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EVALUATING AGRICULTURAL RESEARCH AND PRODUCTIVITY IN AN ERA OF RESOURCE SCARCITY

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PRIORITY SETTING IN A STATE AGRICULTURAL EXPERIMENT STATION: SHIFTING PARADIGMS

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"There are many interesting research problems.
Some of them are important."

Richard Bradfield
(Taken from introduction by Vernon W. Ruttan, in
Agricultural Research Policy.)

Introduction

When I was an undergraduate at Purdue University in the mid-1950s, I first met the director of an Agricultural Experiment Station (AES). I held several jobs to support myself and family. One of them was helping with research on forages and dairy cattle nutrition, both in the laboratory and in the field. On this particular summer day I was at the Purdue dairy center working in the field with dairy cows on an intensive experiment comparing forage management systems of continuous grazing, daily strip grazing and green chopping of forage. The project was co-led by Professor G. O. Mott of agronomy and Professor D. L. Hill of the dairy husbandry department. On this hot summer afternoon they had brought AES Director Norman J. Volk and a dairyman from Indiana to see the project in action. They even asked me, the lowly student worker, to tell what I was doing on the project. I learned some time later that they had a request in to Director Volk for additional funds for the project. Apparently Director Volk was favorably impressed by their proposal because he approved the request for funding. The project went on and I continued to have a job. This simple story suggests at least four things: (1) the AES Director was important; (2) he had control of funds; (3) he had the authority to act on his judgments; and (4) he was interested in the input of a farmer-user.

Let me point to another example of the former paradigm for priority setting, this one from proceedings of the 100th anniversary of the Wisconsin Agricultural Experiment Station: "The attitude here at Wisconsin was best expressed in the words of Professor E. B. Hart - that the station worker in cooperation with the station director take a practical farm problem of importance in a local region or state and then dig as deep as he can in science to find the answer to the problem." (emphasis mine) Let me hasten to add that I happen to believe that there is much merit in this philosophy. I hope that when translated into contemporary terms, it still can be the foundation of the AES process. However, much has changed from those simpler times.

Another example of priority setting is the PIPD, or Problem Identification, Program/Project Development system used effectively at some SAES. In this system the AES administrators and scientists seek input from clientele as well as extension workers and station scientists to get input for identifying high priority problems. Then, by sitting down together, they develop projects to address those problems. There is a risk associated with such a close linkage and implied immediacy of response. Caution should be used in entering into such a planning and program identification process unless you have control of the resources and are prepared to respond positively!

I am suggesting that in the new paradigm (which I'll discuss in some detail later) we go outside to learn real world problems and link that with a joint effort to seek help in attracting funds to address the problems.

This experiment station system, based largely on federal (Hatch and McIntire-Stennis) formula funds plus state funds, and near autonomy of the director, was very productive. However, the paradigm has shifted for some SAES, is shifting for

many others, and likely will shift for all by the year 2000. In my view these shifts are not inherently either good or bad. They simply are reality and our challenge is to deal effectively with them to identify the high priority problems and assist in obtaining funds to address them.

With that hint of how I intend to approach my assignment, let me make just three introductory points:
1) I don't pretend to have the formula for setting priorities in State Agricultural Experiment Stations (SAES). Even the ideas I will be sharing with you certainly are not mine alone, but a composite of where I'm at in my synthesis and thinking process.
2) I will talk about some key components of a priority setting process which seem to me to be important wherever we may be.
3) Priority setting, in terms of both parameters and process, has changed and likely will be dramatically different tomorrow than it is today. I suggest that our challenge is to be prepared "to do the best of things in the worst of times."

Changes and Impacts

Of course many things have changed over the years. Here are just a few that come to mind:
- In the 1950s to 70s, AES funding was largely federal formula funds and state funds.
- Today more sources are involved and many of them priority setting implications.
- Funds directly to a Station are more limited and restricted.
- Directors have less "power" in the sense that funds controlled represents power.
- The priority setting process is more complex and there are many more stakeholders.
- SAES are not nearly as centrally managed (and funded) as are the USDA Agricultural Research Service (ARS) laboratories and international centers.
- Science has greatly advanced and has become much more sophisticated and expensive to conduct.
- An expanded, more diverse groups of stakeholders are asking questions, such as:
  - -is too much emphasis is being placed on research at the expense of teaching.
  - -what about public vs. private roles.
  - -is too much emphasis is being placed on "farming" at the expense of neglecting other increasingly visible areas related to our mission (and where our graduates go for employment!). Here I'm thinking of things like: diet and health; food safety; environment and water quality; waste management etc.

    Need to be cognizant of such concerns and to recognize that these priority issues must be evaluated as well.

    [There is something of a paradox here. Farming or production agriculture makes up less than 3% of the food and agricultural sector, but still has more "clout" than that in terms of getting things done.]

These changes have several impacts relevant to priority setting and implementation in SAESs today.

- Less ability to fully fund research projects out of resources controlled by the AES.
- More emphasis on using the limited flexible resources to "jump start" programs of new faculty members, provide start-up packages, and as matching requirements to get additional funds.
- Greater reliance on outside funds, which dampens any singular effort or plan to set priorities.

Priority Setting

Needs and opportunities always exist. Research is conducted on some topics and not on others. Priorities are always there; the question is who selects them. Without a well thought out timely plan, pressures are in charge and the present gets undue attention, not the future; fighting brush fires become the priority of the day; defense is the game, not offense; infighting rules, not meeting outside needs, threats and opportunities.

Levels of Priority Decision Making: At this point I'll simply introduce this topic, so we all can think about as we examine the process in more detail in the remainder of this paper.

- National level

The process of priority setting and establishing categories for funding tends to be more long-term considering impact and appropriation of funds. The SAES community expends considerable time and effort by in "tending" the system.

There have been some big payoffs for the efforts. For example, the start of the competitive grants program in 1977 and the influx of additional funds for biotechnology in 1985. This program was grown further with the initiation of the National Research Initiative (NRI) in 1991. The Water Quality Special grant is another example of the success of initiatives by the Land Grant Agriculture community. While there has been debate about whether emphasis should be placed on "formula funds" or "competitive grants", it is interesting to note that in recent years the only times there have been increases in formula funding was in those years where a major competitive grant program was started or "grown". Although arguments showing the importance of, and impressive returns from formula funds, Congress has favored research funding options where they have more control over the agenda.

- State and Local

Some states realized significant growth in state funding for AES during late 70s and early 80s

Unfortunately not all of it has "stuck" as states got into fiscal trouble.

However, it a very critical point today, whether to maintain what we have or in some cases to actually capture some growth.

- A simple outline of various kinds of funds used in AES programs is shown in Table 1: "Funding Sources and Uses"

Principal strategies

Next I would like to discuss some of the critical points for "priority setting" in these times of shifting paradigms.

Mission.

The first and foremost strategic decision which each SAES must make is determination of its purpose or mission. Failure to determine that and determine it well leaves the SAES with no focal point or central thrust for lining up the organization's energies and resources to accomplish the most desirable ends. We need to realize that an organization cannot really determine its mission or purpose in isolation; the client or "customer" makes this determination! Therefore, to be effective in developing our mission statements and subsequent strategies and tactics we must proceed from the outside (the client and the world in which we must operate) to the inside (management's response to the client's needs and wants). (McConkey, 1981)

To determine the mission of any organization it is necessary to carefully answer three major questions:

1. What is our present purpose?
2. How will the future impact on our present purpose if we make no changes?
3. What should our purpose become?
   (Of these, number two is more important than number one and number three is the critical one.)

Infrastructure at the strategic level.

Where and how to allocate scarce, flexible resources, or base funding in the AES, is key. By this I mean faculty, facilities, and core operating budgets. Since most universities and SAES are in a re-allocation rather than in a growth mode, it is important to make such decisions at "targets of opportunity" when transitions can be least disruptive to the "losers."

Strategic Allocation of Faculty Positions:

- Faculty members (or AES scientists, if you prefer - I'll come back to this distinction later) comprise the "engine" which powers the entire system. Thus wise allocation of scarce faculty positions is critical.

Deciding which areas of expertise to capture in a faculty position is key area for strategic placement of resources. The impact is long-term because a faculty member (and the area of expertise carried with that person) may be with us for 25 years or more.

In our Purdue Agriculture system, all open positions created by retirements or persons leaving the university for any reason, revert to the Dean's office. To prepare for the strategic allocation of scarce faculty positions, departments have developed long-term (10-year) staffing plans and they are asked to update them periodically. Once (or in good times, perhaps twice) per year department heads are invited to submit their high priority requests for positions, along with justification. The Dean and Directors make decisions about which positions will be allocated. Occasionally, a very high priority position will be acted upon immediately upon learning of the (impending) vacancy, but that is rare. Any downsizing (rightsizing)

that is to occur is accomplished by decreasing the number of positions in the pool, not by making such decisions on a position by position basis as the vacancy occurs. Thus, departments technically do not have "open positions" until a position is (re-) allocated to them. Also, they have not lost any specific positions; it may not have been requested, it may be a possibility for later consideration etc., but positions are not collapsed at the Department level by this system of allocating scarce faculty positions.

Now let us get on with factors involved in the process of deciding which positions are to be allocated. Areas of expertise needed for the teaching function may be the more important driver, or the aspect receiving first consideration today. Guidelines I use in evaluating the priority of the position for my input in terms of the priority of research component of a position (especially if more that 25% time assignment to research) include the following:

- Importance and likely impact of area.
- Needs of clientele and users.
- Opportunities in science and technology anticipated for the specific field.
- Availability of infrastructure - equipment, facilities, appropriate space (and start-up funds).
- Opportunity for outside support to develop and sustain a productive research program.

A more detailed version of this list in the format of an evaluation guide is shown in Table 2.

Selecting the individual faculty member.

- Some traits may be universally required, but many have to be specific to the position.
- Overall, priority is given to:
  - Excellence in their field.
  - Evidence of strong productivity
  - Communication abilities (and ability to relate their work to a variety of audiences).
  - Entrepreneur with a team spirit.
    - A self starter who can develop nationally recognized programs.
    - Yet, one who will work effectively as a team member for at least part of their research.
  - Ability to handle multiple responsibilities.
    - Education and research
    - More than one area at a time. (For example, to conduct basic and applied projects at the same time; individual project and a team project.)

A candidate for a faculty position in the plant sciences area that we were interviewing recently described the situation rather nicely. I had asked her a question about how she would select particular specific problems to work on. She responded, "There is a tendency for scientists, especially recent graduates or post-docs, to think, well I have these abilities, techniques, capabilities, let's see what problem I can find to use them on." She added that she believes it would be much better to go out and listen to what the problems (of farmers) are, and then design investigations to solve those problems.

She had the insight to add, "I'd better go out and tell people what I'm doing If people don't know what you're doing, they may think you're dispensable." I would simply add, that statement applies as well to research programs as it does to individual faculty members! More vigorous approaches to informing clientele and the general public about what we're accomplishing to help them are necessary. We need to capture and communicate the excitement and relevance of discovery.

Faculty members or Station Scientists?

There are significant differences in philosophies and operational models among the Land-grant colleges of Agriculture and each institution must address this issue in their own context. However, it is becoming much more common for an individual to carry responsibilities in two of the functional areas of teaching, research and extension. Or to put it another way, it is common for an individual to have responsibilities for both education and discovery.

Faculty members participating in the AES at Purdue (and I believe in most settings) must be "complete" faculty members in context of the definition appropriate for each of our respective universities. Most AES Scientists (i.e. faculty members with AES appointments) also have a responsibility to participate in education (classroom teaching and/or extension education). It is generally accepted that teaching is the fundamental function for a college or university. Over time, some so-called "research universities" developed a pattern where some faculty did not teach, spending all their time on research and related scholarly activities. On the other hand, most predominately teaching colleges and universities have expected their faculty members not only to teach, but also to be involved in some research or scholarly activity.

In the new paradigm, I believe that every faculty member - even those at research universities or with an AES appointment - will be expected to participate more fully in the education mission. It seems to me that this is an appropriate expectation. But, considering the purposes of this paper, I do not wish to digress into a discussion of the synergism between research and teaching.

Rather, I would like to focus on the unique research responsibilities of a faculty member with an AES appointment. Such a faculty member is expected to do more than simply "conduct research" and to obtain some funds to conduct research or engage in a scholarly activity of his/her choosing. The AES faculty member already has part of his/her salary paid and time assigned to conduct research. It is part of the contract for such an appointment. In addition, that research is to be directed to jointly determined thrusts. This is done not to stifle creativity, but to provide focus. Creativity should be encouraged and rewarded. Changes in the defined thrust can be made by means of revisions in the AES projects. I would

suggest that the AES faculty members have fundamental responsibility for the kinds of research related activities listed here. Note, a specific faculty member may be involved in 1 and/or 2, and/or 3, but all will be expected to be involved in 4 and 5.

1) Mission oriented basic research
2) Applied research and site specific systems development.
3) Consumer-report type research activities.
4) Educating and training graduate students
5) Communicating to a variety of "publics" (and not just to colleagues).

Operating Resources.

The level of operating resources and funds to put around faculty members is another important component of infrastructure. Strategic decisions in this area also are critical. The funding process used at Purdue places most of the core or base funding in the departments. The department head has responsibility to allocate and manage those resources in the context of that departments research program as defined by their AES projects.

The cost of conducting research varies among the disciplines encompassed by agriculture. This needs to be taken into account when an AES Director evaluates the equity of funding provided to various departments. I have developed some estimates of costs by discipline/department, starting with expenditures data for several SAES and making some adjustments based on known anomalies. More precise estimates of the cost by discipline would be very helpful. Part of the charge I was given when invited to prepare this paper, was to identify areas where the NC-208 Regional Research committee could contribute to the priority setting process. Here is one example. We need better estimates of the cost of doing research in various disciplines and in department composites.

Another strategic decision which must be made is the allocation of scarce resources to faculty positions versus operating funds. Institutions vary in the flexibility that exists at the College or Station level. In situations where the College has significant flexibility in moving funds between positions and operating funds, a critical strategic question is, "At what point should some faculty positions be eliminated and the funds re-allocated to support programs and projects?" It was noted that faculty is the engine which drives the research machine, not only in terms of creativity and productivity, but also in getting grants! But at what point on the curve of shrinking resources available to put around faculty members to make them productive (and somewhat direct the research program) should the decision be made to decrease the size of the engine in order to fuel it for more effective operation? Not at all an easy decision, but one that is crucial!

Multi-State Programming.

Another strategy which needs to be considered is to build and expand on Regional research, developing innovative ways to enhance multi-state programming. Typically in regional research a topic or problem is identified and then the Stations divide up the effort for solving the problem. Regional research

often involves most all of the states in the region and increasingly may involve Stations from other regions as well.

Alternative models for multi-state planning should be pursued. In terms of alternatives to regional research, there are (at least) two other kinds of Multi-State Planning needs, usually involving 2 to 4 contiguous states who may choose to get together and target areas to:

(1) Cooperate by picking different parts of the puzzle on which to work, OR

(2) Cooperate by agreeing to work on different puzzles.

Such bordering state coalitions require a shared vision for a need to get together and seriously consider how to do things more efficiently.

(1) Pursue, and ultimately agree on, problem and model to be pursued.

(2) Develop truly integrated efforts in specifically targeted areas. May involve both research and extension and perhaps teaching.

(3) The process often may start with discussions among Deans and /or Directors.

(4) Next need to get together with department heads. Keep faculty informed by each department head and invite input and ideas.

(5) Faculty planning and implementation (with appropriate administrators to facilitate and to uphold the pledge).

(6) Note, some of these activities could go the route of establishing regional research projects, but the appropriateness of keeping linkages from targeted states need to be met. It may be difficult under the formal regional research system to achieve some of the flexibility and speed of response required by the "virtual corporation".

NOTE, THE MODEL: the "Virtual Corporation", book by William H. Davidow and Michael S. Malone (1992) (Also highlighted in Business Week, February 8, 1993, cover story on pp. 98-103) The Virtual Corporation can be defined as a temporary network of companies that come together quickly to exploit fast-changing opportunities. It can be the ultimate in adaptability.

The key attributes of such an organization are: (1) Excellence; (2) Technology; (3) Opportunism (partnerships will be less permanent, less formal, and more opportunistic); (4) Trust (these relationships make companies far more reliant on each other and require far more trust than ever before); (5) No borders.

Capitalize on contemporary issues and concerns.

Agricultural research needs to be both forward looking (basic research) and also active in solving the important problems of the day (applied and adaptive research). Thus, it is obvious that the leaders and scientists have a responsibility to conduct research on problems of concern.

However, there is another reason to vigorously address contemporary issues and concerns. Agriculture no longer has the political clout it once had. To gain the public and political support necessary to achieve research funding, it is necessary to build coalitions with groups who have captured the imagination of large segments

of the general population. Current high priority issues include the environment; food safety, diet and health; competitiveness; rural community and economic development; and upgrading skills of individual citizens. Most of the disciplines within Agricultural Experiment Stations can participate in productive research addressing these problems. It is especially critical that we build coalitions to develop plans to address these contemporary issues and concerns.

Building an Empowering a Constituency within the State.

The following discussion is based on a presentation I made to the New Directors' Workshop sponsored by USDA-CSRS in Washington, D.C. on April 22, 1992. I don't pretend to claim credit for the ideas and concepts described here. Rather, I'll relate principles and examples that I have observed and been associated with. Each institution has a structure and situation unique to their respective state. Specific plans, strategies and actions must be developed within the specific context. For purposes of this paper I will simply **outline** some of the important principles that seem to me to be fundamental to success in building and empowering a constituency.

I. What is the essence of building a constituency? Communicate:

- In the real estate business it is said that three things are important: Location, Location and Location.
- In advocacy efforts for a public entity such as an AES, three things are important: Communication, Communication and Communication. It is extremely important to remember that communication means, "- - the **interchange** of concerns, opinions, and information - -." Thus, communication must involve listening as much as talking.

  1) Communication: Ask, learn, know the concerns of those we exist to serve and whose support we need.

  In terms of both the "need to" and the "how to" of listening to our customers, I refer you to a paper written by John Gerber, while he was Assistant Director of the Illinois AES.

  Tom Peters (of In Search of Excellence fame) writes, "to begin with, good listeners get out from behind the desk. Good listeners construct settings so as to maximize naive listening, the undistorted sort." Similarly we need to get out with our "customers" and listen to their interests and concerns.

  2) Communication: Develop a crisp plan of how your group (AES) can be an important part of the solution to the problems they see.

  3) Communication: Tell them clearly and simply what you propose to do and learn.

  4) Communication: After you get the funds/support, inform them what you are doing. No, better yet, tell them what you are learning. Update often. Provide brief vignettes of what is being learned in appropriate AES newsletters and reports and as handouts at meetings around the state..

  5) Communication: Inform them of what has been learned and how they can adapt the findings to their situation. (Even whether or not it might fit their situation.)

6) Communication: Continuous, although intensity may vary. It is very important to maintain contacts especially when you don't want them to do anything. One of the key reasons (Applies to legislators, their staffs, and to user or support groups.)

7) Opportunities can be created to keep clientele informed and seek their input on various relevant processes. For example, ESCOP has an elaborate planning process to develop research priorities (which are then inserted into the Joint Council and the USDA planning and budget development processes). The SAES directors vote to develop the final ranking for ESCOP each year. I have found it helpful to seek input from various groups in Indiana in terms of ranking these priorities.

II. Build trust and credibility:

- To be successful, an advocacy effort has to be built on trust and credibility.
- Be positive
- Don't over commit or promise more than can be delivered (for the dollars available/being asked for etc.). To do so essentially guarantees failure at some point in the future.
- Programs need to be relevant. Show what can be accomplished to help them; to solve problems and address issues of concern; to prepare them for future challenges.

  Note, many kinds of research are relevant, but it must be presented that way!
- Get back to people; let them know that things are happening

III. Empower others:

- Key actions: Identify, Listen, Energize.
- Build coalitions, not only with traditional clientele, but also with larger segments of society. (In most cases, it is no longer possible for a few university administrators to get agreement of the presidents of one or two farm organizations and then to be sure that good things will happen.)
- Building coalitions requires time, patience, and communication.

IV. Create a vision and develop a plan:

-Can one plan for an effective advocacy program by an empowered constituency?
-Yes, but I've saved that to last because my bias is that for a plan to be successful one must know the critical elements of the process you are about.
-Therefore, I chose not to approach this activity as a planning exercise, but rather to suggest some of the elements which in my judgment are critical.
-In the case of the "Crossroads 90" agricultural research and extension funding initiative in Indiana, Dean Thompson and key leaders of the "Coalition" of 45 organizations developed the "vision" and empowered many to "charge on."

Information Needed to Make the Priority Setting Process More Effective

Priority setting is never easy and much of it is subjective. The development of several kinds of information would enhance the objectivity of the process and make it more reliable. Several of the needs identified here could be developed by the NC-

208 Committee. Development of the benchmark data and estimates of the impacts as listed her would be very useful.

Support costs

It would be useful to have reliable estimates (median and range) of the costs of conducting research by discipline and/or department. It would be most useful to have such data presented both as total costs and then also as total support costs minus faculty salaries, all on a research FTE basis. Presenting these as index values, or per cent of the overall mean would be most useful. Data classifications should include "hard funds" (state and federal formula); grant and contract; and other; as well as total for all sources.

Access to reliable data of costs of doing research by discipline would provide one index to aid Directors in the equitable allocation of scarce resources ("hard funds") among departments in the AES. Furthermore, it would provide a more objective means of measuring the relative degree of success in getting outside funds by discipline or department. CRIS data from the USDA system could be a useful source for arriving at some of the information (raw data) needed to calculate the index costs of doing research. Additional specific data might be obtained by surveying SAES Directors.

Alternate funding sources

It would be helpful to have benchmark data on what sources of outside funds are typically available to faculty in various disciplines. The data should include the average size "grant" and the total outside funds per research FTE, by discipline.

Accomplishments

Individual Stations and the total agricultural research system need to improve their effectiveness in communicating with many audiences concerning what was accomplished with the investment in agricultural research. Too often the "annual reports" of AES research tell what was done rather than what was learned. And, the reports often are too detailed for most audiences. There is a great need to develop crisp, readable vignettes of what was learned or accomplished from research projects.

Impacts

This committee should be in an ideal position to lead an effort to further develop methodology for making ex ante impact assessments of doing particular kinds of research. The assessments should include social and environmental as well as economic impacts.

Furthermore, it would be valuable to provide estimates of economic impact of NOT doing the research in U.S. (vs. doing it). Agricultural economists can provide estimates of the impact of doing or not doing specific kinds of research. Some real examples should be studied and should include the impacts of learning new principles that lead to practices and/or technologies, as well as ultimate technologies.

SOME SUGGESTED READINGS

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TABLE 1

AGRICULTURAL RESEARCH FUNDING CATEGORIES AND USES

Federal formula (Hatch, McIntire-Stennis, Animal Health) **and State match:**
- Infrastructure and core competencies of expertise.
- Project funds for priority state, regional and national needs (Shrinking!)

Federal Competitive Grants (eg, USDA-NRI, NSF, NIH)
- Targeted basic research

State Special Lines:
- High priority state problems;
- Systems; Cost reducing; Site specific etc.

Federal Special Grants:
- High priority regional and national problems

Industry Grants and Contracts:
- Usually product oriented
- Often linked in terms of moving discoveries (of public and private sectors) to users.
- Consumer Reports type function

Commodity Market Development and Research programs ("Check-Off"):
- High priority needs perceived by producer community
- Often product, new use, and market oriented (Sometimes forbid "production" research)

TABLE 2

CRITERIA FOR DETERMINING LONG-RANGE STAFFING PRIORITIES FROM A RESEARCH PERSPECTIVE

EVALUATING STRENGTHS AND WEAKNESSES OF SPECIFIC RESEARCH AREAS
(an aid in targeting areas for future growth)

FACTOR	Evaluative Criteria	Rating Categories
RESOURCES	Faculty expertise	Exceptional, Strong, Adequate,Weak
	Quality of graduate students	High, Medium, Low
	Availability of graduate students	Good, Poor
	Quality of equipment & facilities	Excellent, Adequate, Insufficient
	Quantity of equipment & facilities	Excellent, Adequate, Insufficient
IMPORTANCE	Centrality of mission	Yes, No
	Importance to users	High, Medium, Low
	Progress potential	High, Medium, Low
	Demand for graduates	High, Medium, Low
	Contribution to graduate education	High, Medium, Low
	Comparative advantage	Yes, No
FUNDING	Cost of this research	Low, Medium, High
	Cross-disciplinary potential	High, Low
	Grant funding potential	Good, Adequate, Poor
	Industry funding potential	Good, Adequate, Poor
	Priority for reallocated funds	High, Low
	Likelihood for new State funds	High, Low
	Other sources of funding	(Listing)