ENDURE

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PP Restricted to other programme participants (including the Commission Services)	
RE Restricted to a group specified by the consortium (including the Commission Services)	
CO Confidential, only for members of the consortium (including the Commission Services)	

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Glossary

In the report with the review, acronym names were allocated to specific DSS, which are referred to in analyses of DSS and also in this report. The acronyms include a country code and a short name of the DSS.

DSS acronym names

Bu_GreenhouseOrnamentals	Ge_Pomsum
Cz_GrowerSys	Ge_Proplant
Da_BlightMan	Ge_Simblight1
Da_CPODiseases	Ge_Simcerc3
Da_CPOWeeds	Ge_Simlep3
Es_Report	Ge_Simonto
Fr_ActivLimaces	Ge_Simphyt1
Fr_Bruchilis	Ge_Simphyt3
Fr_Cocloconium	Ge_SkleroPro
Fr_Colibri	Ge_ZEPP
Fr_CryptoLis	Ge_Ökosimphyt
Fr_Dacus	Hu_AgroAdcoTele
Fr_DecidHerb	Hu_BoreasIntermet
Fr_Epicure	Hu_LufftSmart
Fr_EVA	Hu_MetosLink
Fr_KitPetales	Ir_Report
Fr_MildiLis	It_GestInf
Fr_MilMel	La_Report
Fr_MilpvOignon	Li_Report
Fr_MilpvPomTer	Nl_MLHD
Fr_MilVit	Nl_NemaDecide
Fr_OptHerbClim	Nl_Opticrop
Fr_Phytochoix 3	Nl_PlantPlus
Fr_Presept	Po_IPMIDSS
Fr_QualProtVege	Pl_SPEC
Fr_SeptoLis	Sk_GalatiViti 3
Fr_Simbad	Sp_Gep
Fr_SovBurgundy	Sw_DoseKey
Fr_Spirouil	Sw_Fusaprog
Fr_TaveIurePomme	Sz_Phytopre
Fr_Tordeuses	Sz_Sopra
Fr_TordeusesPlum	UK_Fororls
Fr_TraitOptPietin	UK_Fororps
Ge_Cercbet1	UK_WheatDiseaseMan
Ge_Cercbet3	UK_WeedManager

Total count: 70

Some abbreviations are also used in this report:

Abbreviation	Explanation
DSS	Decision support system.
FMS	Farm management system.
Model	Models are often developed and used to simulate functionality of smaller or bigger parts of biological systems. For example, models have been developed to predict outbreaks of various diseases and pests or to predict the biological activity of pesticides under various conditions. Models are widely used to support decision algorithms and calculations in Decision Support Systems for crop protection.
Pest	When used alone, 'pest' is a rubric including insects, various diseases and weeds. When listed in connection to 'diseases' or 'weeds', 'pest' means: 'insect'
TFI	Treatment Frequency Index. Accumulation of the number of full doses applied. TFI can be accumulated for specific spray programmes or for a spray season, etc.

Summary

This report documents deliverable DI2.3 provides a short summary of a published report counting 128 pages, which contains:

- a review on the status of DSS and FMS for crop protection in Europe in the year 2008, which is based on a survey including 70 DSS's
- proceedings from a pan-European workshop, which were venued in Denmark in March 2008, where 49 DSS's were presented and 'best parts' of these DSS's relating to potentials for reducing dependency and/or use of pesticides were identified. Programme, links to presentations and consolidated, concluding remarks have been included in the proceedings

The survey behind the review was jointly planned and executed by 12 participants in ENDURE IA2.4, who represent 12 European institutions, which are all involved in research, development of DSS or advisory service relating to crop protection.

The results from the survey indicate that the present supply of DSS's for crop protection represent a diverse collection of driving forces, crops, pests, modeling approaches, potentials, technical platforms, levels of implementation, etc.

In the perspective of reducing dependency and/or use of pesticides, 'best parts' of DSS's for unification on a European level have been identified within 4 crop x pest groups, which dominated the data that was collected in the survey:

- diseases in horticultural- and fruit crops, 18 DSS's
- diseases in arable crops, 37 DSS's
- pests, 18 DSS's
- weeds, 9 DSS's

Introduction

Weeds, pests and diseases are global threats to crop production, and pesticides are widely used to reduce quantitative and qualitative losses due to damage caused by these organisms. In many crops, pesticides are relatively cheap and effective as compared to alternative measures, why pesticides are often used more or less by routine, and dose rates are often higher than required by conditions on a field level.

By nature, weeds, pests and diseases are not equally distributed in time and space. For example, some insects attack specific crops only in some areas and only in short period of time. Consequently, only pesticide applications that are adjusted accordingly will be valuable.

Also by nature, the efficacy of various pesticides varies with conditions that vary considerably in time and space. For example, some weed species in early growth stages in one field may be efficiently controlled by just 5-10% of the labelled dose-rate of an herbicide, while other weed species in later growth stages in another field may be practically unaffected by a labelled dose-rate.

Therefore, pesticides are only valuable when applied according to conditions in time and space, but different strategies for decision-making may be considered to be rational. Directions for use on product labels often include just a few dose-rates for a few scenarios of conditions. Correspondingly, ‘best practices’ for pesticide applications as recommended by advisors, are often expected to be robust for a relatively wide range of conditions. If pesticides could alternatively be applied according to the motto: ‘as little as possible, as much as required’ taking into account existing knowledge bases and conditions varying in time and space, a substantial potential exist for reducing input of pesticides without jeopardizing robustness in production lines.

Potentials for reductions in pesticide use are expected to increase with increased differentiation in pesticide applications which integrate conditions in time and space.
With an increased differentiation in application of pesticides, however, decision-making becomes more complex, and DSS’s may serve as dynamic points of references to manage such increased complexity.

Existing DSS for crop protection have been developed for different objectives, for different crop x pest systems, for different geographical regions, etc., while identification and prioritization of future needs for DSS require political negotiation in order to identify and prioritize aspects which are considered to be most important. Such negotiations were conducted on the pan-European workshop, and results are documented in ‘concluding remarks’ from this workshop.

1. Methodology

The review is based on objectively identifiable aspects of existing DSS for crop protection as documented by a survey, which was conducted in EU member states and Switzerland in the year 2008. The survey was jointly planned and executed by the participants in ENDURE IA2.4 which include the following persons and institutions, sorted according to surname of participants:

Name and surname	Institution	Email address
Thomas Been	Applied Plant Research B.V (PPO), The Netherlands	thomas.been@wur.nl
Antonio Berti	Consiglio Nazionale delle Ricerche (CNR), Italy	antonio.berti@unipd.it
Neal Evans	Rothamsted Research (RRES), United Kingdom	neal.evans@bbsrc.ac.uk
David Gouache	Association de Coordination Technique Agricole (ACTA), France	d.gouache@arvalisinstitutduvegetal.fr
Volkmar Gutsche	Julius Kühn-Institut (JKI), Germany	v.gutsche@bba.de
Jens Erik Jensen	Danish Agricultural Advisory Service (DAAS), Denmark	JNJ@lr.dk
Josefa Kapsa	Plant Breeding and Acclimatization Institute (IHAR), Poland	jkapsa@wp.pl
Nora Levay	Szent Istvan University (SZIE), Hungary	Nora.Levay@mkk.szie.hu
Nicolas Munier-Jolain	Institut National de la Recherche Agronomique (INRA), France	munierj@dijon.inra.fr
Samuel Nibouche	Centre de Coopération internationale en recherche agronomique pour le développement (CIRAD), France	samuel.nibouche@cirad.fr
Marc Raynal	Entav ITV, France	marc.raynal@itvfrance.com
Per Rydahl	Aarhus University (AU), Denmark	per.rydahl@agrsci.dk

A DSS for crop protection may be perceived as a component in a complex line of decisions and actions on farm and field levels. In order to capture various qualities of such DSS's, a rather wide range of characteristics were included in the survey. A joint form was developed for collection of data on DSS's. This form includes a number of detail questions, which were formulated within the following main areas of questions:

- Which decisions are supported?
- Which modelling approaches have been used?
- How is communication with users being done?
- Has some impact been demonstrated?
- Have opportunities for integration with naturally adjacent systems been identified?
- Are procedures for updating being followed?
- Have opportunities for unification been identified?
- Has feedback to research been identified?
- In a local perception: have some 'best parts' been identified?

In order to focus the survey, a set of minimum requirements to constitute a DSS of relevance to the survey was identified. According to these requirements, a DSS of relevance to the survey must include the following 4 elements:

1. evaluation of economic thresholds and/or recommendation of options for treatment
2. integration of various sources of information. Some ‘added value’ as compared to label- and standard recommendation must be demonstrated
3. use of decision algorithms and/or calculation models
4. use of computers

In the form for data collection, supplementing explanations and examples were provided in connection to each single question, and instructions were also provided on how to document collected information by use of references. These instructions are comparable to standards for reviews that are published in peer-reviewed journals.

In a perspective of possibly reducing dependency and/or use of pesticides, the collected data was analyzed to possibly identify some ‘best parts’. As the questions listed above cannot immediately be integrated in a common scale, ‘best parts’ were searched for different characteristics.

The search included 27 EU-member states and Switzerland, and the survey was conducted by allocation of 1-4 countries to each participant. Consideration was observed to possibly allocate countries in geographical neighbourhoods to the data collectors.

The work of data collection included two separate periods: June – October 2007 and March – August 2008. The latter period was added as a result of conclusions made on a pan-European workshop in March 2008 where it was realized that obviously some important DSS’s had been overlooked in the first period of the survey.

2. Results

In September 2008 the total count of received reports were 72 including 65 filled in data forms and 7 unofficial reports, which were immediately considered to be a relatively high rate of returns. Two unofficial reports were excluded due to lack of quality, while 70 data-reports were included in the review.

The analyses work was organized by dividing the 70 data-reports in 4 major crops, according to the crop x pest systems that were covered by the data-reports and the skills and interests of different participants in ENDURE IA2.4. The following 4 analysis-groups were appointed:

- diseases in horticultural- and fruit crops, 18 DSS’s
- diseases in arable crops, 37 DSS’s
- pests, 18 DSS’s
- weeds, 9 DSS’s

As some DSS’s cover more than one of these groups, the total count of DSS’s exceeds the total count of data-reports. The results from the analyses of data-reports have been presented separately for these 4 groups.

Some DSS’s cover a large range of decisions that may include complete programmes for monitoring, treatments and follow-up throughout one or more growing seasons, while other DSS’s focus on isolated decisions, e.g. prediction of the time for attacks of a single pest which exceed the economic threshold in a single crop. Some DSS’s recommend ‘ready-togo' actions on farm- and field levels, other DSS's recommend actions that require some interpretation by- or linkage with advisors, before output from the DSS's can be implemented on a field level.

A report titled: '*Review of new technologies critical to effective implementation of Decision Support Systems (DSS's) and Farm Management Systems (FMS's)',* which present much more detail on methodology and results of analyses has been produced separately (128 pages).

This report also include programme, links to presentations and consolidated concluding remarks, which thereby constitute *'Proceedings of a pan-European conference on the current status and future needs for DSS',* which was venued in Flakkebjerg, Denmark in March 2008.

2.1. DSS's for diseases in horticultural- and fruit crops

Tactical decisions are supported in terms of whether to spray, mainly driven by weather data and weather forecasts and models that refer to the life-cycles of specific diseases. It a spray is needed, mainly recommended dose rates will be suggested. Use of economic thresholds and use of dose-adjustments are rare. Strategically decision considerations are restricted to a single DSS, which include considerations regarding reducing risk of inducing pesticide resistance.

The main end-users are advisors and farmers, and the DSS's communicate by use of a wide variety of modern electronic communication tools. Only 3 out of 19 DSS's provide some indication on demonstrated impacts, however, potentials of reducing input of fungicides are only reported as levels of variability, referring to spatial and seasonal differences. Potentials for reductions are mainly explained by reductions in the number of treatments as compared to routine spraying programmes on a seasonal level.

Several DSS's have been integrated with weather stations and with infrastructures of consultancy networks. A few DSS's have also been integrated with complex farm management systems. Most DSS are updated on a regular basis, utilizing experiences from the late growing season. Opportunities for unification were reported for several DSS, however only the model structure itself might be exported. Some DSS have already successfully been adapted to conditions in different countries

Although more and more information is available to support decision making of stakeholders, still system approach seems to be in an initial stage of development. On the contrary, the spread of GIS technologies support the landscape level thinking, keeping in mind that an area wide approach would never replace the field level decision making procedure. Based on this survey, it can be concluded that the mainstream of development is the accelerated integration of data sources and DSS modules both at national and supranational level.

2.2. DSS's for diseases in arable crops

Initial studies of received data forms indicated that separate analyses could be made in 4 different crop x pest groups: a) Potato Late Blight group, b) cereal group, c) non-blight/non-cereal group and d) multiple crop x disease group.

All DSS's on potato late blight support decisions relating to the timing of first fungicide application. 2 French DSS also recommend date of spraying, compound to spray and dose rate and future applications.

DSS's on diseases in cereals use weather data to predict infection periods and risk of epidemic progress. Some DSS's focus on epidemiology, other DSS's focus dose-response relations with fungicides and a 3rd group integrate both.

In the non-cereal/potato group, a diverse set of decisions algorithms and tools have been developed, e.g. use of spore-traps, petri dish plate-based bioassays in the field. In the multiple crop x disease group, DSS's developed by private companies seem to have a substantial appeal to growers and advisors, although the decisions supported may not be differing much from DSS developed by public sector.

DSS's for potato late blight and for cereals share a basic concept of using weather data and weather fore as input for algorithms that predict risk of infection. Timing of first application of fungicide is recommended. More advanced systems also calculate subsequent risk timing of subsequent applications.

DSS's in the non-potato/cereal and multi-system groups are more diverse in the modelling approaches, including decisions thresholds, regression based epidemic progress models to predict economic and epidemic severity thresholds and 'knowledge-based' algorithms to predict when and what should be applied.

Considering communication with end-users, most DSS's for potato late blight are accessible from the internet. In cases where meteorological data is needed, such are often automatically 'pulled' from relevant access points, thus reducing efforts by end-users. Communication of DSS's for cereals are relatively simpler.

DSS's for potato late blight have proven capable of reducing the number of sprays in a growing season. Treatment failures leading to epidemics and crop failures and a comparative low cost of routine fungicide applications are, however, an important hindering for uptake of such DSS's.

DSS's for cereals, where substantial seasonal variation in infestation levels exist, are often rather in-transparent with respect to algorithms and calculations. At the same time, effective fungicides are relatively cheap, why routine-based treatments are perceived as rational 'insurance policies'. Non-cereal/potato and multi-system DSS's have had a relatively low impact, however, a few systems have a relatively high number of end-users.

Many DSS's have been integrated with natural adjacent systems, e.g. farm management systems, suppliers of various meta-data, e.g. weather stations. As DSS's for potato late blight are all web-based, updating can be made easily from a central point. DSS's for cereals and other cultures include web-based and PC-based techniques, but all DSS's are regularly updated.

The major group of DSS's has not yet been unified for conditions in other countries. A few DSS have, however, a least on a conceptual and/or structural level, been implemented in different countries.

Most DSS's for potato late blight are in a continuous process of development and validation in order to improve the predictive power, the potentials and other objectives too. There seems to be a common consensus that there is a need to extend the blight DSS's to provide predictions for other potato diseases, for the production of a 'one stop shop' for potato diseases.

Many factors influence the connections between DSS's and research, e.g. introduction of new growing practices, identification of new biological connections, factors that have specific influence, etc. DSS's should dynamically over time be adapted to such changes, offering qualified support for decisions.

2.3. DSS's for pests

Most DSS's support decision in different crop/pest systems, however 4 different DSS cover codling moth on pomefruit. Most DSS's support short term (tactical) decisions, mainly decisions on sampling periods and decisions on choice of chemical compound, dosage and timing and spraying techniques. Some DSS's also recommend non-chemical treatment options, e.g. techniques for mating disruptions. A few DSS's also include long term (strategically) decisions, e.g. choice of crop variety or use of trap crops.

To basically different modelling approaches exist:

- predictions of pest occurrence
- actual presence of pests in time and place.

The presence of pest populations, are assessed in basically 2 ways:

- sampling by the user
- forecasting based on sampling by other users

Possible economic damages are assessed in two ways:

- by comparing observed/predicted attack levels to economic threshold levels
- by use of yield loss model.

Outbreaks are predicted mainly by pest population dynamics models, which are mainly driven weather data, in particular temperature data. Some DSS's also integrate agronomic factors on a field level. Spatial distributions of pest are also modelled from catches in pheromone traps. A few DSS's also integrate models that predict crop growth-stage, which is relevant in cases where a pest will attack only at specific growth stages.

The major target groups are farmers and advisors, but all DSS's needs an intermediate step in terms of e.g. 'warning services' or advisors, in order to connect to farmers. The theoretical potential of the analysed DSS's is to reduce the use of pesticides and/or to achieve a more efficient positioning of pesticides. Demonstrated impact in practice is sparse, however. Uptake by farmers is generally quite low, but more advertising, training and a more strict regulation on pesticide use could promote additional uptake. Cheapness of routine application of insecticides and reluctance to conduct field inspections constrain additional uptake.

Several DSS'S have been integrated with FMS's and with suppliers of meta-data, e.g. characteristics of crop cultivars, weather-data and label information on pesticides. Basic models the predict occurrence of pest are generally suitable for unification. Models that include interactions between specific crops and pests are probable suitable for unification on a regional scale. Several DSS'S have contributed to pin-point new research objectives that could also support specific DSS'S concepts.

2.4. DSS's for weeds

Older DSS's support decisions on whether a treatment is required, and which of a list of suggested and more or less standardised treatments that is favourable, given a set of constraints. Newer DSS's are characterised by more holistic approaches, including also much more differentiation in the recommendation of treatments.

Developments have progressed since the early 1990'ies, from tactical 'spray'/'no spray' approaches towards optimisations including many biological and environmental aspects.
Some additional evolution trends have been observed: 1) from strict economic approaches towards approaches that also include various environmental aspects, 2) from short-term (tactical) approaches towards long-term (strategic) approaches that also include aspects of the crop rotation.

Some DSS's have implemented various supportive tools, e.g. tools to assist weed identification and tools to identify spraying techniques, which may be perceived as a set of matching recommendations relating to the spraying equipment, e.g. combinations of spray tasks, wind speed, water volume, driving speed, nozzle type and –size, etc.

The older DSS's are generally installed on separated computers, while the newer DSS's can be upgradable by internet or internet-based.

Transparency of recommendations from the DSS's back to underlying data and literature is relatively weak. Consequently, the recommendations from the DSS'S will often be perceived as a 'black-box' to the end-users, why the integrity and reliability of the DSS's should be documented in different ways, e.g. by results from tests in practice.

All DSS's were designed to support decisions made primarily by farmers, and some of them are also supporting decisions made by advisors. Two DSS's use a generic modelling approach, which have enabled them to work in a large number of crops, a large number of weeds and a wide range of 'conditions', enabling them to manage most situations of crop infestations.

Most DSS's have demonstrated a potential for reducing input of herbicides while maintaining requirements for weed management on a farm level. Three DSS's take into account differences in potential environmental impact for alternative herbicide treatments. Some of the DSS's are still under development, while other DSS'S have been released for years.

The uptake of the DSS's is relatively sparse: up to 3% of national farmers. Even though some DSS's have demonstrated potentials for reducing herbicide input up to 40-50% in some crops, a number of reasons have are reported for a relatively low uptake of such DSS's. For example, low incentives due to relatively low cost of routine herbicides treatments and low interest to conduct scouting for weeds before decisions on herbicide applications are made.

DSS's which have been designed mainly for farmers, may conveniently be integrated with naturally adjacent IT-tools used on a farm level, as needs for entering input data can thereby be rationalized. Several DSS's has been integrated with FMS's and suppliers of meta-data, e.g. weather-data, databases on pesticides and systems for site-specific herbicide application.

Some DSS's have been found suitable for unification on an European level in terms of basic principles, basic system architecture or as it is. A general shortcoming is the availability of specific data needed to establish specific algorithms and/or to estimate specific parameters in calculation models. Some DSS's have been successfully adapted and implemented in different countries, typically in countries, which are geographically near to the country of origin. Several existing DSS's have interacted dynamically with research groups to identify new questions for research which also benefitted the robustness and potentials of specific DSS's.

2.5. Identification of 'best parts' of DSS's

On 17th-19th March 2008, a pan-European workshop was convened in Flakkebjerg, Denmark. The objectives of this work-shop were:

- to shortly present as many as possible of the 65 DSS's on which filled-in data-forms were received to conduct a process that inspired for involvement and discussion of 'best parts' of these DSS's in relation to perspectives of reducing use and/or dependency of pesticides
- to achieve consensus regarding identification of specific 'best parts' for various attributes of various DSS's in various crop x pest systems

Allocation of the task of identification of 'best parts' to a pan-European workshop, possible bias arising from subjectivity among the authors of this report, which could arise from personal involvements in national programmes for development of DSS's for crop protection, is expected to be insignificant.

After short presentations of 49 different DSS's, a representative from ENDURE SA4, which aims to build up a European Information /-Competence Centre (EIC), presented results from a survey, which was conducted in 2007 to identify needs from end user with respect to decision support relating to crop protection in a broad sense. It was concluded that DSS's were generally highly ranked among farmers and advisors as compared to alternative sources of decision support. However, some general requirements to DSS's were identified in order to form a basis for successful implementation in practical farming. Use of a DSS should:

- offer some advantages as compared to alternative sources of decision support, e.g. better control, lower cost, lower environmental impact, etc.
- be at least as robust as alternative sources of decision support, as false recommendations may lead to a total rejection of DSS's
- strive for adaptation to existing operations on a farm level

'Best parts' with respect to potentials for reducing dependency and/or use of pesticides were identified in 5 separate groups: 1) potato late blight, 2) diseases in cereal crops, 3) diseases in horticultural- and fruit crops, 4) pests and 5) weeds. Each group gave a short presentation to the plenum of the workshop, and 'concluding remarks' from the plenum discussions were subsequently consolidated by the participants of ENDURE IA2.4.

2.5.1. Best parts of DSS's for diseases in horticultural- and fruit crops

Modeling approaches are often very specific to specific crop x pest systems, why only little opportunity exists for identification of 'best parts' for possible unification. Considering the decisions that are supported, the identification of 'high risk' periods seem to be a prosperous way to follow for additional research and development. Later on, also systems that can recommend treatment options may be feasible, but still much research and development are required to construct operational applications.

In a relatively short time span, DSS's may be developed to make recommendations on a regional level, thus underlining the importance of involving also regional advisers in order to make systems operational on a field level. To ensure productivity and progress among researcher and developers behind a DSS, procedures that provide feed-back from farmers and advisors should be established.

Some steps to possibly fertilize the ground for more operational applications, e.g. ensure basic compatibility of different data sources, first of all: weather data.

Other steps may be made operational and valuable within a relatively short span of time, e.g. monitoring schemes for selected crop x pest systems, development of tool to assist identification of pathogens and strategic management of prevention of resistance development and environmental side-effects.

Cost-benefit analyses from a point of the end-users may be fruitful tool to evaluate potentials in different stages of DSS-development: from conceptual ideas to implementation plans. Arbitrary assessments of impacts of DSS's should also be made in different stages of DSS development, so that efforts may be concentrated on potent ideas, concepts and applications.

2.5.2. Best parts of DSS's for diseases in arable crops

Identification of "best parts' has been made separately in different crop x pest groups. Among the DSS's for potato late blight, systems that are based on the 'Simphyt' or 'NegFry' models, i.e. Da_BlightMan, may be adaptable to different geographical regions/countries is with only minor modifications of core systems.

DSS's for diseases in arable crops are dominated by 'single disease' generic systems, which could probably be combined to provide information on more than one disease (utilising generic metadata i.e. weather data). The Danish system (Da_CPODiseases) is well defined and already used in other Baltic countries with good success, and could be amenable to further development throughout northern Europe.

Considering the non-cereal/potato group of DSS's, potentials may exist to capitalise in-field monitoring techniques to be used: 1) in new geographic areas and/or 2) as a measure to further 'fine-tuning' of DSS-algorithms and -models. Furthermore specific models for diseases on oilseed rape have reached a level of maturity that inspire for construction of a specific DSS's. Considering diseases in beets, additional work on core model is required.
Integrated multi-model DSS's in Poland shows the potential to integrate systems (developed under Danish conditions) for other countries. This approach could be taken more widely. Commercial systems such as Nl_PlantPLus demonstrate proven track record on a global scale, but integration with and/or from such systems would probably be limited by IP/commercial concerns.

2.5.3. Best parts of DSS's for pests

The major challenges for development of future DSS's are to develop structures at the European level for:

- construction and updating of DSS's
- communication languages
- exchange of biological data
- exchange of weather data

'Best parts' have been identified in several existing DSS's, which have been developed in different countries / institutions, and which cover different crop x pest systems

2.5.4. Best parts of DSS's for weeds

'Best parts' were identified in terms of 'building blocks', which are characterized by some kind of demarcations, e.g. in terms of crop x pest systems, modelling approaches, IT-structures, etc. Building blocks may be perceived as components, which may have some value/potential in themselves or as possible components for construction of DSS's that integrate 'best parts' from different DSS's. Such building blocks were identified the following groups of decisions:

- Decisions on activities and timing on a farm level: different operational approaches have been implemented in Da_CPOWeeds, UK_WeedManager and Fr_DecidHerb
- Decisions whether control needed:
    - weed density equivalents is implemented in It_GestInf
    - weed dynamics in crop rotations have been implemented in UK_VM
    - aspects of crop yield, weed seed production and cosmetic considerations have been integrated in Da_CPOWeeds
- Decision on herbicide and dose selection:
    - cross-tables have been implemented in Nl_MLHD
    - dose/response functions and optimization of herbicide mixes for cost or for TFI have been implemented in Da_CPOWeeds
    - site-specific evaluations have been implemented in Nl_MLHD
- Decisions on environmental impact:
    - risk factors and multi criteria assessment have been implemented in Fr_DecidHerb
    - risk of leaching have been implemented in It_GestInf
    - Treatment Frequency Index (TFI) is implemented in Da_CPOWeeds
- Integration of climatic conditions:
    - long term conditions has been implemented in Fr_DecidHerb
    - short term conditions have been implemented in Da_CPOWeeds and Fr_OptHerbClim