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**Conference of Directors and Representatives of Agricultural Knowledge Systems (AKS)  
(Agricultural Research, Extension and Higher Education)**

**COMPARATIVE ANALYSIS OF AKS APPROACHES IN ADDRESSING  
PROBLEMS RELATED TO FOOD SAFETY IN OECD MEMBER COUNTRIES**

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(Note by the Secretariat)

This paper, prepared by Dr. William WAGNER, Executive Director, Joint Institute for Food Safety Research of the USDA, Washington, D.C., is the second in a series of three reports that present a comparative analysis of country notes submitted by Member countries. The other two documents deal with the AKS organisation and functioning in individual countries and agriculture/environmental interactions as addressed by Agricultural Knowledge Systems.

## COMPARATIVE ANALYSIS OF AKS APPROACHES IN ADDRESSING PROBLEMS RELATED TO FOOD SAFETY IN OECD MEMBER COUNTRIES

### SUMMARY

1. Program statements from 20 countries were provided for this review. While there was rather wide variation in the country reports, which makes it difficult to clearly identify specific trends, there are a number of common themes emerging. Although strategies differed among countries, all of them acknowledged the importance of the consumers' views on food safety and the impact these views have on decisions related to food safety programs. Many countries have only recently, within the past 2-4 years, passed new legislation that has changed the structure of their food safety system. For 4-5 countries, this has resulted in a move to a single food safety agency. One exception is the United States, which has undergone major revisions in the type and intensity of interagency collaboration and cooperation to provide a system that is more nearly like a single agency, while retaining the distinctive features of the existing multi-agency system.

2. While some countries are giving significant attention to contaminants such as pesticides and heavy metals, most programs are directed mainly at the microbial pathogens (*E. coli 0157:H7*, *Salmonella*, *Campylobacter*, and *Listeria*) at this time. While these pathogens are the major identified causes of acute illness and death in the consuming public, recent U.S. data indicate that nearly 80 per cent of the illnesses and deaths are due to unknown causes. As these agents become better controlled, greater attention may then be given to other contaminants such as pesticides, toxins, and the role of enteric viruses in food borne illness.

3. Most countries state that their food regulations and policy shall be based on sound scientific principles. The use of risk assessment as a tool for determining where to focus regulatory efforts or to assign research priorities is becoming very common. This will undoubtedly have more impact as time goes by. The increasing use of HACCP principles by producers and processors is a result of this shift in attitude on how to solve food safety problems. All of these shifts or changes in approach place more emphasis on the importance of the AKS in solving the food safety problem. A question for the AKS is: Are you prepared to meet this challenge or will it be met by other organisations or structures?

4. The development of regulations for the food industry has taken on a clear multi-national flavour. European countries work at having their national food regulations match the EU directives. Other countries have looked to international bodies such as Codex Alimentarius for guidance in preparing their regulations.

5. Although there remains much work to be done, it seems appropriate to have an optimistic attitude about the safety of food in OECD countries. While we still have improvements to make, the food safety programs have improved significantly in the past 5-10 years. Foremost among these improvements one could include better and more informed input from stakeholders on priority needs, closer interactions within the AKS and between the AKS and the food system, and more emphasis on risk assessment and HACCP programs. Continued demands for improvements in food safety from consumers will force the

system to continue these improvements. Strong educational programs that target all segments of the food system, including consumers, are identified as being of crucial importance in continuing to improve the safety of our food supply and to provide a scientific basis for consumers to make informed judgements.

## INTRODUCTION

6. This summary analysis was based on individual reports from 20 countries (Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Hungary, Iceland, Ireland, Italy, Japan, Korea, Mexico, the Netherlands, Norway, Poland, Portugal, Spain, and the United States). Also informative in the preparation of this report was the summary analysis of the Agricultural Knowledge System (AKS) papers which was made available to provide more background on the function of this structure. A general theme in all of the reports was an increased concern by consumers about the safety of their food supply. This increased concern was focused on the issue of pesticides in two or three countries while for other countries it resulted from outbreaks of food-borne illness caused by organisms such as *Salmonella* or *Escherichia coli* 0157:H7 (*E. coli*). Several of the reports expressed a growing concern about Genetically Modified Organisms (GMO's) and the impact of these genetic manipulations on the safety of the food produced.

7. The French report provided an interesting progression of consumer preferences in which they stated that the 70's represented "cheap" food, the 80's represented "fast" food, and the 90's represented "healthy" food. Other countries expressed rather similar conclusions, indicating that the consuming public demands a level of safety of its food supply that may be inconsistent with the reality of food production. One report explicitly stated that "food is not a sterile product". These changing demands put increasing pressure on the food supply system.

8. For countries who are members of the European Union (EU), their approach is heavily influenced by the EU directives on food safety and the implications for trade, both within and external to the EU. As well, countries which have a large export trade were also very concerned about meeting the consumers' preferences in order that they maintain their export markets. An example would be Denmark, which exports a large proportion of its total pork production.

9. Other key issues include:

- a need for a more holistic view of the total food system, not isolated segments;
- the need to use risk assessment and risk-based approaches in developing regulations;
- concerns about the use of antibiotics in animal production, especially as growth promotants;
- the role of science-based Hazard Analysis Critical Control Point (HACCP) programs in controlling or preventing food-borne illness in the human population; and,
- the distance of the consumer from the production site, either in actual distance or in philosophical distance, was cited as a need or reason for an increased educational effort to provide consumers with the needed information.

## GOVERNMENT POLICY RELATED TO FOOD SAFETY

10. The various governments represented in these reports have clearly heard the increasing demand from the consuming public for a higher level of food safety. Several countries either have established a new single food safety agency or are in the process of deciding how that will be accomplished. Others, such as the United States, are making a substantial effort to develop coordinating structures that will link together the several food safety agencies and create a more functional network to ensure a safer food supply to the consumer. For some countries, especially the geographically larger ones, such as the United States and Canada, there is also a significant effort to improve the linkage between the federal and state/provincial level agencies responsible for food safety.

11. As mentioned above, these efforts represent a response by government to look at the entire food system as a unit, rather than as fragmented parts. The roles of the various segments such as production, processing, storage/handling, transport, and consumption are being given more attention while still viewing them as integral parts of a larger system. In several countries, there is an increased emphasis on the production sector, with both research and educational programs focused on methods to reduce the prevalence of food-borne pathogens in the animal or plant production setting. While most countries can only encourage or educate producers in proper management practices, some countries have regulatory authority over management practices and methods in the initial production phase if they relate to the occurrence of food-borne agents. However, pesticide usage is a different situation with nearly all countries having specific rules on use of such chemicals. To correct this deficiency in control of food borne pathogens, an approach is to use voluntary guidelines, commodity group-enforced quality assurance (QA) programs, and educational programs targeted on Good Agricultural Practices (GAPS). An example of this approach is the publication of "A Guide to Minimize Microbial Contamination of Fresh Fruits and Vegetables" by the U. S. Food and Drug Administration. This is now being coupled with an organised educational program utilising the Cooperative Extension Service and other avenues for delivery of educational materials to the growers. This has involved a collaborative effort among government agencies, industry companies, and grower organisations.

12. An outcome of looking at the entire food system is to foster implementation of QA programs throughout the food chain, rather than just monitoring the end product. The use of HACCP programs in processing plants and in other parts of the system where food could be exposed to pathogens has increased rapidly within the past two to four years with much of the responsibility for ensuring food safety shifted to the manufacturer and processor. A similar increase in surveillance or monitoring programs for detection of human illness has also occurred. The increased surveillance has allowed public health authorities to be more aware of the true level of food safety problems. At the same time, it has sometimes caused increased public concern as they learn about the number of food-borne illness outbreaks; an increase that may be due solely to the improved surveillance methods.

13. With the rising level of public concern about food safety, it has become more important for the government and industry participants to be more open in their communications with the public. Lack of information at the time of a possible food-borne illness outbreak only creates more distrust and lack of belief in the food safety system of the country. In most cases, this results in a marked increase in educational programs for all stages of the food chain, from producer to consumer.

14. A growing food safety concern for consumers is the issue of Genetically Modified Organisms (GMO's). Governments are responding to this with increased requirements for review and testing prior to being approved for the marketplace. Because the majority of the current GMO's were developed by commercial companies as proprietary products, the research sector of the AKS has only limited information about the details of the products. Thus, they do not have specific information that can be used by the extension sector to educate the public in a non-biased manner. More evaluative studies on these crops or products are needed that will provide an objective assessment and unbiased information to the consuming public. Some of the reports suggested the need for permanent fora where this topic could be discussed.

15. As consumer interest in food safety has increased, certain actions are being demanded from government agencies by their public stakeholders, including consumers, producers, and other special interest groups. Consumers have not been accepting of food that is contaminated, and have demanded that agencies provide for trace back to the offending source of infection, even back to the farm itself. This has fostered a marked increase in studies on use of electronic identification (ID) such as computer readable ear tags for cattle or use of implanted electronic chips to facilitate trace back on contaminated food to the original source. A potential issue of concern is that one may find *Escherichia coli* 0157:H7 (*E. coli*

0157:H7), *Salmonella*, or *Campylobacter* on a number of farms where they are a normal part of the background flora. Eradication or elimination of these organisms using traditional procedures may be difficult if not impossible. This is especially true for *E. coli* 0157:H7, which has now been found to occur in still or flowing water supplies.

16. Official policy actions taken by OECD countries have included establishing single food safety agencies, e.g., Canada, Ireland; mandating the use of HACCP plans in all food handling plants (specifically mentioned in 14 reports); and sampling of products for contamination at various stages of the food chain. While there are early signs of improved food safety, it is too early to know, with certainty, if these new practices will continue to reduce pathogen occurrence and the incidence of human illness.

#### **TRENDS**

- There is a shift from control of final product to monitoring of the process with HACCP-based plans with the responsibility being carried by private companies.
- Countries are beginning to move from multiple government food safety agencies to a single food safety agency or only one major controlling agency.

#### **EXISTING REGULATIONS FOR FOOD SAFETY**

17. Nearly all countries reported several recent changes in food safety regulations with a number of countries having enacted new laws that mandate a single or dominant agency for food safety. In most cases these new laws represent efforts to streamline government functions, reduce the number of agencies, and make the system more responsive to consumer desires. At least two countries have now formed a single food safety agency, Canada and Ireland. In other countries, e.g., France and Denmark, new laws have created a primary food safety agency but they do have other agencies that provide support for this work or contribute certain components to the food safety arena. Several countries still have a more traditional approach with 2-3 agencies involved, usually involving the Ministries of Agriculture, Health, and Fisheries.

18. Most of the countries which are also members of the European Union have based their food safety laws or regulations on the existing EU directives. Other countries have utilised the international standards such as those prepared by Codex Alimentarius for guidance in developing their regulations. In the European setting this approach provides an optimum agreement among neighbouring countries and permits easy trade of food products as all countries have similar standards. An interesting exception to this is the situation with *Salmonella* in Finland. When they were preparing to join the EU, it was clear that their high standards for *Salmonella* control would not be compatible with the EU standards. In fact, using the EU standards would have compromised the food safety level then being met by the Finnish producers. They were able to negotiate a compromise that allows Finland to have a higher standard on this particular agent than the general EU standard.

19. The scientific basis for HACCP is well recognised and is being implemented in nearly all countries in some form. Fourteen countries made specific mention of the use of HACCP programs in the food processing industries, including the abattoir sector. This places less emphasis on the testing of the final product for safety and quality but with more oversight and monitoring of the actual process in the plant. Thus, the companies become more responsible for the final product through their quality and safety assurance efforts. This represents a significant shift of responsibility to the private sector.

20. There is increased use of risk assessment in most countries for identification of the processes or stages with the greatest risk of contamination. This then allows for regulatory efforts to be focused on those processes. The research community has benefited from application of risk assessment for identification of knowledge gaps and for establishing research priorities.

21. In some countries, the principles of HACCP are also being applied to the production unit. While the concept of Critical Control Points does not always fit well in the production setting, use of the hazard analysis and the defining of control measures do offer improvement in the safety of food products. For many fruit and vegetable growers and animal producers, the preference is to use an alternative term such as Good Agricultural Practices (GAPS) or Good Production Practices (GPPs). This approach usually has broad acceptance by the commodity groups, as they have often been already involved in QA programs that addressed issues of quality in their product. This is important because such programs need strong buy-in from producers if they are to be successful. In addition, the implementation of HACCP type program throughout the food chain from farm to table, requires a major investment in education of all persons involved, including the consumer. This effort, which should be a major focus for the extension component of the AKS, did not receive clear recognition in many of the reports.

22. Although most countries have been moving toward more centralised control of food safety, there still are countries with more fragmented approaches to control of food safety. In these instances, they tend to focus on specific commodities such as fruit/vegetables, dairies, public health issues, etc. While this may be effective in some circumstances, food products that combine various ingredients may present a jurisdictional issue.

23. Heavy metals, pesticides, and other similar chemicals continue to be a food safety issue in all countries, and in some of the reports such as, for example, Korea, these substances appeared to be a major concern in government food safety policies. At the same time, these countries were acknowledging that other food safety problems such as microbial contamination would need to be given more attention. In the United States, the emphasis has recently been on pathogenic organisms. With use of more sensitive testing procedures, metals such as lead and cadmium are now being targeted on certain vegetable crops and more research is being directed toward this area.

#### **TRENDS**

- There is increasing use of HACCP or HACCP-like Good Agricultural Practices (GAP's) in the various segments of the food chain.
- Individual country regulations are becoming more alike as they pattern them after the EU standards or an international standard such as Codex Alimentarius for non-EU countries.
- Countries are basing their food safety programmes on strong science and use of risk assessment tools to target regulatory efforts and assign research priorities.

#### **RESPONSIBILITY OF THE AGRICULTURAL KNOWLEDGE SYSTEM**

##### *Type of knowledge products used*

24. All of the reports agreed that a most important need was to have good communications with all sectors of the food chain. The media to be used are many and varied. For consumers, popular press articles, television, radio, and similar avenues were the ones most often cited as the source of information for the general public. Several countries also provide specific training for consumers in proper food handling techniques. Italy has interregional efforts for consumer education which focus on the following topics: sustainable agriculture and integrated pest management, typical products and labelling, nutritional characteristics of food products, food hygiene and preservation procedures, control of the quality of agri-food products, and promoting a healthy life style. This activity is organised under a National Committee comprising the Ministries of Agricultural Policies and Forestry, Public Education, and Health plus other governmental units at the national and regional level. Norway's Ministry of Agriculture initiated a communications program in 1996 focusing on risk communication with the intent to inform consumers, media, food industry and trade organisations about food safety. This is now an integrated part of the

government's food policy but appears to have little direct involvement from the AKS. The United States has provided specific funding for support of educational programs targeting youth and consumers through the country's extension system (part of the AKS).

25. The role of the extension agents in the dissemination of knowledge and how to apply it in solving food safety problems is very important. Several countries described the role of the extension agents or system in educating producers and other participants in the food chain about proper methods to ensure food safety. Among these were Spain, Poland, Korea, and the United States. In Spain, the major focus of educational programs for producers is on pesticide and animal drug usage. Poland reformed its agricultural extension service in 1991, adding more specialists and using them as a critical link in the food safety effort. These extension agents receive their information materials from the research centres that are either within government agencies or in universities and disseminate this information via demonstrations, experiments, exhibitions, study tours on farms, and at fairs. The orientation of the research groups providing the information could be agricultural, public health, or general food science/technology oriented. When functioning properly, the extension persons can be the conduits for transfer of technology to the end user and providing critical educational support for such implementation. In contrast to the Polish situation, the Czech Republic closed its state network of extension centres in 1989 and they now operate as a private advisory service with no link to the Ministry of Agriculture. Some of the extension work is now being done by some of the research institutes which do it for compensation as a part of their other work.

26. As the demographics change in each country, especially with reference to percent of meals prepared and consumed within the home, parents and children become less knowledgeable and skilled about food preparation. In some countries this has now created a situation where there is a serious lack of knowledge about food safety and the role of food preparation in ensuring the safety of food. Whether the use of mass media for delivery of food safety information to consumers is sufficient is questionable. For many consumers, detailed instruction is needed before they will be equipped to manage food items properly. Belgium provided an excellent discussion of the importance of maintaining the integrity of the product through proper storage and handling all the way to the consumer. They further emphasised the important role of the consumer in reading the label and following instructions about preparation and storage if food borne illnesses are to be avoided. In the United States, there is an increasing effort directed at educational programs for use in elementary and secondary schools to inform students about food safety, and how to handle and prepare food safely.

#### **TRENDS**

- Changing demographics and increased distance from the production site have created a need for more education of consumers and youth in safe food handling and practices.
- Communication has to be a two way process with information on safe food practices going to all segments of the food chain (farm to table) and input on needs and priorities coming to the AKS from stakeholders.
- The education component of the AKS is critical for the education of the sectors of the food chain.

#### ***How the AKS receives input from the public***

27. As many of the country reports have emphasised, communication is vital to solving the total food safety issue. Part of this communication must involve the governmental agencies in not only putting information out to the public, but also listening to concerns and needs of the stakeholders. Perhaps the most important concept is that, for food safety issues, the perception of the consumers and society becomes the reality that governmental agencies must respond to. Whether a food product is completely safe or not is only part of the issue. If the government does not respond in a timely and effective manner to major food-borne illness outbreaks, the public loses confidence in the system. When this occurs, then agencies and

organisations must work much harder to overcome the natural reluctance of consumers to believe what they are being told about the safety of their food supply.

28. Most countries reported that they had some type of system for getting input directly from consumers and other interested parties. The United States has an extensive requirement that all research priority setting is done with full public input as a basis for the decisions about research direction and the consumer organisations have been very vocal in insisting that the government agencies need to be much more aggressive and proactive in their approach to the food safety issues. In some countries, there are Consumer Unions that monitor the safety and quality of food products and seek government action when needed. An example would be Korea where the consumer groups have targeted contamination with pesticides and, secondly, heavy metals as a concern. In Austria, they do consumer surveys and also have industry working groups that include a diverse set of individuals.

29. France has developed networks involving industry and the research institutes, referred to as Groupements d'Intérêt Scientifique (GIS, Scientific Interest Groups). These groups represent a collaboration of government ministries, research institutions, and other interested partners. They state that these interest groups have recognised the importance of responding to consumer and societal demands.

30. In other countries such as Japan and the Czech Republic, there appears to be no system for gaining such input. The Czech Republic report made the comment that the high level of fragmentation of interest groups makes it difficult to obtain a clear consensus on priority needs. These approaches may appear to be less responsive to the demands of the consuming public but if the public and societal needs for a safe and secure food supply are being met, then it may not be an issue. Certainly open communication from the government agencies to the public about food safety programs would be important in informing the public about specific hazards and their role in preventing food borne illnesses.

#### **TRENDS**

- There is a trend for increased participation by and input from stakeholders, including consumers, producers, and industry.

#### **HOW IS THE AKS ADDRESSING THE TOPIC?**

##### *Identification of problems*

31. The various countries identify their problems in several ways. Some countries, e.g., Ireland, United States, and Canada, use monitoring and surveillance programs. These programs provide continuous information about frequency of food-borne illness in the population. Also, it can provide identification of the causative organism. The United States has a program called Pulse-Net which provides for rapid DNA finger printing of isolates from food-borne outbreaks which allows for comparisons and tracing of causative agents among outbreaks. This greatly improves the epidemiological analysis and can offer additional insights to potential control measures. In this manner, information is provided that can help direct the research programs on to new or emerging disease agents before they become a major problem. Spain uses a similar approach, stating that they utilise local expertise to attempt solving the problem and involve other agencies only as necessary.

32. For most other countries, the identification of problems occurs when major food-borne illnesses occur, or when consumers identify a specific issue that concerns them. It was also stated in some of the reports that the institutes or government research entities were aware of the problems that were arising, perhaps through laboratory submissions from patients. It is clear that the increased level of consumer awareness has made these groups much more vocal in demanding action on important food safety issues.

It is important to note that, as surveillance techniques improve and become more thorough in their coverage, the public may perceive that food safety problems are increasing when, in fact, the increase may only be the result of increased monitoring.

33. Translating these issues or needs into action requires the governmental agencies or the AKS itself to adopt these priority needs and problems and provide financial support to resolve the identified issues. This can occur through the funding mechanisms of governmental agencies to external research and extension groups such as universities or it could be by initiation of research and educational projects by the agencies themselves. In some countries both events can and do occur simultaneously. There are also instances where the agricultural university may get direct input from the public and proceed with initiation of the needed work, using local or regional funding.

#### **TRENDS**

- Several countries use monitoring and surveillance programs to monitor human food borne illness and inform the system about developing problems.
- Food safety systems need to be flexible to be able to respond to new or changing priorities.

#### ***Program planning and development***

34. Program planning and development can occur in a variety of ways, but broad input to the process from various stakeholder groups seems to be very important. Although one or two of the country reports indicated that they were not doing good program planning nor did they have a real strategic plan to follow, these were the exceptions. Several successful but different approaches are provided by the following examples:

- Many countries are following the model that includes a wide array of inputs and discussion prior to committing resources. An excellent example was the procedure being used in France. Within their Scientific Interest Groups, which are managed by the government, there are ample opportunities for them to consider diverse views from groups including industry, producers, government agencies, and universities. These groups also appeared to give consideration to the consumers' concerns as well. In this regard there is the need to reconcile industrial farming with the idealised version as envisioned by consumers. Such information might be included in other consumer education programs.
- In a similar manner, Ireland has collaborative discussions among university scientists, government agencies, and producers using a Consultative Council that includes consumers, retailers, processors, and producers. This Council advises the Food Safety Authority of Ireland, which has ultimate authority for all food safety efforts in Ireland.
- The United States has developed a strong process for gaining input to the planning process. The Cooperative State Research, Education, and Extension Service (CSREES), which provides funding to the land grant and other universities, now has a legislative requirement that all universities must demonstrate that they collected and considered input from stakeholders such as producers and consumers. If this is not done, federal funding can be withheld. In addition, CSREES and its sister agency, the Agricultural Research Service (ARS), have frequent meetings with university scientists and industry persons, to determine gaps or unnecessary redundancy. ARS also meets with staff from the Food Safety and Inspection Service in order to determine research needs related to regulatory issues. ARS serves as the primary research resource for the Food Safety Inspection Service.

- The rigorous control programs for *Salmonella* in Finland and Denmark have contributed to a significant decline in incidence of *Salmonella*, but this disease agent has not been eliminated. A major reason for the success of these programs has been the ability to educate producers and processors about the problem, define the approach to solving the problem, and then getting very significant support from an entire industry to carry this forward. . Whether this approach could be successful in a country with a much larger industry, and significant regional differences in type of production units, is not known. Applied studies are currently underway in the US to see if the procedures that have been successful in Denmark and Finland will also hold promise of success in the American setting.

#### **TRENDS**

- Successful programs appear to be based on strong input about emerging issues and support for action from the various segments of the food system from producer to consumer.
- Providing informational and educational components appear to be critical for successful outcomes..

#### ***Qualifications required for program implementation***

35. Increased levels of integration of programs and integration of research with extension and teaching were demonstrated in several of the country reports. The linkage of extension with research provides more immediate transfer of technology and adaptation of knowledge into the production sector. A typical example is the United States where funding projects within the Cooperative State Research, Education, and Extension Service has been increasingly moving toward such an integrated approach. This highly desirable outcome ensures that the public will more quickly see a system that is supportive and helpful in solving their food safety concerns.

36. A few countries stated that there was a lack of adequate numbers of educated and skilled people to work on food safety problems or issues. As a partial solution, the countries have passed significant responsibility on to the producers or other industry components. They are expected to develop quality assurance programs and implement HACCP programs in processing plants and on farms. If properly implemented by well-trained personnel, this can be a very effective approach.

37. Among the newer member countries of OECD, financial resources appear to be a constraint on full realisation of their strategic goals. This suggests that sufficient funds to support specific and critical research projects are needed to avoid that the entire process will falter. Similarly, a lack of trained extension or educational personnel will reduce the opportunity for stakeholders to gain the needed information. Countries that are major importers of food from such countries may find it in their own interest to be involved in providing some portion of the needed educational programs. For example, the United States is at present working on plans for such an effort with respect to microbial contamination of fresh fruits and vegetables.

#### **TRENDS**

- Newer OECD member countries expressed some concern about lack of adequate financial resources to meet the challenges that they face.
- Close cooperation and collaboration between the research and education/extension components of the AKS are vital to a successful programme that solves problems.

#### ***Description of strategies, approaches, and instruments:***

38. The most effective systems have a significant level of flexibility in allocation of financial and personnel resources and the specific approach to solving food safety problems. As specific food safety problems are solved or brought under control, other new or emerging disease agents or chemicals can arise

and the research agenda must be able to adapt to new needs and priorities. Having funding support from a variety of sources is also useful for maintaining a strong program.

39. Korea provided an interesting example of a strategy to improve the quality of products and efficiency of agricultural units. The Rural Development Authority established the Korean National Agricultural College in 1997, which is designed to educate students in modern farming methods during a three year period.

40. Local resources are often used to solve a specific food safety problem when it occurs in order to give a quick response and solve the problem before it has become more widespread. But it becomes evident from the reports that countries also need a plan for mobilising resources on a broader basis when new pathogens are involved or when the identification of the causative agent or the size of the outbreak is regional or national. Serious food-borne illness outbreaks have often provided the opportunity for introduction of educational and training programs to ensure that the problem does not happen again. When the public attention is focused on food safety issues, it usually provides an opportunity for changing habits or patterns of food handling.

41. Embedded within these various country programs is the issue of mandatory vs. voluntary programs to improve food safety. The increasing cost of providing the numbers of inspectors to monitor the entire food system argues against a continued regulatory approach. Implementation of Good Agricultural Practices is quite successful without specific mandatory regulations but does require well-prepared guidelines for producers and processors to follow. An important step in this process is the thorough education of the producers and processors about food safety and the importance of this topic for continued success in their enterprise. Negotiated, voluntary reduction of food borne hazards may become increasingly useful as all participants recognise the merit of improved food safety. The AKS can and should have a very significant role in facilitating these voluntary programs.

#### **TRENDS**

- It is important to have flexibility in assigning resources to enable the system to respond to current or changing needs.
- Use of local resources as a first effort to solve the problem can be effective in containing the size of the outbreak if backup sophisticated laboratory support is also available.
- A few reports discussed the use of mandatory vs. voluntary approaches to food safety; while either approach will work, the voluntary approach is often more effective.

#### ***Mechanism by which the AKS is involved in policy formulation***

42. For several of the country reports, it was difficult to find comments about the role of the AKS in any type of policy or priority setting. Either it was not mentioned or the AKS has become more marginal in providing this sort of input to the larger community. However, for some countries, there is extensive consultation between the members of the AKS and government regulatory agencies. The usual procedure is to hold public meetings in which scientists and educators from the AKS have an opportunity to express their views. Usually in such settings, other interested parties such as consumers and industry personnel are also given an opportunity to present their views. This may take the form of interpretation of the research findings or scientific information as viewed by the consumer group and how they feel it should be used to establish regulatory policy. Other mechanisms may be to have external people, such as university scientists, who serve a term of 2-3 years as members of an external advisory board or council.

43. Groups such as the GIS in France, and similar working groups in other countries, e.g., The Netherlands, seem to gather broad general support and allow for direct input from the AKS, producers or other stakeholders. In the United States, increasingly close relationships are developing among the various

segments of the farm to table continuum and the agencies involved in overseeing food safety. One example is the new program from FDA to protect fresh fruits and vegetables from microbial contamination that was developed with joint effort from regulatory and research/educational units. The AKS is being asked to assist in developing the needed training materials and then providing the educational delivery system for the producer.

44. In other countries, the agency in charge of food safety may utilise the published information but not make use of the individual scientists as consultants or advisors. In these situations, the government agency(s) responsible for enforcing food safety laws will make decisions on these regulations with very little dialogue with external consultants. Given the increasing use of HACCP principles to improve food safety throughout the food system, this may not be the best approach. It becomes evident from the country reports that the end users of the new food handling techniques and the ones who must apply the techniques or methods, need to be brought into the decision process to ensure there is agreement with the regulations to be imposed and that they will use these new procedures in their units.

#### **TRENDS**

- There were only few examples of the AKS having a significant role in policy formulation but many examples of the AKS implementing policy decisions.
- Given increased emphasis on science and risk based food safety programs, there could or should be a larger role for the AKS in policy decisions.

#### **DESCRIPTION OF FORMS OF COOPERATION**

45. There is substantial cooperation among the various governmental agencies, universities, and the private sector in most programs. In Austria, there is regular and strong interaction among the major research units, the provincial associations, the elementary and secondary schools, and the private sector. Canada utilises a variety of formal and informal cooperative arrangements. Many different types of research facilities are involved and there are frequent interactions among the units. Research at private facilities can also be included in the decision making process. In the Czech Republic, much of the cooperation stems from work on individual projects that gradually coalesces into a larger program effort. The country notes indicate that lack of cooperation and focus on a single goal leads to fragmentation and loss of interest by the scientific community. They feel that the amount of cooperation is less than optimum, except in those cases where individual contacts have resulted in a strong linkage.

46. Danish food safety research is coordinated through the Centre for Advanced Food Study that also helps to link universities with industry. In Finland, the official *Salmonella* policy is established by the Veterinary and Food Department under the Ministry of Agriculture. There is substantial cooperation among the various federal and private mission-areas. France makes excellent use of the GIS structure to disseminate information about new research findings. Prioritisation from both the scientific and technologic communities is needed to give direction to future work. Public meetings are also held to gain a broader input to the decision process.

47. In Ireland, the Food Safety Authority consults with the other three major players: Teagasc (which in itself is an excellent example for AKS integration), universities, and industry. These cooperating units jointly fund various projects including those that provide for transfer of research results to industry. The training programs are operated by various universities to ensure wide availability of knowledge about food safety. While much of the collaboration in Portugal is between various governmental agencies, there is also interaction with the universities. They then utilise industry contacts for development of training and dissemination of information.

48. Poland has had a low level of cooperation between the research system and the private sector due to the industry being fragmented and lacking in funds. Large, wealthy, multinational companies that come into Poland have a high level of research of their own and are not especially interested in such collaboration. However, there is growing cooperation between government and the private sector with conferences, seminars, and radio and television broadcasts. There is also good cooperation at the international level in helping with implementation of HACCP programs.

49. Spain has a network of inspectors who provide supervision and are expected to solve problems as they arise. In complex food safety problems, other components of the AKS system become involved. This could include diagnostic laboratories, universities, or even international centres. The Mexican system utilises close cooperation among the research, extension, and education components of the AKS to ensure rapid transfer of new information. Also, there is further interaction with other national or regional groups as needed. Korea utilises multiple agencies with the Rural Development Administration providing linkage to the provincial centres. The extension agents provide educational programs to the producers based on research information from the Korean Food and Drug Administration and other sources.

50. The AKS in the United States rests on the land grant universities which have both research and extension capabilities within the same institution. Further, many faculty members have appointments which expect both research and extension programs to be done by the same individual. Most universities have extensive ties to the commodity groups of interest in their state or region. Other alliances include the Partnership for Food Safety Education, which involves government, academia, and private industry in a joint educational effort on food safety. There are many linkages between the federal and state government within the regulatory arena and the land grant universities frequently provide the educational component for such efforts.

#### **TRENDS**

- Programs are more effective when there is a strong alliance of research and extension groups to ensure effective transfer of technology and information.
- Most countries have some type of collaborative relationship among the multiple agencies and the public and private sectors with the AKS but the degree of cooperation and integration varies considerably.

#### **FORMS OF PROGRAM FUNDING AND SOURCES OF FUNDING**

51. In general, most food safety programs are funded largely by government funds from the national level. In smaller countries, this is nearly always the case. For some of the larger countries, such as the United States, Canada, Spain, and France, there is usually funding available at the state or province level and there is an expectation that these smaller, more local, governmental units will provide a significant part of the funding. Research funds from the central government do not appear to be growing very much, even with the increased emphasis on food safety as a societal issue. At the same time, private sector funding has continued to increase, probably due to the need by the individual companies to solve specific problems that threaten their survival. However, it is important to remember that private sector funding has usually been at a much lower level than other sources.

52. An increasingly common and successful approach is to have joint funding of projects, thus leveraging the federal or state funds with private sector support. The allocation of central government funds usually is based on a review of the projects available and allocation of support to the best proposals and those that focus on the most important issues. A trend in the United States is to consider the relevancy of the proposal to the topic or issue and then do a second review to determine scientific merit. This makes it more likely that funded projects are focused on issues of importance to the public.

**TRENDS**

- Central and local governments provide much of the support for research and outreach in most countries.
- Given the lack of increases in governmental funding, leveraging of these funds with private sector funding is very important to the success of the research and extension components.

**ASSESSMENT OF RESULTS AND SWOT ANALYSIS**

53. Nearly all of the country reports indicated progress in solving the food safety problem. However, the degree of improvement is difficult to measure. Changing techniques for diagnosis of specific pathogens, the increased ability to identify agents using molecular biology techniques, and more comprehensive surveillance schemes make it nearly impossible to compare current data with those of ten or even five years ago. Thus, as stated earlier in this report, it may appear to the public that there is an increased level of food borne illness but this may be due only to the more efficient monitoring programs being used.

54. The increased level of funding for food safety research and educational programs and the emphasis on HACCP based systems reported from the United States is not typical and many countries expressed concern over the gradual erosion of funding for such programs. Based on the latest data from the Centers for Disease Control in the United States, 80 per cent of the food-borne illnesses and 60 per cent of the deaths have no etiologic diagnosis. If this is representative of other countries, then the food safety problem is still very large. The issue is perhaps exemplified by a statement in the Poland report which commented that although there had been improvements in the level of food safety, the consumers were impatient and wanted faster improvement. As evidence that funds spent on food safety are a good investment, Finland estimates that their strong, comprehensive *Salmonella* control program gives about a 5:1 return for the meat program and a 20:1 return for the egg control program. If market disturbances caused by discovery of *Salmonella* contamination are included in the calculations, then the return on investment is even higher.

55. Strengths of the various systems include a strong desire by producers and growers to be good stewards and provide a wholesome and safe food product to the consumer. The strong linkages between the extension personnel and the people they serve make it possible for them to have a major impact on production practices as well as food handling techniques. In several countries, e.g., Czech Republic, United States, Poland, the extension programs are heavily influenced by the needs of the producers.

56. A general weakness appears to be the lack of clear criteria and indicators to measure the achievement of objectives. Other weaknesses may include the narrow profit margins in the food industry and, therefore, the lack of adequate funds to address changes in their procedures. A weakness for several countries was the difficulty of getting the coordination that is needed among various governmental units and the private sector. Poor integration within the AKS was also cited as a problem for several countries in some cases, even when the various functions, research, extension, and education were within the same institution. To provide more incentives for collaborative approaches, some countries have introduced joint programme funding. For example in the United States changes in program regulations now require that a portion of Federal funds (25 per cent) to the land grant universities must be used for joint research/extension projects. Also, some competitively awarded funds are being managed as integrated programs to create more incentives for linkages between these two functions. In Italy, they cited the same problem of integration and indicated that they are currently implementing plans to begin and strengthen such collaborative efforts. Finally, for some of the more recent member countries, finding the necessary financial resources continues to be a serious problem.

**TRENDS**

- Funding for food safety programs is static or decreasing in most countries; a surprising fact given the strong public interest in the problem.
- One report gave economic data demonstrating that there was a return of 5:1 and 20:1 for the cost of salmonella reduction programs in the meat and egg programs, respectively.
- Poor integration of activities within the AKS was cited in several reports as a cause of unsatisfactory progress in food safety.
- Voluntary programs appear to be the better solution, particularly in the production settings where mandatory regulations could be difficult to enforce and very costly.
- Lack of clear criteria and indicators has hampered appropriate evaluation of outcomes and achievement of objectives.