ASTRA -- PAST, PRESENT AND FUTURE[1]

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1. Introduction

ASTRA was born in 1974. It was preceded by a presentation on "The Choice of Alternative Technologies" which evoked a great deal of interest amongst the faculty of IISc. Several of these faculty members suggested that an attempt be made to translate the ideas of alternative technology into a practical programme. An opportunity to make a presentation to SCRAP was therefore requested. Following this presentation to SCRAP (Appendix 1), the Institute accorded permission for the formation of a Cell for the Application of Science and Technology to Rural Areas.   This cell became known by its acronym ASTRA (which is the word for "weapon" in Sanskrit) and was meant to be a weapon against poverty in rural areas.

25 years have now passed and this is a long enough time to evaluate how ASTRA has changed over the years. How has it grown and what changes have accompanied this growth? More importantly, how is ASTRA to become sustainable over the long run, i.e., how should ASTRA become a sustainable institution? What is the way forward?

There are many ways in which such an evaluation can be done. The procedure adopted here is to start with analyses of ASTRA's strengths and weaknesses, the opportunities that it has and the threats it faces. Fortunately, such a SWOT analysis carried out in 1989 (after 15 years of operation) was found in the files. To this was added a SWOT analysis for 1974 (i.e., soon after ASTRA's inception) and another one for July 2000 along with this paper. To understand the major changes revealed by these SWOT analyses at ASTRA's birth and after 15 and 25 years, a model of a sustainable institution is described and used with the aid of indicators of sustainable performance. It appears that there are three phases in ASTRA's existence -- 1974-84, 1984-90 and 1990-97 and each of these periods has important characteristics.   Finally, a way forward is prsented.

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1   Keynote Address on 20 July 2000 to the Silver Jubilee celebrations of the Centre for the Application of Science and Technology for Rural Areas, Indian Institute of Science and the National Workshop on "Rural echnology -- A 25 year Perspective".

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2. SWOT Analyses

ASTRA SWOT Analysis (September 1974)

STRENGTHS	WEAKNESSES
- Prestige and competence of IISc - IISc infrastructure for technology generation - New rural development and poverty-eradication perspective - Pioneers in the field - Several key technology areas identified -- energy, low-cost housing, drinking water - Feeling of excitement - ASTRA, a hub of intellectual activity - Sensitivity to social concerns - Moral fervour - Support from large number of faculty including some FAScs - Support from Institute and Council	- No infrastructure for technology micro-dissemination in rural areas - Inadequate linkage with state-wide and country-wide technology dissemination agencies - Reputation in Karnataka, India and abroad yet to be earned - Meagre funding - Little work on income-generation technologies (agro- and mineral processing, handicrafts, etc.) - No expertise on health, education

OPPORTUNITIES	THREATS
• Challenge of poverty alleviation • New thrust towards environmentally sound development • Demands on ASTRA from alternative energy and rural development groups • Can avoid becoming isolated and withdrawn and having little impact on other departments like other department • Creation of a Rural Technology movement • Correction of the elitist and urban bias of institutions of higher learning	• ASTRA may become a bandwagon offering a more rewarding career path • ASTRA may appear an easy path to limelight and promotion • Intellectual productivity (refereed reports and papers) may decrease • Relevance may undermine excellence • Absence of established peer groups may erode quality control • May not become a movement • IISc faculty may lose interest • IISc students may not be attracted • Competition with voluntary groups

ASTRA SWOT Analysis (20 February 1989)

STRENGTHS	WEAKNESSES
• Has survived for 15 years • Has infrastructure for technology generation and micro-diffusion • Excellent reputation in Karnataka, India and abroad • Sufficiently well funded • Has excellent linkage with state-wide and country-wide technology dissemination agencies (KSCST, CAPART, DNES, etc.)	• No new perspective • No new faculty • No success in several key technologies (low-cost roofing for rural poor, potable water from brackish water, farm ponds, etc.) • Little work (except sisal) on income-generation technologies (agro- and mineral processing, handicrafts, etc.) • No expertise on health, education • Little excitement • Little moral fervour

OPPORTUNITIES	THREATS
• New emphasis on decentralised planning/adminisration requires new S & T inputs • Challenge of employment generation in rural areas will grow • New thrust towards environmentally sustainable development requires new technologies • Demands on ASTRA from ZPs, MPs, ecodevelopment and alternative energy groups will grow • Technology missions with rural relevance have thrown up demand for new technologies	• Stars have left • Decreasing as hub of intellectual activity • Intellectual productivity (refereed reports and papers) decreasing • Diminishing concern for excellence • Novelty and world class decreasing • Ceasing to be a movement • Becoming like any other department (isolated, withdrawn, little impact on other departments, etc.) • Shift in emphasis from technology generation to demonstration and dissemination • Some competition with voluntary groups • Royalty considerations entering decision-making • Isolation of Ungra Centre from people in Ungra region • Ungra centre decaying • IISc leadership losing interest in ASTRA

ASTRA SWOT Analysis (20 June 2000)

STRENGTHS	WEAKNESSES
1. Has survived for 25 years	1. No new perspective
2. Has infrastructure for technology generation and micro-diffusion	2. Very few new faculty
3. Reputation in Karnataka, India and abroad for past work	3. Active groups (Gasifiers, GHG mitigation) are working separately
4. Sufficiently well funded	4. Coasting on old reputation
5. Has linkage with state-wide and country-wide technology dissemination agencies (KSCST, CAPART, DNES, etc.)	5. No success in several key technologies (low-cost roofing for rural poor, potable water from brackish water, farm ponds, water harvesting, etc.)
	6. No work on income-generation technologies (agro- and mineral processing, handicrafts, etc.)
	7. No expertise on health, education
	8. No excitement
	9. No moral fervour
	10. Harnessing of new frontier areas (biotechnology, IT, etc.) for rural areas not explored
	11. ASTRA scientists are not considered different from other government agents

OPPORTUNITIES	THREATS
1. New emphasis on decentralised planning/adminisration requires new S & T inputs	1. Not a hub of intellectual activity
2. Challenge of employment generation in rural areas will grow	2. Intellectual productivity (refereed reports and papers) decreasing to "zero"
3. New thrust towards environmentally sustainable development requires new technologies	3. Little concern for excellence
	4. Novelty and world class decreasing
4. Demands on ASTRA from ZPs, MPs, ecodevelopment and alternative energy groups will grow	5. Ceased to be a movement
	6. Becoming like any other department (isolated, withdrawn, little impact on other departments, etc.)
5. Technology missions with rural relevance have thrown up demand for new technologies	7. Shift in emphasis from technology generation to demonstration and dissemination
	8. Isolation of Ungra Centre from people in Ungra region
	9. Ungra centre dead
	10. IISc leadership lost interest
	11. Search for premature publicity before proven achievement
	12. Publicity for plans rather than for achievements
	13. Poverty is being driven off the agenda by liberalization

3. A Simple Model of Sustainable Institutions

An understanding of the changes revealed by the SWOT analyses (at different times) and of the delineation of phases in the development of ASTRA is best accomplished in terms of a model. Models, it will be recalled, are simplified representations of reality. Good institutional models capture the essence of institutions, help us to understand their past behaviour, and to anticipate and shape their future.

Every organisation that aspires to become a sustainable institution has to be in interaction with the environment within which it functions. This interaction consists of flows of *inputs* from the environment -- objectives, challenges, problems, funds, infrastructure, human resources, knowledge, experience, paradigms, values, etc. -- and of flows of *outputs* to the environment -- analysis, new knowledge, new materials and devices, new paradigms, course materials, instructors, and trained human resources, paradigm-shifting advocacy, and action-oriented dissemination of hardware and software, etc. Thus, the environment of the organisation consists of all those bodies that provide the inputs to, and utilize the outputs from, the organisation.

When a organisation is set up, its objectives are developed in interaction, and by negotiation, with the environment. The environment thereafter monitors the organisation's adherence to the objectives. The functioning of the organisation is actively promoted as long as it sustains the delivery of the outputs consistent with the objectives. When the organisation stops delivering the desired outputs as per the objectives, the inflow of inputs from the environment to the organisation may be reduced or even stopped. An even worse reaction consists of the environment ignoring the organisation. Thus, a organisation has to earn active interest from the environment by sustaining the continued delivery of outputs of relevance to the environment. *Relevance*, as defined by the organisation's objectives, is therefore the first crucial requirement of a sustainable institution.

Relevance involves clear definition of the organisation's objectives, external and internal monitoring of the extent to which the organisation's progress is consistent with its objectives, the internalisation of objectives by the leadership and the rank and file, the balanced distribution of inputs and outputs towards sub-objectives, and strong interaction with the organisation's socio-economic environment. In the case of ASTRA, the environment includes the Institute and its bodies (Faculty, Senate, Divisions, Director, Council), the villages where ASTRA works, the local bodies and agencies, the concerned agencies of government, and the naional agencies dealing with rural technologies, international aid agencies, etc. The achievement of relevance earns for the organisation local, national and international kudos, support and assistance.

Relevance is not measured merely by the quantity of outputs, but also by the *quality* of these outputs. Thus, relevance is also determined by the quality of analysis, new knowledge, new paradigms, new technology, course

materials, instructors, trained human resources, paradigm -shifting advocacy, and action-oriented dissemination of hardware and software, etc. It follows that relevance is inevitably, intimately and inextricably dependent upon excellence of the organisation' outputs. *Excellence*, therefore, is the second crucial characteristic of a sustainable institution.

Excellence involves selection of outstanding and committed staff, adequate funding, satisfactory facilities, freedom, a shared vision emerging from interaction between the leadership and the staff and implying a community of interacting personnel, the development of a strong peer review system to ensure the natural selection of ideas and observations, and a discerning consumer ommunity to screen devices and processes, interaction with the world community of rural technologists, a system of rewards and incentives that will promote excellence in ASTRA's activities of information, training, technology generation, advocacy and dissemination. The achievement of excellence earns for the organisation national and international recognition (that society will accept as an independent external review of the organisation). Relevant excellence also ensures excellent relevance.

If an organisation has to gear its development to the objectives defined in collaboration with its environment, it must be a goal -seeking system steering towards its objectives with feedback from the environment and with internal motivation. This means that there must be internal mechanisms for transforming broad objectives into strategic visions, grand visions into specific programmes and concrete programmes into discrete projects. Mechanisms are also required for internal monitoring of the match or mis - match between progress and objectives. Above all, there must be a combined emphasis on both excellence and relevance -- diminished concern for excellence undermines relevance, and a neglect of re levance invites neglect from the environment.

If an organisation like ASTRA has non-routine objectives for which there are no tried and tested recipes, it has to encourage creativity. And there cannot be creativity unless there is transparent, accountabl e and participatory self-governance. The implication is that there must be intra - institutional mechanisms of self-governance in technological, managerial and administrative matters. It is in this context that the intra -institutional structures acquire importance for they are the channels through which the staff interact with the leadership.

When the functioning of the organisation does not show sustainability, the situation leads to a negative attitude of the environment towards the organisation. Some characteristics of unsustainability are *ad hoc* and non-participatory functioning, the absence of transparent procedures, the lack of checks and balances, over-dependence on authority, etc. The result of this negative attitude is a further reduction of inputs that in turn leads to a further decrease in outputs and aggravation of unsustainable functioning ... and the organisation spirals down into decline. Thus, *transparent, accountable and participatory self-governance* is the third crucial requirement of a sustainable institution.

Self-governance involves compatibility between the organisation's objectives, structure and functioning, an understanding and internalisation of the philosophy, objectives, structure and functioning by the staff of ASTRA, the evolution of an institutional culture (in the form of a tradition and a set of unwritten and universally accepted codes of conduct reinforcing a collection of rules and procedures) based on this understanding and internalisation, transmission of this understanding and internalisation to new entrants to ASTRA via its culture, clear signals from the academic, scientific and administrative leadership that are unambiguously understood by the faculty and students (no possibility, as happened in a neighbouring organisation, of a faculty member thinking that his work was being appreciated when the leadership claims that he was being encouraged to leave!), participation of the faculty in strategic decisions and in policy formulation, procedures and means for conflict resolution (because there are many possibilities of conflict -- conflicts between the Convenor/Chairman of ASTRA and its faculty, between ASTRA's faculty and staff, between ASTRA and other centres/departments of the Institute, between ASTRA and the Institute, and between ASTRA and the villagers of the rural areas where ASTRA works, etc.), and adequate resources (because poverty of resources is the breeding ground for conflict).

Relevance, excellence and (transparent, accountable and participatory) self-governance are necessary conditions for an organisation to become sustainable, but they are not sufficient. *Financial viability* is also a requirement of a sustainable institution.

The issue of financial viability depends upon how ASTRA should secure its funds and survive. Attention should first be focused on the extent of financial self-sufficiency for which ASTRA should strive. One extreme of zero self-sufficiency implies that ASTRA will be totally dependent on its

funders. In addition, if ASTRA tells donors that it does not plan to achieve any measure of self-sufficiency because it needs to be able to provide core services, these donors are bound to get nervous that they are making an open-ended commitment. The other extreme of complete self-sufficiency implies that ASTRA will be totally cut off from the signals of the funders and driven to revenue-producing activities at the expense of the public service function it was created to carry out.

Thus, the two dangers -- being survival-driven and not being demand-driven at all are the Scylla and Charybdis of fund-raising strategies -- ASTRA must steer clear of each without being trapped by the other.

Clearly, ASTRA must achieve a reasonable measure of financial self-sufficiency so that it can advocate the paradigm of its founding charter and pursue its founding vision irrespective of the twists and turns of Institute fashions and the dictates of the funding market-place. At the same time, ASTRA must be motivated by a measure of insufficiency to listen to and be influenced by the signals from the real world. Thus, ASTRA's strategy must involve a judicious mix of financial self-sufficiency and insufficiency (and dependence).

The next issue concerns how ASTRA how achieves this judicious mix of self-sufficiency and dependence. It is clear that ASTRA should not adopt a self-destructive approach of developing vested interests like some other rural development actors. If ASTRA strives for self-sufficiency through the "sale" of its services, it will be viewed as a threat by potential allies, for example, groups that depend upon consultancies and execute projects in the field. If ASTRA finds itself competing for fees, its ability to be non-threatening (and objective) may be compromised. In other words, this type of approach contradicts ASTRA's vision of its role as an honest broker bringing together all the rural development actors without having conflicting interests with any of them.

It appears, therefore that ASTRA should pursue a two-pronged fund-raising strategy involving

(1)   an *Institute budget* to support ASTRA's core expenses for establishing and operating its Extension Centre and its convening office at the Institute at Bangalore
(2)   a *diversity of funders* to support ASTRA's Information, Training, Research/Analysis and Advocacy activities

(3)   *specific donors* to support on a project-by-project basis its large
      technology micro-dissemination projects.

For instance, ASTRA could strive for a 1:2:4 ratio between (1) Core
expenses (for establishing and operating its Extension Centre and its
convening office), (2) expenses on Information, Training, Research/Analysis
and Advocacy activities, and (3) expenses on technology micro-
dissemination projects. This would result in the following break-up of total
funds requirements and strategy for fund-raising:

ACTIVITY	EXPENDITURE (%)	SOURCE
Establishment & Operation of Extension Centre and IISc office	15	Institute Budget
Information, Training, Research/Analysis and Advocacy	30	Diversity of Funders
Micro-dissemination Projects	55	Specific Donors

Such a strategy would keep ASTRA's core costs at about 15% of the total
funding with the demand-driven proposals for ASTRA's Information, Training,
Research/Analysis and Advocacy activities accounting for 30% and its micro-
dissemination projects for 55% of the total. This will facilitate ASTRA's
objectivity and independence a few years at a time but ties ASTRA to the
success of its other (demand-driven) proposals.

The model of institution-environment and intra-institutional interactions
presented above leads to a simple definition. Institution-building for
sustainability involves growth of an organisation, but must not be equated with
mere growth; it is above all the process of achieving and maintaining relevance,
excellence and self-governance and financial viability. This definition begs the
question: what are the mechanisms for the development of relevance, excellence
and self-governance and financial viability? This is a crucial question of
institution-building and organisational behaviour that deserves far deeper analysis
than is possible here; what one can try to do here is to identify some ingredients

in the hope that they are the right ones.

4. Criteria for the Sustainability of ASTRA

The sustainability of ASTRA must be judged on the basis of the criteria that follow from the model of sustainable institutions discussed above:

- *Criteria of Relevance*

⇒ Applicability to rural areas
- Decentralised energy generation from local sources
- End-use energy Devices
- Low-cost Buildings
- Water for domestic and agricultural purposes
- Agro-industrial processes

⇒ Advances sustainable development
- Direct improvement of QOL
- Improvement of QOL via income generation
- Empowerment of rural communities
- Environmental Soundness

- *Criteria of Excellence*

⇒ Faculty from departments
⇒ Publications
⇒ Seminars
⇒ Courses
⇒ Degrees (PhD, M Tech)

- *Criteria of Self-governance*

⇒ Faculty interaction (formal and informal)
⇒ Transparent strategies and policies
⇒ Accountability
⇒ Participatory functioning

- *Criteria of Financial viability*
$\Rightarrow$ Core support for faculty salaries
$\Rightarrow$ Core support for basic functioning
$\Rightarrow$ Programme funding
$\Rightarrow$ Project funding

5. Phases of ASTRA's Development

Phase 1: (a) Integration of social concerns and technology and (b) Legitimization of ASTRA within IISc and national framework (1974 -84)

- Development of awareness of rural conditions
- Motivation of IISc faculty
- Establishment of Ungra Extension Centre
- Identification of technical problems of relevance to rural areas
- Development of conceptual framework for generation and dissemination of technology for rural areas
- Legitimization of ASTRA in IISc and in the national scene

Phase 2: (a) Technology Demonstration and (b) Departmentalization of Governance (1984-90)

- Transformation of ASTRA from cell (with Convenor but no faculty) to centre/department (with Chairman and permanent faculty)
- Chula, low-cost housing and gasifier programmes
- Community biogas plant project
- Decrease in number of peer-reviewed publications
- Decrease in the number of seminars to build awareness and create interest in IISC

Phase 3: (a) Market-oriented liberalization and (b) Marginalization of social concerns (1990-98)

- Post-1990 influence of LPG on ASTRA
- Dominant influence of funding agencies on design of projects

- Poverty driven off ASTRA's agenda
- Exclusion of people from technology choice and management
- Emulation of top-down government-type technology implementation
- Decrease of delivery/promise ratio
- Growth of Chairman-oriented opaque governance
- Secession of SUTRA from ASTRA
- Separate growth of successful GHG and Gasifier programmes

6. A Way Forward for ASTRA:

q **Reaffirm Socio-economic Objectives**
q **Induct New People**
q **Strengthen Old Areas**
q **Initiate New Areas**

- *Millenium Areas (IT, Biotechnology)*:
  – Identify brainstorming groups (one/area) with majority of new people
  – Take them on field trips to villages
  – Have brainstorming sessions on how area can advance Rural Development

- *Millenium Challenges*
  – Literacy, Health, Drought, etc.
  – Focused Workshops to develop programmes of work

- *Panchayat Level Development*
  – Form ASTRA team (with Civil, Mechanical and Electrical Engineering, IT, Biotechnology and Systems expertise)
  – Visit and understand PLD in states (e.g., Kerala)
  – Formulate an S&T agenda to enhance PLD

- *Linkage with other Rural Development Groups*
  – Seminar with other rural development groups
  – ASTRA Web site

- *Fresh Thrust to Old Areas*
  - Workshops with review presentations of 25 years of work
  - Committees (1/3 ASTRA veterans + 1/3 new faculty + 1/3 outside experts to generate fresh thrust

- *Reaffirmation of ASTRA's Goals and Strategies*
  - Workshops to reaffirm ASTRA's role in the context of LPG (Liberalization, Privatization and Globalization)

- *Definition of ASTRA's role in the Institute*
  - Interaction between Institute leadership and faculty of ASTRA to define special role of ASTRA

- *Reinvent Governance of ASTRA*
  - Development of TAP (Transparent, Accountable and Particpatory) style of governance