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# Evolution and efficacy of transfer of technologies in small ruminant production systems in North Africa

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**Abstract.** Livestock sector is important to the economy of North African countries. Sheep production is considered as the most important livestock subsector especially for its large population all over the region, and as it is an important source of income for rural and vulnerable communities. However, and due to the climate conditions and the traditional livestock systems, the region could not reach its sufficiency on livestock products. Improving sheep production systems has to focus not only on the public sector but also on the research sector and professional organizations (producers needs and limitations,...). Professional organization contributes to the livelihood improvement, to the producers' awareness through training and extension, to ensure the food security in local and vulnerable communities which will contribute to the development of the sector. In North African countries, research on small ruminant is active despite the lack of resources. The main topics of research are genetics, feeding, rangelands and production systems. The related research findings have contributed to an important improvement of the productivity of small ruminants. However, research on animal health, socioeconomics and valorization of small ruminant products are still weak.

The main gap is the weak linkages between research, national development institutions and producers. Research programmes should be based on producers constraints and results should benefit to improve their productivity through efficient extension programmes. In North African countries, extension is mainly provided by Government technicians with very limited resources. Efficacy of transfer of technologies in sheep production is conditioned by the establishment and implementation of an effective national small ruminant council that includes representatives of the Ministry of Agriculture, Research/Extension institutions and Producers' Associations.

In this regard, FAO supported the creation of small ruminants' producers' association union in the Maghreb region, which will collaborate with the public sector for the development of the production systems, valorization of livestock products and agricultural production chain (production, processing, marketing, quality control and logistics).

In order to improve linkages between research, extension and producers, FAO has developed the Virtual Extension, Research and Communication Network (VERCON). VERCON provides a powerful tool for establishing and strengthening linkages among and within the human and institutional elements of agricultural research and extension systems. The VERCON's innovative nature is its capability to evolve into an effective communication system and serve as a basis for Rural and Agricultural Development Communication Network (RADCON) which is the second generation of Vercon.

The objective of this paper is to highlight the potential role of modern Information and Communication Technologies (ICTs) to induce evolution and efficacy of technology transfer in sheep production in North Africa.

**Keywords.** Agricultural extension – ICTs – North Africa – Producers' associations – Research – Small ruminants.

## ***Evolution et efficacité du transfert de technologies dans les systèmes de production de petits ruminants du Nord de l'Afrique***

**Résumé.** L'élevage est un secteur important pour l'économie des pays d'Afrique du Nord. La production ovine est considérée comme le sous-secteur le plus important de l'élevage, en raison notamment de sa vaste population sur toute la région, et de l'importante source de revenu qu'il constitue pour les communautés rurales et vulnérables. Toutefois, dû aux conditions climatiques et aux systèmes traditionnels de production animale, la région n'a pas pu atteindre l'autosuffisance pour les produits de l'élevage.

*L'amélioration des systèmes de production ovine doit être axée non seulement sur le secteur public mais aussi sur la recherche et les organisations professionnelles (besoins et limitations des producteurs, etc.). L'organisation de la profession contribue à améliorer les moyens d'existence et la prise de conscience des producteurs à travers la formation et la vulgarisation, en vue d'assurer la sécurité alimentaire pour les communautés locales et vulnérables qui contribueront au développement du secteur.*

*Dans les pays d'Afrique du Nord, la recherche concernant les petits ruminants est active malgré le manque de ressources. Les principaux thèmes de recherche sont la génétique, l'alimentation, les zones de parcours et les systèmes de production. Les résultats des recherches dans ce domaine ont contribué à améliorer fortement la productivité des petits ruminants. Cependant, la recherche en matière de santé animale, de socio-économie et de valorisation des produits des petits ruminants est encore faible.*

*La principale lacune est le faible lien entre la recherche, les institutions nationales de développement et les producteurs. Les programmes de recherche devraient être basés sur les contraintes des producteurs, et les résultats devraient être mis à profit pour améliorer leur productivité à travers des programmes efficaces de vulgarisation. Dans les pays d'Afrique du Nord, la vulgarisation est principalement mise en place par les techniciens du gouvernement avec des ressources très limitées. L'efficacité du transfert de technologies en matière de production ovine est conditionnée par la création et la mise en place d'un Conseil national sur les petits ruminants, qui soit efficace et comporte des représentants du Ministère de l'Agriculture, des institutions de recherche et de vulgarisation et des associations de producteurs.*

*Dans ce sens, la FAO a soutenu la création d'une union des associations de producteurs de petits ruminants dans la région du Maghreb, qui collaborera avec le secteur public pour le développement des systèmes de production, la valorisation des produits animaux et la chaîne de production agricole (production, transformation, marketing, contrôle de qualité et logistique).*

*Afin d'améliorer le lien entre la recherche, la vulgarisation et les producteurs, la FAO a développé un Réseau de vulgarisation, de recherche et de communication virtuelles (Virtual Extension, Research and Communication Network – VERCON). VERCON constitue un outil puissant pour établir et renforcer les liens inter et intra-éléments humains et institutionnels de la recherche agronomique et des systèmes de vulgarisation. La nature innovante de VERCON et sa capacité d'évolution en un système efficace de communication lui permettra de servir de base au Réseau de communication et de développement rural et agricole (Rural and Agricultural Development Communication Network – RADCON) qui est la deuxième génération de VERCON.*

*L'objectif de cet article est de mettre en lumière le rôle potentiel des Technologies modernes de l'Information et de la Communication (TIC) pour induire l'évolution et l'efficacité du transfert de technologie en matière de production ovine en Afrique du Nord.*

**Most-clés.** *Afrique du nord – Associations de producteurs – Petits ruminants – Recherche – TIC's – Vulgarisation agricole.*

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## I – Introduction

The North Africa region has a special location; it is situated in a point linking the three Continents of Asia, Africa and Europe. It's characterized by medium population growth, low and erratic rainfall, limited areas of arable land and limited water resources for irrigation. Climates vary from Mediterranean to monsoonal and from temperate to tropical. All its countries (Mauritania, Morocco, Algeria, Tunisia and Libya) are classified as developing countries and characterized by a large varied economy based on oil in some countries and on agriculture and services in others. The arid and semi-arid zones, liable to frequent droughts, represent 80% of the total land surface and employ 60% of the population. Most of these lands is used for grazing and animal production.

The livestock sector plays an important role in the North African economics, especially sheep, goats and cattle which account for 25-80 percent of the value of agriculture output in the region.

Livestock owners in the North Africa struggle not only against natural physical and environmental conditions but also against adverse political and economic setup. The livestock sector is char-

acterized by a growing dichotomy between (i) livestock kept by large numbers of smallholders and pastoralists in support of livelihoods and rural food security, and (ii) intensive commercial livestock production, supporting the global food supply system and providing employment to producers and others in associated processing, distribution, marketing and support services. While traditional livestock systems contribute to the livelihoods of 70% of the world's rural poor, increasing numbers of large-scale operations with sophisticated technology, based on internationally sourced feed and animal genetics, cater for the rapidly growing markets for meat, milk and eggs. This trend is also observed in North Africa.

Despite the existence of large number of animals in the region, many of its countries are still depending on the import of animals and animal products to meet their food needs; and inter trade among region's countries are still weak. The average per capita share from animal proteins in the food supply is very low and its growth rate is lower than the demand of the population. The gap between production and demand is becoming wider and imports are already considerable for some countries.

Sheep and goats contribute significantly to the livelihoods, self-employment and food security of the rural poor. However, because of instability of resources and inputs, climatic challenges, conflicts and insecurity, livestock rearing in the marginal dry areas is challenged by low productivity and poor access to markets.

The region has increased the availability of livestock products through changes in livestock production systems and importation of livestock and livestock products.

Yet, despite this relatively good scenario for livestock production, underlying and recent trends raise questions about the sustainability of growth. For example, regional problems with pasture and rangeland degradation limit the ability to raise cattle and small ruminants. Additional serious concerns relate to raising cereal prices associated with demand for biofuel production and for food in the fast growing regions of Asia. As countries in the North African region have found alternative suppliers of livestock products, this has created further difficulties for transboundary animal disease control.

## **II – Overview on small ruminant systems in North Africa**

### **1. Evolution of animal populations**

Small ruminant populations in the West Asia and North African region reached 213 million sheep and 109 million goats in 2007 (FAOSTAT) accounting for 20% and 14% of the World populations, respectively. High concentration is recorded in countries such as Sudan and Iran and secondly Algeria, Morocco, Syria, Mauritania and Tunisia. The region is home to genetic resources that are renown all over the world with more than 200 breeds. This population decrease strongly after the feast of sacrifice. Some countries such as Sudan, Syria and Mauritania export sheep especially during the feast of sacrifice. The evolution of North African small ruminants census is shown in Table 1.

### **2. Evolution of small ruminant production systems**

Small ruminant production throughout the region is mainly based on traditional systems where animals are managed through a agro-pastoral and extensive system with large herds or flocks grazing on arid and semi arid rangelands with varying degrees of livestock movement from nomadic to transhumance. Given the constraints of aridity and water shortages, there should be a clear limit to the number of livestock that can be kept and fed on natural pastures and non-grain supplementation.

**Table 1. Evolution of small ruminant population (million) in North African countries per from 2005 to 2012 (UMAOC report, 2013)**

Country	2005			2012		
	Sheep	Goat	Total	Sheep	Goat	Total
<b>Morocco</b>	16.87	5.33	<b>22.2</b>	19	5.6	<b>24.6</b>
<b>Tunisia</b>	7.2	1.4	<b>8.6</b>	7.7	1.4	<b>9.1</b>
<b>Mauritania</b>	6.82	4.54	<b>11.36</b>	9.59	6.39	<b>15.98</b>
<b>Algeria</b>	18.91	3.59	<b>22.5</b>	22.87	4.29	<b>27.16</b>
<b>Total</b>	<b>49.8</b>	<b>14.86</b>	<b>64.66</b>	<b>59.16</b>	<b>17.68</b>	<b>76.84</b>

Because of drought and overgrazing, which have caused severe rangelands' degradation, there are trends towards migration to urban centers and emergence of semi-intensive production systems in periurban and suburban areas. In general, these farmers move to rangelands during rainy season by using trucks for animal transportation and return to periurban and suburban areas during the dry season where they supplement their animals by agricultural by-products and have more access to market by selling their products directly to consumers. This system seems to be economically advantageous. However, its uncontrolled development in the absence of control and supervision by the local authorities may constitute a risk to the environment and public health. Therefore it is important to characterize these suburban and periurban small ruminants production systems including management, feeding strategies, breeding and genetic resources management, marketing, product quality and public health, diseases control, farmers professional organizations, investment and access to bank loans, extension and government interventions, and other issues.

### 3. Main small ruminant diseases

Compared to other domestic animals, small ruminants are more resistant/tolerant to several diseases. In addition to common diseases (enterotoxaemia, mange, internal and external and internal-parasitic diseases), emergency of transboundary diseases is a problem of growing importance and calls for coordinated global and regional action plans to strengthen veterinary services and build human and physical resource capacity to respond to disease. The small ruminant priority diseases of common interest at the regional level are foot and mouth disease (FMD), peste des petits ruminants (PPR), and brucellosis in addition to sheep and goat pox which is endemic in almost all countries (Table 2). The recent developments in the ecology of diseases due to climatic changes and global warming, the region is now faced with the expansion of vector borne diseases such as Rift Valley Fever (RVF) and Blue tongue (BT).

**Table 2. Priority diseases of small ruminants in North Africa**

Country	PPR	FMD	RVF	Bluetongue	Sheep Goat pox	Brucellosis
Algeria	+	-	-	+	+	+
Libya	+	-	-	+	+	+
Mauritania	+	-	+	?	+	?
Morocco	+	-	-	+	+	+
Tunisia	+	+	-	+	+	+

### **III – Research and extension on small ruminants in North Africa**

#### **1. Research**

In North Africa, research on small ruminant is active despite the lack of resources. The main topics of research are genetics resources, feeding, rangelands management and production systems. Research programs on small ruminants implemented by research institutions or universities are not coordinated and are often discontinuous because of lack of sustainable funding. Research on animal health, socioeconomics and valorization of small ruminant products are still weak. But research findings have contributed to an important improvement of the productivity of small ruminants in intensive and big herds.

The important research results were slightly adopted by the main actors especially small holders for improving their productivity due to weak linkages between research, national development institutions and producers. Research programmes should be based on producers constraints and results should benefit to improve their productivity through efficient extension programmes

#### **2. Extension**

In North African countries, there is a large dichotomy between large intensive farms that have improved their productivity and extensive systems kept by small holders and pastoralists with very limited productivity. Access to information and adapted technology is the main factor limiting the productivity. Transfer of technology includes first innovations and its adaptation to the system and then adoption by the farmers. Efficacy of transfer of technologies in sheep and goat production is conditioned by the establishment and implementation of an effective national small ruminant council that includes representatives of the Ministry of Agriculture, Research institutions and Producers' Associations. In North African countries, extension and advisory support is mainly provided by Government technicians with very limited capacity and resources and lack of monitoring and evaluation system. The key persons keeping small ruminants herds (women and shepherds) do not benefit from extension activities.

The small ruminant producers' organizations should play an important role in defining research priorities and transfer of technology to livestock keepers. There is a need for strengthening their capacities in extension, technical support and equity facilitating access to information to all actors including women and youth. In this regard, FAO supported the creation of small ruminants' producers' association union in the Maghreb region, which will collaborate with the public sector for the development of the small ruminant sector using new communication tools for information sharing and technology transfer.

### **IV – Promoting extension and knowledge sharing through information and communication technologies**

There has been an important development of information and communication tools during the last 2 decades. These tools includes mobile phone, internet, social networks...In this context, FAO has developed different new information and communication technologies (ICTs) and tools for extension and knowledge sharing. A better understanding of the information, communication and knowledge sharing systems implies reviewing four key concepts including Information and Communication Technologies, gender approach, management of information and communication for development.

## **1. Information and communication technologies**

The technologies used to handle information and aid communication include hardware, software and media for the collection, storage, processing, transmission and presentation of information in any format (i.e. voice, data, text and image): computers, the Internet, CD-ROMs, e-mail, telephone, radio, television, video and digital cameras, etc. These are digital and under constant evolution, hence the qualifier “new”. New ICTs are generally networked via the global Internet and/or telecommunication networks. They can include mobile phones, personal computers, personal data assistants (PDAs), and the Internet and its myriad applications (interactive websites, online communities, virtual libraries, electronic publications, electronic mail, online databases, and video conferences).

The rural digital divide is the term used to describe the unequal access to Information and Communication Technologies (ICTs) between rural and urban areas. It prevents rural populations from accessing information sources and knowledge available throughout the world.

## **2. Information management**

It covers the various stages of information treatment: producing, collecting, processing, storing, classifying, and disseminating information; information can be presented in different formats and originate from different sources. Knowledge management is the systematic process of finding, selecting, distilling, presenting, organizing and storing information in a way that improves its comprehension and usage.

## **3. Access to information and the gender approach**

Women and youth play an important role in keeping small ruminant herds. Rural women and girls usually have less access than men to information and to new technologies. Without equal access to information, they are at a disadvantage in making informed choices about what to produce and when to sell their products. Lack of information also limits their influence in their communities and their ability to participate in decision-making. On the other hand, if women gain access to information technologies, they can benefit from increased educational opportunities and channels for better networking.

In fact, the opportunities offered by information technologies rarely reach rural women in developing countries. The reasons for this include lack of training in the use of these technologies, a low percentage of women working in the media, as well as higher illiteracy rates among rural women.

Globalization and new information technologies are transforming the way that production is organized and information shared around the world. These changes could accelerate progress toward gender equality. But unless researchers and policymakers and communities themselves give attention to gender when considering the opportunities and risks, and unless women have a voice in how these new technologies are developed and deployed, the new technologies could very well exacerbate existing inequalities.

## **4. Communication for development**

This approach is based on the premise that successful rural development calls for the active participation of the intended beneficiaries at every stage of the development process. Rural development cannot take place without changes in attitudes and behaviour among the people concerned. Communication for Development, often referred to as Com4Dev, is defined as the planned and systematic use of communication, through inter-personal channels, ICTs, audio-visuals and mass media. It combines participatory communication methods and processes with a variety of tools ranging from local media and traditional social groupings, rural radio, videos and multimedia

modules for training farmers to ICTs. The planned use of communication techniques, activities and media expose people to change and give them a greater say in decisions that affect their lives. A good example of platforms that use Com4Dev tools is provided by VERCON (the FAO Virtual Extension and Communication Network) and its second generation tool referred to as RADCON (the Rural and Agricultural Development Communication Network).

## **V – The Virtual Extension, Research & Communication Network (VERCON)**

### **1. VERCON platform**

The Virtual Extension, Research and Communication Network (VERCON) was initially a joint project between the FAO Research, Extension and Training Division (SDR) and the World Agricultural Information Centre (WAICENT).

VERCON provides a powerful tool for improving communication between research, extension and farmers. It is used to establish and strengthen linkages among and within the human and institutional elements of agricultural research and extension systems.

The VERCON's innovative nature is its capability to achieve effective linkages by connecting geographically dispersed people and enhance two-way communication, managing large volumes of data, and rapidly collecting, processing and dispersing information in a variety of formats according to the users' needs.

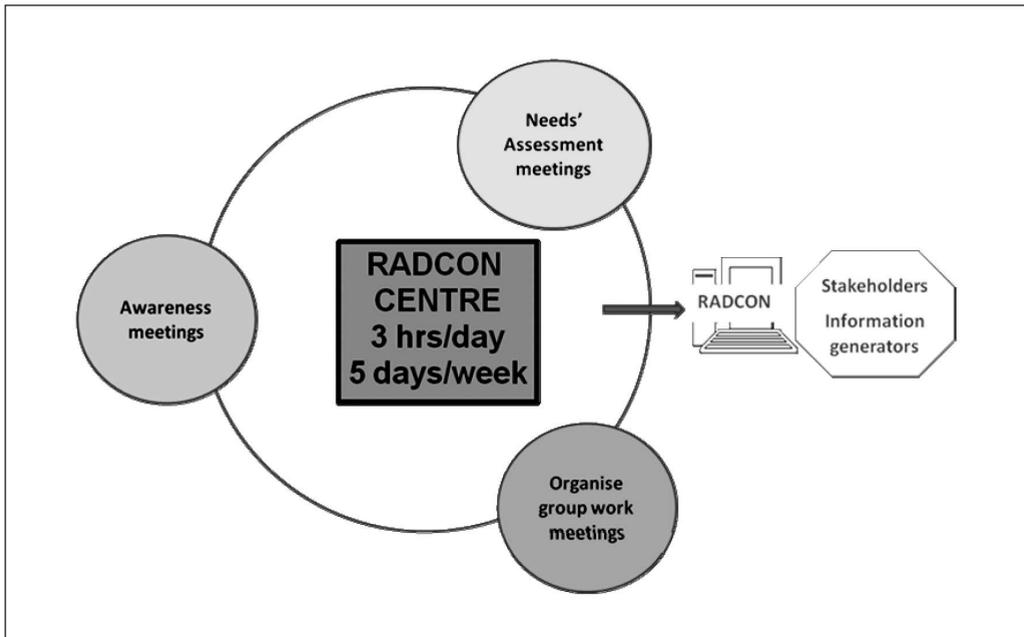
### **2. Evolution of VERCON into RADCON platform**

The VERCON approach was successfully implemented by FAO in several countries including Egypt and Morocco in the Mediterranean region. The success of VERCON led FAO to further develop this tool by strengthening the communication component, which gave rise to RADCON, the Rural and Agricultural Development Communication Network.

RADCON was first implemented in Egypt along the guidelines of the model represented in Fig. 1. The main characteristics of RADCON are:

- Multi-stakeholder dialogue – Government ministries /institutions, Farmers and farmer's organizations, Civil society (NGOs, Youth organizations);
- Strong Organizational structure (multi-stakeholder Steering Committee);
- Demand driven – based on understanding of / and responding to the needs of beneficiaries;
- Use of local resources – agricultural cooperatives, NGOs, Youth centres;
- Use of Participatory Rural Appraisal approaches – RADCON uses PRA tools to assess the information and communication needs of farmers, research and extensions officers, rural communities;
- Appropriate user-friendly internet-based technologies, to provide technical support to rural communities (Fig. 1).

RADCON operates as a Centre which connects via Internet the "Stakeholders information generators", represented by research and extension services on one hand and a "Task force" that provides required information to the users. The task force organizes group work meetings, needs' assessment meetings and awareness meetings with the end-users to better understand the farmers / producers' needs and convey appropriate extension messages to meet these needs.



**Fig. 1. RADCON – Participatory Communication Model.**

The RADCON was developed for farm families and their communities to benefit from an information system, which is operated by agricultural extension in collaboration with the national agricultural research system. In order to achieve this goal, three specific objectives have been identified. These objectives were rephrased to reflect better the expected outputs:

- (i) A sustainable operational dynamic information and communication system is to be developed that responds to the stakeholders requirements including resource poor communities;
- (ii) Resource poor communities are to be identified and enabled to participate in the RADCON activities and benefit of its knowledge and information resources;
- (iii) An innovative media communication programme is developed to increase the benefit of RADCON.

The diagramme of Fig. 2 is a representation of the basic components of the RADCON platform in Egypt.

From the ICT perspective, RADCON has some clear features of complexity in respect to the cost and utilization of both hardware and software. The high cost of equipment and internet connection, in addition to the pre-requisite of a suitable level of education makes this network hard to deal with by poor people especially in rural areas. Intermediate intervention, replacing internet connectivity by mobile phone as a channel to convey extension messages to producers was designed to apply the concept and make the network useful and responsive to the rural poor.

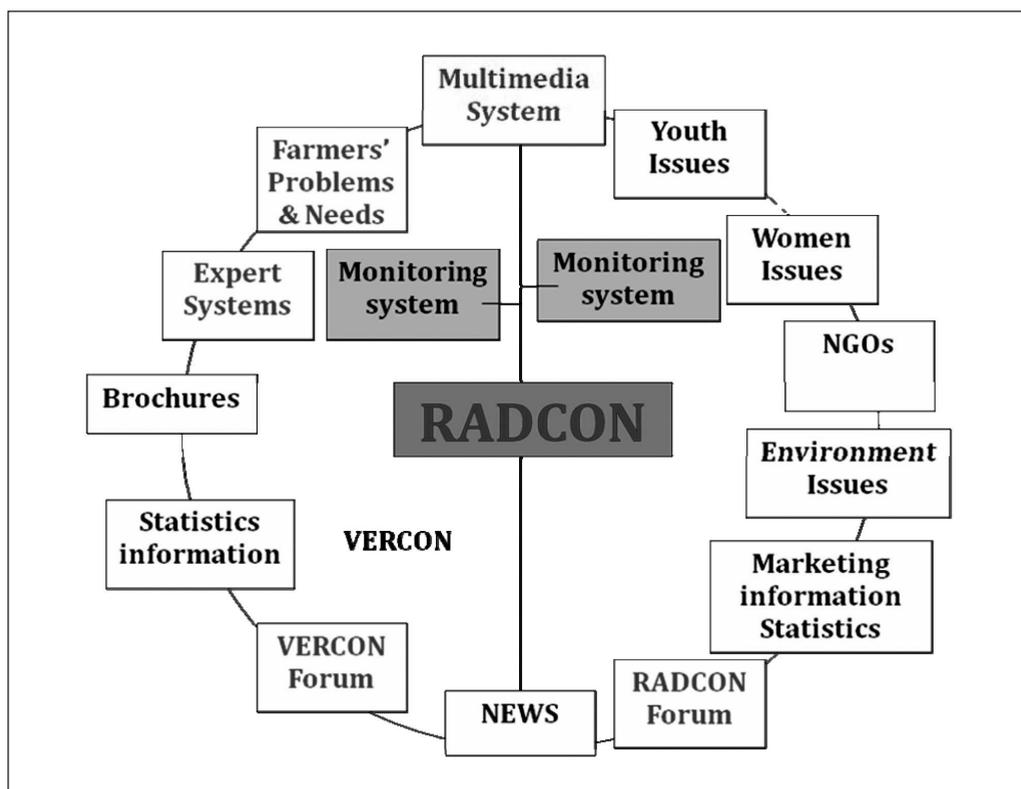


Fig. 2. RADCON – Systems components developed to address the needs of different users.

## VI – Conclusions

The small ruminants contribute substantially to the livelihoods and food security of the rural poor in the Mediterranean dry areas of the North Africa region. Family employment is considered one of the most important contributions of this sector. Livestock also offer the poor low cost and efficient sources of food. However, because of instability of resources and inputs, climatic challenges, conflicts and insecurity, livestock rearing in the marginal dry areas is challenged by low productivity and poor access to markets.

In North African region, research on small ruminant is active and has substantially contributed to improvement of the productivity of small ruminants.

There is potential for developing and transferring small ruminant production technologies, particularly relating to animal health, improved feeds, better post harvest, handling, and farmer access to improved animals. The main gap is the weak linkage between national research and extension systems, national development institutions and producers.

The Virtual Extension, Research and Communication Network (VERCON) developed by FAO was successfully implemented in many countries. It is an innovative extension tool for technology transfer for improving small ruminant productivity.

The VERCON's innovative nature is its capability to achieve effective linkages by connecting geographically dispersed people and enhance two-way communication, managing large volumes

of data, and rapidly collecting, processing and dispersing information in a variety of forms. Its evolution towards RADCON, the Rural and Agricultural Development Communication Network, provides a powerful platform for developing communication channels and strengthening linkages between research and extension agents in order to meet the needs for technology transfer among the small ruminants' producers in North Africa.

## Further reading

**FAO, Gender and ICTs:** <ftp://ftp.fao.org/sd/SDW/SDWW/COAIM-paper-final.doc>

**Harnessing ICTs for Advancement of Rural Women:** FAO Perspectives and Strategic Actions  
<http://www.un.org/womenwatch/daw/egm/ict2002/reports/Paper%20by%20FAO.PF>

**Asian Regional Expert Consultation :** Rural Woman in Knowledge Society  
<ftp://ftp.fao.org/docrep/fao/006/ad450e/ad450e00.pdf>

**Dimitra Project**, an FAO information and communication project to empower rural populations and increase the visibility of rural women and their contribution to food security and sustainable development.  
<http://www.fao.org/sd/Dimitra/>

**GenderIT.org:** changing the way you see ICT. <http://www.genderit.org/en/index.shtml>