

How RTOs innovate innovation—Review on the 23rd WAITRO biennial congress and general assembly

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Abstract. The paper attempts to summarize the theoretical and practical achievements about RTOs on the 23rd WAITRO Biennial Congress and General Assembly and answer the following questions: What is the challenge of RTOs in today's world? How does WAITRO achieve innovation? What is the management model of WAITRO? How does RTOs succeed in the future?

Key words. WAITRO, RTOs, Innovation Best practices.

1. Introduction to RTOs in WAITRO

The World Association of Industrial and Technological Research Organizations (WAITRO) is an independent, non-governmental and not-for-profit association established in 1970 to promote and encourage co-operation among industrial and technological research and development organizations (RTOs). It was founded under the auspices of the United Nations system and has consultative status with many of its specialized agencies. The Association currently has 157 members in 74 countries and co-operates with over 500 other institutes and international agencies worldwide. WAITRO aims to be an enabler for developing action oriented partnerships among member organizations for sustainable development and also assists in technological capability building in member institutes in the developing countries. In order to promote the use of best practices in RTO management, WAITRO over four years

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developed the requisite best practice tools that have proven so successful in private industry. WAITRO has conducted extensive research into management practices of more than 60 RTOs as well as other organizations that support RTOs, in 31 countries and come up with a much deeper understanding of why some RTOs are successful while others are not.

The WAITRO methodology for deriving best practices combines two approaches: case studies, which involve investigating, understanding and describing the context of an organization's practices, and benchmarking, which defines processes, practices and performance indicators for measuring which practices are the most successful in meeting the RTO's objectives. Using relevant performance indicators, all the practices identified within the RTO are then labelled as "best practice" (first choice), "good practice" (acceptable alternative), or "bad practice" (to be avoided). The tools developed in WAITRO have targeted RTOs that provide technical and business extension services, testing facilities, problem-solving services and research and development assistance to industry, especially those in the small and medium-sized enterprise (SME) sector.

The 23rd WAITRO Biennial Congress and General Assembly is held in Medellin, Colombia in September 28th-30th and 180 members and non-members from 70 countries around the world participate in the congress, in which 12 keynote speakers from UNESCO, UNIDO, ECOSOC, IADB, CAF, TNO-Netherlands Organization for applied Scientific Research, DTI-Danish Institute of Technology, British Columbia Research, WAITRO, Colombian governmental authorities, CIDET-Center for Research & Technological Development of the power industry and etc. share deep knowledge in important areas to industry, public officials and RTOs, debate RTOs and sustainable development, public-private partnerships and inclusive innovation with all participants, and explore and indicate the challenges RTOs confront and the ways to solve the societal challenges through science and technology in innovative economy in the future. Furthermore, several discussion panels including CEOs of RTOs and R&D Units with invitation from congress sponsors, and normal attendees thoroughly discuss some important issues covering *Innovation: fueled by Government or Firms? What are the challenges that RTOs are facing to be the key instrument for the innovation PPPs considering current necessities of industry and society? Key Elements for an Effective innovation policy. And Management of RTO and R&D Units.*

2. Technological innovation in RTOs

Innovation has been considered as the major factor for strengthening competitiveness of organizations and gaining new opportunity of the new market (Yang *et al.* 2015). Accordingly, innovation process includes technological development of an invention, merged with market introduction to end-users via adoption and diffusion; it also should occur iteratively meaning that after first introduction of the innovation, improved innovation should be reintroduced (Garcia, Calantone 2002). The most important aspect in regard with needs of organizations is to understand that how they can develop or assess their capability to build up technology innovation.

In order to reach the goal, Technological Innovation Capability or TIC is the target concept which should be studied and TIC should be understood especially by those organizations involved in technology and research such as research and technology organizations (RTOs).

2.1. The definition of RTOs and the role of RTOs in the development of SMEs

According to European Association of Research and Technology Organization (EARTO), RTOs are generally a kind of non-profit organizations, which are generally classified as organizations providing R&D, technology and innovation services to enterprises, governments (EARTO, 2010). Now that the core mission of Research and Technology organization is to harness science and technology in the service of innovation, to improve quality of life and build economic competitiveness (EARTO, 2015), then what is the implication of technological innovation and RTOs and how do RTOs achieve innovation? Technological innovation is an iterative process started by apprehension of a new market or a new service opportunity resulting in development, production, and marketing tasks in order to catch commercial success (OECD 1991). In the presentation of Alejandra Botero, the principal officer of public policy and competitiveness in Development Bank of Latin American, the objective of innovation is to improve firm performance, for example by increasing demand or reducing costs and Mrs. Alejandra Botero divides innovation into two parts, i.e. invention and commercialization and also introduces PPP (public-Private-Partnership) regulation in RTOs in Latin America in recent years, regarding PPP as an efficient way to innovate innovation. PPP is a long-term contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility, and remuneration is linked to the cashflow generated by the project, in which contract underlines everything.

Small and medium enterprises (SMEs) have been recognized as critical in the economic and social development of most countries. They are especially important for their role in job creation with low investment, regional development, as suppliers to large companies, entrepreneurship development, and, in case of new technology-based firms, innovation of new products and processes. Although most governments have undertaken special schemes to develop and strengthen SMEs, the situation has escalated in recent years as governments have, for a variety of reasons reduced funding to SMEs. Over the years it has become obvious that the key impediment to successful RTO performance is often not technology but management. Against this background, WAITRO identified a tremendous opportunity to assist its members to improve their capabilities serve industry assembling a body of knowledge that would provide their management systems.

2.2. The context of RTOs and the evolution of innovation in RTOs.

When discussing *the future of RTOs in the innovation economy* proposed by Jos Leijten, Senior advisor of Join Institute for innovation Policy (JIIP) in Netherlands,

he states that in today's world, human being is involving in three megatrends: globalization, demographic change, and accelerating technology. As the world gets more inter-connected, and economic competition expands, the way we learn, discover and innovate will change. The impact will hit home faster and faster. Meanwhile, the move to cities, the aging population, the shifts family size and social norms—all will change what we expect and can do in education, research and innovation. And most of all, each invention, coming faster and faster, changes not only our society and economy, but also the way we work in education, science and business. So, as a RTO manager, you must consider how business R&D will develop, how university research is developing, what will be your key focus areas and how you build these, and whether you can help build new business opportunities.

There has been a significant shift in the understanding of the relationships between industrial research, innovation and development. In the old industrial Science and Technology (S&T) model, the focus in the context of development was on technology transfer and imitation—imitation to some extent as the opposite of innovation. In the new model, every innovation now appears unique with respect to its application, which is supported by value chain changed in a smiling curve as shown in Figure 1, which demands innovators to put more emphasis on R&D, design, marketing and services and less on logistics and production.

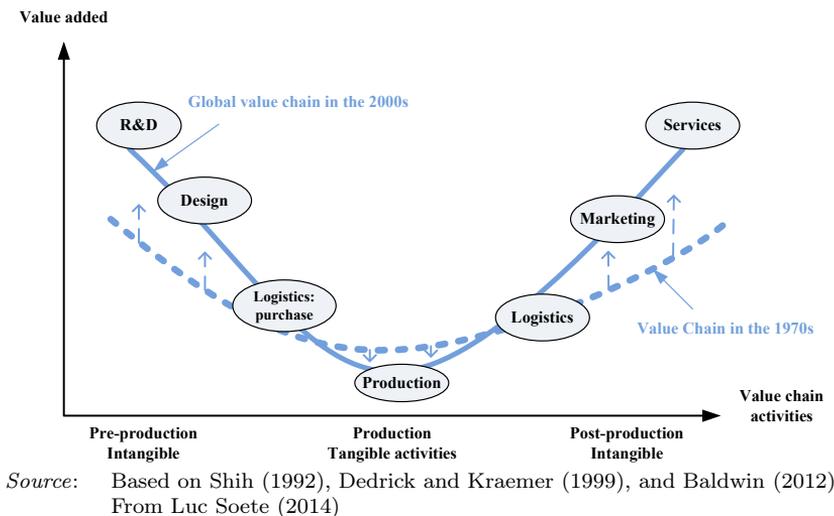


Fig. 1. Value chain changes into smiling curve: the difference between the 1970s and the 2000s.

Studies on innovation systems can consider different levels of analysis: at micro-level is considered the specific company and its bonds, at meso-level are considered sectoral or industrial clusters, while at macro-level is considered the economy of the whole system. Asectoral innovation system, in particular, is composed of a collection of heterogeneous agents, linked to market relations and not to be built, the adoption and use of technologies and for the creation and use of production sector products. The main actors of an innovation system are represented by firms, public research

institutions (PRI) and governative institutions that define the set of rules and laws that govern the interactions between them (OECD and Eurostat, 2005). During the conference, Bernardo Calzadilla Sarmiento, the director of trade capacity building branch in UNIDO, delivers an address on RTOs and sustainable development and maps the exhibit about the innovation system, indicating how the innovation system works (Figure 2). So in the innovation system, RTOs should facilitate access to international markets and enhance industrial competitiveness of SMEs by fostering an efficient innovation system, focusing on standard for innovation and methodologies for developing innovation indicators, executing technology foresight and open innovation initiatives.

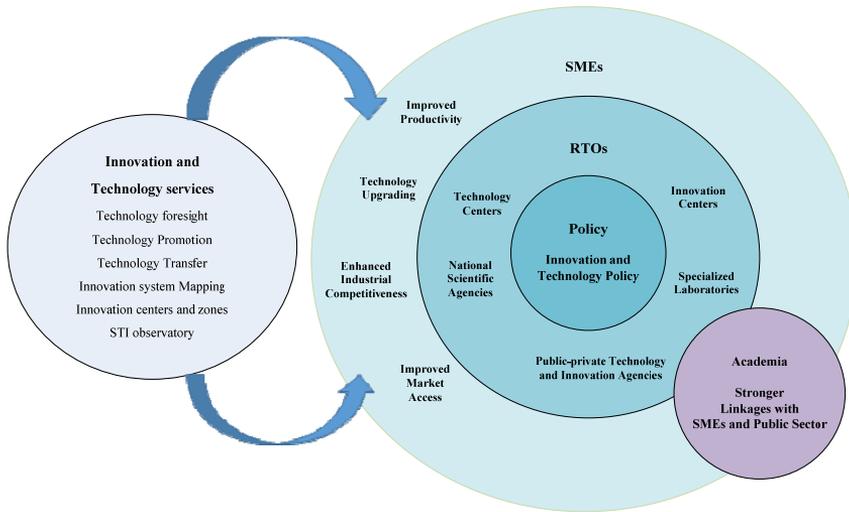


Fig. 2. Innovation system from 2016 UNIDO

Above all, RTOs and SMEs have been faced with new challenges of funding, technology and management in recent years. In order to solve these issues RTOs have to experience reorganization to be able to serve the needs of SMEs more effectively. Under the severe situation, WAITRO launched an international collaborative research project with the objective of identifying, benchmarking, and documenting successful RTO practices (best practices and underlying principles) and assisting RTOs in the implementation of these principles and practices so that they can serve their clients better,

3. Best practices for the management of RTOs from WAITRO

As mentioned in the first part, WAITRO applies the two approaches of case studies and benchmarking to learn from successful stories in order to meet the challenge of the changing world. Then what is benchmarking and how to put it into effect to help RTOs transform successfully? In this part, some critical concepts and model

will answer the questions.

3.1. The objective and concept of best practices

In the context of internationalization, globalization, demographic change, and accelerating technology, the realization that change is essential and that it must happen immediately, is not sufficient. The RTO must know what to change and how to change. There are so many factors involved in the successful management of an RTO that it becomes difficult to know which aspects need to be changed, and which aspects need to be left as they are. This is where the application of the principle of “best practice” becomes useful. Simply defined, best practices are tools for improving organizational performance. They help organizations to focus on the four “Cs”: change, competitiveness, costs, and clients (Figure 3). To accomplish the objective, WAITRO has relied on the extensive experiences of many of its members, both as consultants and as objects of its project. Special mention is made here of the RTOs that provided the project team: Danish Technological Institute (DTI), the National Institute of Science Technology and Development Studies (NISTADS) of India, and the Saskatchewan Research Council (SRC) of Canada. WAITRO also acknowledges with great appreciation the financial backing to this project from Canada’s International Development Research Center (IDRC) and the Danish international Development Assistance (DANIDA). With the financial support of DANIDA and IDRC, WAITRO assembled an international project team consisting of expert from Denmark, Canada and India. SRC studied 20 RTOs in the Americas, the DTI studied 20 RTOs in Europe and Africa, while NISTADS of India investigated 20 RTOs in Asia.

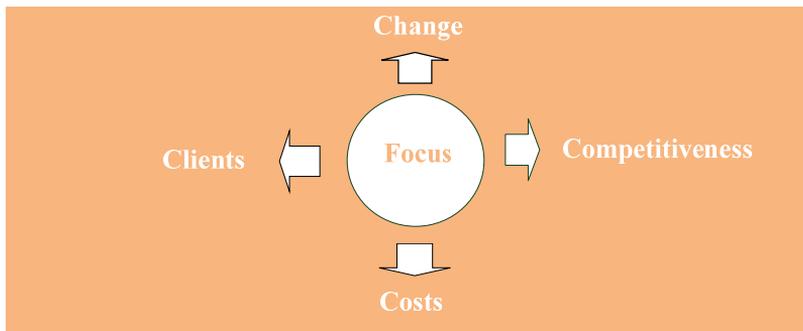


Fig. 3. Focusing on best practices

Studies of RTO mentioned above in European Union, the Americas, Africa and Asia real a great deal of consensus regarding their underlying business principles and the practices used in their daily interaction with client enterprises. A number of RTOs within the European Union have developed network for the exchange of business principles and best practices of their daily operation as a means for strengthening management capabilities. WAITRO sees the potential to build on this approach through the use of “Benchmarking” to establish which of the variety of practices could be considered as “best practices”. Benchmarking is defined

as “the process of continuously measuring and comparing an organization, product or process against leaders anywhere in the world to gain information, which will help the organization take action to improve its performance. Benchmarking is a powerful tool that has been used to assist many companies to improve to meet the ever-changing demands being placed on them by their competitive environment, being aimed directly at increasing operative and strategic efficiency, and leading to learning, skill enhancement and efficiency which in turn leads to development.

3.2. Conceptual model of an RTO

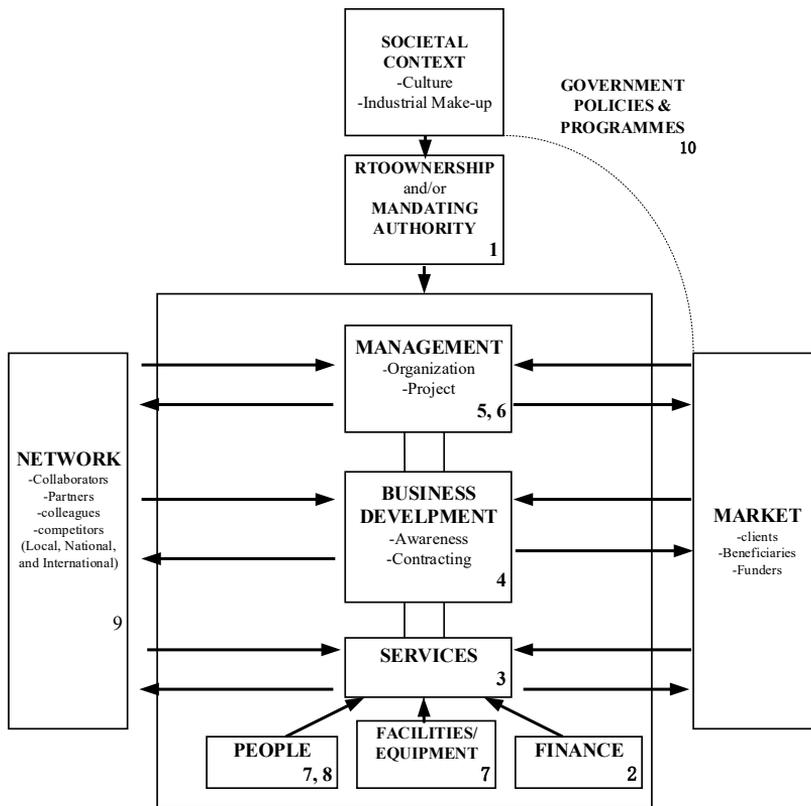


Fig. 4. Conceptual model of an RTO from WAITRO

RTOs exist in different contexts and are established for a wide variety of purposes. In order to establish a common understanding of the basic, structure and functions of an RTO the project team develops a systematic methodology that categorized the management operations of an RTO into major process areas. The processes are further divided into sub-processes, which provides the basis for deriving the daily operational practices used by the RTO to fulfill its functions. The schematic representation of an RTO, shown in Figure 4, manifests that an RTO is created

from the desire of a society or political unit to address the technological needs of its industry. The primary objective of this model is to identify the practices employed by the RTO for managing and operating each process area. To accomplish this a list of 57 sub-processes are derived from the main process areas and the objective of each sub-process is used to evaluate its effectiveness, which is called performance indicator. Using the performance indicators established for the process, the project team is able to rank the practices from the most effective (best) to the least effective (worst) practice for each process.

3.3. WAITRO 2016 best practices

In line with WAITRO's objective of enabling the development of action-oriented partnerships for sustainable development, the WAITRO Executive Board has created the "WAITRO Innovation Award 2016", presenting the award to the Foundation Institute for the Plastic and Rubber Research and Training (ICIPC by its Spanish acronym) and the Antioquia Center of Science and Technology (CTA). ICIPC, based in Medellin-Colombia, is a non-profit organization oriented towards the needs of innovation and high added-value services in material science and polymer processing and production for national and international companies and institutions. Its creation is the result of the collective efforts of the Colombian private sector (Industry-University) and the German government, having 18 businesses from the plastics sector as its strategic alliances. Its mission is to turn knowledge into wealth and it aims to grow integrally by 50 % generating benefits for the Institute, through national and international consolidation of its technological value-added services and certified quality standards, to generate and apply knowledge, retain core talents and create new strategic alliances that contribute to sustain its growth and autonomy. Similarly, CTA, a model example of PPP in Colombia and Latin America in the management and appropriation of science, technology and innovation recognized for providing useful, comprehensive, sustainable and innovative solutions that bring value to organizations and territories involved, and welfare to society. CTA focuses education, water and environment and productivity with 21,214 people being the direct beneficiaries in 2015, including children and youth, entrepreneurs, employees and employers, and people from the community.

4. A Look at the future of RTOs

Facing with the impact of globalization and its consequences of open economies, highly competitive market place, and the trans-national flows of expertise, technologies and services, Raghunath Mashelkar, president of global research alliance, proposes the objective of inclusive innovation, i.e., Getting more (performance), From less (resource), and For more (people), argues how PPPs accelerate inclusive innovation through shared risk, skills, assets, reward, investment and responsibilities. In addition, Jos Leijten from JIIP suggests five methods for RTOs to develop themselves: business connections, university connections, focusing on scale and scope, developing the vision on talents, and longer term commitment.

Apart from the concept model of management above, WAITRO also provides a tremendous source of knowledge that can be used to guide an RTO to achieve transformation process which can be divided into three phases, namely, diagnosis, planning, and implementation. Although some RTOs try to manage the process with internal teams, the best results are obtained by engaging external consultants to drive the process. Most important of all, WAITRO has already established some projects to welcome RTOs to engage in and begin the change process, such as, RTO management training programme, development of RTO-SME collaborative projects and technological capability building. All in all, RTOs should change not only because the directors feel the urge to change or they are even permitted by the government to do so, but also they are equipped with means, that is, the skills, training and the institutional support, as well as the motivation, incentives and subsidies to change.

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