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Sustainable Agriculture:
Increasing Opportunities for IT Tools and Platforms.

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www.eprotecta.com

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Biocontrol & Pest Management

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AGROMETRIX BLUM GmbH

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Michel de Rougemont
Enterprise Consulting

Fundamental question

Can agriculture be sustainable
and at the same time
be sufficiently productive to feed the World?

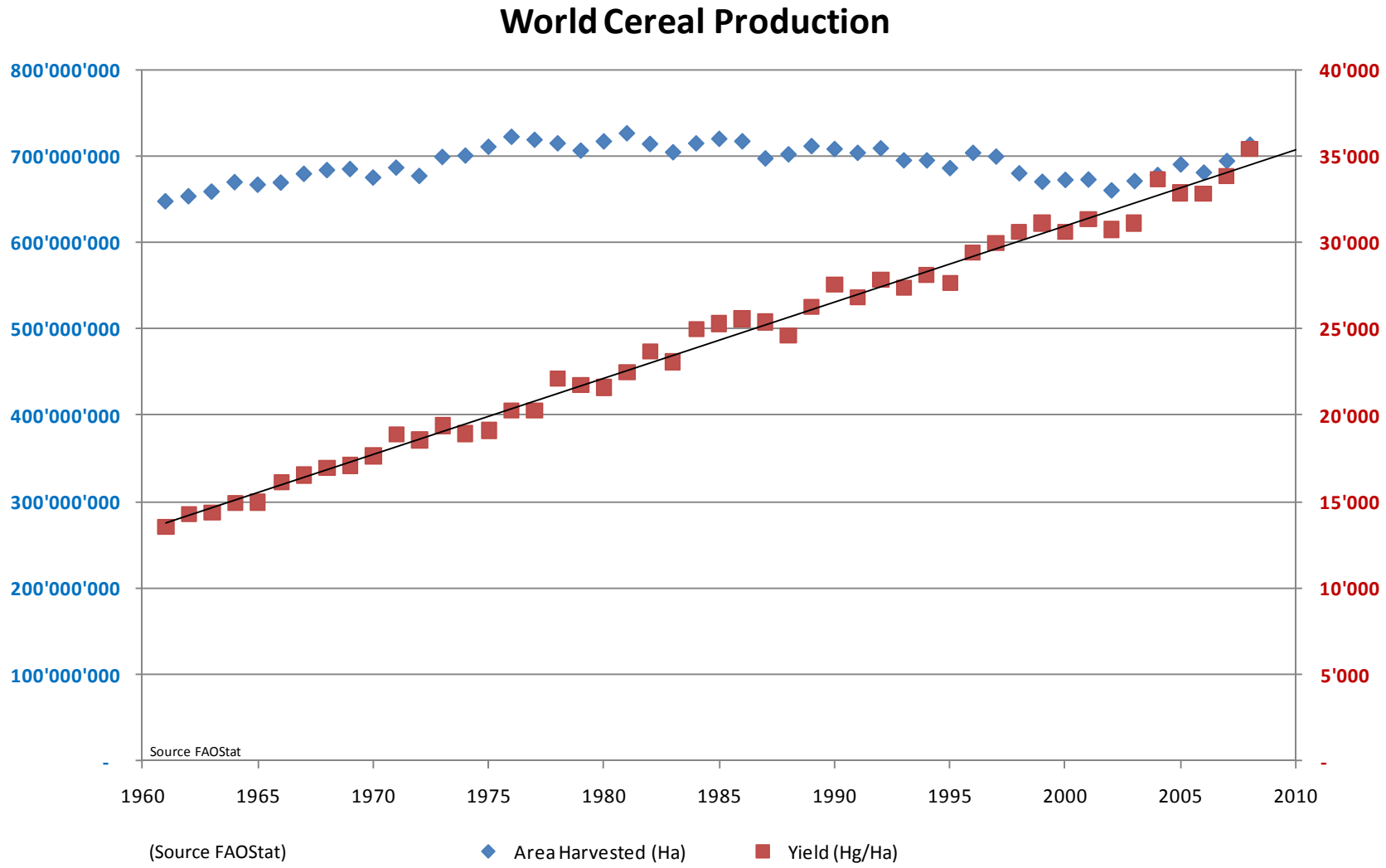
Subsidiary questions:

- What are the limits, known and unknown?
- How to achieve an actually sustainable agriculture?

To the first question the answer is a clear YES!

Which is explained by addressing the two other questions.

World cereal production



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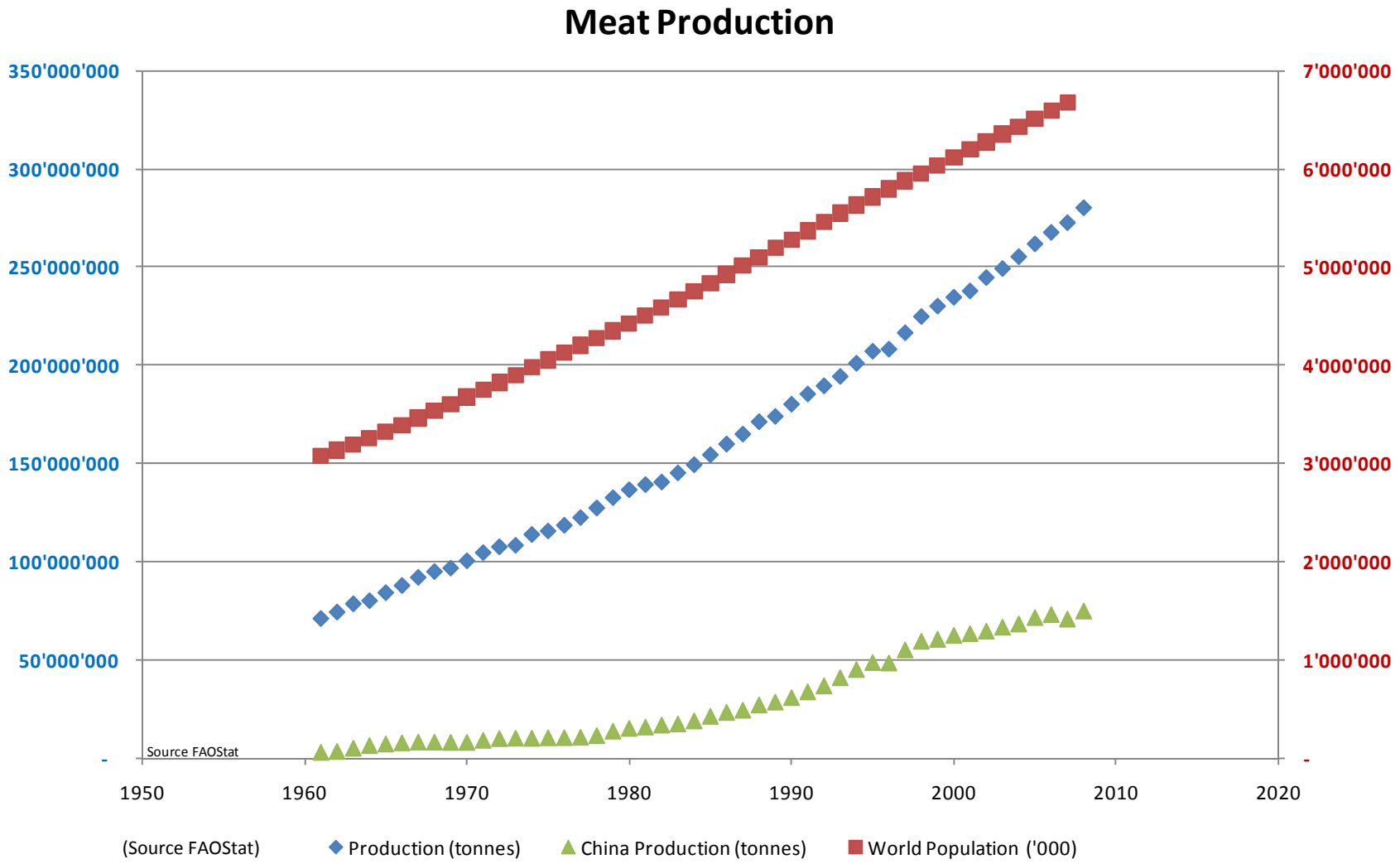
Population and meat production in the World and in China



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Known and unknown limits

Demography

According to the UN, the World population is likely to reach 9.1 billion in 2050 while it is now 6.9 billion, a 32% increase.
Over the next 40 years the population growth rate will be 0.7% each year.

Daily calories will also increase by 5-10% (expressed in Kcal/day).

Food will contain more animal proteins, the production of which requires grain and forage.
Example: China's meat production was multiplied by 3 over the past 20 years.

Cultivated area

According to the FAO, the World agricultural land area went from 45.3 million km^2 in 1968 to 48.8 in 2008, a small change over 40 years.
No large further change is expected in the future and if so, it would rather be a decrease.
Cultivated area for food is also put in competition with biofuels

Crop yields

Over the past 40 years the worldwide average wheat yield grew from 1417 Kg/Ha to 3025 Kg/Ha, a 1.9% annual growth rate.
In the UK this yield went from 4038 Kg/Ha to 7296 Kg/Ha over that same time period, a reduced growth of 1.5% per year, albeit starting from a significantly higher level.

(Source FAOStat)

Challenges

- To increase production by approx. 70% in 2050, agriculture will need to be more intensive:
  - Higher yields
  - Better crop rotation
  - No-till farming
  - Use of all available land, no fallow.
- At the same time, constraints are clearly imposed:
  - Access to water
    - 1.5 m^3 water is required to produce 1Kg wheat
    - 15 m^3 water are needed to produce 1 Kg meat (FAO 1997)
    - Need to live with the consequences of climatic changes, water resources getting more volatile.
  - Environmental protection: fertilizers, crop protection products
  - Safety: farm worker protection, chemical residues, microbiological quality.
  - Sustainable development:
    "meeting the needs of the present without compromising the ability of future generations to meet their own needs".

Wrong "good solutions" to these challenges

- Organic agriculture:
  low efficiency, high land use, a luxury niche.

- Increase cultivated area:
  would be done at the expense of forest area.

- Cultivation on inadequate, poor soils:
  would need even more fertilizers, water, and crop protection treatments.

- Restore and support traditional structures [having low productivity] in developing countries:
  an unworthy proposal for these populations!

Productive and sustainable agriculture: how to achieve it?

- Plant variety improvement
  - High yield
  - Drought and salt tolerance
  - GMO or not
- Increase irrigation
  - Implies infrastructural investments (loss reduction, surface extension)
  - Implies an optimal water management in each water basin
- Irrigation systems improvement
  - Implies investments by the grower
- Crop management method improvement
  - Soil preparation
  - Targeted fertilizer application
  - Integrated pest management (chemical or biological)
  - Use of novel methods to improve plant uptake of water and nutrients, as for example mycorrhizae.
- Improvement of the information provided to the growers and farm managers
  - Meteorological data and forecasts
  - Risk evaluation: drought or flood, diseases and infestations
  - Anticipation of needs: irrigation, crop protection treatment
  - Decision aid for an optimal crop management

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Making progress with Research & Development

- New product discovery and development – seeds, crop protection products, machinery – are mostly in the hands of R&D oriented private companies.
- Other agronomical methods – soil management, crop cycle management – are studied and developed in agricultural research centres (public sector) and by the growers themselves, either alone or in groups.
- Information systems adapted to the grower's needs are still underdeveloped.

Information system: requirements

- Information to be provided to the grower and to the professional community around him:
  - Meteorological data and forecasts
  - Risk evaluation: drought or flood, diseases and infestations
  - Anticipation of needs: irrigation, crop protection treatment
  - Decision aid for an optimal crop management
- In real time, before the risks materialise themselves
- Simple and understandable form
- Easily accessible
  - Internet
  - Mobile phone (SMS, smart applications)

Information platform specification

- Data collection and visualisation of local climatic conditions
  - Taking into account local aspects: terrain and microclimates
  - Using real time data collected by local measurement stations:
    temperature, air pressure, wind speed and direction, rainfalls, air and sol moisture, solar irradiation, etc.
  - Possible integration of locally made observations, e.g. insect counts, disease symptoms.
- Specific, local weather forecasts over 7 to 14 days
  - Rainfalls
  - Soil moisture
- Risk model calculation
  - Drought, flood
  - Pathogen or insect infestation
  - Further physical risks: frost, forest fire
- Decision aid
  - In due time to enable action in a time frame of few days
  - Irrigation planning
  - Alert thresholds justifying a well targeted application of crop protection products
  - Optimal hourly window for an effective and efficient product spraying

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Platform users

- Growers and groups of growers
- Producing companies and coopératives
- Farm consultants
- Water management institutions
- Research stations and extension services
- Insurers

Public or private institutions may also consolidate a network of such users.

Expected benefits provided by an information platform

- Thanks to its easy access (internet, alert messages) and to a simple and understandable representation, the user can optimize the use of his resources during the cultivation cycle, and increase field productivity:
  - Water management with loss prevention and avoidance of watering deficit. Soil moisture can be maintained at an optimal level corresponding to the plant needs for evapotranspiration.
  - Economic savings and improved effectiveness in a rational use of crop protection products. By monitoring of risk threshold values, only the needed treatments will be made and less product will be used.
  - Enhanced effectiveness of treatments with crop protection products by choosing the time of the day with best spraying conditions.

- For resource managers:
  - Water: hydraulic balance and need evaluation over a whole basin. Distribution management by anticipation.
  - Forests:
    - Fire risk evaluation, prevention and alert management
    - Pest monitoring (e.g. pine processionnary moth in Mediterranean forests)

Economic benefits

- As a rule of thumb it is generally accepted that 5-10% of the crop value can be gained or saved through a better resource management.
- The contribution of an information system, as **eProtecta,** is of the order of 10 to 25% of these savings.
- In other terms: a qualified grower practicing integrated crop management (ICM) will get from 0.5 to 2.5% additional revenues thanks to the use of the **eProtecta** platform.
- The representative size for the calculation of economic value is an agricultural zone in which one or a few stations are installed, 10 to 100 km^2 (1000 to 10'000 Ha) depending on terrain and local climate heterogeneity.
  A larger region will be covered by a network of well situated stations.
- Value to the grower
  Approximation for 1 year or one production cycle:

Grower's revenues	10'000	EUR/Ha	, e.g. potato	
Expected total improvement	5%	soit	500	EUR/Ha
Area covered by **eProtecta**	10	km^2	1'000	Ha
of which cultivated	50%		500	Ha
Total economic return			250'000	EUR
attribuable to **eProtecta**	10%		25'000	EUR

Functionning principle

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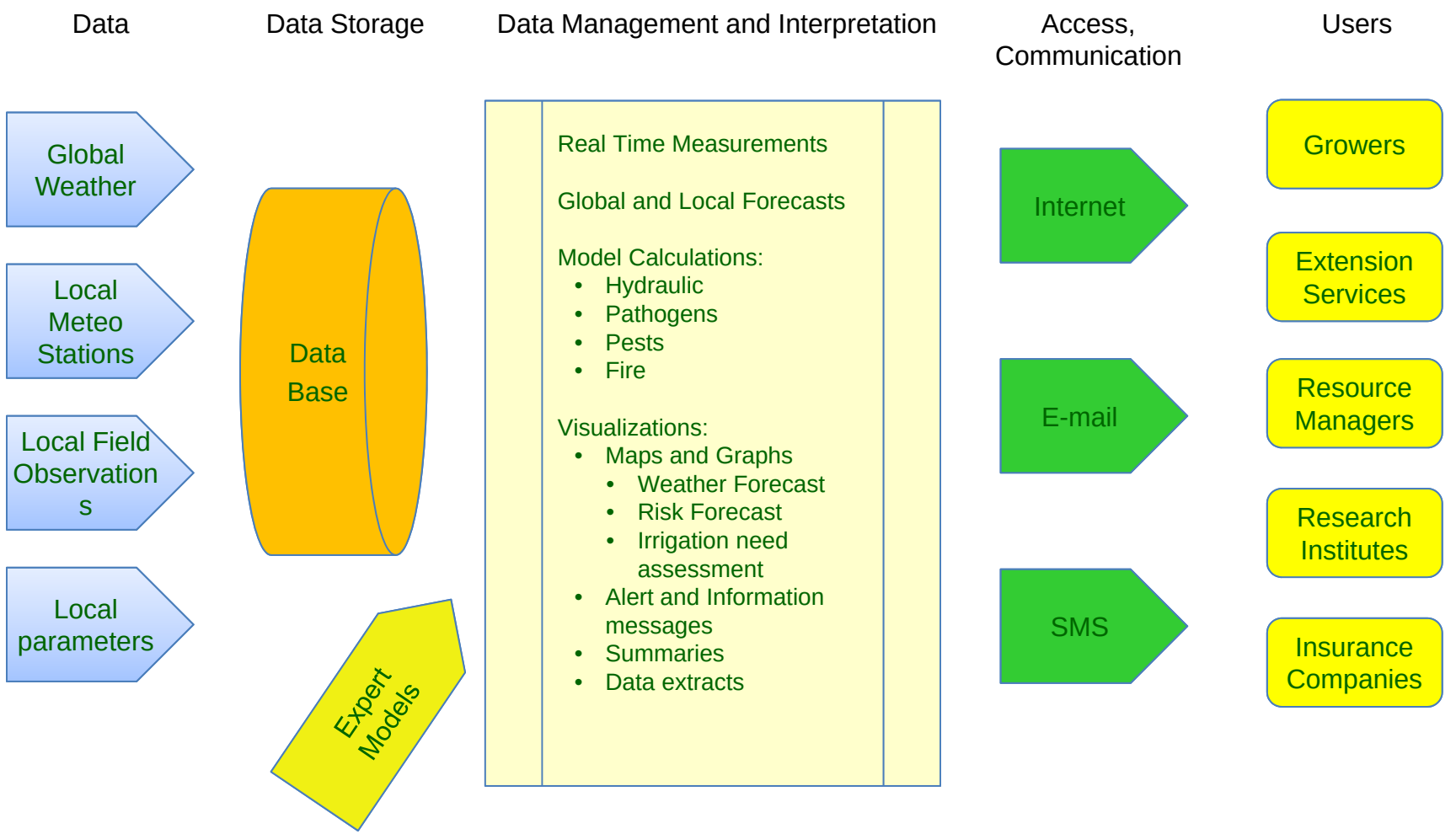
Fonctional scheme



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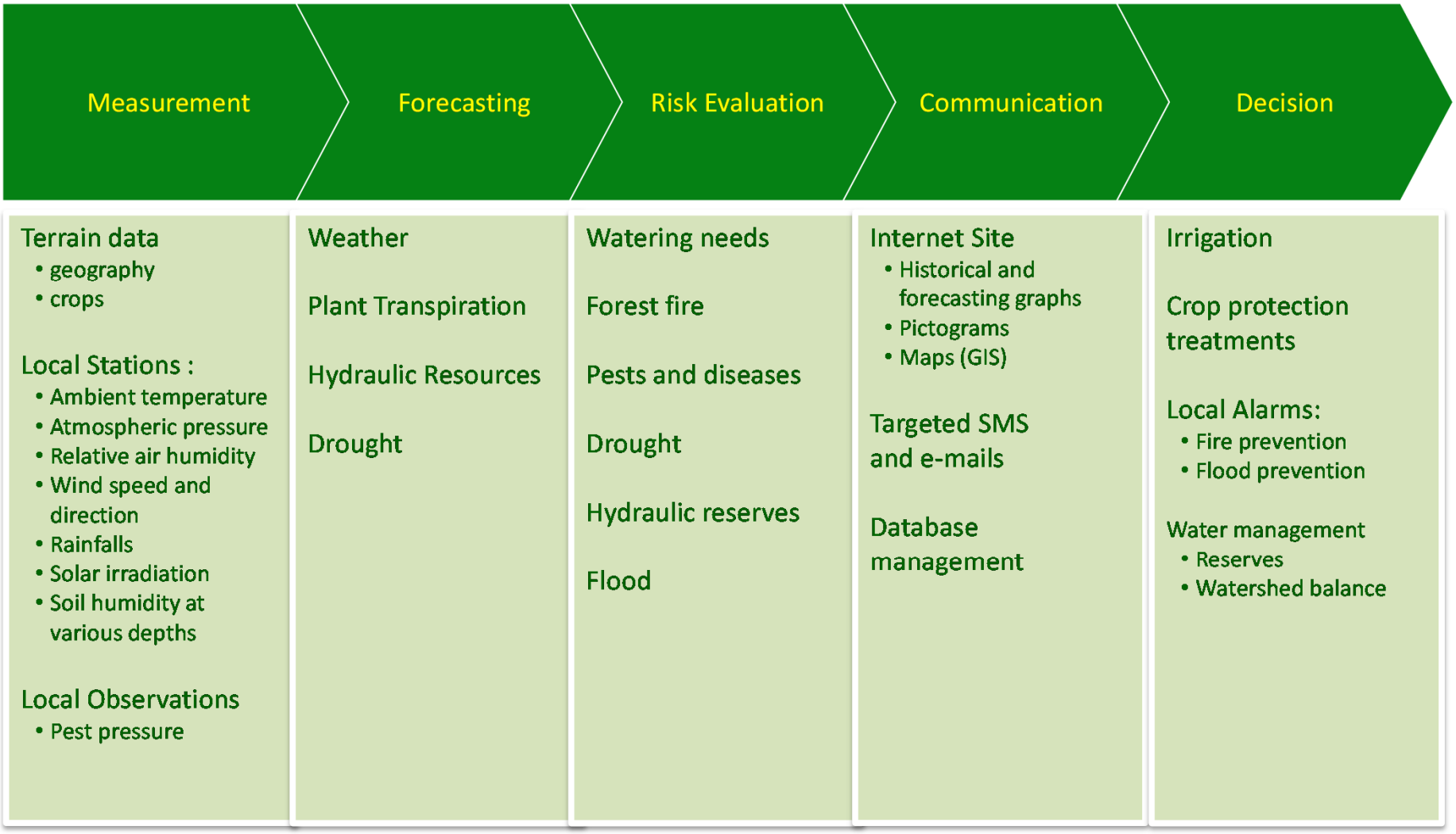
Processes



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eProtecta: development tasks at hand

- Establish partnerships
  - Group of grower, cooperative or similar, aiming at exploiting to the best potential the data from existing or planned local stations.
  - Technologies
    - Data transmission from the local stations to a central server
    - Custom made weather forecasts
    - Predictive models: irrigation, pest and diseases, etc.
- Technical platform development
  - Rough demonstration site already in place (www.eprotecta.com)
  - Information technology assembly to obtain a functional pilot platform
- Promotion and distribution
  - To individual growers and groups: cooperatives, industrial groups, etc.
  - Professional associations (input manufacturers, producers)
  - Research and extension institutions

Economic model

- The service used by the grower is composed of modules adapted to his needs for a crop cycle or on a yearly basis.
- The **eProtecta** service will be:
  - Either directly offered to an individual grower, assuming that he owns or has access to local stations
  - Or grouped by a distributor who owns or has access to a series of local stations.
- All needs of registered users (individually or from a group) will be managed by the **eProtecta** platform.
- Independent partners will sell and maintain local stations and provide real time data transmission to the central server.
  In some markets **eProtecta** may also supply local stations.
- The distributor (cooperative, association, public institution) may also host a replica of the **eProtecta** platform under its own corporate identity.

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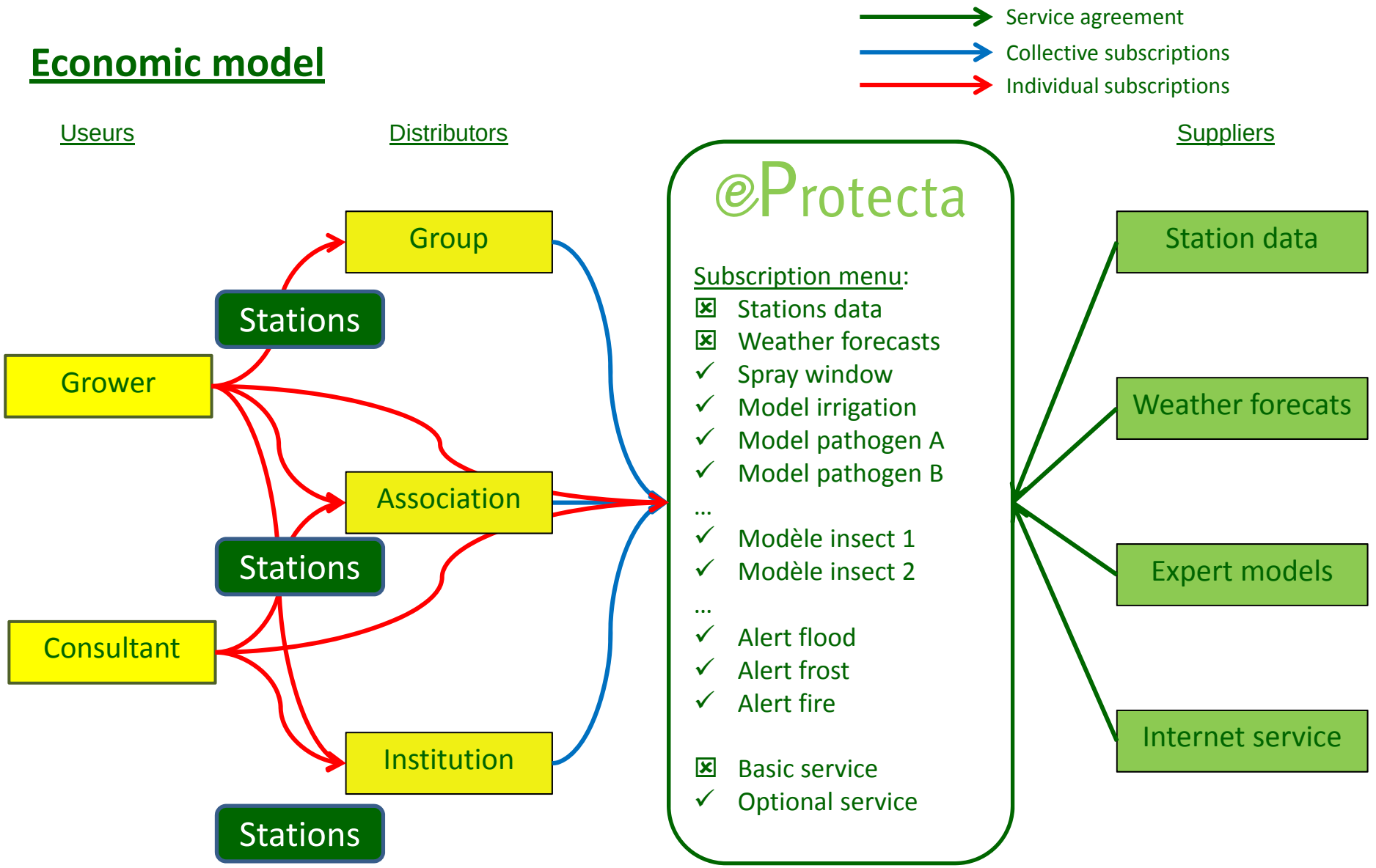
Economic model



Innovation

- **eProtecta** is a platform that integrates forecasts and historical values, and that enables anticipation of future difficult situations:
  - Physical risks: drought and forest fire, flood, frost
  - Biological risks: diseases or pest infestations.
  - Water resource management

- Customization:
  Weather forecasts and model prediction are specifically calculated for a specific site, taking into account data from locally installed stations.
  No other meteorological service offers such customization.

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eProtecta's value is its contribution to sustainable agriculture, enabling a sound environment protection coupled with clear and solid economic advantages.

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