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Innovate or Die: Learning to Survive in the New Agricultural Research Environment

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This paper outlines the results of the first stage of a research project entitled "Sharing Institutional Innovation: A Global Learning Program", launched by ISNAR in February 2002. The first activity consisted of a distance learning exercise, which used the innovation systems model analytical framework to look at commonalities in understanding institutional innovation in agricultural research environments. The approach focuses on a learning process that is expected to develop new capacities and mind shifts in individual participants.

Cases that documented institutional arrangements for research funding, strategic management of change, extension service provision, and farmers' participation in agricultural research were used in this exercise. Twenty-four experienced research managers analyzed the cases and noted similarities between them and their real-work situations. Feedback was also obtained from participants about institutional innovations in their own environments and their potential applications.

The changing agricultural research environment

Rural development in globalized economies is strongly dependent on technological advances. Clearly for developing countries, creating and supporting the technological capacity necessary to compete in the globalized market requires investments that depend on adequate policies and proper management. Research and development (R&D) organizations are constantly under pressure to adapt to cope with the uncertainties and pressures of the new context in which they operate.

Publicly funded agricultural research is going through a serious crisis almost everywhere, not only because of declining budgets but also due to the way scientific projects have been carried out traditionally: in a rigid, mechanical, and linear fashion. This has resulted in knowledge and expertise being locked up in national agricultural research organizations (NAROs), where scientists have limited opportunities for interaction with farmers and private enterprises. As public sector research organizations have weakened, the private sector has become more prominent in developing crucial technologies, particularly in the fields of biotechnology and information technologies, which are strongly influencing agriculture.

The rules by which research is conducted and agricultural innovations are produced are changing simultaneously with the roles of stakeholders. For example, research

alliances are now formed between farmers, agribusiness corporations, and public research centers, in which these actors define their needs for specific knowledge and jointly implement mechanisms to address these needs. In many countries, agribusiness influences and shapes government research policies to suit its demands through its presence on the governing bodies of national agricultural research systems (NARSSs).

The modalities for providing extension services to resource-poor farmers are also changing. With increasing privatization of the extension branches of NARSSs in many countries, nongovernmental organizations (NGOs), which are "closer to the people" and generally better able to support the training needs of poor farmers, are active at two levels. Firstly, they effectively connect the real problems – and knowledge – of farmers with the formal and academic thinking of scientists. Secondly, many NGOs themselves supply extension and education services to resource-poor farmers.

The systemic approach to innovation

The changes outlined above indicate that innovation in the rural context is not the direct result of fundamental or applied research by agricultural scientists to improve productivity and achieve competitiveness, and that most innovations actually emerge out of adaptation as different

agents learn and select improvements. Innovations are better understood in terms of systemic thinking, which “encourages us to examine how things interact, interconnect, interrelate, or, in some cases control each other” (Wilson and Morren 1990).

Edquist (1997) defines a system of innovation as all important economic, social, political, organizational, and other factors that influence the development, diffusion, and use of innovations (Box 1). As an approach to analyzing innovations, the innovation systems model has existed for over a decade now, following the influential work of Freeman (1987), Lundvall (1992), and Nelson (1993). This approach is widely used in academic contexts and also as a framework for innovation policymaking.

The innovation systems model takes a holistic and inclusive view of innovation: it moves from one dominant (public) actor to several equally influential actors at the same level, and it moves from vertical linkages to a web of horizontal relationships, stressing the importance of all actors in the innovation process. The efficiency of the interaction mechanisms depends on the innovation infrastructure inside the system and the external environment (the context). In this model, a network of stakeholders in the system (organizations/actors) and the business production chain (institutions) deliver tangible and intangible novelties – the innovations – to society and markets. The generation, transfer, interpretation, and utilization of knowledge are considered to be the main driving forces of novelty creation. Creativity, cooperation, and commitment among stakeholders play an important role in producing and delivering innovation.

The systems model also takes into account national and regional differences in how innovations are produced. Additionally, it emphasizes sectoral differences and their relationships, for instance between agriculture, industry, and communications. In this model, institutions are important for directing and guiding the process of technical change, and as these become more complex, innovations in institutional arrangements become necessary.

Innovation requires understanding and practicing a new mode of knowledge generation, centered on the web formed by the relationships between diverse actors and in which new rules of the game are being introduced. The characteristics of this new

model include (1) generation of knowledge in the context of its application, (2) social appropriation of knowledge during the process of its generation, (3) transdisciplinary and interinstitutional efforts to interpret and deal with complex problems, (4) incorporation of ethical principles in interactions with society and the environment, and (4) extended social control over the quality of knowledge and validity of its impacts (Gibbons et al. 1994).

Learning, the organization, and the individual

The role of research managers is shifting from direction to facilitation of the innovation process. Therefore, learning is required to develop new skills in critical thinking and problem solving.

Argyris and Schön (1978) argue that in an organization each member constructs his/her own representation of the whole, but the result is always an incomplete picture. They contend that an organization is an artifact of the individual ways of representing the organization. Hence, organizational learning is a cognitive enterprise where individual members are continually engaged in attempting to know the organization, and to know themselves in the context of the organization. Thus, a learning organization is one that nurtures new and expansive patterns of thinking and collective aspiration, and where people are continually learning how to learn together and correct errors. Learning is faster when everyone in the organization is given the opportunity to participate and to discuss and contribute to plans, policies, and strategies.

Learning organizations are those that foster continuous learning for continuous improvement, in which people are able to expand their capacity to create the results they truly care about (Senge et al. 1994). Senge (1990) proposes five disciplines as crucial for a learning organization: systems thinking, personal mastery, mental models, shared vision, and team learning. The first three apply particularly to the individual participant, and the last two have group applications. Systems thinking is considered the “fifth discipline” since it serves to make the results of the other disciplines work together for the benefit of business. Systems

Box 1. Key Concepts for Innovation

Innovation: New creations of economic significance. They may be brand new, but are more often new combinations of existing elements. Innovations may be of various kinds, e.g. technological as well as organizational. The processes through which technical innovations emerge are extremely complex, they have to do with the emergence and diffusion of different knowledge elements, e.g. with scientific and technological possibilities, as well as the “translation” of these into new products and production processes. This translation by no means follows a “linear” path from basic research to applied research and then on to the development and implementation of new processes and new products (Edquist 1997).

National systems of innovation: Systems or networks of private and public sector institutions whose interactions produce, diffuse, and use, economically useful knowledge (Freeman 1987; Lundvall 1992).

Institutional innovation: Creative change in the formal or informal rules of the game (Red Nuevo Paradigma para la Innovación Institucional 2003).

thinking can improve individual learning by inducing people to focus on the whole system, and by providing individuals with the skills and tools to enable them to derive observable patterns of behavior from the systems they see at work.

While change is inevitable, some of those involved within the organization may see it as ill-conceived and disruptive. Frequently, efforts at producing change fail to meet their objectives because people are not fully committed to supporting the process. People need to feel that the change in which they are participating is important. An organization performs better when its people feel personally rewarded and satisfied. Organizational learning can also be complicated by the magnitude of the organizational change involved. Large, transformational change touches so many parts of the organization that top management must be involved for the process to be effective.

Pilot exercise on sharing institutional innovation in agricultural research

In 2002, the Learning for Institutional Innovation Thematic Area of ISNAR carried out a distance-learning pilot exercise to share institutional innovations in agricultural research with several ISNAR partners. The objectives were twofold: (1) to analyze and learn from institutional innovations in collaboration with several researchers (ISNAR partners) by looking at commonalities in understanding the concepts of innovation systems and institutional innovation, and (2) to obtain feedback on cases of institutional innovation in agricultural research in the partners' settings.

Methodology of the exercise

The exercise was centered on research-based capacity building as a combination of action research methodology and the experiential learning cycle (Kolb 1984), an approach used successfully by ISNAR for the last seven years (Manicad and França 2004). In this approach, the gap between the learner and expert disappears, as all individuals are considered to be experts in some capacity.

Forty experienced agricultural professionals from both developed and developing countries who have had previous interactions with ISNAR – either as trainees, trainers or network members – were invited to participate in this exercise. The participants were asked to read 10 documented case studies on institutional innovation, reflect on their experience, draw conclusions, and identify applications in their own working environment. They grounded the lessons in their actual work environment by considering the question of what could or should be done differently as a result of their learning experience.

The case studies represented several areas of institutional innovation in agricultural research, mostly in developing countries, with a geographical balance between Africa, Latin America, and Asia. An institutional innovation in an agri-chain in Germany

and The Netherlands was included for comparison. The cases documented recent or ongoing institutional innovations, both successes and failures, and have been placed on the Internet (<http://www.isnar.cgiar.org/shiip/index.htm>).

A package containing a diskette with an invitation letter, prospectus, guidelines, case abstracts, and questionnaires for case study analysis was sent to each participant. Every participant also received a CD-ROM containing the 10 case studies in full. Each was asked to read three cases, one assigned by the project manager and two selected by the participants according to their own interest. They were asked to fill out a questionnaire for each of these cases. The questionnaires were divided into four sections: (1) identifying the innovation and the forces behind it, and assessing its effects; (2) relating the cases to the respondents' own organizational context; (3) two questions to assist the project manager identify further case studies, with the respondents being asked to provide concrete examples of institutional innovations in their own settings, and/or to provide a concrete reference to a published case known to them; and (4) evaluation of the exercise, with suggestions for improvements.

The respondents were asked to fill out the electronic questionnaires and e-mail them to the project manager within one month.

Results and discussion

The questionnaires were answered by 24 research managers; 60% of those invited to participate. Among the respondents were several professionals with experience as research managers in the public sectors of various countries in Asia, Africa, and Latin America. Professionals from private universities and NGOs, and private consultants from several developed countries also participated. Of the professionals who declined to take part in this exercise, five indicated that lack of time prevented them from participating. The rest did not provide an explanation for declining.

Selection of case studies by respondents

It is hypothesized here that each participant's selection of case studies for analysis is a reflection of his/her own interest in a particular institutional innovation. Consequently, we argue that each selection indicates a need for acquiring particular knowledge on the subject and relates to opportunities and/or constraints that these professionals experience in their working environments. The number of respondents selecting a particular study, their country of origin, and the type of organization they work in is shown in Table 1.

The following cases were selected four or more times.

"Establishing Contract Research with the Agricultural Technology Development Fund, Uruguay", which documents a successful funding strategy for supporting agricultural research, was selected the most. Finding and accessing funding

Table 1. Number of Respondents Selecting Each Study, Country of Origin, and Type of Organization

Number of times selected	Case study	Participants' country of origin	Participants' organizations
9	Establishing Contract Research with the Agricultural Technology Development Fund, Uruguay	Burkina Faso, Cuba, Kenya, Panama, Philippines, United Kingdom, Zambia, Zimbabwe (2)	NARS (4), University (5)
6	Farmer Participation in Conservation and Research: Local Agricultural Research Committees, Honduras and Nicaragua	Cuba (2), El Salvador, South Africa, Kenya, Italy	NARS (4), NGO, Private consultant
4	Commercialization of Agricultural Research at the Council for Scientific and Industrial Research (CSIR), Ghana	Cuba, Kenya, Zambia, Zimbabwe	NARS (2), University (2)
4	Improving Information, Quality, and Marketing of the Plantania Potted-Plant Agro-Chain, Europe	Canada, Cuba, Kenya, South Africa	NARS (3), NGO
3	Introducing Reforms to Provide Sustainable Funding for Agricultural Research, Senegal	Cuba, Zambia, Zimbabwe	NARS (2), University
3	Structural Change at the Department of Agricultural Extension (DAE), Bangladesh	Kenya, Panama, Philippines	NARS (2), University
3	Reorienting Institutional Collaboration to Improve Mango Quality and Marketing, India	Cuba, Colombia, Kenya	NARS (2), Private consultant
3	Developing Public–Private Rural Extension Services, Nicaragua	Burkina Faso, Canada, Cuba	NARS (2), NGO
2	Capacity Development Using Agro-Food Chain Analysis at the Swine Research Institute, Cuba	Cuba, Zambia	NARS (2)
2	Activating Community Participation in Genetic Resource Conservation, CONSERVE, Philippines	El Salvador, Italy	NGO, Private consultant

to support research is one of the main concerns of research managers nowadays, as public funding is being replaced by competitive agricultural technology funds in an increasing number of countries.

“Farmer Participation in Conservation and Research: Local Agricultural Research Committees, Honduras and Nicaragua” was selected six times. This case study documents participatory approaches to agricultural research in risk-prone environments, a problem that is on the minds of researchers working with resource-poor farmers, which several of the respondents are. These innovations involve a soft-systems approach that centers on networks, power relations, and dynamic performance. A key lesson is the use of local knowledge as the cornerstone of development.

“Commercialization of Agricultural Research at the Council for Scientific and Industrial Research (CSIR), Ghana” was selected four times. This documents efforts to commercialize agricultural research results, which has only been successful for export products. It emphasizes the need to evaluate the application of a blanket policy that includes pro-poor research.

“Improving Information, Quality, and Marketing of the Plantania Potted-Plant Agro-Chain, Europe” was also selected four times. This is a successful case of partnership promoting adequate knowledge flow to overcome difficulties in commercializing highly specialized horticultural products.

Analysis of questionnaire responses

The following is a partial analysis of the responses to the questionnaires.

Establishing contract research with the Agricultural Technology Development Fund, Uruguay

The respondents indicated that these funds work best when the government leads the institutional reform initiative, has a clear vision of priorities, and is willing to implement the necessary mechanisms. The reasons for this innovation were: a response to government policy of increasing pluralism of agri-research, budget reductions, a need for knowledge exchange

mechanisms, calls for wider stakeholder participation, and competitiveness. The main effects on institutional management were decentralization, changes in the decision-making process used to assign the funds to make it more participatory and transparent, improved financial management, authority transferred to the Uruguayan NARO, INIS, for subcontracting research that could not be carried out by its own researchers, and increased research efficiency. The efficient implementation of a planning, monitoring, and evaluation system and dissemination of research results were important aspects.

Participants' report on lessons learned

- When successful innovation results are properly and promptly rewarded, the process gets support and a good reputation.
- Indicators of the process are needed to allow for permanent evaluation.
- Be prepared to negotiate power sharing.

Farmer participation in conservation and research: local agricultural research committees, Honduras and Nicaragua

Among the reasons for this innovation were: changing R&D paradigms, a need for better solutions to low agricultural production in degraded areas and agro-ecosystem management, and success of similar experiences in other countries. The effects on institutional management were: change of research from technology push towards attention to farmers' needs, more accountability, sense of ownership, shared decision-making and implementation, partnerships, and community organization and empowerment (of women).

Participants' report on lessons learned

- Cooperation between the local farming community and scientists is effective and sustainable because both benefit from research and innovative processes carried out through CIALs.
- Investments in capacity building by providing training, especially in good facilitation, monitoring, and evaluation skills, are important. These skills are critical for promoting new concepts and processes, especially in poorer communities where more time may be needed to master the operation of CIALs.
- The importance of a farmer-first approach and the involvement of farmers as decision makers at all stages of the research process. The importance of all stakeholders jointly finding solutions to improve agriculture and protect the environment.
- The role of local knowledge and its superiority over "technical science-based" knowledge.

Commercialization of agricultural research at the Council for Scientific and Industrial Research (CSIR), Ghana

The innovation was prompted by a government decision to privatize research to obtain financial resources and reduce heavy dependence on donors. The effects of the innovation were: financial system reform, implementation of performance-based evaluation at CSIR, and increased development of technologies to be commercialized.

Participants' report on lessons learned

- Policy decisions have to be preceded by thorough study of the institutions affected.
- Innovation processes have to be implemented systematically.
- A conducive environment is essential to the success of an innovation. Need to analyze relevance and appropriateness.
- Important to negotiate meaning and sharing of objectives to be achieved.
- Need to examine policy framework before embarking on institutional changes.

Improving information, quality, and marketing of the Plantania potted-plant agro-chain, Europe

The reasons for the innovation were: increasing consumer demand for quality products, a need for closer collaboration between stakeholders, a need for larger market share, a need for added-value products, and a need to ensure steady supply. The effects on institutional management were: new institutional partnerships, better information management, improved coordination, product quality assurance, implementation of electronic marketing, and improvements in chain processes.

Participants' report on lessons learned

- Agroindustrial business chains are highly complex and require time.
- Research institutes can play significant role in facilitating chain performance.
- Ventures in which different institutions of the production chain come together for a marketing goal require high levels of trust and commitment from all parties.

Introducing reforms to provide sustainable funding for agricultural research, Senegal

The reasons for the innovation included very low productivity, society questioning the contribution of R&D organizations to social development, a need for stable research financing, heavy dependence on donors, dwindling funding, previous experience with a competitive fund, and the need for a participatory

approach to research priority setting. The effects on institutional management were: introduction of a competitive element in applying for funding, changes in the fund's management and governance, changes in organizational structure, and the introduction of mechanisms to link actors.

Participants' report on lessons learned

- Research organizations need strong links and communication with producers to respond to demand.
- Research should produce impact to motivate donors to contribute.
- It is critical to consult widely, brainstorm, and test new ideas before adopting funding approaches.
- Political influence should be reduced to a minimum in research and innovation processes.

Structural change at the Department of Agricultural Extension (DAE), Bangladesh

This was successful upgrading by DAE of its agricultural extension system with the assistance of several international agencies. Among the reasons for this innovation were: continual changes in the country's agricultural sector, crisis in the training and visit extension system, new service providers, and lack of responsibility among extension staff. The effects on institutional management were: use of participatory approaches to identify products and services, use of group techniques, improved decision making, and alliances with other actors.

Participants' report on lessons learned

- It is important to involve all actors in promoting changes.
- Having an explicit policy is important for guiding innovation processes.
- Local people know their needs and can successfully guide development in ways that are equitable and productive.
- Demand-driven approaches do not deprive technical people of their professional role, they only make it more effective and hopefully more satisfying.
- Expansion of the innovation toward diversification, particularly to support micro-enterprises for rural women, was a significant development.

Reorienting institutional collaboration to improve mango quality and marketing, India

The respondents concluded that this innovation in public and private efforts to assist farmers in producing and selling export-quality mangoes was not very successful, but that organizational learning had occurred. The reasons for the innovation were: market expectations, opportunity for commercialization of higher added-value fruits, and a need to strengthen interaction between research and production. The resulting changes were: improve-

ments in research management, finance and logistics, coordination and communication, and technology transfer mechanisms.

Participants' report on lessons learned

- It has shown me that other organizations are facing similar challenges and that there are resources to which I can turn to convince my superiors that institutional changes need to occur.
- Alliances can be very useful if they take place in a learning process that permits the analysis of difficulties, limitations, and achievements of the process itself.
- Being very narrow and inward looking will not nurture creativity and success.
- Transformational change is necessary because solving problems with only instrumental change is not enough.

Developing public-private rural extension services, Nicaragua

This reform process aimed at developing a client-driven rural extension system in Nicaragua was prompted by: structural adjustment and reduction of public funds for services, a reduction in international donor funding, the need to respond to farmers' needs, and the appearance of other actors as extension service providers. The effects on institutional management were: targeted services, better planning, improved decision making, improved delivery channels by private enterprises, more responsiveness to producers' needs, and commercial criteria in management.

Participants' report on lessons learned

- System diversity might allow for sustainability.
- Improved links between producers and extensionists contribute to achieving good results.
- Need to know how satisfied users are with this service. Poor and subsistence farmers would be excluded since they might be unable to pay for the services.
- System stimulates extensionists to perform well.

Capacity development using agro-food chain analysis at the Institute for Swine Research (Instituto de Investigaciones Porcinas, IIP), Cuba

Among the reasons for SINCITA's (Sistema Nacional de Ciencia e Innovación Tecnológica Agraria) successful use of technology foresight methodology to analyze agro-food chains at IIP were: profound agricultural transformations and the need for a coherent research program, new market opportunities, steep reductions in the research budget, improved research product dissemination, and staff uncertainty. In the words of a participant, "if the institution does not change it will become irrelevant to the needs of the country". The effects on institutional management were: improved priority setting to support sector demands, improved

programmatic direction, adoption of a holistic multidisciplinary research perspective, making the research focus on problem solving, improved organizational negotiating capacity, improved working relations and teamwork with stakeholders, improved staff motivation and commitment, and improved fundraising.

Participants' report on lessons learned

- Success was result of a two-pronged approach involving political and managerial support and leadership, and broad staff participation and ownership.
- Participatory learning processes are important for success.
- In a change process, support from top management is vital.

Activating community participation in genetic resource conservation, CONSERVE, Philippines

The respondents concluded that, while the work of the Community-based Native Seeds Research Center (CONSERVE) on promoting community-based conservation was successful, its sustainability was uncertain. The effects on institutional management included: participatory approaches to knowledge generation, a systems approach to problem solving coupled with appropriate research, and backup activities by several stakeholders.

Participants' report on lessons learned

- R&D organizations need mechanisms to permanently relate to their environment.
- Identification of key stakeholders was crucial for the initiative.
- Use of participatory methods was important for success.
- The innovation enhanced partnerships, and conservation is undertaken because it is made practical and relevant to the livelihood of the community, farmers are given the chance to make choices/selection in their own environment on a continuous basis, complements adoption efforts/strategies, spells out roles of partners and gives recognition.

Achievement of the pilot exercise objectives

This exercise showed participants that innovation is a complex social phenomenon where every function in the innovation system is equally important. These collaborations (institutional innovations) define the roles of stakeholders in the process and the rules by which it is governed and oriented. As respondents observed, innovation is a continuous learning process evolving in cycles,

and through feedback loops between all the stakeholders. The following are some of the factors that the respondents considered important in learning about institutional innovations.

Awareness of the need for institutional innovation in agricultural research settings

Most respondents identified situations that required innovative solutions in their own working contexts. For example, one indicated: *"although with different realities between cases (successful or not), these are guiding references for identifying the needs for institutional innovation in our own reality"*.

Finding unique solutions according to the particular context

Being context-dependent, institutional innovations cannot be copied; they require adaptation according to the particular organizational context and needs. One respondent wrote: *"...it ratifies that solutions to problems in a country or organization are contextual. There are no universal recipes."* Another observed, *"the lesson learned in this exercise is that most institutions in the developing world seem to be faced with similar problems. However, the difference lies in how they go about tackling them."* This comment is particularly relevant to the cases that document funding of research.

Knowledge sharing and learning

Innovation and learning are closely linked, as there can be no change without previous learning. Knowledge sharing is crucial. Private sector organizations that consciously attempt to innovate make budget provision for research and experimentation, and they often regard unsuccessful innovation attempts as a learning experience rather than a failure. One participant commented: *"the development of institutional capacity to learn from its successes/failures facilitates the construction of institutional sustainability"*.

Promoting creativity for innovation

Leaders of innovative organizations have to create a safe and creative environment where staff feel free to promote institutional innovations. It is important for creativity and commitment to be maintained even when innovating processes take time and much effort. Often, the political stakes are high, and handling pressures becomes a real challenge. Successful institutional innovation processes require creativity, changes in attitudes or practices by those involved, and good leadership.

Need to promote increased stakeholder participation

Many innovations have been successful when stakeholders have taken part in design, implementation, monitoring, and evaluation. The Uruguay case successfully funded mechanisms that actively involved actors from outside NAROs in research. The direct involvement of beneficiaries in adapting improved technologies that are suitable to their conditions and address their priorities increases their enthusiasm for the project.

Promoting indigenous knowledge for agricultural innovation

Indigenous knowledge is a key element of the social capital of the poor and constitutes their main asset in their efforts to

gain control of their own lives. Local people are best qualified to define their problems. As exemplified in the cases of CIALS and CONSERVE, indigenous knowledge is flexible, adaptable, and innovative. It is extensive and systematic, taking account of complex interconnections, which narrowly focused, reductive scientific disciplines may overlook. A respondent commented: *"I learned that the success of the innovation lies in the use of participatory approaches in which the rural communities are involved as key actors. The importance of involving farmers in every step of an innovation process is critical for success."*

Directions for future work

The 10 cases examined in this pilot exercise presented efforts to overcome some of the main problems that impinge on the effectiveness of NARSS and NAROs in developing countries, such as insufficient research funding, inadequate linkages between stakeholders, inefficient agro-chain performance, inadequate mode of research intervention, and inadequate provision of rural extension services. The factors that have impacted on their success or failure have been analyzed in light of the ideas and inputs provided by the respondents to this pilot exercise. The second phase of this project will involve the participation of research managers in a combination of face-to-face events and e-learning, where the framework for analysis presented here can be socialized to obtain more feedback for its improvement. These activities can easily be converted into training modules and workshops that, given the new dynamics of ISNAR and NARSS, could attract donor support.

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