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# Risks and Vulnerability in the Food System: Food Security and Sustainable Development

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# I - Introduction

- Risks, Uncertainties and Vulnerability questions about the economic and social systems are now much more evident than before. The food sector is a specific area where risks and uncertainties issues have been present since the beginning of the organized food production process. However, there are different sources of risks, and the traditional ones are derived from Nature and Biosystems, but today the ones “Man made” are as much or even more important than the initial ones.
- Economic Policy, (and specifically food policy) public but also private, can have an important role regarding the different sources of risks and uncertainties, and intervention directed to improve the food systems resistance/resilience is possible and desirable (at local but also global level in the world), providing a stronger environment with lower vulnerabilities.
- FOOD and AG POLICY in European Union have been able for solving the “food security equation” providing guarantees of sufficient food intake for all in the region with reasonable quality (and save conditions), but health concerns and risks are perceived leading to frequent questioning about “Security.”
- However, Markets and different Institutions are part of the food systems, with relevant contributions designed to improve the system, but also some times (paradox situation) increasing uncertainties and risks. Never before the risks have been so much controlled, but never before so much concern appeared in the public behaviour.

# Introduction - 2

- - The world is improving in consumption levels per capita, but not necessarily in welfare conditions, which is almost a contradiction and/or a new paradox, every day more evident;
- The world is facing an increasing level of risks and uncertainties, where freedom of choice and development also implies frequently higher risks, however the possibilities and desired for a better and safer world is clear.
- Toward a “better world” means always a safer world under “normal conditions” and in general for most people.

# Regarding the Food System:

- - Our society is comfortable, and used to a certain risk level in food consumption and in the food system;
- But risks evaluation is problematic and never a precise scientific fact; However the perception of risks and possible evaluations over time shows that many times there is a compromise between higher productivity and efficiency levels, with clear higher risk levels:
- That is, there is a “trade off” situation.....but not necessarily always in different directions, that is a “win win” situation is also possible.

# II - Objectives

- 1 – Risks and uncertainties are inevitable; however there is space for intervention, in food policy and development (technical) grounds, to move toward a safer world and a safer food system;
- 2 – Indeed, what is necessary is to reduce risks and uncertainties and, from a systemic point of view, there is the need to consider the food system dynamics and vulnerability conditions;
- 3 – The actual work tries to discuss and present possible solutions, basically food policy solutions able to provide a better and safer world ( and lower vulnerable systems).

# III - Facts and Findings (background ideas)

- 1 - Europe and OECD countries are living on an **output surplus capacity phase**, mainly in food production ( but also in several other sectors);
- 2 – “**Consumption space**” a concept to be introduced....quite clear in food consumption. Europe, and most industrialized countries will not increase in food intake levels, which implies a clear consumption restriction in quantitative terms but not for value creation needs.
- 3 – Regulation and Markets are most of the time assumed to be two different dimensions of the system, the first based on Government intervention and the second resulting from the interaction of the economic agents. There is space for convergence perspective: Regulation is necessary, (not sufficient) for good markets functioning.

# Facts and Findings (background ideas -2)

- 4 – Risks, uncertainties and system vulnerability is not improving, at least as much as possible in Europe, neither globally;
- 5 – Climate change impacts, environmental impacts and biosystems sustainability factors are probably some of the new challenges for sustainable development purposes and quality of life improvements ( with lower risks).

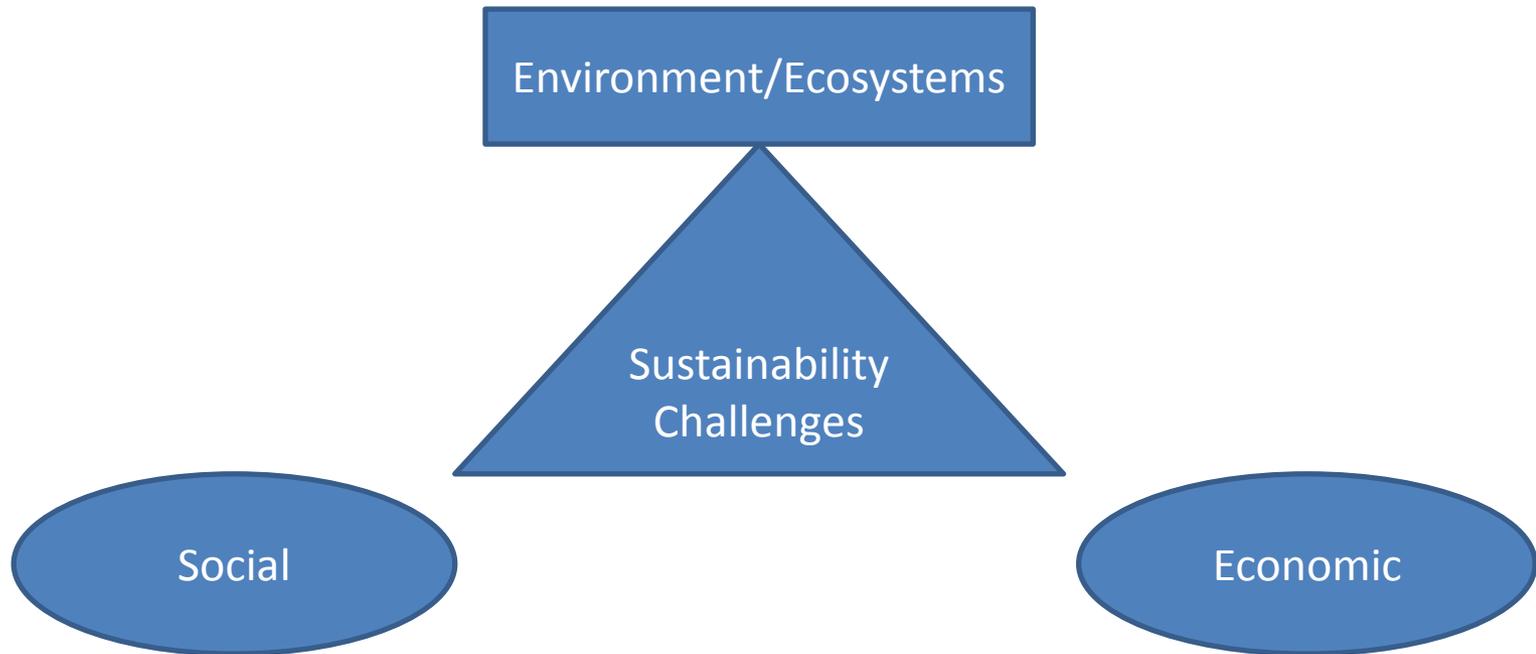
# IV - Methodology and Structure

- Referential Models and Concepts
- Food Policy Examples: Data Facts and Analysis
- Discussion
- Conclusions

# – Referencial Models - Model A

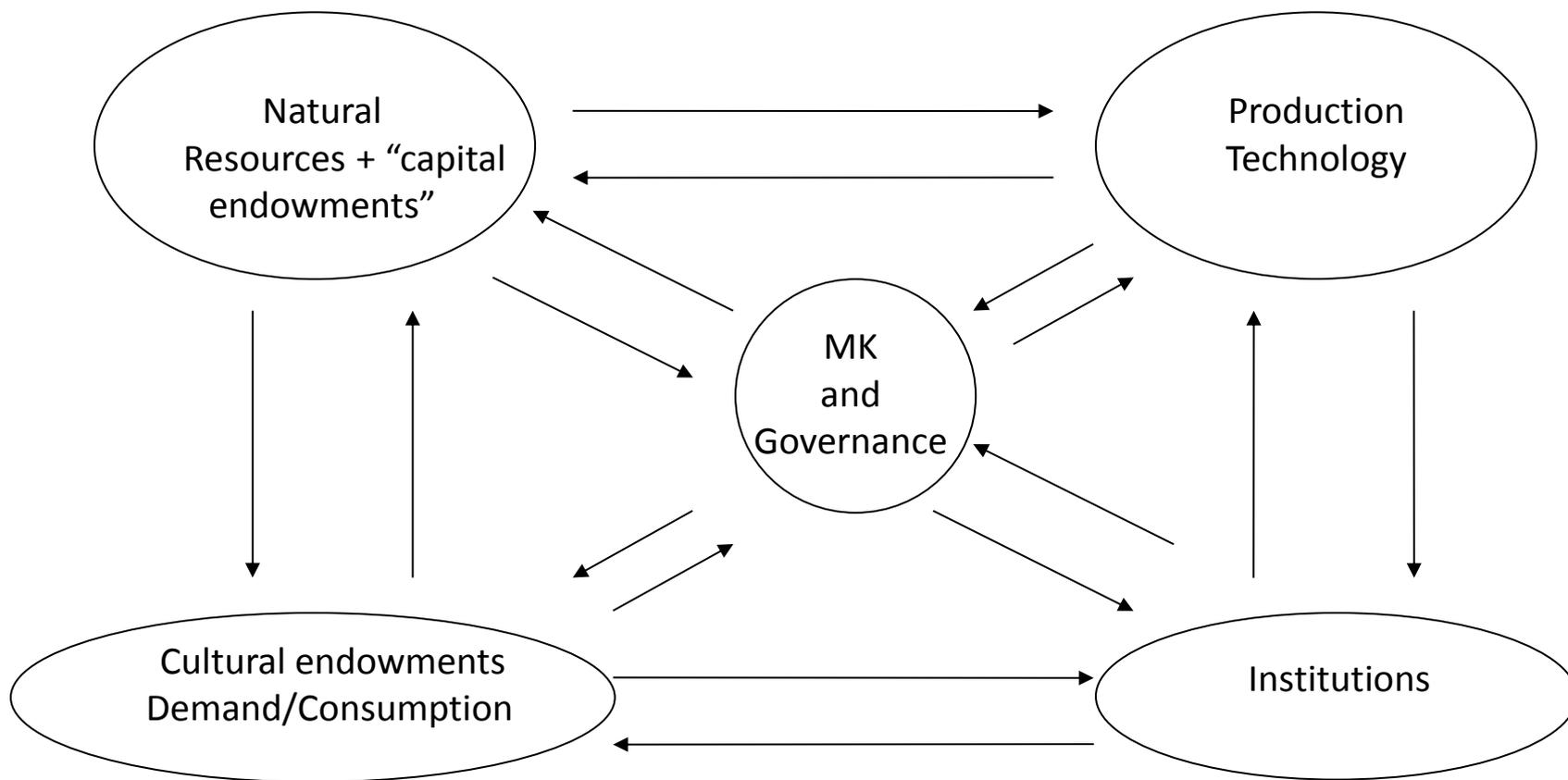
## -Basic Sustainable Dev. Model

A three dimensional model:



# - Referential Model B

## Fig 2. Induced Changes and Innovation model



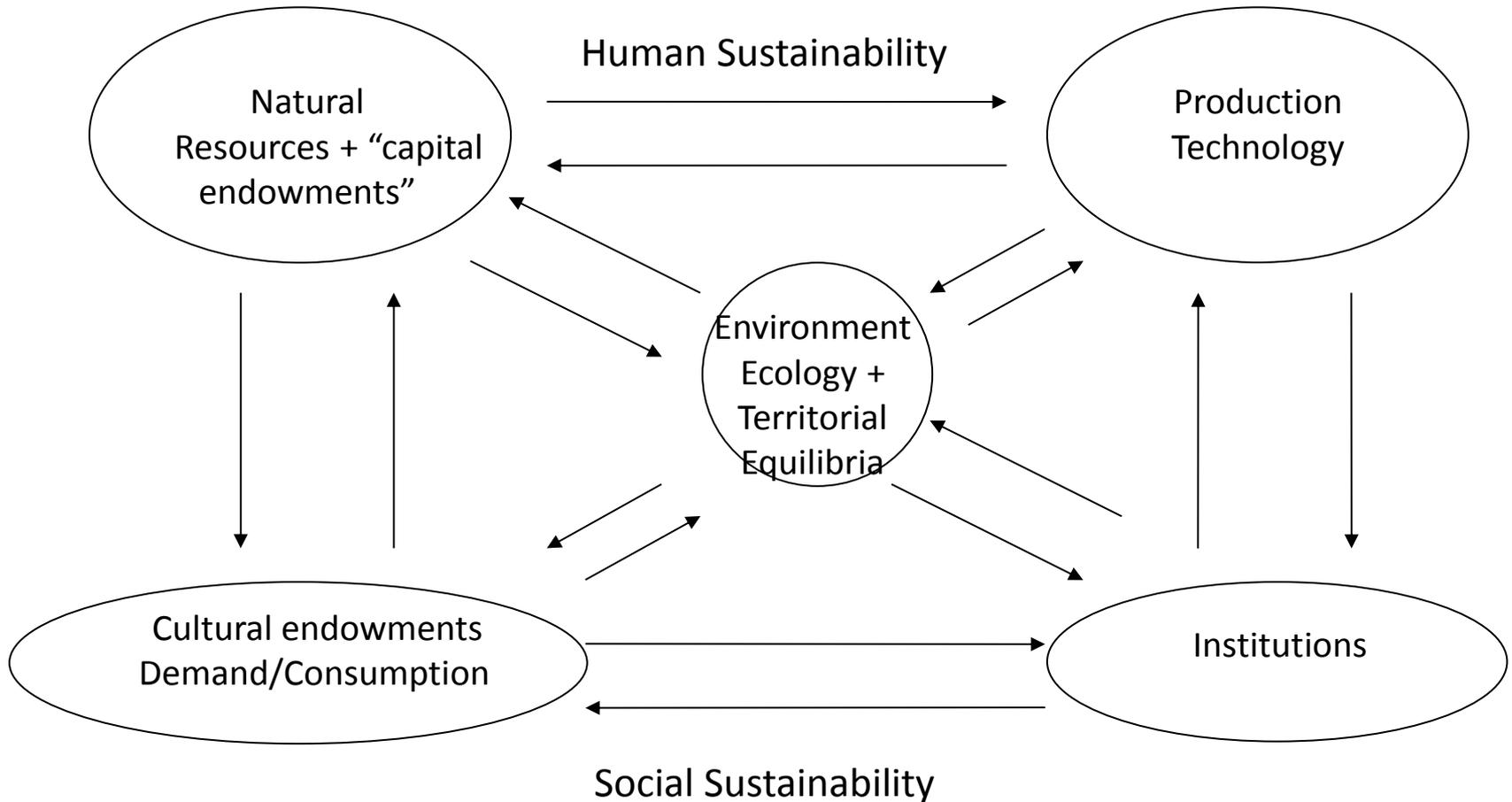
Source: Carvalho, B. P de (2004) and author elaboration

# Merging Both Models

- 1 – Consider that Markets (MK) and Governance dimensions can be included into the Institutional factors set.
- 2 – Environment (and quality of life), plus the ecological equilibrium is a central piece for human considerations in any development process, mainly within a sustainability perspective.

# - Referential Model B2

## Fig 3. Induced Changes and Innovation model+Sustainability



Source: Carvalho, B. P de (2004) and author elaboration

# Referential Model C – Demand Constraints and New Demands

- Demand is the new “driving force” in the modern economy, where production capacity is now beyond consumption possibilities;
- New Demands arrive every day, but some constraints are present, such as the “time frame” and the “value of time;”
- A “modern definition” for production is needed....Production is the last aim of any activity, but we need a chain perspective where the last step is the “production of utility,” present and /or future utility (able to improve the well being of someone). Indeed, with that perspective, Consumption is the last step in the Production Chain and Chain Value.
- Chain Value studies are becoming every day more important, allowing to focus on the essential objective, “creation of value” and at the same time with focus on the Market Functioning, power issues along the chain and respective distribution of the value creation process.

# Derived Comments:

- 1 – Europe (EU-15) is clearly achieving a new equilibria in food production and consumption, with almost no growth in both sides – production and consumption;
- 2 – Demand growth is always dependent from more consumers (population), and per capita growth consumption. In per capita terms, in many products is evident the “plateau” and/or decreasing levels of consumption (Engel’s law, 1857).
- 3 – Food is one of the first consumption needs to be “solved” in any development process (saturation levels are achieved frequently in many consumption goods).

# Demand Constraints and New Demands

- 4 – Food Demand is typically an inelastic price demand system.
- 5 – Development brings new products and new demands, but most of the time with a logistic behaviour (“Pacheco’s curve” in Carvalho 2014). For industrialized countries Engler’s curve is evident for food, with low income elasticity and diminishing with time and “\$” (income growth levels).

# Demand Constraints Relaxation Measures for Food Policy:

- Many solutions can help, some examples:
- A) Enlargement of markets;
- B) Logistics and Information availability;
- C) International Trade;
- D) Processing and Conservation measures;
- E) Adding value strategies with other dimensions beyond nutritional value (such as ludic, historical, cultural, ecological and sustainability dimensions).

# Referential Model D: “Risk Analytic Model” using Food Security Concept

- 1 – Systemic Analysis, Food Systems and Economic Systems (changing dynamics), a necessary condition to study and understand the innovation (development) process;
- 2 – Food Chains, Value Chains and Sustainable concerns, new paradigms;
- 3 – Food security, a new vision for the “hunger problem” in the world, which implies new solutions and analytic capabilities, aligned with food systemic view and chain analysis, within a sustainability framework concern and analytic considerations.

# Food Security Concept: an implicit food system model

- The World Food Summit (1996) referential definition:
- Food security exists when all people, at all times, have access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.”
- The author definition: Food security means ability to access food in physical and economic terms to achieve a healthy diet in permanent and continuous way. Implies on diminishing risks and uncertainties in the food system, at least in the following dimensions:
  - A- Availability;
  - B- Access;
  - C-Consumption/quality, nutritional and utilization;
  - D- Stability;
  - E- Vulnerability, Resistance and Resilience of the Food Systems
  - Obs: Food Security implies a “sustainable perspective”

# Risks and Uncertainties in the Food System: Proposed Approach Method

- Many different approaches can be used to study risk factors in the food system;
- The proposed “model” is to use the 5 dimensions presented as key axes in food security considerations (“hunger equation”), to identify and evaluate feasible policy interventions;
- Look at the food chains and identify and evaluate the “critical control points” where food policy (public and private) can be pursued (HACCP methods, discussed in Carvalho, 2016).

# HACCP – matching food technology engineering with economics and management

- Hazard Analysis Critical Control Points methodology (recommended by the Codex Alimentarius Commission/UN) for food safety – systematic and preventive action.
- It helps to find, correct and prevent hazards throughout the production process in physical, chemical and biological hazards (and now, with the proposed method should include also the economic and social dimension (Carvalho, 2016 proposal)).

# Main Steps in HACCP

- HACCP application is usually based in 7 different principles, which are followed after assuring the existence of the pre-conditions for useful intervention (in summary good practices from production and transformation):
- Principle 1 – To identify and analyse the main possible hazards;
- Principle 2 – Find out the main critical control points (CCP's);
- Principle 3 – Establish the critical limits for the CPP's;

# Main Steps in HACCP - 2

- Principle 4 – Establish procedures to monitor the system and the CCP's;
- Principle 5 – Establish the corrective actions to be taken when monitoring;
- Principle 6 – Establish procedures for verification
- Principle 7 – Establish procedures regarding documentation and registration/records
- General comment: all of this can and should be applied under a food policy analysis, evaluation and food policy implementation/application feasibility – looking to diminish risks and enhance the system.

# V - Important Considerations/Hypothesis Derived from Models and Key Concepts

- 1 – Sustainability questions are always related with an inter-temporal analysis and territorial based;
- 2 – Models are built to help understanding changes over time and underlying rational;
- 3 – The “ICI model” (Induced Changes and Innovation Model, (Carvalho, 2004)) assumes an induced process of changes (mainly economic rational), but also introduced some dimensions for sustainability questions, where food security, territorial and sovereignty concerns can be studied and better understood to allow for improvements into freedom of choices, sustainable development and quality of life.
- 4 – Demand Constraints and New Demands are driving forces, forcing changes but allowing for food policy interventions into the correct (sustainable)direction.
- 5 – Local and global connections, within a “circular economy perspective” are now on the agenda, regarding climate change risks and possible mitigation solutions.

# VI - Revision on Concepts -1

- Sustainability Concerns are not new, and can be found in the literature at least, since the XIX century (for example with Thomas Malthus, in food matters).
- Conservation and Environmental issues are not exclusive matters from the last decades, but a referential moment was the United Nations Conference on the Human Environment, 1972 in Stockholm.
- The problematic and Concept of “sustainable development” gained international support latter on in 1987 with the publication of “Our Common Future” by the World Commission on Environment and Development with the definition: “ development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

# Revision on Concepts - 2

- Space and Time factors are unavoidable dimensions under food security and sustainable development (economic and environmental) considerations.
- “Territorial notion” importance – The notion of a territorial dimension has been always polemic. But it is always a relation between a certain space (and time) and an established relationship of power “over space” “appropriated” for someone. Any society produces a “territory” and depends from a certain territory.
- Obs: A territorial definition is always a social production process....individual initiative or not is a collective outcome.

# Revision on Concepts -3

- Local development a necessary condition for sustainable global development;
- Global development is not sufficient for local development;
- Local meaning an inclusive development process, with territorial/regional linkages, and short chains dynamics;
- “Circular Economy” paradigm applies – from linear economics (production to consumption and waste) to more complex and interdependent systems: agricultural and food sectors can provide strong examples of success on this new perspective.

# VII - Food Policy to Reduce Risks and Uncertainties, Promote Food Security and Sustainable Development (Achievements and Challenges: Facts and Policy Needs)

- European Agricultural Framework;
- The Case of Portugal: consumption innovation in Europe and in the CPLP community (portuguese/lusophone speaking community);
- The African Food Security Equation: the case of Cape Verde.

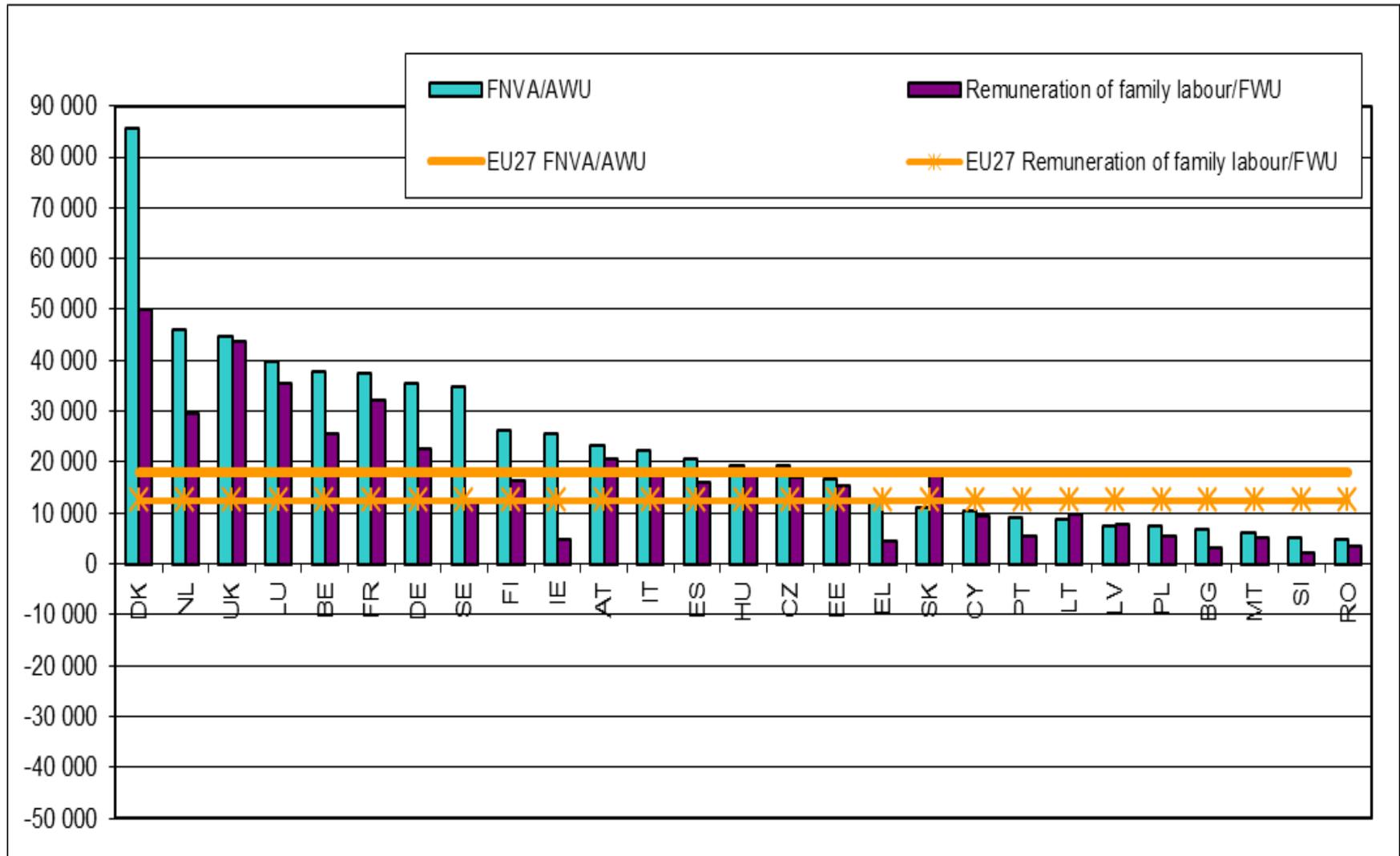
# European Framework: Facts and Findings

- 1 – Europe, EU-27, but mainly the EU-15 are on the 4 stage of the WFSE – Food balance equation, with excess supply (**output surplus capacity phase**); **Maintaining these capacity a future challenge;**
- 2 – Europe is essentially a family based food production system, which is crucial to lower risks;
- 3 – Farming is not only a business and food production oriented; alternative sources of income also lower risks.

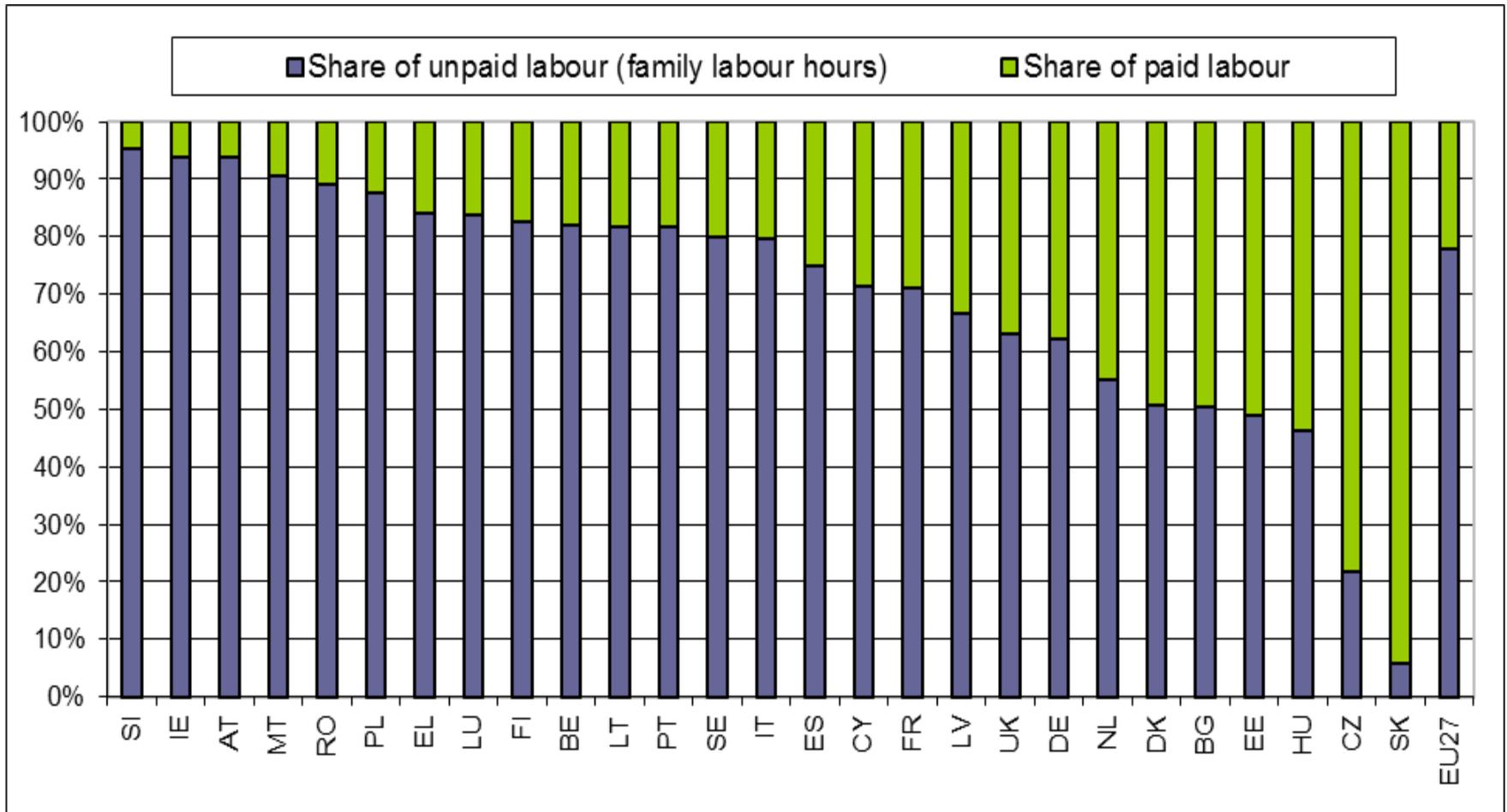
# Data from European Union: (Brussels, September 2014)

- The use of the Farm Accountancy Data Network (FADN) – data from 2011 based on 80 000 holdings in the EU-27, representing 5 million farms (40% of the total FSS – farm structural survey).
- FNVA – Farm net value added, recover after the sharp decline in 2009. The income GAP between the EU-10 and EU-15 appeared to narrow in 2011, but remuneration of family work unit (FWU) in the EU-15 still 3 times higher than in the region that registered the highest income per FWU in the EU-10.

# FNVA per AWU (annual work unit) and remuneration of family labour /FWU, by Member State in 2011 (average in EUR)

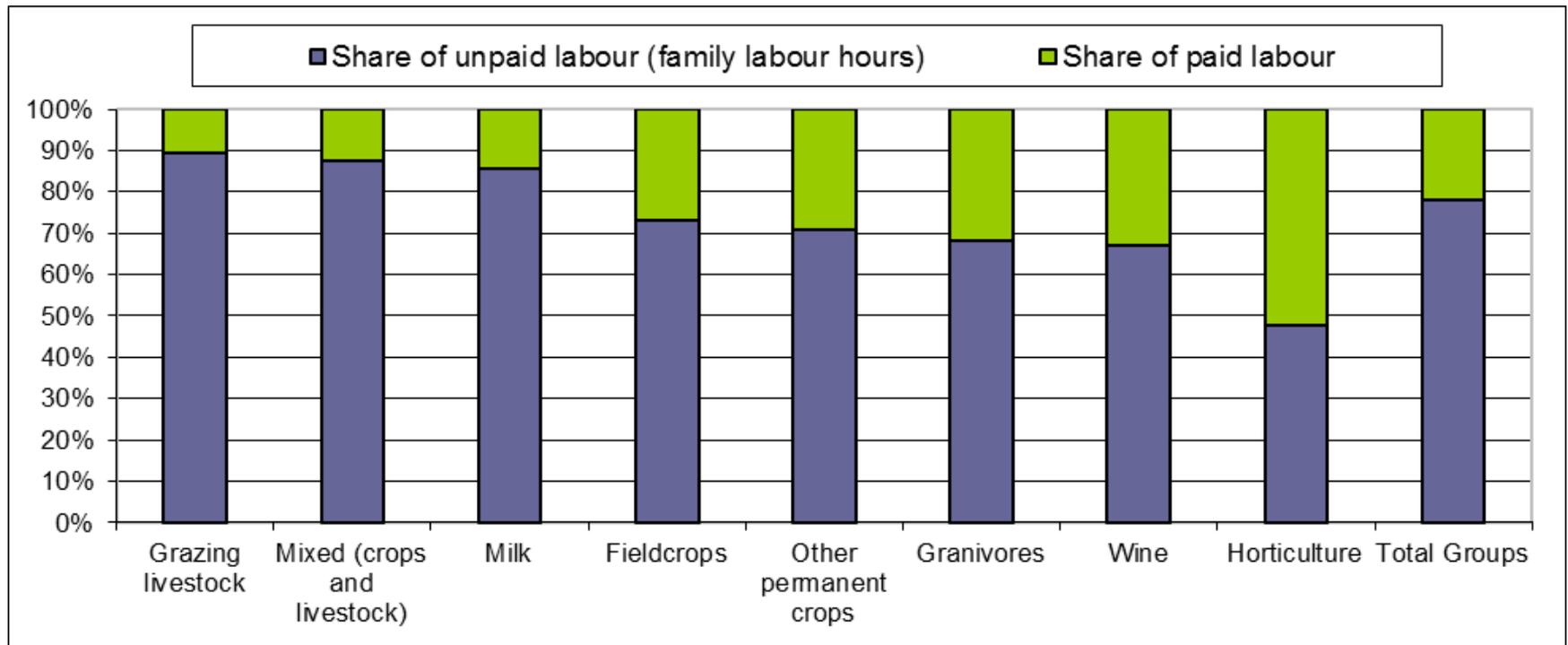


## Proportion of working hours of paid and unpaid labour by Member State in 2011.



Source: European Commission - DG AGRI EU-FADN.

# Proportion of working hours of paid and unpaid labour in the EU-27 by type of farming in 2011



SOURCE: DG AGRI EU-FADN.

# Comments

- 1 – The data shown, shows how important is family farming in Europe.
- 2 – According to FADN survey the average number of workers employed per farm in the EU-27 stood at 1,6 AWU in 2011, and the average farm size was 32ha. The FNVA average was around 28000 euros (EU-27)
- 3 – Family labour accounted for 78% of the total labour force in EU-27. It is the most prevalent form of labour in all member states (more than 50%) with the exceptions of Slovakia, the Czech Republic, Hungary and Estonia.
- 4 – Farming is not only a “business,” is also employment/economic occupation and a “way of living,” providing tangible outputs, but also intangible “goods,” such as environmental services, and/or supporting and exploring services from nature.

# Portugal Innovation: technical (production of value/consumption) and institutional

- Here the new “paradigm” is to look for the value creation action, where consumption innovation is also crucial; Improving consumption alternatives, lower risks;
- Beyond the introduction and promotion of many products into the European habits, like coffee, cocoa, cashew, etc., (most tropical products) there is a changing pattern which is becoming general in many communities: consumption of rice (as one of the main cereals), improving the diversification of diets – lower risks;
- Institutional innovation with the international recognition of certain food habits; again can improve health and lower risk into the system, mainly supporting local production and consumption.

# Consumption of Rice per capita for different communities (kg/capita/day)

	1961	1971	1981	1991	2001	2005	2007
Comun. Lusof.	275	286	327	358	356	380	365
Comun. Anglof.	70.5	78.6	95.6	106	109	115	124
Comun. Francof.	199	227	259	274	279	304	307
Spanish Commun.	142	177	203	208	265	275	269

Source: Carvalho, 2015

# - Mediterranean Diet Example (Intangible Cultural World Heritage) – Unesco Classification (2010-2013): An Institutional Innovation

Average calories available per person per day in  
European States - 2007-2009

Estados Membros da UE	Anos		
	2007	2008	2009
>3700 calorias por pessoa/dia			
Áustria	3816	3826	3800
Bélgica	3736	3751	3721
>3500 e <3700 calorias por pessoa/dia			
Grécia	3637	3656	3661
Luxemburgo	3599	3592	3637
Itália	3628	3612	3627
Portugal	3582	3614	3617
Irlanda	3564	3588	3617
Alemanha	3552	3537	3549
França	3520	3598	3531

# - Mediterranean Diet - 2

Average calories available per person per day in European States  
2007-2009  
(cont.)

Estados Membros da UE	Anos		
	2007	2008	2009
>3000 e <3500 calorias por pessoa/dia			
Roménia	3442	3546	3487
Lituânia	3487	3514	3482
Hungria	3491	3495	3477
Malta	3444	3428	3438
Reino Unido	3453	3453	3432
<b>Polónia</b>	<b>3389</b>	<b>3363</b>	<b>3392</b>
Dinamarca	3393	3370	3378
República Checa	3244	3466	3305
Eslovénia	3221	3268	3275

Fonte: DGS – direcção geral de saúde

# - Mediterranean Diet -3

**Fruits and Vegetables/Legumes Average Quantity Available  
per capita (kg) and per year in several  
EU Member States  
2007-2009**

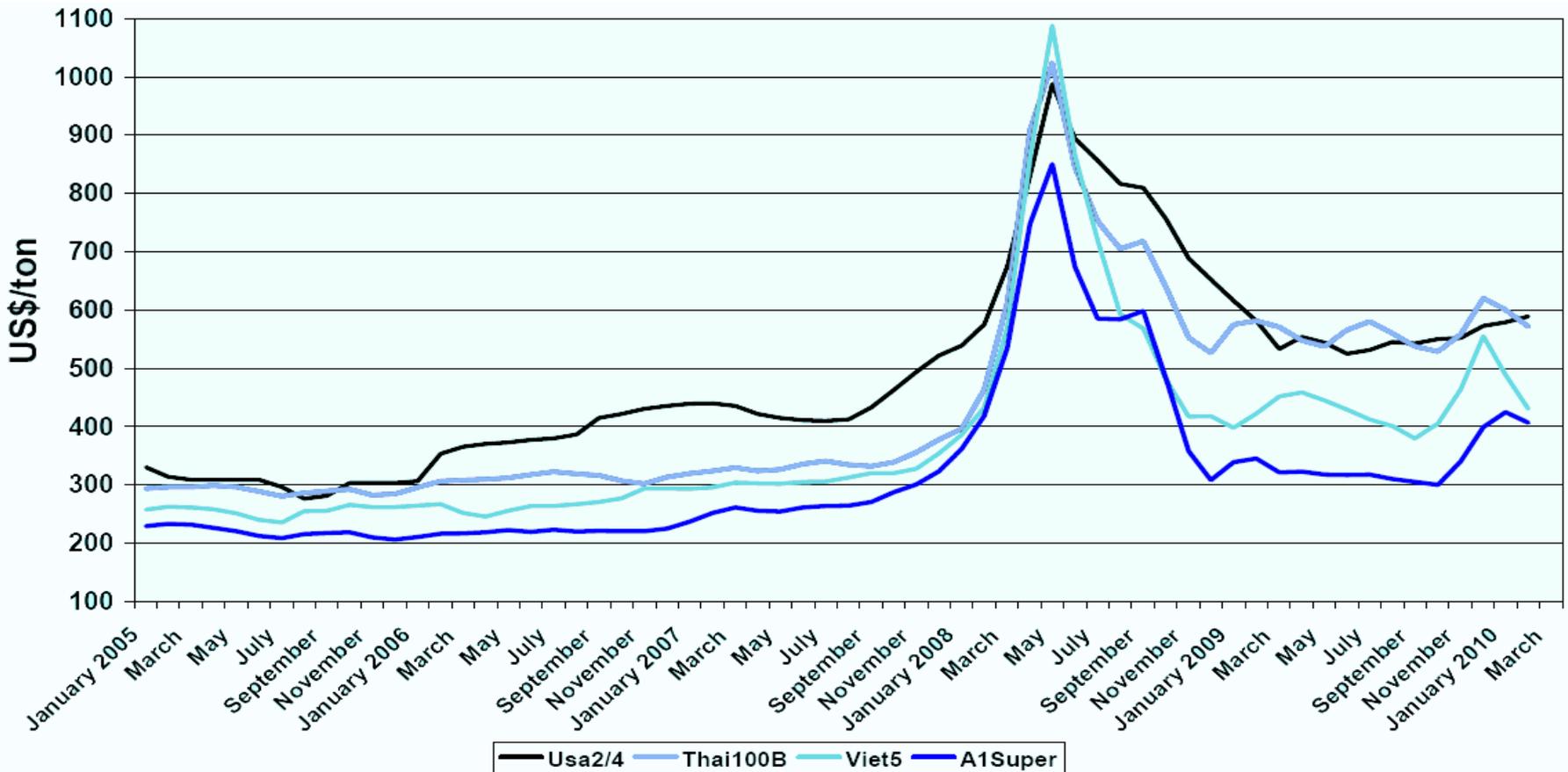
Estados Membros da UE	Anos		
	2007	2008	2009
>300 kg/ano			
Grécia	388,5	360,2	385,6
Portugal	291,2	279,7	313,1
Itália	300,0	284,1	312,4
Malta	307,4	311,6	305,6
>200 e <300 kg/ano			
Luxemburgo	283,0	291,2	277,3
Irlanda	225,6	244,1	244,3
Dinamarca	208,9	210,5	235,4
Espanha	236,5	247,6	231,8
Áustria	245,8	259,9	228,6
Roménia	209,5	229,2	226,6
Chipre	230,4	205,4	225,0
Eslovénia	203,5	210,7	224,5
Bélgica	212,3	223,0	218,3

Fonte: DGS – direcção geral de saúde

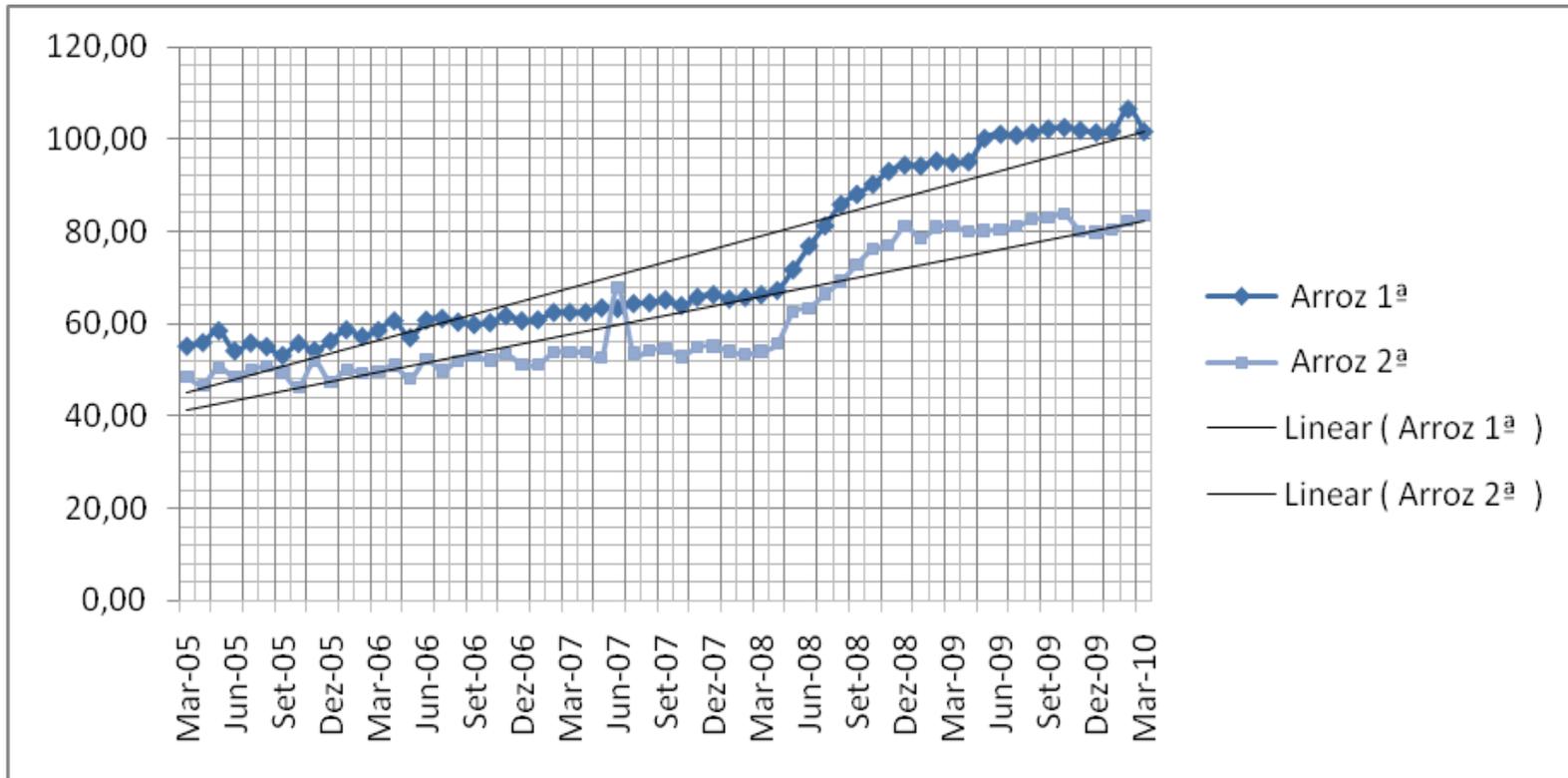
# Africa Challenge: The Cape Verde case

- Cape Verde is one of the worst countries in Sub-Saharan Africa in terms of natural conditions for food production (average rain fall 200 mm in a couple of months);
- Cape Verde is one of the African countries achieving one of the best Food Security conditions and standards;
- Food policy has been (with institutional innovation) one of the key factors with “RISK” oriented policies.

# World Prices for different types of rice (US\$/ton FOB): 2005 - 10



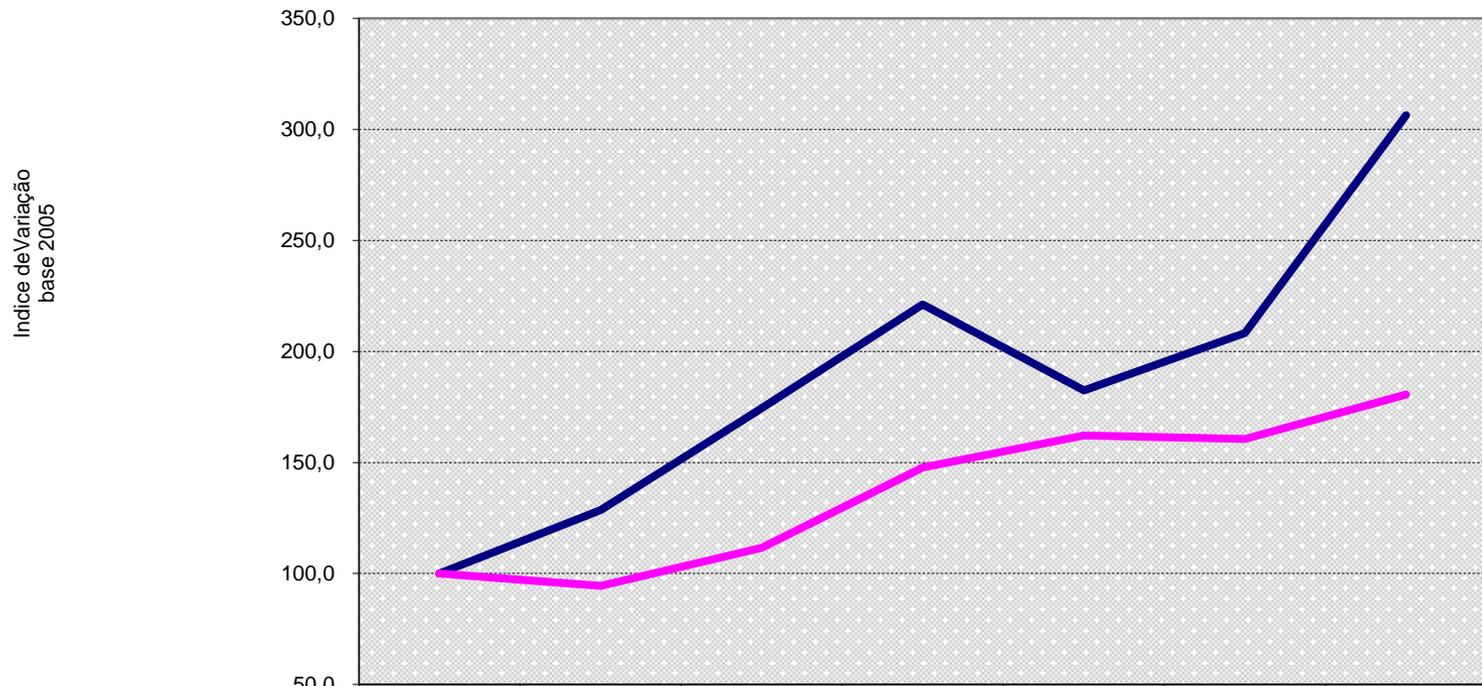
# The Example of Cabo Verde: local rice price evolution – 2005-10



It is important to note the lowest variation for prices; that is, there is a stabilization factor direct related with the existence of ANSA - Agência Nacional de Segurança Alimentar – National Agency for Food Security

# Corn – International and Internal Prices – Price Indices- base 2005

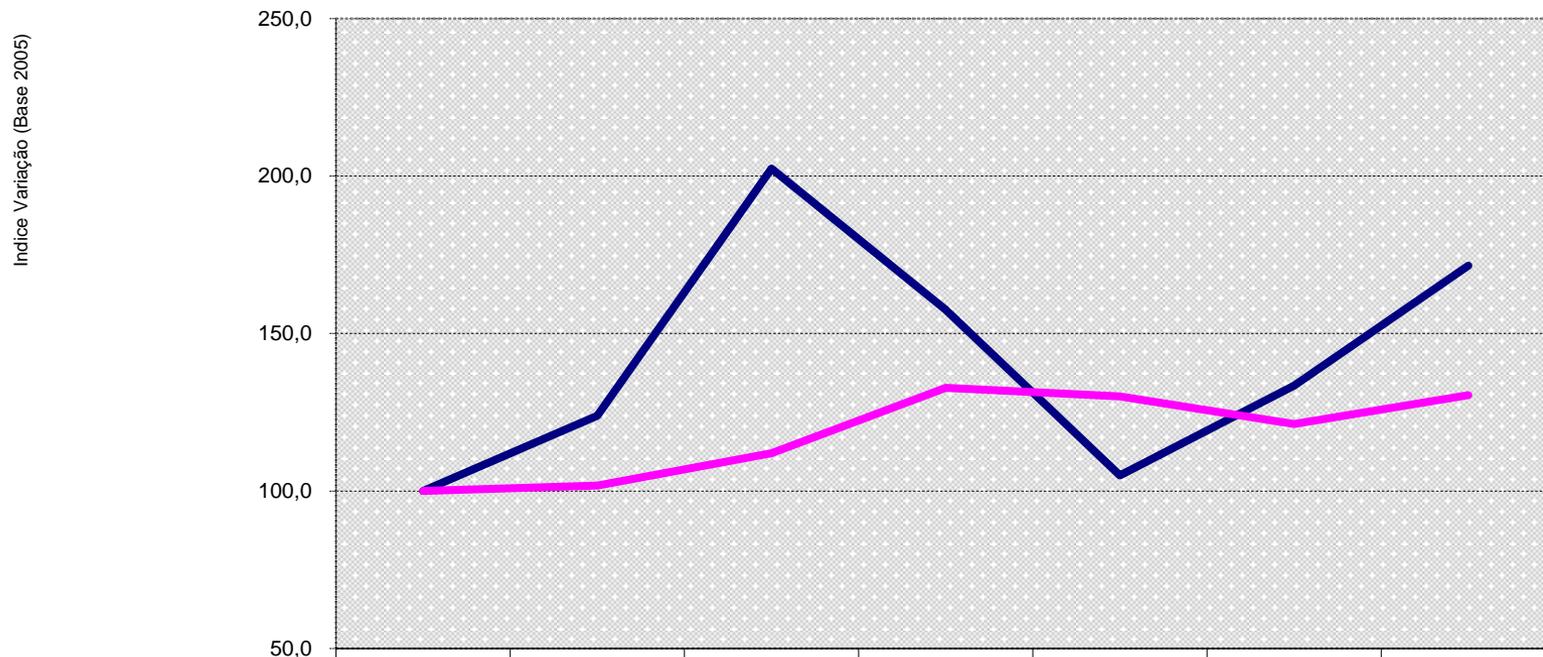
MILHO:Preços nos Mercados Mundial & Nacional-Evolução dos Índices (Base 2005)



— Índice Mundial	100,0	128,6	174,5	221,2	182,4	208,2	306,3
— Índice Nacional	100,0	94,5	111,5	147,7	162,1	160,6	180,6

# Wheat: International and National Prices Price Indices- base 2005

**TRIGO:** Preços nos Mercado Mundial do TRIGO e Nacional da Farinha de Trigo - Evolução dos Indices ( Base 2005)



	2005	2006	2007	2008	2009	2010	2011
— Indice Mundial	100,0	123,9	202,4	157,5	105,0	133,4	171,6
— Indice Nacional	100,0	101,7	112,0	132,8	130,1	121,3	130,4

# Consumption and Institutional Innovation – the case of ANSA-CV

- 1 – Most of the time economists and engineers are concentrated on technological changes, but those should clearly include technological changes in consumption and also in institutional arrangements;
- 2 – Many problems can be addressed looking to systems governance, access to information, access to adequate technology and to capital (at a fair price);
- 3 – Risk factors should be brought into analysis and there is a lot that can be done in food policy intervention.

# VIII - Main conclusions

- 1 – Food Policy and Agricultural policy have been very important, based on markets and different forms of “regulation.” They can be also very important to help building a safer food system;
- 2 – Regulation should be seen as an instrument to support markets functioning when possible, not against markets, but also a change to introduce structural measures to improve resistance and resilience of the food systems; Good information systems and intelligence services working together offer good prospects to improve systems security.
- 3 – Global consumption constraints are already in place, and some times locally, but there are enormous alternatives for expansion locally, and regionally, mainly in the EU-10 where exports outside Europe can also help. Stronger local economic “tissues” well connected globally is probably the way to proceed to lower risks.
- 4 – Local, short chains and circular economy paradigm can help to find better sustainable solutions with lower risks;
- 5 – Consumption should be seen as the last step in the Production Chain, now redefined to be focused in “value creation.” All forms of production and consumption diversification can help to reduce risks;

# Main Conclusions - 2

- 6 – The Food and Ag. Sector is a structural sector, with many function beyond the production of tangible goods.
- 7 - The importance of new paradigm, with the co-relation of demand constraints and new demands with quality of life, (and the co-generation of value) should revealed the need for newer approaches for sustainable development and lower risks.
- 8 – The necessary equilibrium with the ecosystem, food and health factors, and human economic activities should be revisited , looking for news ways of creating value related with services, in particular services from nature.

# Main Conclusions - 3

- Derived from discussion (examples):
- 9 – Natural risks, like the climate change example, shows these type of impacts. Looking into technology, nuclear energy or GMO are other examples of enormous changing capacity, but with higher risks.
- 10 - Looking into institutions, the same can be identified, for example with global institutions and its failures along with global human behaviour connected through social networks.
- 11 – Keep it simple and small when possible are always solutions that work as “safety net” solutions . However there are “trade offs” relationships between costs and benefits, with economic efficiency frequently connected with scale of operations, but not necessarily all the time.
- Thanks for your attention.....