REPORT

FAO/IAEA Consultants' Meeting

on

"INTEGRATED APPROACH FOR IMPROVING SMALL SCALE MARKET ORIENTED DAIRY SYSTEMS"

21-24 August 2000

Vienna International Centre
Vienna, Austria

Animal Production and Health Sub-Programme
Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture
International Atomic Energy Agency

1. Introduction

A Consultants' Meeting was held at IAEA, Vienna from 21-24 August 2000 to discuss the need for, and to develop an FAO/IAEA Co-ordinated Research Project (CRP) to demonstrate increases in the productivity of small scale market oriented dairy systems using an integrated approach to improving nutrition, reproductive management and disease control.

The meeting was attended by five consultants with expertise in specific aspects of research and development in dairy production, three external resource persons who were funded from their own institutes, a staff member of FAO's Animal Production Service, a representative of the IAEA's Department of Technical Co-operation and staff members of the Joint FAO/IAEA Division's Sub-programme on Animal Production and Health. The list of participants is given in Annex 1.

The specific objectives of the meeting were to:

- Review the current research thrusts that are relevant to the objectives of the project, recommend areas that should be included and determine the most appropriate modalities for supporting these activities;
- Define the scientific scope of the project and recommend appropriate technologies and methods that should be applied in field and laboratory studies for obtaining the necessary information;
- Review the background document which has been prepared and make appropriate improvements and modifications; and
- Develop work plans, time scales, schedule of Research Co-ordination Meetings (RCMs) and the project framework matrix.

The meeting was formally opened by Dr Martyn Jeggo, Head of the Animal Production and Health Section, who outlined the Sub-programme's mandate, medium-term strategy and how the planned CRP fits into this strategy. Dr Oswin Perera, the Scientific Secretary of the meeting, outlined the previous activities of the Sub-programme in animal nutrition and reproduction, discussed the background to the proposed project, and presented the objectives and expected outcomes of the meeting.

The consultants and resource persons presented reviews on aspects of relevance to the proposed CRP. Subsequently, discussions were held in plenary sessions and in small groups to develop, modify and/or improve specific aspects of the draft project document. Finally, conclusions and recommendations were drafted, discussed and adopted.

In closing the meeting Dr. Martyn Jeggo thanked the consultants and resource persons for their contributions and confirmed the intention of the Joint Division to provide funding for this CRP from January 2002. The meeting agenda is given in Annex 2 and the summaries of presentations are in Annex 3.

2. Conclusions

2.1. The consultation reviewed the Sub-programme's activities and Medium-term Strategy and fully supports the justification for a CRP on an "Integrated Approach for Improving Small Scale Market Oriented Dairy Systems".

2.2. This CRP intends to build upon the human and institutional resources already developed in FAO/IAEA Member States through previous and on-going projects. It will utilize nuclear and related techniques that have been developed through the Sub-programme to bring solutions to

problems of dairy farmers in an integrated manner, and will also explore the potential of new nuclear techniques to evaluate nutritional status and reproductive potential of ruminants.

2.3. There is substantial comparative advantage of the Joint FAO/IAEA Programme in undertaking this integrated research project, but it will need other collateral support and partnerships, for example with the Animal Production and Health Department of FAO, and with other international organizations such as the International Livestock Research Institute (ILRI) and the International Foundation for Science (IFS).

2.4. The CRP, if successful, will greatly improve the uptake and adoption by farmers of technologies arising from research. It will enhance team building in interdisciplinary research and problem solving skills of National Agricultural Research Systems (NARS).

3. Recommendations

3.1. Recognizing the availability of potentially important technologies developed previously through the Sub-programme, the consultation strongly recommended the need for a CRP to demonstrate integrated application of these to resource-poor dairy farmers, extension personnel and development agencies.

3.2. The CRP should be initiated and conducted according to the project document developed during this Consultants' Meeting (attached).

3.3. An interdisciplinary team is an essential prerequisite for participation in the project and should be strictly applied in order to ensure success.

3.4. The existence of a national programme in dairy development should be considered essential for participation. The CRP should be linked as far as possible to projects funded by national programmes and external donor agencies.

3.5. This CRP should target the small scale market oriented dairy production system, which has been identified as having the potential for improvement.

3.6. The CRP should be for a duration of five years. In view of the multidisciplinary nature of the research, involving a team of investigators, contracts are likely to require a minimum of $10,000 per year per holder.

3.7. Considering the different disciplines and regions to be covered, it is likely to require a minimum of 5 agreement holders.

3.8. FAO should also look for sources of additional funds to complement the research an development efforts in partnership with IAEA and NARS.

3.9. The first Research Co-ordination Meeting (RCM) should be held as soon as possible after the award of Research Contracts and Agreements, and should include training on Participatory Rural Appraisal (PRA) and related survey methodology together with reinforcement of team management skills.

3.10. Isotope techniques to be used in the CRP include the following:

- ^{15}N and ^{125}I-labelled Bovine Serum Albumin (BSA) based tannin assays for studies on feeds and forages;

- ^{125}I-labelled progesterone for radioimmunoassay (RIA) to measure progesterone and relevant metabolic hormones (IGF-I, Insulin, Leptin) in milk and/or blood of cattle;
- Enzyme-Linked Immuno-sorbent Assay (ELISA) and Polymerase Chain Reaction (PCR) based technologies for differential disease diagnosis.

Annex 1

List of Participants

Consultants:

Dr. Dominique Blache	-	University of Western Australia, Australia
Dr. C. Devendra	-	Kuala Lumpur, Malaysia
Dr. Michael Bryant	-	University of Reading, UK
Dr. Ken Nordlund	-	University of Wisconsin, USA
Dr. Arend J. Nell	-	International Agricultural Centre, The Netherlands

Resource Persons:

Dr. Ingrid Leemans	-	International Foundation for Science, Sweden
Dr. Wiiliam Goodger	-	University of Wisconsin, USA
Mr. Thomas Bennett	-	University of Wisconsin, USA

FAO, Rome:

Dr. Manuel Sanchez	-	Feed Resources Group, Animal Production Service

Department of Technical Co-operation, IAEA:

Dr. Reyad Kamel	-	East Asia and Pacific Section

Animal Production and Health Section, FAO/IAEA:

Dr. Martyn Jeggo	-	Section Head
Dr. Oswin Perera	-	Technical Officer (Scientific Secretary)
Dr. Harinder Makkar	-	Technical Officer
Dr. Daniel Ezeokoli	-	University of Trinidad (on Sabbatical)

Animal Production Unit, IAEA Laboratories, Seibersdorf:

Dr. Mario Garcia	-	Acting Head
Dr. Axel Colling	-	Quality Assurance Co-ordinator
Dr. Mutasem Khadra	-	Technical Assistant

Observer:

Ms. Elizabeth de Oliveira	-	Animal Nutritionist, Brazil

Annex 2

JOINT FAO/IAEA DIVISION
OF NUCLEAR TECHNIQUES IN FOOD AND AGRICULTURE

INTERNATIONAL ATOMIC ENERGY AGENCY
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Consultants' Meeting on the Proposed Co-ordinated Research Project (CRP) on "Methodologies for demonstrating increases in the productivity of peri-urban dairy cattle and ensuring safety and quality of milk using an integrated approach to nutrition, reproductive management, hygiene and disease control"

21-24 August 2000
Vienna International Centre, Austria
(Room A22-10)

AGENDA

MONDAY, 21 AUGUST

09.00 - 09.15	Opening Remarks. *Dr. Martyn Jeggo (Head, Animal Production & Health Section)*
09.15 - 09.45	The medium-term strategy for the FAO/IAEA Animal Production and Health Sub-programme and how this CRP will contribute to it. *Dr. Martyn Jeggo*
09.45 – 10.15	Focus of the animal production component of the AP&H Sub-programme, background to the CRP and objectives of the meeting. *Drs. Oswin Perera, Harinder Makkar & Mario Garcia (AP&H Section and AP Unit)*
10.15 - 10.45	Coffee
Session 1	**Presentations by consultants - *Chairperson: Dr. Arend Nell***
10.45 - 11.30	The International Foundation for Science – its approach to capacity building in the developing world. *Dr. Ingrid Leemans (IFS, Sweden)*
11.30 - 12.30	Peri-urban dairy production systems in developing countries: characteristics, potential and opportunities for improvement. *Dr. C. Devendra (Malaysia)*
12.30 - 14.00	Lunch
Session 1 (Contd.)	**Presentations by consultants - *Chairperson: Dr. Ingrid Leemans***
14.00 - 15.00	The role of IGFs and leptin in nutrition-reproduction interactions and their

potential application as indicators of nutritional adequacy and predictors of reproductive performance in dairy cattle.
Dr. Dominique Blache (Australia)

15.00 - 16.00 Use of a survey form to assess gross economic opportunities and increase the commitment of the dairy farmer to problem solving - potential application within the CRP.
Dr. Ken Nordlund (USA)

16.00 - 16.30 Coffee

16.30 - 17.30 Experience with the holistic survey instrument, computer databases, and statistical analytical methods for the peri-urban dairy sector in developing countries.
Drs. William Goodger and Tom Bennett (USA)

18.00 Cocktail reception

TUESDAY, 22 AUGUST

Session 1 (Contd.) **Presentations by consultants - *Chairperson: Dr. C. Devendra***

08.30 - 09.30 Application of improved management and nutrition technologies for small-holder dairy production and their adoption farmers in developing countries.
Dr. Mike Bryant (UK)

09.30 - 10.30 Socio-economic issues in small-holder dairy production and the role of international support for achieving sustainable improvements.
Dr. Arend Nell (Netherlands)

10.30 – 11.00 The disease component – general issues
Dr. Martyn Jeggo (AP&H Section)

11.00 - 11.30 Coffee

Session 2 **Review of draft CRP document and identification of tasks for group work**
Chairperson: Dr. William Goodger

11.30 - 13.00
1. Background
2. Objectives
3. Strategy

13.00 - 14.00 Lunch

14.00 - 15.30
4. Scientific Scope
5. Requirements
6. Operational aspects

15.30 - 16.00 Coffee

16.00 – 17.00
7. Outputs
8. Funding

17.00-17.30 Assignment of participants to Working Groups

WEDNESDAY, 23 AUGUST

09.00 – 12.30	Group work to develop the Project Document for the CRP
12.30 - 14.00	Lunch
Session 3	**Plenary group presentations and discussion** ***Chairperson: Dr. Dominique Blache***
14.00 – 15.30	Presentations by group leaders (3 x 20 min) Discussion
15.30 - 16.00	Coffee
16.00-17.30	Group work continued
19.30	Heurigen

THURSDAY, 24 AUGUST

Session 4	**Conclusions and Recommendations** ***Chairperson: Dr. Ken Nordlund***
09.00 - 10.30	Drafting conclusions and recommendations
10.30 - 11.00	Coffee
11.00 - 12.30	Finalization of conclusions and recommendations
12.30 - 14.00	Lunch
Session 5	**Finalization of Project Document** ***Chairperson: Dr. Mike Bryant***
14.00 – 16.00	Presentations by group leaders (3 x 20 min) Final Discussion
16.00	Closure of meeting

Annex 3* – *Abstracts of Presentations by Consultants

Peri-urban Dairy Production Systems in Developing Countries: Characteristics, Potential and Opportunities for Improvement

C. Devendra
International Livestock Research Institute (ILRI)
P.O Box : 30709, Nairobi, Kenya
(Contact Address: 130A Jalan Awan Jawa, 58200 Kuala Lumpur, Malaysia)

Peri-urban dairy production systems in developing countries are discussed with reference to type of systems, their characteristics, potential, and opportunities for improvement. Three types of dairy systems are identified and described: smallholder systems, smallholder co-perative dairy production systems, and intensive dairy production systems. The first two systems are by far the most important, and are associated with increasing intensification. Buffaloes are especially important in South Asia, but elsewhere dairy production mainly involves Holstein-Friesian cross-bred cattle. Dairy goats are important in some countries, but are generally neglected in development programmes. The expansion and intensification of peri-urban dairy production is fuelled by increased demand for milk with associated problems of milk handling and distribution, hygiene and environmental pollution. The major constraints to production are inter alia, choice of species, breeds and availability of animals; feed resources and improved feeding systems; improved breeding, reproduction, and animal health care; management of animal manure, and organised marketing, and market outlets. These constraints provide major opportunities and challenges for research and development to increase dairy production, efficient management of natural resources, and improved livelihoods of poor farmers. Specific areas for research are identified, as also the need of a holistic focus involving interdisciplinary research and integrated natural resource management, in a shared partnership between farmers and scientists that can demonstrate increased productivity and sustainable production systems. Suggestions for performance indicators for such systems are indicated.

The Role of IGFs and Leptin in Nutrition-Reproduction Interactions and their Potential Application as Indicators of Nutritional Adequacy and Predictors of Reproductive Performance in Dairy Cattle

Dominique Blache
Department of Animal Science, The University of Western Australia
Nedlands 6907, Australia

The interaction between nutrition and reproductive activity has been described in both wild and farm animals. The lactating cow is one of the very best examples of this interaction. During lactation, the length of time spent in negative energy balance around parturition seems to be an important factor controlling the delay to return to breeding after parturition. The mechanism by which nutrition regulates the reproductive system is not fully understood in lactating dairy cows or indeed in any other situation in ruminants or mammals in general. However, to be effective, a nutritional signal should ultimately act on at least one of the 3 regulatory sites in the reproductive axis – the brain, the pituitary gland and the gonads. Nutrition is likely to involve metabolic signals that could act directly on one of these targets or it could interfere with other regulatory mechanisms such as the feedback by gonadal steroids on gonadotrophin secretion. In this presentation, we will use examples from laboratory rodents and ruminants, and from dairy cattle where they are available, to examine how IGF-1 and leptin, amongst several other blood metabolites and metabolic hormones, could be part of the link between nutrition and reproduction in the postpartum dairy cow. A number of studies have proposed a role for IGF-1 in the control of postpartum anoestrus and the framework of the current hypothesis will be presented. The role of leptin is still not clear for ruminants in general, but especially in cattle, because leptin was only recently discovered (about 6 years ago) and because a reliable radioimmunoassay for bovine leptin only became available since 1999. The possibilities and restrictions of a role for leptin in the control of reproduction by nutrition will be discussed. To conclude, we will examine the use of these two hormones as potential indicators of the adequacy of nutritional status for reproductive function and we will introduce insulin as another potentially important predictor.

Application of Improved Management and Nutrition Technologies for Small-holder Dairy Production and their Adoption by Farmers in Developing Countries

M.J. Bryant
Department of Agriculture, The University of Reading,
Earley Gate, P.O. Box 236, Reading RG6 6AT, UK

The objectives of this presentation are to consider some of the factors concerned in the application of technical change to small-scale dairying and the adoption of change by farmers. The presentation will consider (1) the motives of the small-scale dairy farmer, (2) the small-scale dairy farmer's own perceptions of his problems and needs, (3) how farmers deal with the two fundamental technologies implicit in dairy farming, feeding their animals and getting their cows in calf, and (4) dissemination routes most favoured by small scale dairy farmers. The geographical focus of the presentation is East Africa, a region associated with considerable progress and success in small-scale dairying (Kenya) as well as dairying projects in their early development (Tanzania).

The concerns of small-scale farmers have been characterised; thus the farmers have multiple objectives, their households have low capacity to bear risk, their livestock enterprises are often integrated with cropping activities, and their livestock are often expected to be multi-functional. Some of the expected implications for small-scale dairy farmers are that: (1) inputs (including feed) are low and therefore milk yields are expected to be low; (2) inputs are often matched to output so that a reduction in milk price results in a reduction in concentrate allowance for the cows; (3) the use of time and cash are optimised, implying that priority will not be given to cattle if other farm enterprises seem financially more attractive. Perhaps not surprisingly, attitudes and systems vary within the farming community, allowing sub-groups of small-scale dairy farmers to be identified and defined. Thus some farmers emerge as more specialist or entrepreneurial than others, prepared to make greater investment in return for higher outputs. Attitudes and activities also differ according to location. Small-scale farmers close to urban centres may well have off-farm employment, diverting their attention from their cows.

The problems faced by small-scale dairy farmers are diverse but some common threads emerge from a number of different studies. As well as the usual farmer concerns about the low prices received for their product and the high price of inputs, the availability of working capital appears to be a general anxiety. Poor feeding practices, partly consequent on weather but also a result of cash shortages, are widely recognised. Animal disease is also a general source of concern. It is clear from farmer consultations that farmers do respond to these problems with technical innovations appropriate to their resources. Often these innovations represent adaptations to the limited inputs available or affordable. Thus long inter calving intervals, probably a function of chronic under feeding as well as difficulties associated with bull availability, are countered by exploiting the long flat lactation curve associated with the failure of the cow to peak in early lactation as a result of the inadequate feeding. Cows are milked for many months, often with no intervening dry period between lactations. Although this maintains milk production, the production of replacement heifer calves is jeopardised by the long calving intervals, threatening the sustainability of small-scale dairying at both the household and national level.

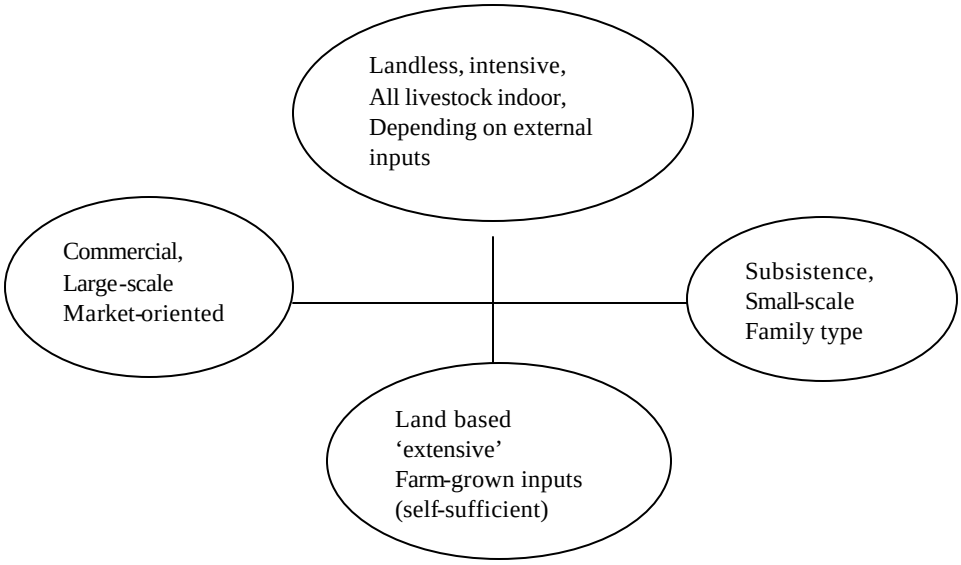
It follows from the above that small-scale dairy farmers have limited capacity for technical change. However, in some areas, the very adoption of small-scale dairying over the past few years is sufficiently novel to illustrate that its practitioners are prepared to adopt change if the proposals are considered feasible within the recognised constraints. Sometimes innovations fail to get to farmers because of inadequate extension services, although increasing access to the internet may signal rapid change in some regions. However, it is also clear that scepticism remains widespread. Recent studies indicate that, in some areas, extension services have limited success at disseminating innovation. Farmers' preferred sources of information are their churches and organisations such as women's groups rather than scientists and government extension agents.

Although peri-urban small-scale dairying can be identified as a largely market-orientated activity, it is clear that the risk-limiting, enterprise-optimising outlook of the small farmer frequently prevails. It must be recognised that the availability of cash, the main constraint and concern of most small-holder households, remains the major limiting factor to the adoption of technical change. It is equally clear that to achieve greater productivity and sustainability, greater investment, particularly in animal feed, is essential. Adaptive research must attempt to achieve a compromise between these two realities. In addition, the research must be carefully targeted from the outset at farmers and the groups and organisations that are positioned to influence farmers. This will require taking stakeholders into the project from the start.

Socio-economic Issues in Smallholder Dairy Production and the Role of International Support for Achieving Sustainable Improvements

A.J. Nell and J.B. Schiere
International Agricultural Centre, P.O. Box 88, 6700 AB Wageningen
The Netherlands

In many developing countries urban and peri-urban agriculture is becoming increasingly important as a source of food for the city. A great variety of urban and peri-urban agriculture and livestock production systems are developing, ranging from large intensive market-oriented and factory type production units to small backyard family subsistence production; from landless farms exclusively based on external inputs to more land-based production in the city outskirts and peri-urban areas, partially or entirely based on farm grown inputs. The production systems also range from units established by wealthy business people looking for good investment and profit opportunities, and sometimes making use of their connections to circumvent some of the city regulations, to impoverished city dwellers who depend on their livestock as their main source of food and income. Urban and peri-urban livestock (including dairy) production systems exist with all possible variations and combinations between these extremes, in terms of scale, type, function etc.

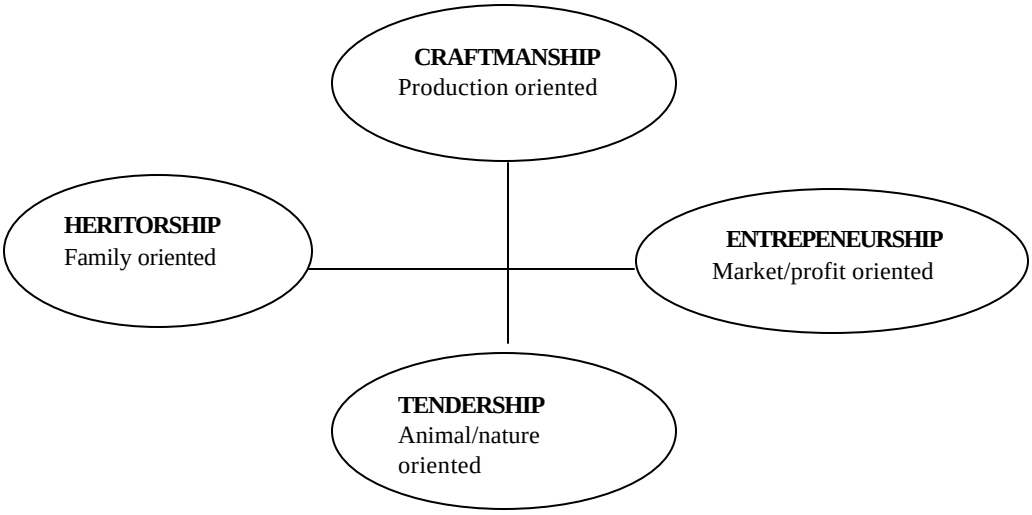


The producers take advantage of the production opportunities existing in the urban areas, e.g. market opportunity, infrastructure, production inputs, cheap labour, lack of regulations, tax exemptions, etc. The result is a large variation of highly complex production systems which form an important economic activity in and around the cities, and which give an important contribution to the supply of food and possibly to the social fabric of the city. Urban agriculture (UA), and this includes the peri-urban dairy production system (PUDS), is highly complex and its success (provide food for the city, contribute to poverty alleviation, improve the position of women) or failure depends on an equal number of interacting factors. Success and failure is also a matter of perception; success for the producers might be felt as a failure for the city planners.

In looking at small and medium scale commercial dairy farms it is important to realise and understand the diversity of farms and farmers. Dutch research has identified 4 main farming styles in

pig farming, the same type of farming styles could probably be identified in commercial farming in developing countries.

Farmers' preferences and priorities (sow farms, the Netherlands):



Such a framework for different farming styles explains priorities and preferences of the farmer and the type of messages the farmer might be interested in. Maximisation of the (short-term or even long-term) economic result is by no means always the main aim of the farmer, sustainability, maintenance of family property and conservation of nature are also frequently guiding principles for interventions in farm management.

Research into the opportunities and the sustainability of the commercial small to medium scale dairy production system should involve a careful and thorough analysis of the system. It should not only include the direct biophysical relations e.g. production inputs (nutrition, health, reproduction,) but also the more indirect relations with its surroundings and the environment. An analysis should lead to an understanding of the different perceptions of the issues by the different stakeholders. It would include:

- Analysis of the system and its external relations with the aim to describe the variations and the patterns in the systems rather than describe an average and an immediate short-term problem.
- Stakeholder analysis: who are the stakeholders, who have an interest (positive or negative) in dairy production e.g. the producer (male – female – children), consumers, neighbours, public health authorities, ministry of Agriculture, city planners, environmental authorities etc.
- Based on the stakeholder analysis, the development of a systems hierarchy and a SWOT (strengths, weaknesses, opportunities and threats analysis): what is their perception of the positive and negative issues of the system and their 'solutions' or rather coping strategies.
- Participatory approach: during the whole implementation of the project a participatory approach should be followed, as many of the interested parties as possible should be included and consulted in the analysis, problem formulation, implementation of research, evaluation of results and formulation of the proposed interventions.

Such an approach will result in a more comprehensive view on the issues of the system, its complexity and its variation. It will make clear that simple standard solutions are probably not available and will not contribute to a sustainable solution.