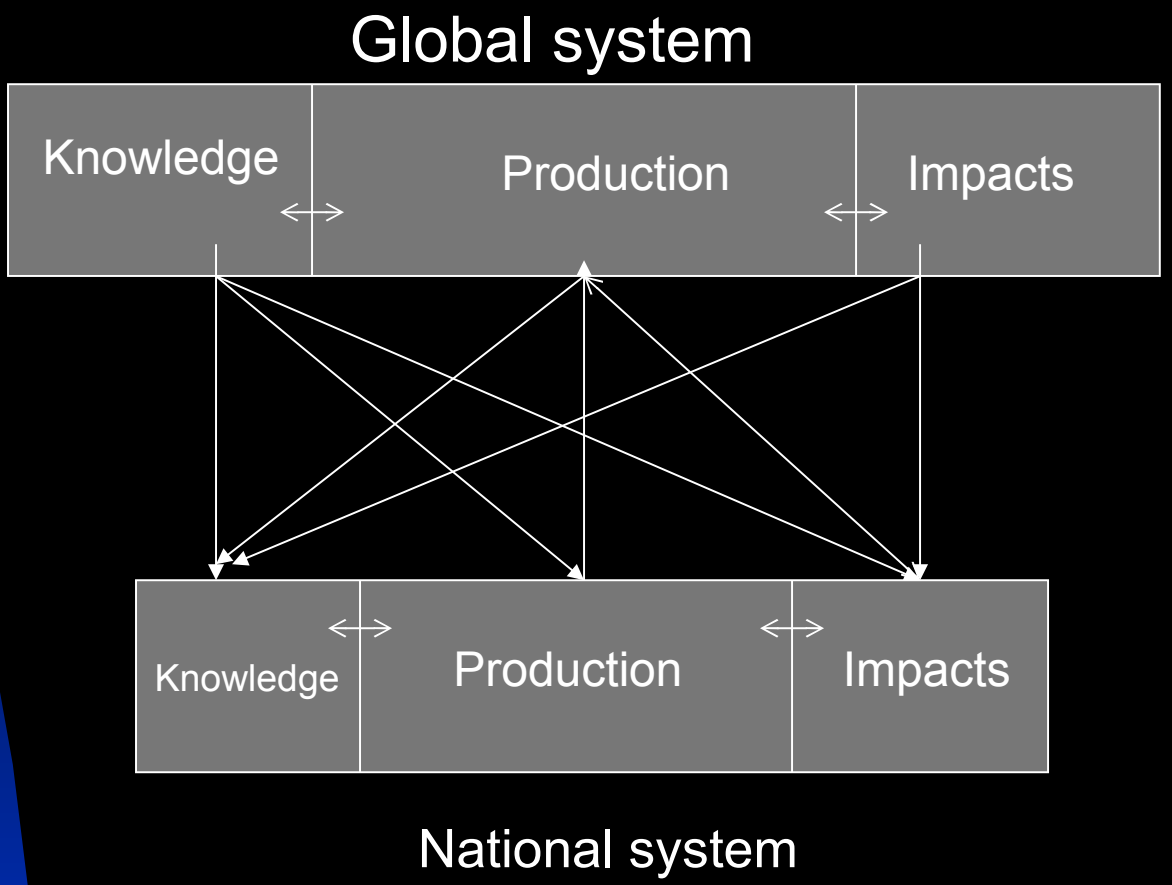
- At the highest level – Local Resources combine with:
- Capacity + Knowledge
- Growth Reduced Poverty
- There is also a positive feedback loop – from growth and reduced poverty to increased demands and resources, investments, capacities and new innovations and new growth.

Innovation = New *applications* of knowledge.

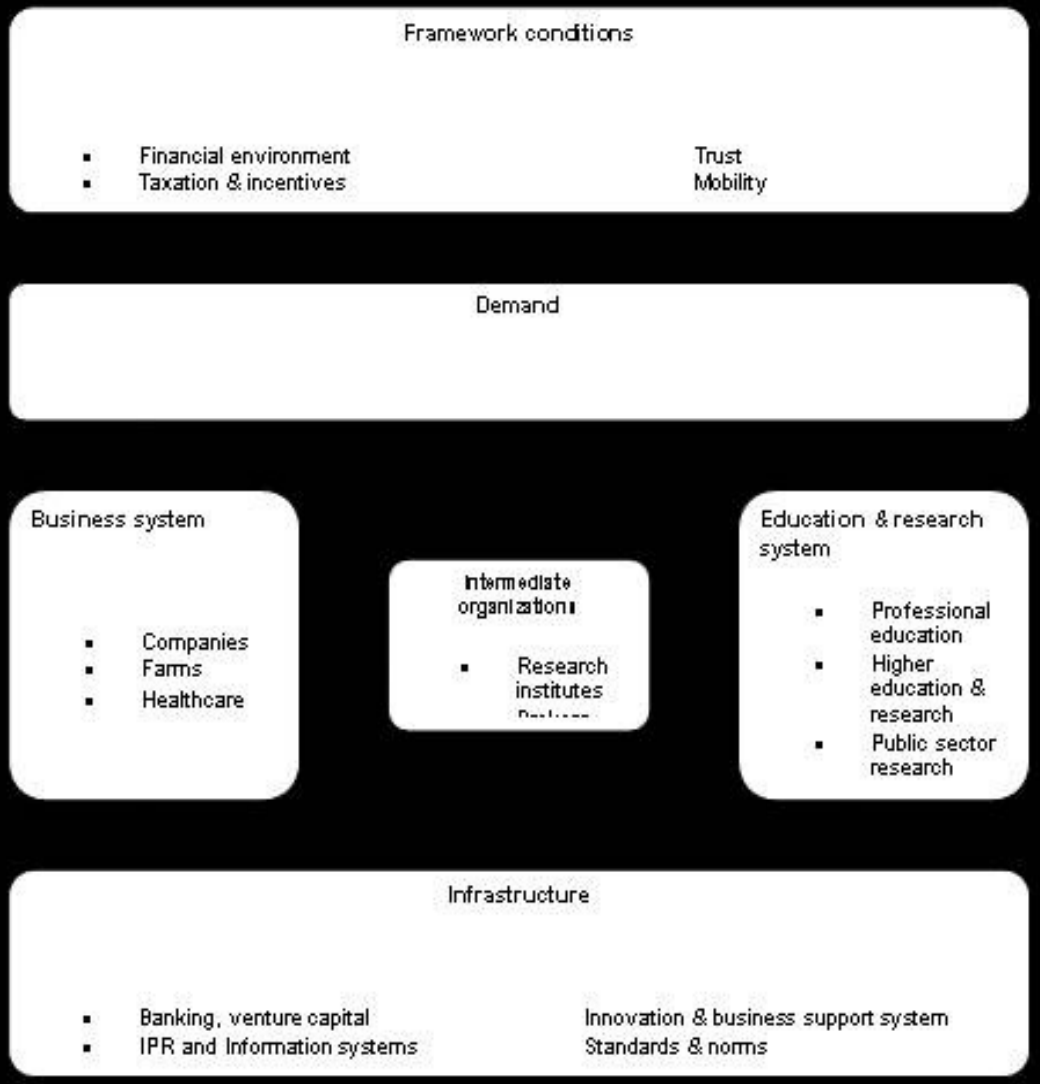
- A picture



A Picture


Global system
Knowledge
Production
Impacts
Knowledge
Production
Impacts
National system

National Innovation System

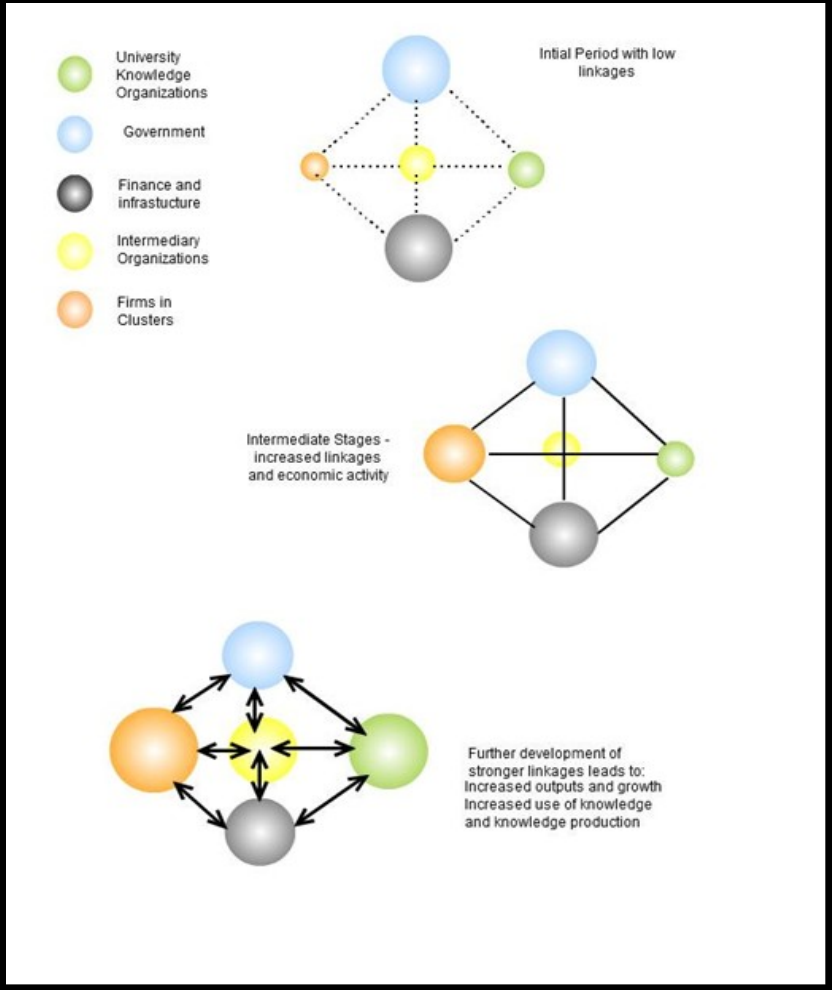


A Rapidly Changing Knowledge Context

- Accelerated changes in science & technologies - examples include IT, bio technologies and others.
- They also affect- Generation, Dissemination and Use; the actors and their roles in the knowledge system.
- Systemic changes include - new multiple locations, greater applications orientation, transdisciplinary, networked, and heterogenous.
- The mode of "knowledge production" had changed to a new Mode 2, where knowledge is created by networks.
- The “Triple Helix” ideas link Mode 2 knowledge generation and innovations, closely with university research.
- The ‘Triple Helix’ - a new relationship between universities, industry and government with systemic links between the three actors.

Triple Helix and Clusters

- The new ideas about innovation systems, knowledge and education – Triple Helix
- New theories of regional development evolved in parallel. dense, closely connected and interacting networks consisting of people, firms, skills, infrastructure and knowledge – to promote nodes for innovation and competitiveness, leading to economic growth.
- A separate strand of work on clusters comes from research on competitiveness of firms, which found that often it is NOT simply the characteristics of the individual firm that dominates competitiveness and hence outputs but competitiveness of the “supply chain”
- Interventions in the real world often include ideas from each of the theories.



Positive Change

Government

Firms
Producers

Knowledge
Organizations

Infrastructure
Organizations
Finance ICT

Initial Conditions
Weak links

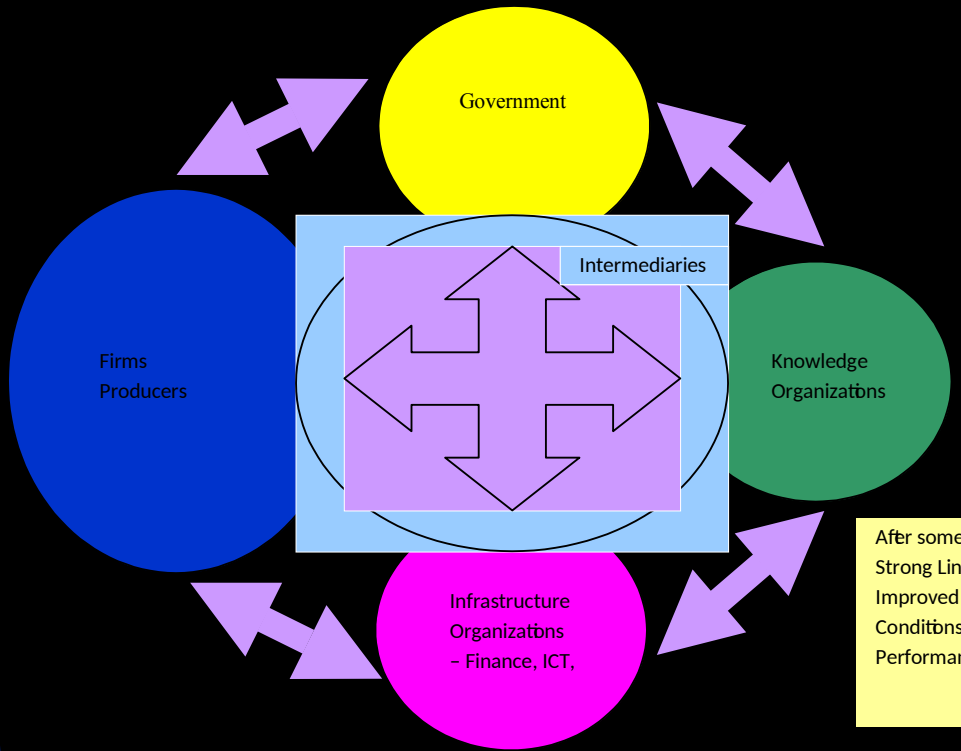
Government

Firms
Producers

Knowledge
Organizations

Infrastructure
Organizations
Finance ICT

Over time – Increased Links lead to Improved Performance

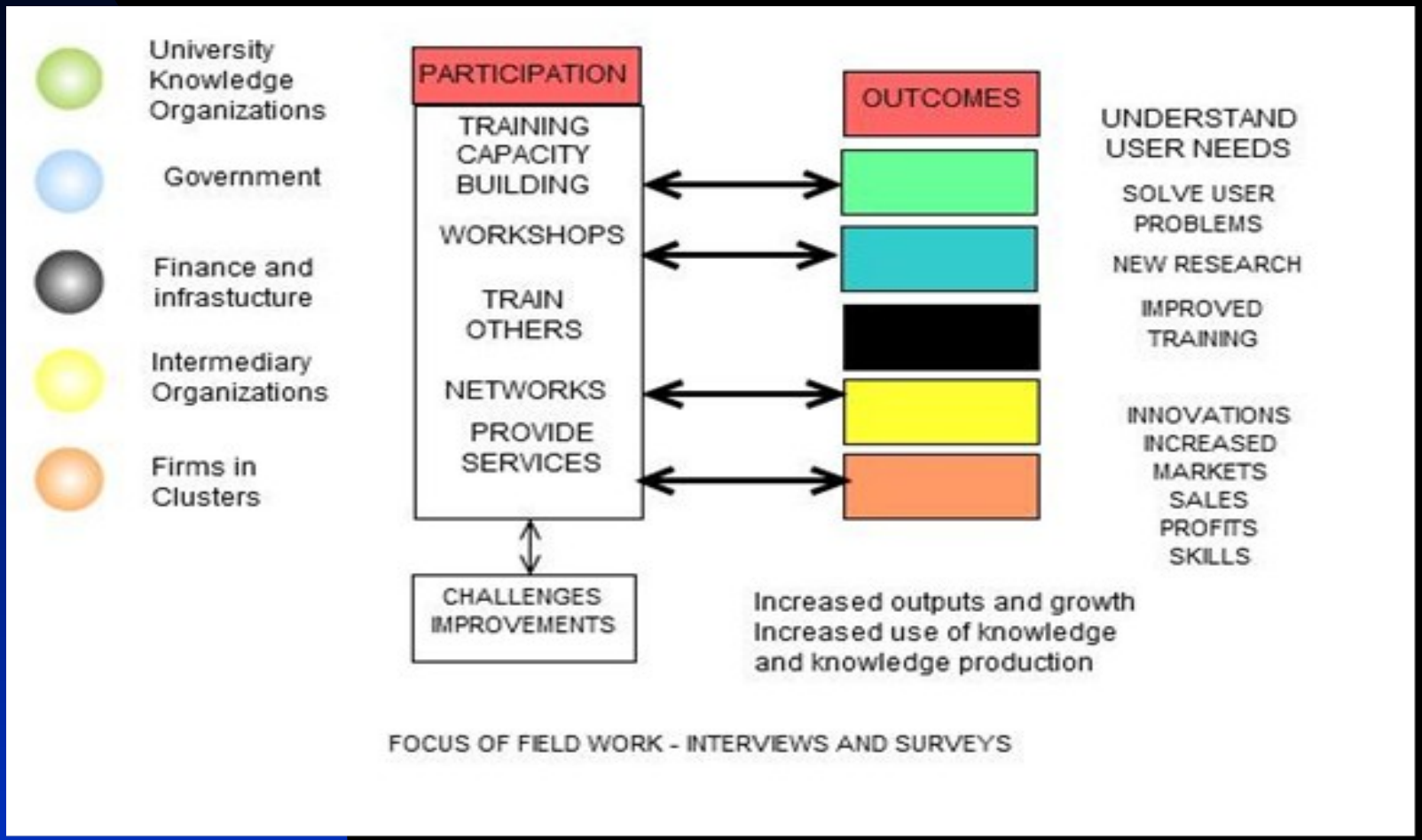


After some time
Strong Links
Improved
Conditions and
Performance

The East Africa Portfolio

Inputs	Activities	Outputs	Outcomes (short term)	Impacts (long term)
Financial resources. National University - management, coordination, knowledge & skills. Swedish knowledge& experience inputs via VINNOVA/SCICD. Volunteer facilitators Support from triple helix organizations.	Analysis and studies of clusters. Research. Meetings and workshops. Training workshops (e.g. for cluster coordinators). Formal training for Masters and PhD Training of researchers to transfer knowledge. Targeted knowledge transfer for policy; for production. Training and Exchange of information for producers.	Reports. Networks across knowledge, policy, production and infrastructure domains. Improved information on production, markets, technology. Trained coordinators. Increase in human resources – who then transfer and spin-off knowledge and research results. Improved human resources. Knowledge transferred.	Actions taken based on analysis or study activity. Learning from portfolio Capacity building of triple helix partners. Improved coordination of cluster, trust, knowledge links. Increased and improved courses, graduates and other trainees, research and problem solving. Increased knowledge transfer Improved quality and relevance. Better understanding of problems and arrival at new solutions.	Improved efficiency and effectiveness of interventions for economic growth and use of knowledge. Firms - Improved policy and support services. Increased innovations - outputs, efficiency, jobs, incomes, productivity. University - expansion of pool of skilled human resources. Engagement in local problem solving, better research outputs. Government - Improved engagement in local problem solving, policy, knowledge and support.

Actors & Activities



Background & History

- Idea conceived in September 2003. Ten participants from Uganda, Tanzania and Mozambique were invited by Sida/SAREC to attend the 6th Global Conference on Innovative Clusters, organized by The Competitiveness Institute (TCI) in Gothenburg.
- The participants were motivated, organized a smaller regional conference in February 2004.
- Sida/SAREC provided support. The lead was taken by the Faculties/Colleges of Engineering at the Eduardo Mondlane University, Mozambique; Makerere University, Uganda; and the University of Dar es Salaam, Tanzania (UDSM).
- In 2005 the work began with one-week training courses in Clusters in Tanzania and Uganda, representing the university, industry and government. A training course in Mozambique was held in June 2006 .
- In each country undertake (i) Research and innovation systems policy reviews;
- (ii) Implementation of pilot innovation systems and/or cluster initiatives;
- (iii) Awareness creation and publications;
- (iv) Competence building; and
- (v) Coordination and follow up forums.
- Common activities included :
- Training teams on clusters and innovation systems through workshops/seminars and short courses
- Identify innovation systems and clusters and determine the characteristic features
- Mechanisms to increase competitiveness
- Assess roles of supporting institutions
- Manage cluster resources and sustain the network
- Case study and benchmarks for gauging the successes and failures of clusters
- Factors contributing to the success or failure of the clusters and innovation systems
- Total Resources provided by Sida was approximately 13 million SEK (2 million USD) over 2003 –2010 for all three countries.

Tanzania

- Lead institute - College of Engineering and Technology (CoET), UDSM.

Metal works and Engineering - Morogoro (MECI) Cluster
The MECI cluster located in Morogoro municipality began with 14 firms working in the metalwork and engineering sector, and 27 micro enterprises, located close to each other, working on charcoal stoves. The metal working group had relatively higher education levels compared to other clusters. The charcoal stove makers, who had started with a single enterprise in 2003, were growing rapidly in an organic cluster. In 2006, members praised the efforts made in training and said that they learned new things, and the stove makers implemented a new technology as a result of the learning. However, the level of social capital and trust was underdeveloped, with potential benefits of clustering and working together not very valued among the cluster members. There was greater anticipation of improved access to capital, though the stove makers seemed to value the idea of working together to minimize costs - especially in regard to the transportation of raw materials such as clay. There was some limited informal collaboration, especially between those firms that are neighbours. In 2007, the earlier mistrust and lack of cooperation by members had been turned around through the efforts made by the CI facilitator. The quality of facilitation and leadership are among key success factors. In September 2010 membership had increased to 44 registered firms with more than 450 employees. The firms working on engineering and production of post harvest machinery and wood working have expanded markets in Tanzania, Southeast Africa and are even linked to emerging markets in Europe. The training of employees and coaching of young entrepreneurs are ongoing activities. A revolving fund for firm level innovations has been established, funded by MECI's own resources. The fund is used for soft loans for entrepreneurs to buy material and components to be used for prototyping. A team of experienced engineers in the CI supports the prototyping activities. When the new products reach the market, the loans are paid back. Cluster firms collaborated in developing a seed drill equipment prototype. They first contacted leading experts worldwide, and then one of the identified experts participated in the development work, producing the new equipment. The final project report states that outputs have gone up from 30% to over 200% for firms. Two firms producing stoves increased their turnover from 12,000 USD 2005 to 160,000 USD 2009. There is increased specialization, with one firm making ceramic inserts only, one making the outer shell and a third undertaking assembly.

Examples: Continued

- Zanzibar seaweed

Seaweed farming introduced in Zanzibar during the 1980s by researchers at the Institute of Marine Sciences (IMS), who had noted its use in some Asian countries and its potential as a cash crop.
Active individuals increased from a handful in the early days to about 100 in 2006. The majority of persons involved in its harvesting, collection and sales are women (estimated at over 90%) also engaged in common activities of seaweed farming and soap making.
Two species of seaweed are farmed with different market prices.
The Seaweed Cluster Initiative members are engaged in common activities of seaweed farming and making value-added products including soap, body creams, and food. At the moment, the cluster activities are centered in six villages in Zanzibar:
Just like mushroom cluster (see below), most important environmental factors for this cluster is a huge natural resource endowment, huge potential for export marketing and the close involvement of the higher learning institution, the Institute of Marine Sciences (IMS).
In the beginning it received some impetus from the government, though the cluster organically evolved over time, with people joining the business spontaneously.
This initiative has built on the existing linkages between farmers, researchers at the IMS, government officials and some of the traders. There is evidence of sharing knowledge on new techniques and market conditions, which are essential for sustainability of the cluster.
Membership has grown from one village and 20 cluster members in 2006 to 10 villages with 3,000 members 2010. 17 new firms work with value added seaweed products. The farming methods of high price seaweed has improved productivity and profits, development of new sea weed products has increased the income of the woman farmers, contributing to family incomes and wealth. Seaweed is used as raw material for a whole range of products - soap, cosmetics, snacks and soups – in 29 different products.
Participation of women in innovation activities, production and sales is immense. New designs of equipment for deep-water farming have been developed farmers' teams, working together with the facilitator. The facilitator as researcher has introduced new farming methods to cope with environmental and climate changes. The women take participate fully in all activities of the CI.
A development and production centre is functioning as a site for innovation, training, development and production of seaweed products. There is increased recognition of the need to protect the environment and this has become a priority among cluster members.

Examples: Continued

- Mushrooms

- This cluster had access to good natural resource endowment, potential market - internal and export, existence of a stakeholders association, that was meeting and discussing barriers before the cluster initiative began, and close involvement with UDSM. It said that the message on the cluster initiative spread rapidly, there was enthusiasm for working together, as there were known knowledge and value chain gaps - production of good quality spawns, quality and cost of substrates, temperature and humidity conditions and market requirements for higher quantities that small producers could not meet.

- Findings included that mushroom production is better established, hence producers have better access to financial and material resources. A mushroom collection centre was secured from the local government, and funds for training were availed of and a mushroom growers' manual was produced. Mushroom farmers got to know each other and there was improved flow of market information and knowledge on better methodologies on farming and collection of wild mushrooms. Local banana leaves were introduced in mushroom farming, reducing costs and increasing the use of local by-products. There was product diversification to include mushroom cakes and snacks. An increase in numbers of mushroom farmers was noted and increased membership in the CI. It has trained over 80 farmers, who then train others. It won matching funds from a national programme.

Examples: Continued

- Sisal:

- This cluster is made up of small-scale sisal farmers and two large private companies – Gomba and Katani Limited, that is the monopoly buyer of sisal. The farmers are linked to Mlingano Agricultural R&D Institute, and Katani had some limited linkages with CoET- UDSM. The aim is to develop value addition to sisal, mainly processed for the fibre, but potential products include, sugar, alcohol, bio-fuels and sugar.

- The review found a lack of social capital and trust, both among farmers and between farmers and the firm; poor linkage between the R&D institute and farmers;

- Hypothesis: this CI was largely driven by academic and research interest on alternative, innovative products from sisal.

- The cluster was inactive in recent years.

Overall findings: Tanzania

CIs	At End of Phase 1	At End of Phase 2
Phase 1 - 8 CIs	Positive - 4 Potential - 3 Unsuccessful -1	Positive - 4 Dormant - 3 Unsuccessful - 1
Phase 2 - 11 CIs		Positive - 2 Promising - 4 Unknown - 4 Unsuccessful - 1

Example: Uganda

- Katwe Metal Cluster:
- The Cluster started its activities in 2006. It is estimated that there are about 800 firms employing over 3000 people in involved in activities such as: general fabrication, light machines, foundry, forging, furniture, motor vehicle parts, and industrial machinery. They make a large variety of products for mostly the local market.
- The outcome of the involvement of cluster in the initiative include the following:
- -The Metal Fabricators Cluster has been able to interact and benefit from other partners like Kyambogo Univeristy, Makerere University, Uganda Industrial
- Research Institute, Nile Vocational Training Institute, and as a result there has been products improvement in quality.
- Job sharing when order is beyond the capability of individual firms.

Mozambique

- The work in Mozambique suffered from many problems.

- Work was delayed.
- There was little commitment from the University and the Faculty of Engineering. In Uganda and Tanzania, on the other hand, the project coordinators were the Deans/ Principals of Colleges, who had greater authority and resources to allow for smoother project implementation.
- The hypothesis is that there was insufficient ownership of the project within the important organizations.

- The selection of the clusters located at distances of 200, 500 and 2000 km from Maputo was challenging in the extreme. Given the main program purpose to engage the university in stimulating, catalyzing and promoting the transfer of knowledge, and the development of the clusters, a useful strategy could have been to limit the initial choice of clusters to those closer to the University. An example of conflicts between immediate efficiency and effectiveness versus principles and goals of equity.
- Problems also in accessing the Sida funds due to delays exacerbated due to the procedures at the university, which were difficult and bureaucratic.

- We believe most of the challenges faced by the project are likely due to the larger country specific barriers - - high levels of poverty; low levels of education, including higher education, and a high level of illiteracy; the system of higher education struggling with problems of quality, efficiency and inequality, lack of basic scientific infrastructure, and weak capacity for training and doctoral studies; and the system of research, innovation and technology in early stages of development.

- Within these larger obstacles some of the design problems in cluster choices and sequencing of activities added to the difficulties in Mozambique.

Results

Results: Outputs and Outcomes	Noteworthy and/or Positive Factors
Many reports; networks built across knowledge, policy, production and infrastructure domains Improved information on production, markets, technology Produced CI coordinators Improved human resources. Knowledge generated; transferred. Better understanding of problems and arriving at new solutions. University - expansion of pool of skilled human resources. Engagement in local problem solving, better research outputs Government Improved engagement in local problem solving, policy, knowledge and support Economic growth - increased outputs, efficiency, social capital, jobs, incomes and revenues	Very high positive outcomes compared to the cost of the initiatives. Suggests the possibilities for new designs that can scale up these initiatives. Increased and improved courses, graduates and other trainees, research for problem solving – more limited impacts. Increased knowledge transferred, of quality and relevance for producers is noteworthy and second is the fairly rapid impacts efficiency and effectiveness of interventions for economic growth and use of knowledge at the production level through improved policy and support services and innovations that increased outputs, efficiency, jobs, incomes, productivity. Many additional features are possible in a new range of Sida and national interventions. There is a considerable potential to expand on all achievements. Potential high value to Sida support for research cooperation, especially bilateral initiatives, for Universities, and also for a number of other sectors.

Hypothesis	Results Observed	Comments
Innovation in poor countries will most often mean "local innovations", first applied locally and followed by wider use.	Almost all innovations observed were local. Some were national-level improvements, but most were sub-regional, cluster or firm specific innovations.	Observations from many of the successful CI initiatives. These are most relevant and growth promoting.
Innovations required interactions, effective communications, networks and partnerships between key actors.	This was seen most positively in the case of the four CI.	Where the knowledge using sectors were not intimately involved from the beginning outcomes did NOT include direct use in the short term. The longer term "indirect" impacts can often be important and need different methods for observation.
In many low-income countries, the links between key actors in the innovation system are weak, and need to be systematically attended to and organized in order to stimulate cooperation.	Many interviews with all stakeholders confirmed this as a fact. The “idea that there exists relevant research and solid research capabilities within universities, but the private sector have little knowledge of the type of services that universities can provide, was very common when explaining the weak linkages between universities, industries and other actors.”	One central finding for both innovation theory and many studies in both industrialized and developing countries is the difficulties with increasing weak links, Analysis points to the lack of incentives to improve the pertinence of universities’ research. In almost all cases in the portfolio, the participants commented on their additional learning and economic impacts were observed when increased links were emphasized.
Sida said that universities are a potentially powerful vehicle for development, particularly with	The longer term "indirect" impacts are not a part of this study, and are likely to be much larger than those studied here. Hence, new	It is important to distinguish between the different functions of the university and the direct and

Conclusions

Universities are a potentially powerful vehicle for development, particularly with respect to knowledge, science and technology.	The longer term "indirect" impacts have not been studied, and are likely to be much larger than those studied here. Hence, new studies exploring these effects should be undertaken. The economic value of the direct use of a small subset of knowledge in the universities to support small and micro entrepreneurs through the Triple Helix model was a striking result of this study. The difficulties of making additional and greater direct use of modern science and technology to develop products and processes in poor countries was also illustrated in all countries, and this requires additional review and possible new strategies.	It is important to distinguish between the different functions of the university and the direct and indirect, more diffuse impacts. If that is not done, core functions of training and human capacity building can be neglected for more fashionable ideas. The difficulties of making greater direct use of more modern science and technology to develop products and processes in poor countries should NOT suggest that this is hopeless but that new designs with additional resources for the local context are required.

Innovations

- Almost ALL productivity-enhancing activities were "local innovations".
- They emerged first in local application and followed by wider use in the region or country.
- This is not as prestigious as innovations that are generated for the first time in the world.
- But the local innovations and use in new countries and for new applications, are crucial for positive poverty and growth impacts, especially in poor countries.
- Often innovations that are first in the world are less relevant for growth and poverty reductions. But, sometimes there are also a number of innovations with high relevance to poor countries that are close to world frontiers. Mobile communications are one example of rapidly diffusing technology with widespread positive impacts in poor countries. New seeds (e.g. the NERICA rice in Africa) and low cost generic drugs for HIV/AIDS are examples of outcomes of local research efforts that, complemented by international links, are both first in the world and have high impacts.
- The findings show that this hypothesis on use of research knowledge needs to be divided into two sub-statements. First, it is correct that there is a gap between the basic knowledge that is available in the education system versus what is available to many entrepreneurs and poor producers. The results support the view that universities are able to offer more than education.

Final Conclusions

- The hypothesis, was confirmed across the portfolio, that innovations require interactions between researchers, industry and political bodies, effective communications, networks and partnerships across organizations and channels. This is almost a tautology in the innovation systems literature.

- These links are often weak and need to be systematically organized in order to stimulate cooperation; weak links are practically a symptomatic feature of poverty. The most important corollary of these two facts is the need to add support for increased links and interactions across system actors and to strengthen weak system elements in many interventions. .

- On the positive side, the core hypothesis that increased links and interactions could be crucial for development is illustrated in all the project interventions. In the countries with the CIs, the increased links and interactions ranged across a wide group of socio-economic actors - universities, firms, governments and other supporting institutions. Except in Mozambique, where the initiative was largely stalled due to challenges of implementation, they all indicate highly positive (though non-uniform) results on the actors along various development dimensions.
- The potential role of the HE system in promoting one type of innovations – through direct and immediate application of generic knowledge is confirmed in these studies.
- The conclusions provide confirmation for similar engagement by Universities as one component of their many functions. Further studies are required to learn about the many other indirect impacts of HE institutions' through indirect impacts created through human capacity development.