European platform comparative critical analysis. Learning from KASSA platforms'reports

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Introduction

The objective of this document is to present a comparative analysis of the WP1.1 reports of the four KASSA platforms (European, Mediterranean, Asian and Latin American), in order to improve the overview on sustainable agriculture in Europe (WP 1.2. of the KASSA project). The work was focused on five topics:

1. Features regarding the shifting from conventional agriculture to sustainable agriculture,
2. Technologies and approaches used,
3. Impacts reported,
4. System of governance,
5. Proposals for the European Platform.

The methodology followed to achieve this work was split in several steps:

1. All the partners have filled in a grid in order to make a comparative analysis of the WP 1.1 final reports from the other platforms.
2. The five issues have been distributed among the partners. Each group of partners prepared and animated a discussion during the PF2 meeting in Prague (from 13-06-2005 to 15-06-2005) on the section he was responsible for.
3. Taking advantage of the remarks emitted during the discussion, each group of partners was in charge of writing the section for the WP 1.2. report.

This document gathers the contributions from all the groups on the 5 items mentioned above. It presents as a conclusion, the topics that the European partners have chosen to refine for the WP 1.3. of the KASSA project.

I- Features regarding the shifting from conventional agriculture to sustainable agriculture

(Partners 2, 5 and 13)

In the Latin American, Mediterranean and Asian Platform, it appears that the mean reasons which lead farmers to switch from conventional agriculture to conservation agriculture are profitability (especially when farmers shift to market-oriented agriculture) and resource conservation (mainly soil and water). The results reported in these platforms show that the impact of Conservation Agriculture on resource conservation (erosion mitigation, better water use efficiency, nutrient recycling) often lead to increase yields and profitability through two processes:

- **Increase in fertility** when resources are limiting (organic matter, nutrient, water...)
- **Increase in the number of cash crops per year**, thanks to the reduction of the intercrop duration in no-till systems, which is possible owing to favourable climatic conditions (temperature and rainfall). For instance, in Latin American platform, 2 or even 3 crops per year can be grown.

Hence, the increase in profitability of conservation agriculture is often reached through the intensification of the production process.

In the European platform, the impacts of conservation agriculture on the functioning of the cropping system are globally similar as the other platforms, but **the context of development of these practices is different**. Four major differences have to be highlighted:

- In most of regions of Europe, agriculture is already intensive, except in some areas of eastern countries. Consequently, conservation agriculture does not permit to increase yields. In the best situations, yields are maintained, but it some cases, a decrease in yields can be observed (e.g. for spring crops).
- Farmers are often not at the edge of economic sustainability on a short term scale. Nevertheless, if so, they usually can find a solution to increase profitability in the conventional agriculture system. That's why conservation agriculture does not appear as a solution to reach a certain level of economic sustainability.
- Soil degradation (erosion, compaction…) is mentioned, but only in certain areas, which are in the minority at the platform scale.
- Excess of water and low temperature are most often seen as constraints for the implementation of conservation agriculture.

Do these considerations mean that conservation agriculture is suitable only for restricted areas in northern Europe, which would explain its low level of development?

As far as the short term economic sustainability of farmers is concerned, it may be confirmed. In this case, the constraints to CA extension are often stronger than driving forces, except if there is a crisis regarding soil fertility (e.g.: hugely degraded soils, intense erosion, non availability of water resource, …) or regarding labour requirement (that probably explain the higher extension of CA in large size farms). This point is confirmed in the other platforms, where soil fertility and labour requirement are also major driving forces.

Nevertheless, as far as sustainability in the middle and long term is considered, considerations on conservation agriculture are different.

First, **from the farmer's point of view**, CA permits to:

- reduce costs, even if it does not appear immediately after the shifting,
- increase soil quality (soil organic matter quality, nutrient availability…). Similarly, this effect is often not observed immediately,
- decrease the risk (stabilization of yields and system resilience), even if at the beginning, risks are higher (time is required to acquire new know-how and to stabilize the system).

These effects are confirmed in the three other platforms.

The benefits in the medium/long term, regarding both economic and environmental sustainability, appear after a "transition period". This notion is commonly accepted in all the platforms but remains rather vague (in the Latin American platform, 4 phases have been distinguished, but no studies are available in the other platforms).
For the farmers, it is not easy to overcome the risk taken during the transition period and to work on this long term scale. Hence, the role of policies to support the transition is crucial, if the new practices permit to reach objectives of sustainability which are major in Europe: cost reduction, soil quality improvement and risk mitigation. Moreover, the role of researchers and extensionists is also important, in order to assess the risk taken when shifting and to provide tools permitting to minimize it (models, indicators…).

Secondly, **from the society's point of view**, the three main concerns related to CA are:

- resource conservation: biodiversity, water, air and soil. All the platform reports mention that CA impacts may be highly positive (increase in biodiversity, in soil quality…), but sometimes, impacts are potentially negative. However, few references are available on that topic in the European platform.
- climate change: a positive effect of CA on carbon sequestration is shown in the Latin American platform. Nevertheless, as there are few results in Europe, this issue remains questionable for the European platform.
- sociological aspects and life environment: CA seems to have positive impacts. Latin American platform and pioneer farmers in Europe show that CA leads to increase dynamism in rural areas (associations, networks…) and to improve the attractiveness of the rural space (landscape diversity, fauna and flora diversity …). Nevertheless, at this level of CA development in Europe, only speculations can be made.

These issues are crucial, but it is difficult for farmers to work for positive externalities on a long term scale, without any direct benefit for them. In fact, most often, it is not possible to observe direct impacts of externalities on yields and farmers are more influenced by economic factors than by environmental concerns.

The considerations mentioned in each platform on the transition period and on environmental issues show that it is necessary to **provide general support** to CA for its development, taking into account both farmer and public concerns.
In the Latin American platform, adoption of CA is a farmer leaded process, supported by research, the private sector and the government. The detection and the support of leader proactive farmers is a key factor to develop a valuable strategy of farmers to farmers' knowledge transmission, through farmers associations and foundations. Institutional arrangements, with strong interaction among public and private institutions, played a major role in CA extension: funds from the government to research support, equipment

improvement, and credit for the acquisition of machinery, technical assistance and training. These forms of support are determinant, especially, during the transition period.

More generally, five forms of support have to be distinguished:

- Subsidies: it is direct financial help to farmers. Subsidies are generally limited in time (mainly during the transition period), limited in space (concentrated in areas sensitive to soil degradation for instance, or in certain regions depending on local policies), and targeted (e.g.: to buy machinery).
- Support to extensionists and research institutions: in Latin American platform, and to a lesser extent, in Asian platform, many projects of development are carried out, aiming to adjust packages and tools for farmer use. But, there are few studies on impacts of CA, especially on environmental impacts.
- Regulation: some regulations make easier, or at least, do not prevent from switching to CA (e.g. authorization to crop GMOs, no herbicide restriction…).
- Partnerships between private companies, public institutions and farmers
- Communication and training: experience in the Latin American platform shows that evolution of farmers toward CA is possible only it is promoted, if demonstrations and training periods are organized and if there is a social acceptance and social support of the new farming practices.

In all the platforms**, policy support is the major factor leading the development of CA**. It closely depends **on the choices and priorities of each government**: some trades-off often appear, leading to the enhancement or the restriction of CA extension (e.g.: erosion mitigation versus pesticide reduction in the European platform, resource conservation versus self-food sufficiency in Asian platform).

In Europe, first experiences of CA are also launched on farmer initiatives as in Latin American platform, but they are generally not supported by government. In restricted areas, supports exist, mainly aiming at erosion mitigation, which leads to an important local extension of CA practices. Nevertheless, there is usually no support because the value of CA for the farmers and the society has not been clearly proved (lack of references on the impacts of CA), the collaboration between public and private institution is limited, the system seems to be inflexible for farmers to be proactive and project leaders, and there is no social acceptance of the new practices. These reasons can explain the very low level of development of CA in Europe: either farmers don't dare to switch to CA or they sometimes give up during the transition period.
It appears that the issue of general support (suitable forms of support, partnership …) in Europe have to be deepened in the next Work Package of the KASSA project (WP1.3. "Refining platforms' results").

II- Technologies and approaches used

(Partners 6 and 15)

II. 1 Technologies

The development of appropriate CA technologies is most advanced among the countries of the Latin American (LA) and the Asian Platforms, although substantial differences exist between Vietnam and the Indo-Gangetic Plains (IGP) in the latter. Both the Mediterranean Platform (MP) and the European Platform (EP) countries lag behind in the development of own "home-grown" CA technologies, but are substantially ahead of the other two platforms in terms of research and experience with organic farming (OF).

In ***Brazil and Argentina*** (and to a lesser extent in Bolivia), CA is practised as an integrated and holistic system elegantly combining chemical, physical and biological technologies and strongly relying on the interplay of all the fundamental principles of no soil disturbance, permanent cover and crop rotations to maximise sustainability and profitability. In the ***Indo-Gangetic Plains*** *(IGP)*, on the other hand, CA is perceived as part of a family of individual "resource conserving technologies" (RCTs) including minimal tillage, methods of preparing a seed layer, mulching, adapted crop rotation and green fertilizers, the major emphasis being on physical and mechanical (engineering) technologies of CA rather than a broad and holistic system intertwining the biological with the physical as in LA. In contrast, in ***Vietnam***, there is a tradition of mulching fields on sloppy terrain and hence biological technologies are more prominent. Systems of CA presented by the ***MP and the EP*** present are often limited in their adherence to all fundamental principles of ideal CA. In the Mediterranean region, winter cereals are grown in rotation with legumes, sunflower and canola, and some no-till and cover cropping is practised between rows of perennial crops. Among EP countries, minimum tillage without mulch is more common than actual CA, and while winter cereals are sometimes not ploughed, spring crops in rotation generally are. There appears to be a lack of diversity or creativity in European CA due to the rigidity of the research and extension system, the CAP, the conservative way of thinking of farmers, and the 'culture' of ploughing, which transpires to farmers viewing fields unploughed in the autumn as not being really cultivated.

Cover crops: In LA and Vietnam, CA systems emphasise producing cover, while in the IGP there is mention of research on the use of cover and brown manure species grown in combination with rice. In LA, *more than 100 cover crops* have been trialled/are being used by farmers, often in mixtures, for a wide range of purposes, priorities and situations, ranging from *nutrient pumping and fixation, competing against and smothering weeds (= reducing reliance on herbicides), biological ploughing and biomass production to providing additional human or livestock food or marketable produce*. "Farmer-researchers" have resorted to using both traditionally cultivated crops (such as black oat, vetches, ryegrass, oilseed radish, mucuna, pearl millet), as well as to traditional weeds or spontaneous plants as cover crops. In Vietnam, farmers also experiment with and use both cultivated and spontaneous plants for cover. This dynamism in cover trialling/research appears to be largely lacking in the IGP, EP and MP, both among farmers and research institutes.

CA implements: In LA and the IGP, there has been "home-grown" development of suitable CA equipment for farms of various scales, resources and conditions. Such implements in both the IGP and LA include multitask machines for sowing in untilled soil, fertiliser placement, mincing of residues, mulching, etc. However, while in LA such implements were mainly

developed by farmers (later with some assistance from the local industry and researchers) in response to their own situation/problems, in the IGP, they were commonly developed by researchers and the industry for, but not with, farmers. Consequently, in LA, there is a much broader spectrum of implements for all kinds of conditions and they are much more commonly used by farmers than in the IGP, where adoption of the machinery is often rather limited. Neither in the EP nor MP reports a similar dynamism in the development of suitable implements for CA is evident.

II.2 Approaches

More so than in the other platforms, CA research and development in LA are bottom-up and farmer driven. Both the momentum in CA spread and the lucrative nature of CA production has led to the local industry joining suit, and a very strong link between farmers, industry, researchers and NGOs emerging. In terms of the research paradigm, LA approaches to CA contain strong emphasis both on researching detailed techniques (i.e. crop rotations, suitable times for knife-rolling, etc) and on integrating components to create a holistic system using all principles of CA. Biological methods are consequently more intrinsic to LA CA approaches than is the case in other platform approaches.

In the IGP, efforts to develop and extend CA have combined initiatives of several universities, department of agriculture in states, Agricultural Research Councils of Pakistan, India, Bangladesh and Nepal, and several CGIAR centres (CIMMYT, IRRI and ICRISAT) in partnership with the Rice-Wheat Consortium for the IGP. Strong links between industry and researchers, at least where the IGP are concerned, exist, but unlike in the LA cases, the link between *farmers* and the *research and industry sectors* is much weaker. The general approach to development and extension is very much more top-down than in the LA. This has led to implement development and some guidelines concerning suitable crops, timeliness, etc, but adoption among average farmers is still low.

While both the LA and the Asian Platform reports study detailed CA technologies, the MP and EP approach focuses largely on researching general trends rather than specific farmer-orientated guidelines. The MP emphasises NT as a means of improving water budget, crops diversification, reduction of costs, and liberation of labour for other occupations, rather than providing CA technologies that could be used by farmers. What is fairly strong within the EP research approach to CA and OF, on the other hand, is the research of technologies within contrasting soil and climatic conditions, as well as, in some instances, the rational combination of chemical and mechanical means of weeds control, the generally high level of development OF research and adoption, and the many long-term stationary field experiments which combine analytical research into physical, chemical and biological aspects.

II.3 Conditions for CA implementation

The adoption of CA by farmers is by far the most widespread in Brazil. Here, the extensive erosion/soil degradation from widely practised continuous summer soybean/winter wheat rotations in the 1970ies and 80ies initially convinced many southern Brazilian farmers to shift their production paradigm towards promoting better soil conservation. Inspired by no-till production concepts emerging in the USA at the time, a handful of dynamic “farmer-researchers” started to develop own their implements and systems without initial assistance from government or researchers. Farmer associations and co-operatives, NGOs and local industry then joined suit and were later followed by the international agro-industry, governmental agencies, national and provincial agricultural research stations, universities, etc.

The real CA evolution impetus, however, has remained farmer-driven in Brazil, and industry and governmental research is participatory.

In Vietnam, the presence of real erosion-linked problems has allowed the development of various mulching technologies, while the concerted research efforts by various agents have facilitated the development of a range of "technical" systems and implements in the IGP. However, in the absence of farmers' participation in research or vis-à-vis challenges to which CA can provide immediate solutions (i.e. erosion), widespread adoption in the latter region remains unachieved.

In essence, what appears to be *necessary to foment widespread CA adoption* is a combination of

- ⇒ very real and acute problems to trigger real responses,
- ⇒ proactive and dynamic farmers with sufficient knowledge and resources,
- ⇒ and good linkage between industry, farmers and research communities.

II.4 Special concerns for the European Platform

Neither EP, nor MP countries have gone through similar agricultural transformations as have the countries of the Latin American and the Asian Platform. Neither the urgency of biophysical problems (erosion and land degradation), as in southern Brazil or Vietnam, nor the external research and development effort, as in the IGP, has manifested itself in Europe. Societal discontent with agricultural pollutants has been an issue, on the other hand, which may explain why OF research and adoption has been more widespread compared to CA research when compared to results from the other platforms.

In terms of research, in Europe, existing CA research has perhaps also failed to be sufficiently multidisciplinary, holistic and participatory, given the various priorities and needs of farmers, with research often being focussed more on the needs of the environment and society as a whole rather than on those of the farmers as such. Possibly as a consequence of both the lack of a real acute problem and the skew of research towards societal rather than farmer goals, CA research and adoption in Europe has yet little of its own momentum, and too few guiding "reference" or CA role model farmers exist. The general "mindset" in respect to abandoning ploughing and thinking in terms of a new, highly integrated and holistic production system among European farmers is still little changed.

In order to improve CA research and adoption in Europe, various aspects should be considered:

- Firstly, farmer-driven and inspired research should be promoted and assisted as much as possible. On-farm and on-field demonstrations and trials, combined with seminars involving farmers and generating scientifically supported production guidelines could help support participatory research and extension of CA.
- In terms of general research paradigms, whole system analysis of farming systems from a multidisciplinary point of view, but also over a range of physical and temporal scales, should be applied in terms of CA research rather than just "narrow" technical solutions alone. Only in this way can we really address potential and acute impacts accruing from CA in a meaningful context and with relevant priority, attempting to combine marketing concerns with environmental or biophysical impacts, etc. In terms

of CA research guidelines for the EP, it is mainly from the LA Platform that we have things to learn due to the similarities in crops and agro-ecological challenges. However, it is probably also important to try to elucidate where CA makes most sense rather than try to promote it throughout, because CA cannot be used with equal justification in all the environmental conditions – the more favourable conditions are to be more clearly identified. More "regionalised" research should accommodate different edaphic, climatic, topographic, level of farm specialisation, etc., in order to allow for different contexts and priorities in different regions.

- In terms of research foci, design and research of appropriate equipment and machinery with and by farmers is important, as such specialist equipment for CA is largely lacking in Europe. Especially communication and dialogue between farmers engaged in CA and machinery manufacturers, which has proven so successful in LA, should be encouraged. Secondly, more rigorous and participatory research on cover crops adapted to our environments, priorities and constraints, could be useful to provide a broader "palette of informed options" for willing farmers, although changing the crop rotation with due attention to climatic and soil conditions on the one hand and to the market situation on the other is a considerable challenge. Thirdly, in terms of CA adoption and extension research, the LA Platform report emphasises the importance of various stages of transition from convention tillage to CA, and these should be factored into European thoughts on this.
- In terms of actual extension, in LA, the formation of CA farmers' associations has both furthered the dialogue between industry and farmers, as well as advancing adoption of CA by helping individual farmers overcome some of the hurdles associated with obtaining information or even funds for CA implements. Farmer-to-farmer dissemination of CA principles through the work of active farmers' associations could help make CA extension more bottom-up rather than too "top-down" and unidirectional technology-transfer from researcher to farmer.
- Perhaps incentives to CA could be achieved if "conversion subsidies", loans or grants (in Europe) from the government are granted to farmers willing to convert to CA. Some of this could also include soft credits or partial funding for the acquirement of specialised CA equipment. For all of this, however, more objective means of defining, assessing and monitoring what CA comprises and produces, are certainly necessary.
- Also, efforts should be made to try to make CA less reliant on agrochemicals. Ultimately, such forms of CA could be marketed under an eco-label similar to IP, and perhaps even benefit from associated price premiums in environmentally conscience and quality-driven markets. This is where EP cutting-edge and expertise and substantial farmer experience in OF is crucial and could help make a difference, especially if combined with, for example, inspiration from Brazilian experiences in respect to herbicide reduction, nutrient recirculation, etc. This could certainly go both ways, general OF research also benefiting from CA research, as in OF, there is often an over-reliance on intensive tillage to control weeds. In Denmark, for example, OF research has looked into various organic crop rotations, catch crops and weed management techniques without soil disturbance (e.g. increasing competitiveness of main crop through appropriate fertiliser placement, flame or thermal weeding, etc). Deepening this kind of research-knowledge and working with what European farmers are already using in terms of catch crops and crop rotations, and then applying these to a CA context.

III- Impacts reported

(Partners 10 and 11)

The evaluation of the impacts of CA will be divided into three parts: environmental, agronomic and socio-economic impacts.

III-1- Environmental impacts

The implementation of CA has several impacts on environment:

- mitigation of erosion,
- increase of leaching risk through macropores,
- higher content of soil organic matter,
- changes the stratification in C : N-ratio,
- less soil crusting,
- increase of biological activity

Mitigation of erosion: This is certainly one of the main driving forces for the promotion of CA. The potential erosion risk (water and wind erosion) varies depending on site morphology, rain intensity, slope gradient, field length and soil texture. Very high potential erosion risk exists in Latin American and Asian platform, high in the Mediterranean and low to middle risk in the European platform.
It is important that mitigation of actual water and wind erosion risk depends on soil cover by plants or plant residues. The management of soil cover seems to be developed to a higher degree in the Latin American platform (Brazil) than in the other platforms.

Water infiltration: Water infiltration into the soil occurs by matrix flow and macro pores. The number of biogenous vertical macropores is increased in CA compared with conventional agriculture (tillage). The increased infiltration rate, especially in no-tillage systems, could be a driving force or a constraint. Driving forces for accelerated infiltration are reduced runoff and faster trafficability after storms. A constraint is increased risk of pesticides or nutrient transport into the groundwater layers.

C-storage: CA produces a higher input of plant residues from crops and mulch into the upper soil horizons. At the same time, the mineralization rate of organic matter is lower, caused by reduced tillage without plough. The long term effect is a slowly increase in soil organic matter content within limits and a significant differentiation between the soil layers. However the reported rates of C-sequestration differ in several experiments a lot in the platforms, caused by big climatic differences, different level of C-content on the experimental sites, soil texture and different rates of additional C-inputs by cover crops and crop residue. CA includes land use systems and components suitable to increase locally the soil organic matter content with site-specific limitations and is therefore the basis for increased soil fertility. Most expertise about the C-household are reported in the Latin American region (Brazil).

Emission of greenhouse gases: The results of experiments are contradictory about the release of greenhouse gases. The evaluation of emission between CA compared to conventional agriculture is uncertain due to different methods of measurement in the different countries. But it is not sufficiently documented that higher potential for the CO_2 sequestration from atmosphere by CA will give reduced climate warming compared to conventional cropping systems.

Biodiversity: Increased soil surface cover with plant residues from main crop or cover crops improves the micro climate, nutrition situation and the habitat quality for insects. The biodiversity of natural fauna and flora is improved, but also the diversity of cultivated crops is usually higher in CA-systems. This is an important feature regarding multi functional farming and it may be important for CAP. This is reported in the European platform.

Soil crusting on loamy and silty soils is in CA reduced due to soil cover with plants or plant residues all trough the year. The reasons for this are higher biological activity in the mulch layer and prevention from destruction of soil structure by heavy rains and runoff.

III-2- Agronomic impacts

The main agronomic impacts of CA are:

- increase of crop yields in most areas
- saving of water by reduction of evapotranspiration
- increase of soil fertility

Many results are reported about *crop yields* in CA-systems compared with conventional tillage. Generally, an increase of yields was observed on Mediterranean, Latin American and Asian platform. In Europe, we see a more different situation: yields on poor and medium fertile agrarian areas doesn't change (+/- 10%), yields on very fertile with a high-intensive level of production are slightly decreased.

In all regions with refined crop rotation systems based on no till or reduced till (CA), the crop yield is more stable and more independent of the yearly climate variations than in conventional systems. The crop rotation and exploitation of the residues from previous crops reduces the pressure for plant diseases and weeds and save finally production costs and time. This means more time for farming on more land.

The most important field report about the importance of crop rotation as a basis of successful CA was given by the Latin American platform.

Cover crops, catch crops and intercrops are often integrated in CA-systems. Cover of soil surface with these crops or crop residues (mulch) is the key factor for soil conservation and to provide a high supply of plant residues for the main crops. Catch crops are used for many purposes like reduction of nitrate leaching, suppression of weeds or reduction of diseases and damage from specific pests. Cover crops are integrated in crop rotations reported in the Latin American platform. In Europe, intercrops are much less common because additional costs for sowing, fertilising, pest control and water and nutrient competition in some years. Also in the

Asian report, the use of cover crop is much less emphasised than in the Latin American report (except in Vietnam).

Saving of water could be a driving force or constraint, depending on biophysical conditions of soil and climate. In dry areas, the benefits of water saving by reduced tillage and shortened time for sowing are driving forces. In areas with high humidity and low temperature, the reduced evaporation could be a constraint (e.g. Norway, UK and Asian platform during monsoon).

Soil fertility was generally reported to be improved in all platforms. This is due to several reasons: mitigation of erosion, stabilisation of soil organic matter, no fallow without vegetation cover due to mulch or intercropping.

Constraints: In many countries of the European platform, slugs and mice and special weeds are favoured by reduced tillage. The part of cash crops like cereals in CA-crop rotations should be limited and should be replaced with root crops. However, the management of crop rotations with main and additional crops in the European Union is not a question of biophysical conditions for growing, but more a question of the support system, market prices and profitability. The major part of maize (to about 50 % in some farms) as the first crop before winter wheat without conventional tillage, increase the risk of mycotoxins in harvest products and could cause some times human problems.

Low *soil temperature* in spring in CA-systems on heavy soils retards the sowing and plant growth in cool and wet areas in the European platform.

III-3- Socio-economic impacts

Generally the living situation in the different platforms is not comparable. Nevertheless, there are some main and common socio-economic impacts of CA:

- general cost reduction
- reduction of labour
- reduction of labour peaks
- reduction of drudgery
- reduction of fuel costs
- reduction of machinery costs

Cost reduction: In all platforms are cost reductions the main driving force in dissemination of CA. The cost reduction is distributed on different categories: less fuel consumption because of reduced or no soil tillage, less time for labour, less machinery costs. The diversification of crop rotation breaks labour peaks. Also the reduction of drudgery is reported (Brazil). From Latin American platform is reported, that savings in time for seedbed preparation are extending the growing season. The general reduction in labour time could be used for non agricultural incomes, for more working intensive branches of the farm or an expansion of the farmed area.

CA leads to a reduction of labour in rural areas. On one hand this is a driving force, because of better incomes for the remaining farmers. On the other hand, we have constraints by producing unemployment in these areas. In this case are the impacts of CA in contrast to

organic farming. Organic farming employs more labour forces per hectare because of more working intensive production methods and often an integrated further processing of agricultural products (e.g. bread, cheese).
This comparative new system of agricultural land use promotes different kinds of networking in farmers associations, partnerships between research and farmers or companies and farmers.

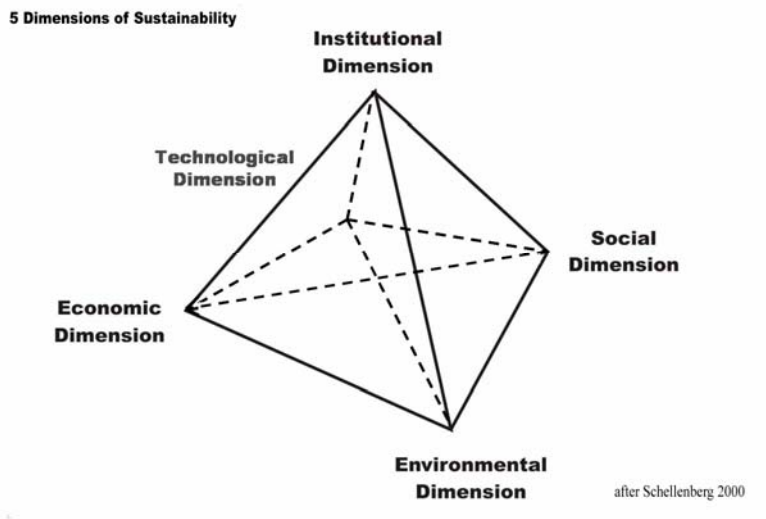
Constraints: The main constraints are high investment costs for drillers, tillage and harvest machines in the transition time. This is mainly for small farmers an obstacle. During transition period, the yields are generally lower or instable. During this time, the farmer has to learn to asses the new situations in growing crops. The costs for pesticides are often increased during this period. In some countries the lack of extension service is a constraint.

IV- System of governing

(partner 12)

In the following it is assumed that the term "sustainable" in the title of the KASSA Project is meant to be defined in relation to 'sustainable development' as shown in Figure 1, below.

Figure 1: 5 Dimensions of Sustainable Development



IV-1- Governance

While a conceptual visualisation of the relationships between actors in sustainable agriculture (see Figure 2) are provided in the final report of the European Platform[1], on reviewing the four platform reports it was felt that a straight comparison between these platforms is not a suitable approach for the analysis of governance. This is the case as the platforms primarily are constructed on criteria of climatic/geographic significance, while in terms of their politico/economic significance they are differently grouped. These groups are represented by 3 supra-national economic organisations: the European Union (EU), the Southern American Common Market (MERCOSUR) and the Association of South East Asian Nations (ASEAN). In addition, all participating countries, with the exception of the Ukraine and Vietnam, are existing World Grade organisation (WTO) members.

In terms of sustainable agriculture, all countries of the four platforms have been adversely affected by the late 20th century ideology of the "green revolution" with its focus on maximising production. This ideology was often heavily promoted by Governments, NGOs, multi-national companies, research and extension organisations, academics and others, with little regard to the long-term effects on the possibility of environmental degradation, social change and sustainable development in general.

[1] Work Package 1.1; Platform Assessment Report R 1.1; **Comprehensive inventory and assessment of existing knowledge on sustainable agriculture; European Platform**

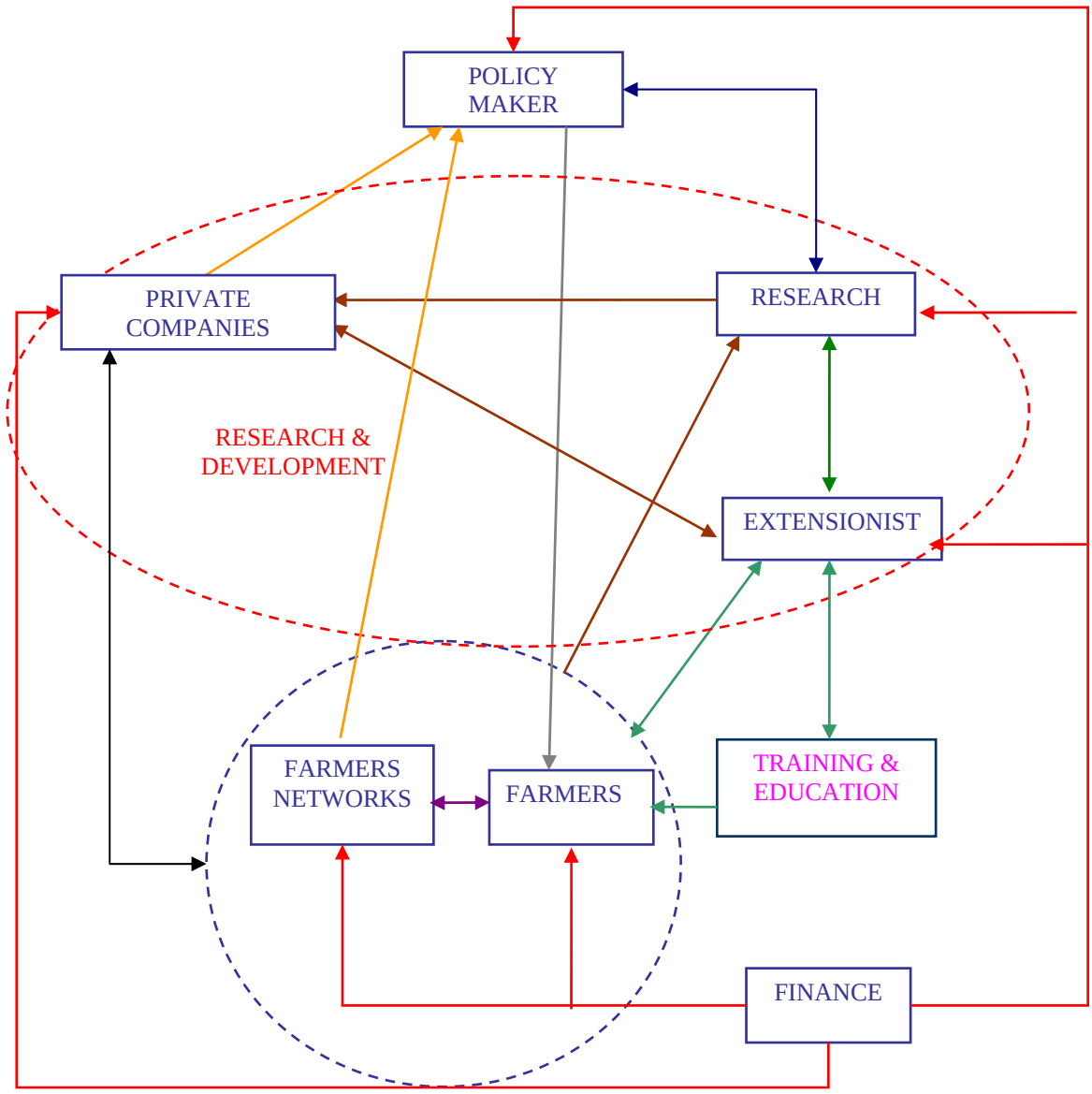


Figure 2: Conceptual System of Governance in Sustainable Agriculture (see WP1.1 report, section III-2, page 43)

Trade organisations, economic agreements, administrative and financial support all are matters of governance and they have arguably more effect on what a given farmer actually does than any other single factor. Within the European Union, which includes many of the states in both the European and Mediterranean Platforms, dealing with the bureaucratic demands of the Common Agricultural Policy (CAP) and the various national agricultural ministries and departments that administer this policy and its financial support schemes constitute a considerable part of the farmers' workload as a very important part of his income

is derived through this channel. Indeed for most farmers a computer has become as important a tool as the tractor.

While the reports of those states in the Mediterranean and European platforms that are EU members are rich in references to the EU, there is no apparent reference to the other two associations in the Asian and South American platform reports (for further details on these organisations see Appendix).

It is also most striking, in many of the KASSA reports, the degree to which political factors with a key influence on agriculture have not been addressed, even with regard to states where recent political change, current political instabilities, inter and intra-national conflicts or a general lack of enforcement of legality must be regarded to have considerable influence on the delivery of sustainable agricultural systems. Examples of omissions include the lack of information on the government type, mention current or ongoing apparent political problems, regional trading associations or the membership of the World Trade Organisation (WTO) a dominant organisation with sanction-imposing powers by proxy through its member states.

Making a comparison of the effect of governance on the extension of sustainable agriculture, across the four KASSA platforms, thus is far from simple. There is considerable variance of available information within each platform. Given the long-term nature of agricultural development, we not only need to consider the recent and present historical circumstances - but also need to address possible future developments. Some of the nations participating in KASSA that are currently parliamentary democracies have until fairly recently been under soviet systems or totalitarian regimes that have had noticeable impacts on agricultural policies, the systems of land holding, and farmers' confidence and attitudes. Whether the farmer is a secure or insecure tenant or owns his land, can result from historical conditions of some antiquity, and may affect his attitudes to any change of technique involving investment or risk. In some cases considerable differences may exist even within a single state as is exemplified by the considerable variance in the size of holdings between East and West Germany, or land ownership differences between Scotland and England in the United Kingdom. Legalities (and inheritance traditions) as they affect land tenure are also very significant in relation to the size of holdings and in what the farmer will or will not contemplate investing in.

All states in this project, except the Ukraine and Vietnam, which have observer status, are WTO members, There are many who consider that the WTO is favouring the commercial interest of a few over other considerations such as sustainable development.

Trans-national commercial organisations exert considerable influence on the development of agriculture, in all the platforms. As they may far exceed individual states in economic power they need to be considered as a significant part of governance. However benign their individual representatives, they are, as corporate entities, of their nature primarily concerned with short and medium-term profits. In the context of the EU and other economically developed states their influence is largely exerted through very extensive lobbying activities which can significantly influence legislation – the ongoing GMO debate is just one of the more pronounced examples of this.

In less developed economies or less open regimes (in South America, Asia, and also parts of Europe) such interests can have more direct impact through large-scale ownership of land and the control of other aspects of food production and processing, e.g. vertical industrial

integration and patents, as well as levels of political influence that may be considered undemocratic and in contravention of basic human rights.

Farmers' organisations are mentioned in the reports of all platforms although to make a valid assessment of their importance would require more detail on their specific natures, strength and purposes.

IV-2- Education

Institutions, including research and educational facilities also are part of the consideration of governance and existing provision and facilities of extension in the platform countries are not always referred to in the individual reports.

IV-3- Social aspects

In almost all the states covered, a dichotomy is made, in the reports, between the small-scale farmer and the larger scale market-oriented producer. The small producers are typified variously according to the country as subsistence farmers, part time farmers and peasant farmers. On the whole they are seen in all the platforms as less advanced in taking up the technologies of conservation agriculture. As formally defined within the KASSA project, we should however bear in mind that some subsistence / peasant farming systems have proven sustainability over extended historical periods. The status of and attitudes toward small producers can be a political issue. In many places they represent different cultural strata when compared to the larger farmers, their representative interests - and indeed the agricultural 'experts'. This is most obviously the case where as in South America the former are more representative of an indigenous pre-colonial culture - but also in the other three platforms where, as in Scotland, they may be more likely to speak a minority language or exhibit some other cultural distinction. Such differences are not unknown to lead to cultural prejudices between farmers on the one hand and government officials, scientists and extensionists on the other. Such attitudes can play a decisive role in the delivery of governance in agriculture in any country.

IV-4- Information & Communication Technology (ICT)

ICT is rapidly becoming a dominating factor in the execution of governance and as such was not addressed in the platform reports in a sufficient manner.

IV-5- Conclusions and recommendations on governance

In conclusion, the observations afforded by the comparison of the four platform reports covering 18 countries, point to:

- the necessity to consider the components of sustainability, i.e. governmental, social and ICT aspects in the KASSA study
- the preparation of SWOT[2] analyses that are able to identify the elementary issues afforded to the development and delivery of sustainable agriculture in these platform countries
- comprehensive multi-disciplinary reporting recognising the existing socio-political, economic and industrial interests, their representative organisations and groupings in the

[2] Strengths, Weaknesses, Opportunities, Threats

platform countries that exert a crucial influence on the present and future characteristics of agricultural systems at the national and global level.

Accordingly, any recommendations for policy support arising from the KASSA Project will need to be provided with a caveat.

It is recommended that, for the European Platform, the study of the governance of sustainable agriculture should be included in the next work package 1.3. in order to identify issues of governance that are at least common to the whole of the KASSA European Platform

V- Proposals for the European Platform

(Partners 7 and 9)

V-1- Gaps to be filled

A huge amount of experiences and scientific data on CA were presented from the other platforms. In the European Platform (EP) a lack of reliable data was identified for several topics, though. The following topics were named in special:

- water and matter fluxes,
- carbon stratification and sequestration,
- fate of pesticides and other pollutants
- adopted machinery (residue management, no-till, plant protection),
- strategies for the reduction of pesticides,
- effects on biodiversity,
- lack of information on specific crops/ species,
- lack of information on varieties.

Furthermore, there are no suitable tools available for monitoring CA systems, which makes it difficult to assess the sustainability of CA systems.

A strong emphasize by the EP is made on the need for long-term experiences, because especially on the EP scale, it was mentioned that several benefits do not appear directly but after a certain transition period. Short-term experiments therefore often may show distorted results. Too less is known about the transition period and there is a need for strategies – agronomic as well as socio-economic and political – for this period. In fact, it is identified as one of the major constraints for European farmers to shift from conventional to conservation agriculture.

The fruitful discussion with farmers (partner 5, partner 13) on the platform scale showed, that the information transfer from science to farmer and vice versa has to be improved. Experiments in co-operation with farmers are recommended to have a stronger link to used practices. Furthermore, knowledge sharing and learning from each other should be improved by platforms, where an exchange is possible.

V-2- Refined research topics

The rich experiences of the other platforms of the KASSA project are very helpful and a lot of knowledge could be shared. The reports definitely helped to understand which significance and value CA has for the other platforms. On the other hand, it became clear that biophysical, socio-economic and political conditions partly were very different between the platforms. It occurred that the EP is concerned with other topics than discussed in the other platforms (EP mainly environmental, whereas Latin American (LA) platform is strongly into an agronomic discussion and Indian platform is pointing out social and environmental (mainly erosion) subjects). That leads to a discussion of several subjects that are regarded from a different point of view on each platform. Talking of nutrients for example, for the LA platform, it is important to minimize nutrient losses from an agronomic point of view. In EP, this issue is mainly discussed on an environmental background regarding water pollution.
This is why there will be different emphasis on several research subjects by each platform and even within a platform.

V-2-1- Environmental

Environmental subjects are pronounced in the EP, because environmental issues are one major topic of concern and discussion when it comes to agriculture and the Common Politics (CAP) in the European Union. While several topics have been intensively discussed, three major subjects were pointed out where further research is needed.

1. *Pollutants*

   Especially the fate and behaviour of pesticides (especially herbicides) in CA systems, on which it was agreed, that the use might increase under conservation tillage, is an important subject for further research. On the EP scale, this research should focus on herbicides used in conservation tillage systems (e.g. glyphosate). It was reported that these herbicides and especially their metabolites were found in water bodies although it is known that glyphosate for example is broken down quite fast.
   There is also only little knowledge on the fate of other pollutants accruing from the recycling of municipal wastes in agriculture (sludge, composts). The main pollutants named here are heavy metals and persistent organic pollutants (POP), of which the second are a strongly discussed issue in Germany at the moment.

2. *Greenhouse gases and carbon cycle*

   There are very few reliable data available on the emissions of greenhouse gases from CA. Another problem poses the comparison of different data, which are obtained by various measuring means. The challenge would be to establish long-term experiments to compare conventional to conservational systems. It could not be clearly stated that CA has benefits in the point of greenhouse gas emissions. Even on a global scale this should be thoroughly investigated.

3. *Biodiversity*

   Generally, biodiversity is a major issue for agriculture in Europe. There are several benefits of CA on biodiversity identified; knowledge is far from complete, though.
   Different scales should be taken into account, when regarding biodiversity. Tillage affects soil fauna in a first attempt. Therefore, knowledge about the changes in soil fauna when shifting to CA is a subject of interest.
   These small-scale effects are responsible for effects on a larger scale and even on a landscape scale.

   Another not well examined subject is soil microbiology under CA.

   Regarding biodiversity, it seems very important to mention the benefits known from Organic Farming systems in Europe. Although the KASSA-Project more and more focuses on conservation tillage, on the EP scale OF must not be neglected, as it is a major subject to European agricultural politics and is strongly supported by several member states.

Other subjects mentioned were:

- soil physics (compaction, dynamics in conversion phase, long-term impacts),
- soil chemistry (linked to agronomic issues, nutrients, CEC, liming, pH),
- erosion (on- & off-site damage),
- water (impact on quality, water use efficiency, flood prevention).

On these subjects, it was agreed that a good knowledge base is available, although several aspects are still not known and should be subject of future research. It was recognized that some of these topics are much more important to members of the other KASSA platforms, where erosion and water use efficiency are the major driving forces for the dissemination of CA. Therefore, it would be a task to evaluate knowledge transfer from the EP to other platforms.
Furthermore, it seems important that some topics are of special interest to single regions. In Norway for example, soil water content combined with the evolution of soil temperature is of crucial relevance regarding the already short vegetation period, whereas water use efficiency is an important factor for dryer areas in the eastern part of Germany.

V-2-2- Agronomic

The shift to CA provokes many changes in the agronomic system and poses a challenge for the farmer to adapt to the new conditions. Several agronomic topics were discussed and especially the experiences of the LA platform were considered very helpful.
Seven main topics were discussed:

- **weed control:** is a major challenge when abandoning ploughing. There is a need for strategies in weed control with adapted crop rotations and a new management. In the EP, the reduction of the use of herbicides is the main goal to be achieved. It has also to be proven if GMO could be a way.
- **varieties:** Are there crop varieties available that can be used to increase or stabilize yields and/ or may improve the weed management and decrease the use of pesticides? Again: Is the use of GMO one possibility?
- **cover crops:** discussed in terms of weed control, but also in terms of their nutrient impacts (nitrogen fixing, "nutrient pump"). These effects are not well investigated and should be a subject of future research.
- **nutrients:** the conservation of soil fertility and SOM is an important point regarding the changes in organic matter stratification in CA systems. Too less is known about these changes and especially for the eastern European countries, SOM is a crucial element for plant nutrition.
- **technical issues:** machinery for sowing and residue management are good developed in European countries. Nevertheless, improvement is required here. Improved spraying technology could save money for the farmer and save herbicides for environmental benefits.
- **yields:** certainly one of the major issues discussed when it comes to agronomic changes. In contrast to LA where an increase of 10-20% in yields is reported, this effect is documented contradictory in the EP. Under the European biophysical conditions the transition period after changing to CA is a concern to farmers. Short-term experiments often show less yield stability and several studies even showed a severe decrease in yield.
- **crop rotation:** is a major means for weed control but also for nutrient management. Adapted crop rotations for CA under different biophysical conditions and different market demands have to be developed. There are differences between the platforms and even within the platforms regarding biophysical conditions and markets that should not be neglected.
- **strategies from OF:** a strongly discussed question on the EP scale was if it is possible to adopt agronomic strategies in from Organic Farming systems. Especially for the weed management, this could lead to reduction of use of pesticides.

V-2-3- Socio-economics

Main issues for future research were discussed to be the following subjects:

- **profitability:** Where (biophysical conditions) and under which market conditions is CA profitable? What are the boundaries for profitability?
- **savings:** It is known that shifting to CA is linked to savings in time, costs, labour and natural resources. Research has to focus on the assessment and the quantification of these savings under different conditions.
- **investment:** A constraint for the farmer to change his system to CA are high investment costs for new machinery. Especially on the EP scale, where there are uncertainties in the transition period, strategies have to be developed here.
- **CA as alternative:** Good experiences from EP and LA are reported for large-scale farms. But is CA a viable alternative for small-scale farming and has it benefits in income for rural areas?
- **farmers networks:** LA reported that a major driving force for CA were farmers networks. Ways have to be found to strengthen these networks and the knowledge exchange between European farmers.

V-3- Appropriate local and regional policy

One task for future research is the definition of appropriate local and regional policy regarding the dissemination of CA in Europe.

On the EP scale four main topics were discussed:

- **support for transition period:** As stated above, the transition period is a crucial time for the farmer. Training and education is needed and trials should be supported. It has to be proven, if subsidies or financial support in another way are viable means for support of CA in Europe.
- **suitable areas:** If suitable areas, where CA may develop good benefits, could be determined, specific regional support could be given.
- **CA as alternative for rural areas:** It has to be proven, if CA is an alternative for rural areas and if it shows to be economically viable there.
- **support for farmers initiatives:** As shown in the report of the LA platform, farmers initiatives are a main driving force for the dissemination of CA. In which ways these initiatives could be supported by a political or institutional framework is a question for future research.
- **publicity of CA:** CA is not known as well as OF to European politics. For the promotion of CA, it will be inevitable to improve the knowledge transfer from science to politics about the benefits and constraints of CA.

V-4- General questions to be tackled

Some general questions have arisen that do not fit into one of the above mentioned categories and are of a more overviewing kind.

The major question which has to be answered is about sustainability of CA. It has to be answered under which conditions (biophysical, economical, political) conservation tillage is sustainable. This is basically a question about WHERE and HOW it should be done to be called sustainable.

For this reason, the development of suitable indicators for sustainable CA is a future task. A helpful mean would be modelling to assess all effects of a change in agricultural practices. The knowledge base for modelling has gaps to be filled, though.

Furthermore, the reduction of pesticides may enhance the acceptance of CA to politicians and to the people. Certainly, strategies for the reduction of pesticide use in CA are a major challenge for research and development in Europe.

Strongly linked to the question of sustainability is the question after a value of CA for the society. Benefits have to be identified that can support the promotion of CA in the society.

There are lots of practical experiences reported from the other platforms (especially in LA). For the different biophysical and political conditions of the northern European countries one crucial question is whether strategies from the other platforms may be adopted or how they have to be changed according to our conditions to be adopted.
The same is true for strategies adoption from OF.

After all, the members of the European platform agreed that the effects of shifting from conventional agriculture to CA can only thoroughly be investigated and assessed in long-term experiments. So there is a substantial need for long-term and comparable research to evaluate the mosaic of CA´s effects.

Conclusion

The European partners have chosen to refine their findings on the conditions and the strategies which potentially permit farmers to shift from conventional agriculture to conservation agriculture. This point was highlighted by the Steering Committee, who met at the beginning of June.

The issue of the shifting can be linked to the statement presented in the WP1.1 report of the European platform: “I should change what I can change.” Two questions are tackled in this statement:

- **Why and Where should I change?** What are the benefits of conservation agriculture and which problems does it permit to solve? Where is it suitable to perform conservation agriculture (for which soils, for which crops and in which farming system)?
- **How can I change?** What are the strategies leading to conversion, from farmers’ point of view (economic, agronomic and technical aspects), and from governance’s point of view (level of extension, partnership …).

Hence, the work that will be achieved for the WP 1.3 will be oriented on the two axes: 1- the “why/where” question and 2- the “how” question.

Appendixes

WP 1.2
Learning from platforms' reports

Grid for critical analysis

This grid has to be filled in by each partner in order to set up a comparative critical analysis of the 4 platform reports. Please, send it back to us by 27/05/2005.

Partner number:

I- Features regarding the shifting from conventional agriculture to sustainable agriculture

In the sections I-1, I-2 and I-3, you have to:

1. *Identify the main driving forces and constraints regarding the shifting from conventional to sustainable agriculture;*
2. *Highlight the common points and differences between the 4 platforms;*
3. *Identify the conditions necessary for the adoption of sustainable practices by farmers.*

I-1- Biophysical conditions

To be filled in

I-2- Socio-economic conditions

To be filled in

I-3- Policy opportunities and constraints

To be filled in

II- Technologies and approaches used

In the sections II-1 and II-2, you have to:

1. *Highlight the common points and differences between the 4 platforms;*
2. *Identify the conditions necessary for the development of alternative technologies and approaches (II-1) and of ways for their implementation improvement (II-2).*

II-1- Alternative technologies and approaches

To be filled in

II-2- Implementation improvement

To be filled in

III- Impacts reported

In the sections III-1, III-2 and III-3, you have to highlight the common points and differences between the 4 platforms.

III-1- Environmental impacts

To be filled in

III-2- Agronomic impacts

To be filled in

III-3- Socio-economic impacts

To be filled in

IV- Proposals for the European Platform

In the sections IV-1, IV-2, IV-3 and IV-4, you have to emit proposals at the European platform scale, regarding the topics developed in the sections I, II and III.

IV-1- Gaps to be filled

To be filled in

IV-2- Refined research topics

To be filled in

IV-3- Appropriate local and regional policy

To be filled in

IV-4- Other proposals

To be filled in

Notes on the section "system of governance"

The EU, a hybrid intergovernmental and supranational organization, consists of 25 countries[3]. Through the "Common Agricultural Policy" (CAP) the EU probably exerts the single strongest controlling effect on agriculture and agricultural producers in those countries of the European and Mediterranean Platforms that are members (see http://europa.eu.int/index_en.htm).

The MERCOSUR was created by Argentina, Brazil, Paraguay and Uruguay in March 1991 with the signing of the Treaty of Asuncion. It originally was set up with the ambitious goal of creating a common market/customs union between the participating countries on the basis of various forms of economic co-operation that had been taking place between Argentina and Brazil since 1986. The Treaty of Ouro Preto of 1994 added much to the institutional structure of MERCOSUR and initiated a new phase in the relationship between the countries, when they decided to start to implement/realize a common market. A transition phase was set to begin in 1995 and to last until 2006 with a view to constituting the common market. In 1996, association agreements were signed with Chile and Bolivia establishing free trade areas with these countries on the basis of a "4 + 1" formula. During this period, MERCOSUR also created a common mechanism for political consultations, which was formalized in 1998, in which the four countries plus Bolivia and Chile all participate as full members of the so-called "Political MERCOSUR ". See http://www.mercosur.org.uy/ (site in Spanish and Portuguese)

The Association of Southeast Asian Nations or ASEAN was established in 1967 in Bangkok by the five original Member Countries, namely, Indonesia, Malaysia, Philippines, Singapore, and Thailand. Brunei Darussalam joined in 1984, Vietnam in 1995, Laos and Myanmar in 1997, and Cambodia in 1999 (http://www.aseansec.org/home.htm).

Norway's relations with the EU are mainly governed by the Agreement on the European Economic Area (EEA). The EEA Agreement is in force since 1.1.1994 and extends the Single Market legislation, with the exception of Agriculture and Fisheries, from the EU Member States to Norway, Iceland and Liechtenstein. Through the EEA Agreement, Norway participates in a large number of EU programmes covering most EU policy areas, including enterprise, environment, education and research programmes. In the EEA context, Norway is also associated to various EU agencies and the INTERREG programmes. Norway is also associated to the European Spatial Development Perspective (ESDP) (http://europa.eu.int/comm/external_relations/norway/intro/)

The European Free Trade Association (EFTA) was established in 1960 as an alternative for European states that did not wish to join the European Union. Iceland, Liechtenstein, Norway and Switzerland are members of EFTA. The EFTA Convention established a free trade area among its Member States. In addition, the EFTA States have jointly concluded free trade agreements with a number of countries worldwide (http://www.efta.int/).

The World Trade Organization (WTO) is the only global international organization dealing with the rules of trade between nations. At its heart are the WTO agreements, negotiated and signed by the bulk of the world's trading nations and ratified in their parliaments. The goal is to help producers of goods and services, exporters, and importers conduct their business (see http://www.wto.org/english/thewto_e/whatis_e/whatis_e.htm).

[3] Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, UK; (note - Canary Islands (Spain), Azores and Madeira (Portugal), and French Guyana, Guadeloupe, Martinique, and Reunion (France) are sometimes listed separately even though they are legally a part of Spain, Portugal, and France. Candidate countries include: Bulgaria, Croatia, Romania, and Turkey.