

# Evaluation of ICT Policy for the Agriculture and Rural Development in Developed Countries: A Comprehensive Lesson for Developing Countries

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## ABSTRACT

Information and Communication Technology is now widely accepted by developing countries as a development tool in their efforts to alleviate poverty, enhance human development, and achieve Millennium Development Goals. Recognizing this untapped potential and development strategies incorporating ICT are being increasingly promoted and launched across the developing countries requiring a comprehensive ICT policy that plays a crucial role, in particular, in the area of agriculture and rural development. While the potential advantages of ICT for development are enormous in developed countries, national policies of developing countries are yet to adequately reflect truly comprehensive and integrated strategies for harnessing and exploiting this potential. This paper tries to provide implication of ICT policy to the agriculture and rural development in developing countries, in particular through lessons learned from European Union (EU) IT policy. Through the examination of vital projects in the agriculture and rural development sectors and case study analysis of applied policies and strategies implemented in the European Union, this paper provides tangible examples and lessons for policy-makers and practitioners involved in the field. Hence, this study provides policy-makers the necessary tools, information and knowledge to facilitate the formulation and adoption of ICT policies and strategies in the agriculture and rural development sector.

**Key Words:** Agriculture, rural development, Information and Communication Technology, Millennium Development Goals, comprehensive ICT Policy

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## 1. Introduction

The debate on ICT has permanently shifted from ‘why’ ICT for Development, to ‘how’ comprehensive and holistic ICT policies can unleash human potential and enhance people’s capabilities to improve their lives. As a result, sound ICT policies that are truly pro-poor must be an indispensable part of national development strategies [1]. In this line of development strategies, ICT policy plays a crucial role, in particular, in the area of agriculture and rural development. While the potential advantages of ICT for Development are enormous, national policies of developing countries are yet to adequately reflect truly comprehensive and integrated strategies for harnessing and exploiting the potential of ICT. Hence, policy-makers and practitioners involved in ICT in developing countries requires thorough understanding the implication of ICT Policy to the agriculture and rural development. Specially, they need to incorporate the lessons learned from developed countries where they have successfully adopted these policies.

Therefore, in this study, we examine the vital projects in the agriculture and rural development sectors and analyze case study of applied policies and strategies implemented in the European Union. We also analyze European ICT strategic research agenda in the context of agriculture and rural development.

EU has widely recognized ICT as a key tool to raising productivity and stimulating innovation in rural areas and community development. The European Economic Recovery Plan (EERP) [3] highlights the importance of broadband communications for modern economies and aims to ensure that broadband is available to all Europeans by 2010. In this context, EU commission has proposed an additional funding of €1.0 billion to bridge the broadband gaps, which would allow rural areas to specifically address some of the problems they are confronted with as a consequence of the economic and financial crisis [4]. This

joint Communication of EU responds to the better access of rural areas to modern ICT, with special reference to high speed internet access [5] which adds to the policy debate on how rural development contributes to the Lisbon strategy and the Community ICT policy [6].

This study is designed to provide policy-makers the necessary tools, information and knowledge to facilitate the formulation and adoption of ICT policies and strategies in the agriculture and rural development sector. We do hope this study will positively contribute to assisting policymakers in moving forward on this agenda.

### 1.1. Policy Context

The role of rural development in enhancing ICT take-up in rural areas was recognized in the renewed Lisbon agenda [7]. In 2005, the i2010 strategic framework for modernizing and deploying the EU policy instruments to encourage the development of the information society up to 2010 was set in place. The European Agricultural Fund for Rural Development (EAFRD), the EU information society policy and EU the competition policy in a joint drive to bring broadband to all Europeans.

Rural development policy is the second pillar of the Common Agricultural Policy(CAP) and focuses on jobs, growth, the competitiveness and sustainability of agriculture, forestry, the food industry and rural areas; upgrading human capital; maintaining and enhancing the environment; quality of life and fighting climate change. Within this context, encouraging the take-up and diffusion of ICT for farmers, agri food and forestry as well as for rural areas in general and rural tourism are identified as key actions in the Community strategic guidelines for rural development [9]. Both the Structural Funds (SF) and the EAFRD support investments in ICT services, infrastructure, products and skills, with large spill-over

effects between and within territories. In the current period, most of the investment planned for the development of the information society in rural areas and less developed regions will support the development of e-services, with more limited investment in ICT infrastructure [10].

In the field of skills upgrading and training, the European Social Fund (ESF) and the EAFRD provide funding opportunities for people and entrepreneurs located in rural areas, with the EAFRD offering specific additional options for farmers, the food industry and forest managers. The 7th EU Research Programme (FP7) further stimulates research and the transfer of innovation in rural areas notably through the initiatives Regions of Knowledge and Research Potential where ICT is one of the core sectors. The strategic guidelines for rural development for 2007-2013 encourage synergy and complementarity between the rural development, employment and structural policies.

## 1.2. Action Plan

Communication on Bridging the broadband gap (2006) [11], the Commission identified the major reasons for the rural-urban broadband divide, such as low density of population, remoteness, lack of competition. Other socio-economic factors, such as low income and education, lack of access to new technologies, low quality of service, lack of applications with relevant content for rural and farm businesses, low awareness, or an ageing population, result in lower levels of adoption [12]. The existing urban-rural ICT gaps demonstrate the need for national and local administrations and institutions to invest in demand stimulation measures. Currently, the use of public services in the EU's thinly populated areas is more limited than in densely populated areas [13].

### Broadband infrastructure

The ongoing efforts to equip the EU's rural areas with modern ICT

connections including the use of new wireless and satellite-based technologies should continue and should be stepped up. In this context, the Commission, in its EERP has proposed an additional funding of €1.0 billion.

#### Farm businesses

Encouraging the take-up and diffusion of ICT in the agri-food sector as a whole, and for the agricultural business in general, is a key action in rural development. The lack of access to broadband reduces farmers' competitiveness considerably, restricts their options for applying better and innovative farm management, adjusting production patterns to current economic developments, controlling the volume and quality of production, and curtails their knowledge of markets and economic trends, agricultural research and development.

#### Small and medium-sized enterprises and micro-businesses

ICT could act as a catalyst for (small) farm and non-farm businesses, including food industry, to work together, to network and to grow, strengthening in this way their competitiveness. It could positively affect their work performance and labor productivity, and can help farmers fulfill their multi-functional role in rural areas. Economies of scale can be achieved and e-business, e-commerce and e-banking can be more easily carried out.

The promotion of ICT use in the food industry and the creation of infrastructure that to ensure the access of food processors to internet can become important growth factors for the sector leading to increased added value and a better integration between farmers and processors.

#### Young people, Women, Elderly and disadvantaged groups

Young people are one of the major drivers behind any ICT development in rural areas. More women in rural areas are becoming entrepreneurs and are getting involved in socioeconomic activities. Their access to labor markets has to be eased further, and one way of doing this is by providing them with high-speed internet access

and raising their digital literacy.

Farmers at the end of their careers, old people and disadvantaged groups in rural areas have specific needs, many of which could be addressed through the supply of accessible and relevant technologies and ICT applications. ICT could ease their access to public services, job opportunities and quality education.

#### Potential impacts of rural ICT projects

By providing rural areas with services, products and better infrastructure, a wide range of impacts and benefits could be achieved. However, existing environmental considerations or limitations have to be taken into account [16]. ICT projects can also have a strong positive impact if focused on adding value to local products or improving supply chain systems, precision farming, mapping and promotion of decentralized renewable energies such as bio-energy, preservation of the natural heritage, provision of public and business information, provision of data for specific users and for educational purposes, capacity building, etc. At the same time, there could be positive spillover effects leading to increased use of bio-energy, better access to training opportunities, development of employment guidance, effective delivery of public services, promotion of sustainable farming and last, but not least, transfer of innovation and promotion of good practices.

The EAFRD supports the development of ICT businesses, services, skills upgrading and broadband in rural areas in various ways [20]. Direct actions on ICT as a basic service for the rural economy and population include the development of e-health, health advice and medical care, business support, local public services, mobile or youth ICT centres, public internet/communication points, broadband infrastructure including wireless technologies, etc. Specific situation-driven actions cover, for example, IT equipment in small schools, transport services by telephone calls, security of rural inhabitants, tele-working or specific village ICT initiatives[21]

Farmers can further upgrade their IT equipment under the farm modernization measure. The creation of websites for marketing and e-booking, tourist web-portals and information centers will characterize the ICT actions linked to rural tourism. The creation of ICT based services, cooperation networking and cluster formation, e-commerce and e-marketing will be main targets for non-farm rural micro-enterprises and businesses. Farmers, foresters and food processors will have access to significant support for professional training in ICT and computer skills, e-learning, information activities using ICT or area-specific actions such as networking, demonstration projects or distance learning. The use of ICT for the environment is represented by forest fire tele-detection and monitoring systems, communication equipment (e.g. for prevention of forest fires) and networking. Leader actions could cover a wide range of ICT investments in rural areas such as innovative communication technologies in addressing tourism, productive sectors, the environment and cultural assets in the fields of transnational and inter-territorial cooperation, training and access to the internet.

## 2.0 ICT projects in Rural Areas

Standing Committee on Agricultural Research (ICT-AGRI and RURAGRI), which are focusing their activities on the coordination of national research programmes, including ICT applications in agriculture and in rural areas. ICT projects in Europe's rural areas focus on (i) equipment to access the internet, (ii) content, covering what people look at and use on the internet, including the services which encourage them to go on line, and (iii) developing new skills to access the internet [17].

### Community financial support

Public funds including EU funds can help to bridge the investment gap in ICT access infrastructure, on-line services and other promotional measures supporting demand in rural areas, including mountains and islands.

### Support from national and regional authorities

Various forms of national and regional support have raised the sustainability and success of ICT projects in rural areas in recent years. Whether financial or legal support has been given or governments and local authorities have kick started the projects, benefits for rural agricultural, food and non-farm businesses as well as the rural population have been created.

### Involvement and cooperation of local actors

Involvement of the local population is needed for projects to achieve sustainability.

### Understanding and reacting to new business opportunities and needs

Globalization and the internet have created intensive business competition for markets and clients. To sustain their business, rural entrepreneurs have to react adequately and exploit the advantages of ICT.

Understanding what potential users want, and in what form, could substantially raise the take-up and provide correct responses to existing demand in rural areas. The creation of greater ownership of a project, which may even imply involvement of the community in its management, could ensure greater take-up, higher efficiency of the investment and continuation of the activity after initial funding has ended.

### Promotion of good ICT practices for rural areas

The exchange of good practices helps the promotion and development of innovative products and services, creates value-added in the development of strategies, improves knowledge and shows how the correct use of the assets can turn into valuable and positive outcomes.

The development of ICT in rural areas requires a strong strategic approach with complementarily and synergies between Community, national and regional funds and policies, all contributing to rural development. Reaffirms the 2010 “broadband for all” objective as set

out in the context of the EERP and recalls that 30% of the EU's rural population [25] is currently excluded from broadband access. This should include actions increasing local and backhaul access to an affordable ICT infrastructure and access to as well as development of on-line services and relevant content for rural farming and non-farming businesses.

#### Fund/Budget

ICT actions in rural development are embedded into several measures, where also non-ICT related actions will take place [22]. In total, for basic services for the rural population the EAFRD will spend €2.7 billion. Another €4.9 billion will be spent on farm diversification, creation of non-farm micro-enterprises and rural tourism. Training and information actions under the EAFRD (including those on e-skills) account for €1.2 billion in total.

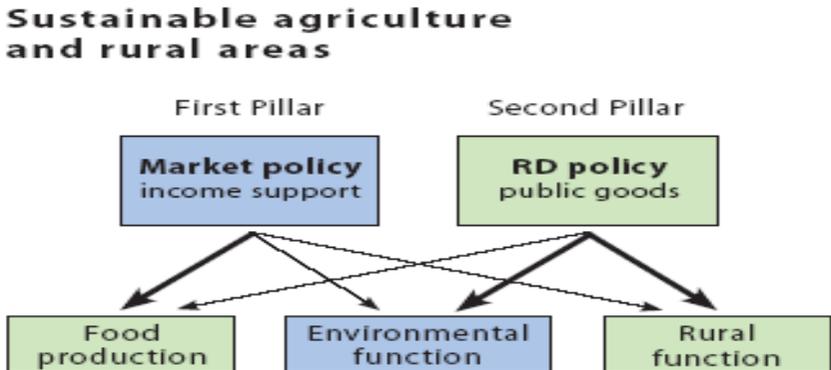
Additional money for ICT projects could be spent under Leader and/or within other rural development measures. A good share of technical assistance funds in RDPs are dedicated to investments in hardware and software in public administration to offer on-line services and consultations to (potential) applicants.

The Common Monitoring and Evaluation Framework (CMEF) for rural development 2007-2013 provides a solid basis for targeting, monitoring and evaluating the situation in rural areas with respect to many indicators, including ICT related.

In the current programming period, Cohesion Policy funds will continue to support the ICT development, including in rural areas. Approximately €15.3 billion (4.4% of the total Cohesion budget) will be directly invested in ICT priorities, including e-public services and broadband infrastructure.

The European Social Fund (ESF) will invest considerably in e-skills in the framework of different strategic priorities such as life-long learning, workforce adaptability and training for unemployed persons, including those in rural areas.

### 3. IT policy for agro-product safety, traceability, SCM, RFID, ICT and robotics and environment:



〈Figure 1〉 Sustainable agriculture and rural areas areas

(Source : EU Director-General for Agriculture and Rural Development, EU Rural Development Policy 2007-2013, Fact Sheet, Luxemburg, 2006, p.5.)

#### 3.1. New rural policy set in 2005 for 2007-2013

New policy set in 2005 for 2007-2013 contains the following agenda: -improving the competitiveness of agriculture and forestry; -supporting land management and improving the environment; -improving the quality of life and encouraging diversification of economic activities ; -building local capacity for employment and diversification.

New EU policies on traceability, food safety, agri-environmental and rural development have renewed the interest in ICT and robotics research as a solution to an efficient implementation of these policies (Danish proposal for a SCAR Collaborative Working Group). The policies are reflected in a demand by European agriculture and related industries, for technological solutions that accommodate the demands

and provide competitive advantages in a market with increased consumer demands and environmental focus.

### 3.2. Traceability

The EU has implemented strict rules on ‘traceability’, whereby animals must be identifiable and all foodstuffs, animal feed and feed ingredients can be traced through the food chain (European Commission 2004) [19]. From Farm to Fork: Safe Food for Europe’s Consumers, Directorate–General for Communication, European Commission, 2005 [20]



⟨Figure 2⟩ Expected evolution of the traceability concept

### 3.3. ICT and Robotics in Agriculture in the EU

The European 7th research framework programme starts 1st of January 2007 and has 7 years duration. The total budget of the framework is at present € 73,215,000,000. There are 4 specific programmes: Cooperation, Ideas, People and Capacities.

To increase the coordination within agricultural research in Europe by strengthening networking and collaboration as well as to influence the future FP7 to enhance future project possibilities several organisations and the Standing Committee for Agricultural Research (SCAR) was established on the coordination of agricultural research.

The working group of SCAR has from national priority areas for collaboration proposed 11 themes for collaborative working groups (CWGs). The CWG for ICT and Robotics in Agriculture and related industries,

### 3.4. Innovative ICT and robotics

Innovative ICT and robotics are preconditions to achieve competitive European agriculture and food production without subsidies; to improve the quality and traceability of food, feed and bio-energy from farm-to-fork; and for entrepreneurship and related business in rural areas in EU. Innovative ICT and robotics can solve hard and monotonous repeated work; minimise negative effect of agriculture and food industries on the surrounding environment; support standard prescription regarding food safety, animal welfare, and environmental efficient technologies.

The research agenda are included 1) Automated Agriculture Machinery, 2) Precision Agriculture, 3) Precision Livestock Farming, 4) Environmental Monitoring of Agriculture, 5) Agricultural Information, Communication and Management Systems, and 6) Agricultural Product Quality Sensing and Documentation.

## 4. Strategic Research Agenda for Agri-food & Rural development: A vision for 2015

In April 2,005, under the FP7 of the European Commission<sup>14</sup> organisations from 15 different countries initiated the AMI@Netfood project (application of Ambient Intelligence technologies to the agri-food domain). The objective of this project was ‘to support the implementation of the Information Society Technologies (IST) Research

Priority and Framework Programme, providing a long-term vision of future trends in Scientific and Technology Research oriented to the development and application of Information Society technologies to the agri-food industry and rural development.

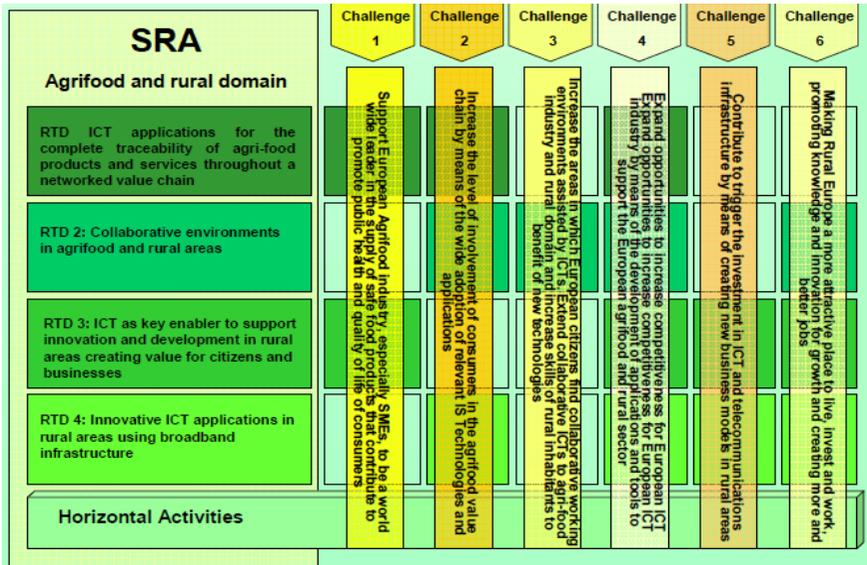
The AMI@Netfood working groups have identified the key issues which should be addressed in the application of ICT in agri-food and rural domains are: (a) Traceability of products & services, (b) Collaborative working environments, (c) Innovation & development in rural areas, (d) ICT applications & infrastructure.

#### 4.1 Strategic Research Agenda

Strategic Research Agenda of AMI@Netfood supports sustainable rural and regional development to improve competitiveness at a pan-European level. These agenda includes i) Improve the level of consumer confidence in food manufacturing in Europe, ii) Support coordination between key policy makers throughout Europe, iii) Contribute to sustainable rural development throughout Europe, iv) Promote the 'fork to farm' approach to add value to the food chain, giving producers a better understanding of consumer requirements by integrating their demands (particularly in reference to quality and safety) at each level of the supply chain.

In addition, the European Strategic Research Agenda will i) Provide an effective and sustained interaction between all stakeholders, ii) Present a well-defined Strategic Research Agenda (SRA) for innovative food production and rural development, iii) Offer a set of Pilot joint activities to promote the participation of key stakeholders throughout Europe for the future development of rural agricultural areas and key agri-food industry, iv) Ensure increased participation of rural residents in agricultural working life through innovations in collaborative technologies, v) Ensure increased confidence in the food

supply among European consumers.



〈Figure 3〉 Vision for the European Strategic Research Agenda for the year 2015 [21]

## 5. Discussion

There are huge gap between developed and developing countries in terms of ICT diffusion and usage. These brings the key challenges to the application of Information and Communication Technologies to the agriculture development, agri-food business and rural development domains in developing countries.

Developed country's challenge 1: Support the European agriculture development, Agri-food industry, especially SMEs, to be the worldwide leader in the supply of safe food products that promote public health and quality of life of consumers.

Lessons for developing countries 1: Most developing countries are agri-dependent. They should support SMEs in exploring safe food

products.

Developed country's challenge 2: Increase the level of involvement of consumers in the agri-food value chain by means of the wide adoption of relevant IC Technologies and applications.

Lessons for developing countries 2: Developing countries should take the similar step starting with pilot projects.

Developed country's challenge 3: Increase the areas in which European citizens find collaborative working environments assisted by ICTs. Extend collaborative ICTs to the agri-food industry and rural domain and increase the skills of rural inhabitants to enable them to reap the benefit of new technologies.

Lessons for developing countries 3: Developing countries should increase ICT awareness plan as well as training programs.

Developed country's challenge 4: Expand opportunities to increase competitiveness for the European ICT industry by developing applications and tools to support the European agri-food and rural sectors.

Lessons for developing countries 4: Developing countries should increase R&D budget for developing various applications and tools understanding the rural people needs

Developed country's challenge 5: Push forward investment in ICT and telecommunications infrastructure by creating new business models in rural areas.

Lessons for developing countries 5: Developing countries should also push forward investment in ICT and telecommunications infrastructure by creating new business models in rural areas based on rural people needs.

Developed country's challenge 6: Make Rural Europe a more attractive place in which to live, invest and work, promoting knowledge and innovation for growth and creating more and better jobs.

Lessons for developing countries 6: Developing countries should also

make rural area for better life through ICT development.

In order to meet these challenges a number of RTD areas were identified and drawn up in developed countries. Developing countries should follow the RTD steps like developed countries. RTD priority programmes adequately succeed in the accomplishment of selected long-term challenges, from the perspective of Information Society Technologies (IST), several RTD activities need to be further developed. Among a number of potential activities discussed among the AMI@Netfood constituency, and lately redefined during validation activities, four specific RTD domains have been selected as the most appropriate to be developed in support to the sector.

ICT applications for the complete traceability of products and services throughout a networked value chain in RTD 1. Research topics will include the following: i) Network collaboration under where technologies that will improve interaction and collaboration between the key nodes on the supply network; Agent based technologies that will distribute and customize the key pieces of information required for complete traceability of products and services; Knowledge sharing and storage technologies for networking in the agri-food industry; Semantic web-based schemas to promote the extraction and comprehension of key information stores. ii) Manufacturing under where technology to improve the efficiency and effectiveness of doing business in a networked environment; Real-time communication methods and technologies throughout the network; and Integrated production networks.

Collaborative working environments for Innovation in agri-food industry and rural domain fall under the RTD 2. Research topics will include the following: i) Integration of Vertical and Horizontal Communities where activity oriented services for collaboration among teams in the agri-food industry and (ad-hoc) groups in rural areas; 'Farm-to-Fork' virtualization-by virtual models and the 'internet of Things' for agri-food industry and rural areas; Open reference

architecture for collaborative working in agri–food and rural domains; Adaptation of available security models to the agri–food and rural domains; Horizontal Communities for Rural Areas: i) Context–sensitive collaboration services for rural domains; and ii) Proactive services to support creativity in rural areas.

ICT as key enabler to support innovation and sustainable development in rural areas creating value for citizens and businesses fall in RTD 3. Research topics will include the following: i) Rural Living where technologies that will improve the level of interaction and collaboration between inhabitants in a rural setting; Technologies that will specifically improve the quality of life in a particular region; New business models to support rural business; and Technologies that will support sustainable management and sustainable environmental resources. ii) Rural Optimisation Applications where Support small business in the rural area; and Aid governments through e–Government initiatives to improve the level of collaboration between citizens and governments.

Innovative ICT applications in rural areas using broadband infrastructure fall in RTD 3. Research topics will include the following: Technology Infrastructure where technologies that will improve the level of knowledge and skills in the rural domain; Technology that will improve the level of service provided in the area of e–Health, e–Government and eLearning for the rural domain; Technologies that will improve the level of business–to–business and business–to consumer in the agri–food domain; Technologies that will realize the advantages of technology in the rural domain through the use of broadband technologies; and Mobile technologies to improve the level of application deployment in all aspects of the agricultural and rural working environment. iii) Technology Transfer where technologies to support multi–modal and multi–lingual interfaces would also be provided; and Middleware technologies to be developed to enable the realization of technology in the rural setting.

## 6. Conclusion

Through the examination of vital projects in the agriculture and rural development sectors and case study analysis of applied policies and strategies implemented in the European Union, we provided tangible examples and lessons for policy-makers and practitioners involved in the field. Hence, this study provided policy-makers the necessary tools, information and knowledge to facilitate the formulation and adoption of ICT policies and strategies in the agriculture and rural development sector. Specially, they should incorporate the lessons learned from developed countries where they have successfully adopted these policies. We also provided some ICT strategic research agenda for developing countries in comparison European ICT strategic research agenda in the context of agriculture and rural development. Finally, this study has provided policy-makers the necessary tools, information and knowledge to facilitate the formulation and adoption of ICT policies and strategies in the agriculture and rural development sector. We do hope this study will positively contribute to assisting policymakers in moving forward on this agenda.

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