

REFEREED PAPER

## **DEVELOPING A STRONG RESEARCH-EXTENSION-GROWER LINKAGE TO ENSURE ADOPTION OF NEW SUGARCANE TECHNOLOGY IN SOUTH AFRICA**

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### **Abstract**

Agricultural research and extension are conducted under a single umbrella at SASRI. The management of the research-extension-grower linkages can limit or enhance extension service effectiveness. Weak links between research and extension can limit the effectiveness of the extension service, leading to constraints in technology transfer. The linkage problems most commonly associated with these constraints are those affecting co-operation between research and extension and the feedback from growers through extension to research, and *vice versa*. Modern extension methods now acknowledge the grower's own expertise as a major resource in the development of solutions to local issues. It is therefore essential to develop a strong research-extension-grower partnership to ensure the adoption of new technology at a local level. SASRI has encouraged the strengthening of the linkage between research and extension by developing a strategy which enables the participation of both the researcher and extension specialist in a number of key internal activities. These key activities include bi-annual staff meetings, participation of extension specialists in research project teams, provision of input by extension specialists in the determination of the composition of the overall research project portfolio, discussion groups, seminars and conferences, and extension requests for advice. The linkage between growers and the extension service has been strengthened by the introduction of local industry Research, Development and Extension committees, which define the objectives, needs and problems of the particular area and establish priorities to be included in the extension specialists' annual programme of work. The objective of this paper is to provide an insight into the methods used by SASRI research and extension to create a successful strong research-extension-grower partnership.

*Keywords:* sugarcane, extension, research and development, adoption, technology

### **Introduction**

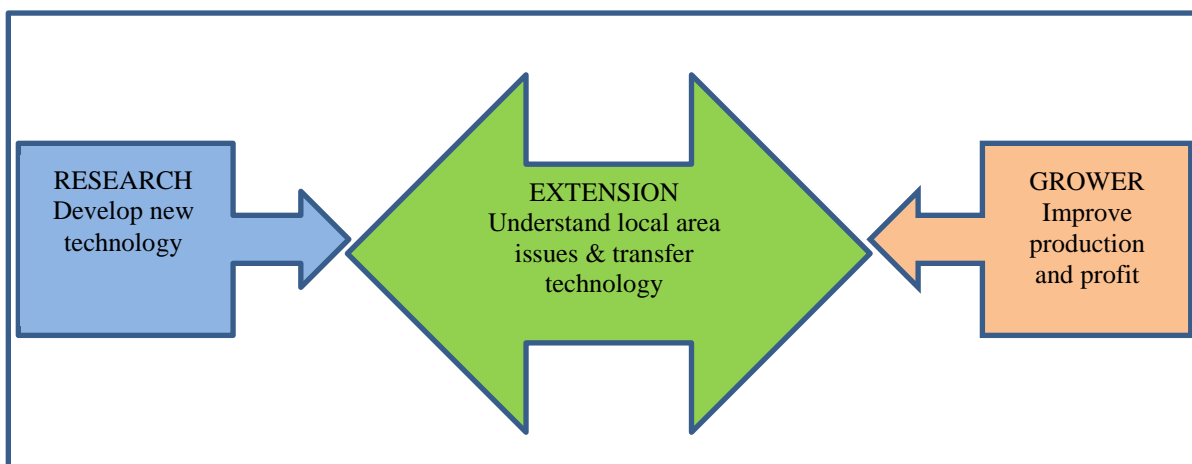
The birth of modern agricultural extension probably began in the 1840s. During this period, agricultural science was evolving rapidly in Europe, especially in Germany at Giessen and England at Rothamsted. The technology developed by these institutions was passed on to the farmer through agricultural societies who put on shows and produced numerous publications aimed at farmers. However, it took a crisis in the form of the potato blight outbreak of 1845 to introduce the extension link. The then British Viceroy in Ireland urged the Royal Agricultural Improvement Society of Ireland to appoint itinerant lecturers to travel around and show farmers how to improve their cultivation (Jones and Garforth, 1997). The linkage

between research, extension and the grower was thus established and the evolution of extension began.

The past development of agricultural sciences has enabled rapid agricultural expansion globally, with the new technology being largely created outside the farming sector by public sector research organisations. The research-extension-grower linkage was based on the philosophy that research results had to be transferred to the grower through extension, often at the cost of local grower knowledge, the traditional top down approach. Farming systems research and the rediscovery of farmers' knowledge (Chambers *et al.*, 1989) has shown that new technology is developed from a collection of inputs and practices that often come from different sources.

### Research-extension-grower linkages

Agricultural extension is the provision of a two-way flow of information and new technology between research and grower (Figure 1); therefore extension needs to form partnerships with both the researcher and the grower to ensure technology generation and transfer. However, the way that research is structured and organised, coupled with the planning and management of the research-extension link can limit or enhance extension's effectiveness. Typical factors that negatively affect the linkage could be a lack of financial resources, shortage of skilled scientists, inadequate facilities and equipment, inadequate operating budgets and lack of grower feedback. Unfortunately, these negative factors can affect the generation of new technology, resulting in fewer research outputs for extension to transfer, which is particularly troublesome for a client-based/client-controlled extension service. An understanding, by extension, of research problems is an important step in planning extension activities and co-ordinating them with research (Peterson, 1997).



**Figure 1. The research-extension-grower linkage. The diagramme illustrates the function and the two-way flow found in a typical research-extension-grower linkage mechanism.**

There are two problem areas affecting the research-extension linkage; firstly, the feedback from growers to extension and research, and secondly, the co-ordination and co-operation between research and extension. When assessing the research-extension linkage, consideration must also be given to other organisations such as fertiliser and herbicide companies, who also play a role in developing technology and offering advice to growers.

Combine this with the existence of a number of stakeholders such as government, miller and development companies, in an area providing an extension service, there is a real danger of conflicting messages being passed to growers.

By understanding the research-extension-grower linkages and considering the outside forces influencing the extension service, one is better able to plan methods, approaches, resources and linkages that will be more responsive to grower needs. It is therefore important for the leadership of any research and extension institute to endeavour to strengthen these linkages. Critical to this is the appreciation of the important role that growers play in disseminating technology and in helping set priorities and improving the research/extension programme's relevance. These linkages exist primarily to enable the efficient transfer of technology from research to grower.

Technology is the key word and can be defined as a complex blend of materials, processes and knowledge. Because of this complexity, different institutional arrangements are needed to transfer different types of technology to the different types of technology users. This is especially evident in the South African situation where there is an added complexity of different cultural practices and grower capabilities – large scale commercial growers vs small scale subsistence growers. Growers in different agro-ecological zones need access to a wide variety of locally validated technologies if they are to increase productivity (Swanson, 1997). So, in essence, the research-extension-grower linkage forms an agricultural technology system (ATS), which needs to integrate the individual research efforts and relate them to increasing the productivity of different grower groups.

### **Agricultural technology system**

In an effective ATS, numerous groups depend on one another to get improved technology to growers. These groups have to work in concert and the failure of one link in the chain diminishes the overall performance of an ATS (Merrill-Sands, 1992). In the process of transferring new technology to growers, linkage mechanisms are used to channel information between the groups and to co-ordinate required tasks. There are two types of linkage mechanisms making up a typical ATS, these being organisational and managerial.

#### *Organisational*

This refers to the structural modification of the research/extension institute and other organisations involved in the ATS. Such modifications would be the merger of research and extension under one umbrella and the creation of permanent committees. These permanent committees should have representation from research, extension, growers and other relevant bodies. The committees have the responsibility of co-ordinating and facilitating the flow of technology and feedback through the ATS. In creating a committee, there must be agreement among all participating groups that (1) such a committee should meet on a regular basis, (2) its members are senior enough to implement decisions and recommendations, (3) the committee's mandate is limited to programme co-ordination, and (4) the committee's work is visible and supported by senior management (Merrill-Sands, 1992).

#### *Managerial*

This is where research and extension collaborate on joint planning and review activities such as joint priority setting and in planning joint programme activities (on-farm trials and demonstrations), plus joint decision making on technical recommendations. Research and extension collaborate on joint grower training activities. The implementation of joint

programme activities requires researchers and extension agents to share responsibility for different tasks and to regularly consult with each other on an informal basis. Through these joint programme activities, research and extension personnel develop a positive professional relationship that is essential in facilitating the flow of technology and feedback within an ATS (Swanson, 1997).

### **SASRI agricultural technology system**

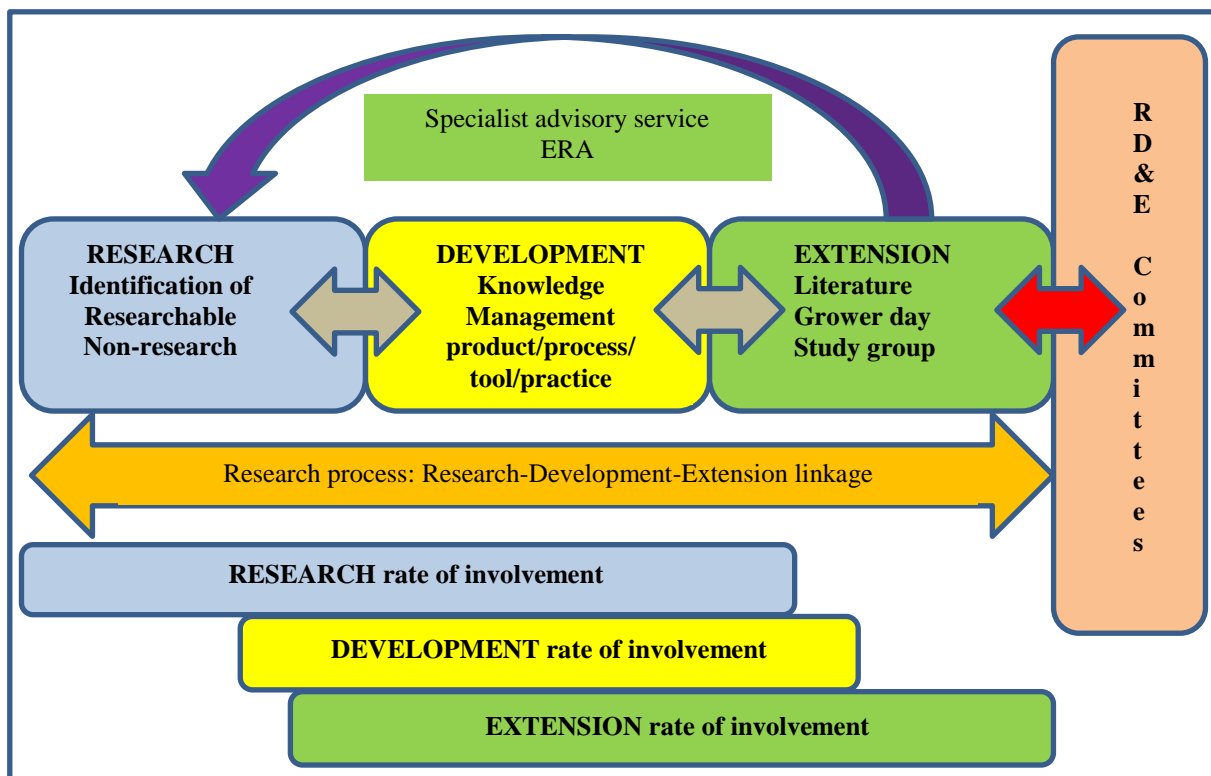
Extension was introduced into the then South African Sugar Association Experiment Station (SASEX) in 1964. The need for this structural modification came about due to the realisation that, because agricultural science was inexact, there was a high probability that the grower was receiving inconsistent advice. Previously, research and extension did not fall under the same umbrella. Extension was provided through the government's (then) Department of Agricultural Technical Services (DATS). Experience has shown that when the grower realised that the advice received from the extension agent differed to that of the researcher, the credibility of both the extension agent and the researcher was questioned. Once this credibility was lost the ability to transfer new technology was severely hindered.

To ensure credibility was maintained, SASEX placed research and extension under one umbrella and followed the principle of 'it is always the extension agent who presents the advice' to the grower. This did not mean however, that the researcher could never visit the grower, in fact this was encouraged, but the extension agent should be the one to convey the message to the grower. The development of an ATS had begun. The research-extension-grower linkages were further strengthened with the introduction of research, development and extension (RD&E) committees into each of the extension areas as another structural modification in the mid to late 1990s.

The RD&E committees have since evolved into an important part of the new ATS currently being developed at South African Sugarcane Research Institute (SASRI, formerly SASEX). Figure 2, provides a conceptual diagram of the current complete SASRI agricultural technology system. SASRI has continued to evolve the ATS by improving the linkage between research and extension with the development of joint programme activities. Currently the joint programme activities, which are based on the original SASEX model, consist of the following:

- Staff meetings: SASRI extension specialists and researchers attend general staff meetings together to ensure a sense of belonging together as a team. The importance of having research and extension in an integrated body. The extension specialists have the opportunity to meet researchers individually.
- Specialist advisory service: The SASRI extension specialist is free at any time to request the services of research staff to assess and help solve particular problems in the field. The foundation will be laid for the best possible liaison and provision of sound consistent advice to the grower.
- Co-ordinated projects: The SASRI extension specialist becomes an essential member of the investigatory team. A further degree of liaison is achieved and the association between the extension specialist and researcher is maintained, which ensures a common conclusion is reached for the benefit of the grower.
- Research programmes: It is necessary for the SASRI extension specialist to be familiar with and involved in the development of research programmes. The extension specialist is an ideal consultant, being the most conscious of the growers' problems.

- Discussion groups/recommending committees: For SASRI to be satisfied that the practical implications of accumulated research data are correctly translated into formal recommendations, the extension specialist should be a regular member of these groups/committees. This ensures that the grower receives a uniform message.
- Grower days, study groups, modular courses: The SASRI extension specialist may wish to receive direct support from researchers by holding these events, which provide another means of liaison, and demonstrates the confidence that the extension specialist has in the researcher.
- Papers: The scope exists for joint authorship of scientific papers.



**Figure 2. The SASRI agricultural technology system. The diagram depicts the research-extension-grower linkages in the system and the rate of involvement of each in the research process.**

### The new research, development and extension committees

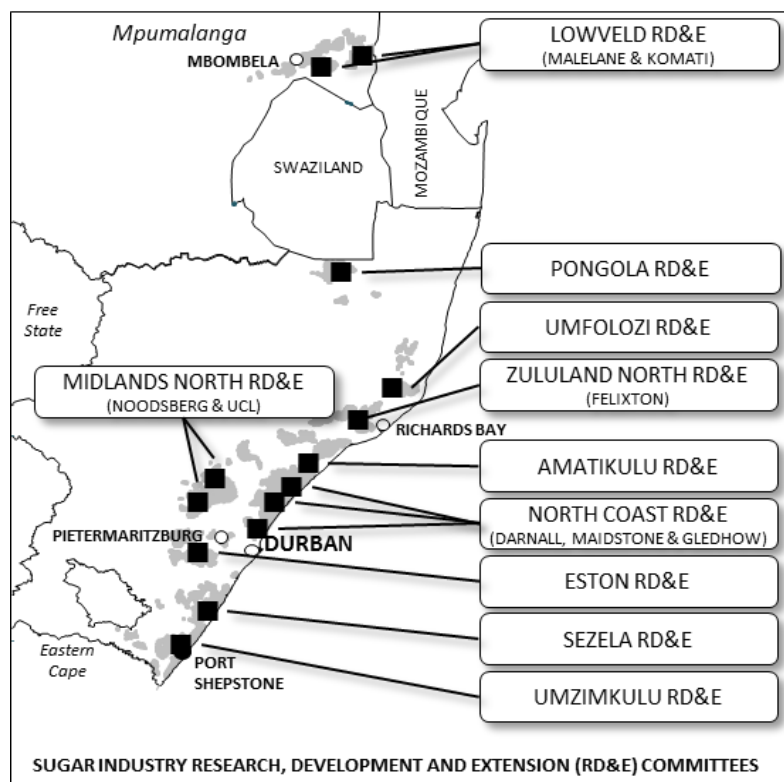
As the SASRI R&D programme is responsive to the needs of the South African sugar industry, wide consultation and participation by stakeholders in the formulation of the annual R&D programme are core activities (Watt *et al.*, 2013). To achieve this SASRI, in conjunction with the various local grower organisations have implemented ten RD&E committees in the industry, each affiliated to a specific extension area (Figure 3). The primary function of these committees is to act as the conduit through which the following activities take place.

- Communications regarding SASRI extension services are made.
- Local research issues are gathered, collated and prioritised.

- Interaction between grower representatives, extension specialists and SASRI research is facilitated.
- Report backs are made to the industry through the local RD&E committees on research, development and extension issues.

#### *RD&E primary objectives*

- To ensure that research is directed towards meeting the operational, tactical and strategic needs of the industry in the short, medium and long-term.
- To optimise mechanisms to facilitate open and active communication between Mount Edgecombe-based researchers, extension specialists working in the field and the local RD&E committees.
- To encourage the adoption of SASRI-developed better management practices (BMPs) by all growers.



**Figure 3. Distribution of RD&E committees throughout the sugar industry in South Africa.**

The strengthening of the research-extension-grower linkage is ensured by the holding, each year, of the RD&E workshop. It is at this workshop that the committees submit to the SASRI researchers, through extension, lists of the most pressing issues in each of the ten regions. These issues are discussed, clarified and prioritised before being tabled in a document to be reviewed by the SASRI research committee.

To ensure that the linkage between grower and extension is maintained at a high level, at the local level the RD&E committee would be expected to carry out the following functions.

To assist the extension specialist in:

- Defining the objectives, needs and problems of the particular area.
- Establish priorities and formulate the extension specialist's programme of work (POW).

To meet regularly with the extension specialist, at least three times a year:

- At the annual RD&E workshop held in March of each year.
- During July of each year to discuss the proposed extension POW and the documented report back on outcomes from the RD&E workshop.
- During November of each year to review the extension POW and prepare for RD&E workshop to be held in March.

To ensure the local grower membership understands:

- The SASRI research cycle, the role of RD&E committees and the role extension plays in the cycle;
- The process of technology and information transfer and the responsibilities of each of the partners in the process.

### **Extension specialist POW**

The format of the SASRI extension specialist's POW has been developed to ensure that the research-extension-grower linkage is considered and enhanced. To achieve this each of the key performance areas (KPA) are structured to include some aspect of the linkage mechanism (Table 1).

In order to ensure local area issues are tackled timeously, the POW includes a section, specifically designed for this, called 'issue extension' (Table 2). Issue extension focuses on local area issues raised by the growers in a specific extension area, which need immediate or special attention. The issues are brought to the local RD&E committee, where they are discussed and prioritised. Some of these issues may be brought to the RD&E workshop, should the extension specialist believe SASRI research involvement is required.

Other important aspects of the POW include sections dealing with the extension specialist's involvement in SASRI projects and local trials in the area, other local committees and working groups and the long term plan (five years) for the area. The extension specialist's POW is used as a measure in the annual performance review.

**Table 1. Generic example of a typical Extension Specialist programme of work.**

KPA	Activity
Extension	<ul style="list-style-type: none"> <li>• Plan and implement extension strategy in consultation and co-operation with the RD&amp;E committee.</li> <li>• Identify individual grower problems, and provide the appropriate extension and advisory packages to enable long-term solutions.</li> <li>• Ensure prompt response to growers' requests to assess problems and follow up with appropriate recommendations.</li> <li>• Ensure optimum use of newsletters, the Link and Ingede, grower days, study groups and demonstrations to transfer SASRI technology.</li> </ul>
Advisory	<ul style="list-style-type: none"> <li>• Provide specific advisory packages according to grower needs that include economic benefits where appropriate.</li> <li>• Analyse mill data to provide growers with information on their productivity and cane quality.</li> <li>• Organise and co-ordinate ERAs and appropriate follow-up assistance in the implementation of specialist advice.</li> <li>• Promote of the use of SASRI technical services (e.g. the Fertiliser Advisory Service) and provide assistance to growers to interpret and make management decisions based on these inputs.</li> </ul>
Feedback	<ul style="list-style-type: none"> <li>• Prepare monthly, annual and <i>ad hoc</i> written reports for SASRI, and make presentations at staff meetings.</li> <li>• Source and collate regular up-dates on progress in research programmes and participate in the preparation of new or amended current recommendations.</li> <li>• Participate in determining research priorities and grower needs in consultation with the RD&amp;E committees leading to the formulation of the SASRI Programme of Work.</li> <li>• Organise a regular visit by the SASRI Director and specialists to each area.</li> <li>• Organise groups of growers to visit SASRI.</li> <li>• Identify themes for the roadshow, SASRI Grower Day, and local grower field days. Participate in the annual roadshow.</li> <li>• Attend the annual SASTA Congress and endeavour to present papers.</li> </ul>
Committee support	<ul style="list-style-type: none"> <li>• Participate in local committees, provide technical advice and follow-up action as appropriate.</li> <li>• Participate in the following committees: RD&amp;E, Local Pest &amp; Disease Variety Control, Local Environment, Mill Cane Committees, Local Grower Councils.</li> <li>• Attend the SASA P&amp;D Steering committee AGM.</li> </ul>
Education and training	<ul style="list-style-type: none"> <li>• Lecture and participate in the SASRI Certificate Courses.</li> <li>• Attend skills/self-improvement courses.</li> </ul>

KPA = key performance areas



**Table 2. Generic example of a typical Extension Specialist issue extension in the programme of work. Issue extension focuses on local area issues raised by the growers in a specific extension area.**

Issue	Objective	Outcome
Environmental management	<ul style="list-style-type: none"> <li>• Implement SUSFARMS model.</li> <li>• Become familiar with the new SUSFARMS manual and assist growers with Progress Tracker and corrective actions.</li> <li>• Identify the need for Land Use Plans (LUPs).</li> </ul>	<ul style="list-style-type: none"> <li>• SUSFARMS is in operation on all farms. Progress Tracker results are sent to ES on an annual basis to monitor progress of individual growers and ecozones. Training/skills needs are identified.</li> <li>• Draw and implement new LUPs.</li> </ul>
Small scale growers (SSGs)	<ul style="list-style-type: none"> <li>• Help with identified development projects.</li> <li>• Work with SSG extension specialist.</li> </ul>	<ul style="list-style-type: none"> <li>• Group farming schemes are in operation.</li> <li>• Upliftment of small growers.</li> </ul>
Eldana control	<ul style="list-style-type: none"> <li>• Implement integrated Pest Management (IPM) on all farms in co-operation with P&amp;D Officer.</li> <li>• Monitor progress of IPM on Eldana farms.</li> <li>• Promote habitat management and push-pull system.</li> </ul>	<ul style="list-style-type: none"> <li>• IPM in operation on all farms.</li> <li>• Eldana numbers reduced to manageable levels.</li> </ul>

### Discussion

Understanding that research needs and technology development are dependent on the needs set by the various individuals, groups and organisations within the sugar industry, has become key to any extension service. As these needs reflect the interests of their stakeholders, they differ according to specific situations and development philosophies. The features of an extension programme, such as its organisational structure, choice of clientele, operational design and methods will therefore be directly influenced by these needs. At the same time no one group should dominate another. The seriousness of an issue for an individual group must be taken into consideration and not shelved because it does not reflect the needs of the majority. In order to ensure that growers needs are better understood going into the future, social learning has now become an important component in the extension programme and it is in this area where skills need to be honed. SASRI has recently initiated several projects, which look into social learning and systems dynamics to help with developing the skills.

Going into the future, the SASRI ATS will need to continue evolving and be flexible enough to initiate changes to the operational design and methods of its extension programme. Possible areas of improvement are the development and strengthening of the linkages with the other industry stakeholders such as the South African Cane Growers' Association (SACGA), milling companies and the Department of Agriculture. Outcomes from the projects involving social learning and system dynamics will provide guidance on evaluating the rate of adoption of new technology and why in some instances technology adoption is

slow. Although the SASRI ATS has enabled the evolution of a successful extension service to the sugar industry in South Africa, there will always be room for improvement and the monitoring and evaluation of the extension programme will remain an ongoing process.

### Conclusion

SASRI has developed an agricultural technology system (ATS) which strongly supports the belief, that the SASRI extension specialist is the means by which a uniform message is presented to the grower. This vital development has been achieved by the integration of two disciplines, research and extension, within a single organisation. The SASRI Extension Service is an integral part of the research process and is the crucial link between research and grower. Couple this with the acknowledgement of the importance of local grower expertise as a major resource in the development of solutions to local issues, and therefore critical to the adoption of new technology, SASRI has ensured the continued development of strong research-extension-grower linkages to the advantage of all stakeholders in the industry. Extension which is not in touch with and does not significantly contribute to improving the life situation of its clientele has lost its legitimisation (Nagel, 1997). This is possibly one of the key reasons why new technology is not adopted and why the SASRI ATS has focused on strengthening the grower-extension-research linkages.

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