

## Possible Contributions of Research to Solve the World Food Problem

Results from the TAB Project

by Marc Dusseldorp, TAB

The alleviation of hunger and poverty is one of the most serious challenges the global community has to face. According to FAO estimates, 925 million people suffered from hunger in 2010, the majority of them living in developing countries and newly industrialized countries. Moreover, several billions of people have to be added who suffer from the so-called “hidden hunger”, i.e., an inadequate supply of vital micronutrients such as vitamins or minerals. Given the urgency of this problem, the Office of Technology Assessment at the German Bundestag (TAB) carried out a TA project on behalf of the Committee on Education, Research and Technology Assessment entitled “How can research contribute to solving the problem of world food?” which was recently completed. The assignment of tasks of the project can be defined by the following questions: What are the most important gaps of knowledge concerning the world food problem? Which research areas might offer relevant contributions to solving the problem so that a more intensive support would be justified? Where is it necessary to overcome specific restrictions or to develop new forms of interdisciplinary and transdisciplinary research?

### 1 The TAB Project

Within the framework of the project, the question how research can contribute to solving the problem of world food was addressed from various perspectives. In terms of a heuristic one, it was initially assumed that all factors having a noteworthy influence on the world food situation can offer approaches for measures to be taken in order to alleviate the problem and thus, finally, can also offer corresponding approaches for research. In this way, it should be focused on such fields of research which have to date been neglected in relevant discussions and which could thus be part of a comprehensive research strat-

egy. Moreover, the survey focused on the field of research organization. Here, it concentrated on questions like which lessons can be learned from the so-called knowledge and technology transfer problem of development-oriented research with regard to future research design and which obstacles have to be overcome for this purpose.

In the first project phase, thirteen short expert analyses were assigned to external experts highlighting potential topics for research and dealing with issues of research organization. These short expert analyses as well as analyses of other relevant literature served as the basis for TAB to develop three main issues of the project's topic to be discussed in a workshop on “Possible contributions of research to solve the world food problem”. This workshop, which was an integral part of the second project phase, took place in June 2010 at the German Bundestag. Finally, in a general overview on the project results, possible priorities for future research on global food security as well as options for action regarding research policy were outlined. All results of the project (including evaluations of the short expert analyses and the expert workshop) can be found in the project's final report (Dusseldorp, Sauter 2011).

In the following, three possible priorities for future research on global food security will be presented in more detail.

### 2 Consideration of Production and Consumption: Approaches for Research

Although the current world food problem is not due to the low global food quantity being too low, there will also be challenges in this regard which research will have to deal with in the future. These challenges result from two development trends: worsening production conditions (loss of fertile agricultural land, competing usages, negative impacts of the climate change) and an increasing demand for food worldwide (population growth, change of dietary habits) compared to the status quo. As a further expansion of agricultural land is mostly not taken into consideration, i.a. for reasons of protecting the natural bases for life, two fundamental approaches remain: to secure or even increase food production on the

existing agricultural land and to change the structure of the demand for food.

#### *Consideration of Different Approaches*

Very often, the opinion is put forward that the productivity per unit area has to be increased in order to satisfy an increasing demand for food. In contrast, it is pointed out that changes of consumption patterns towards resource-conserving food would do (at least partly) without an increase of the productivity per unit area and that a reduction of post-harvest losses could compensate (at least partly) a further increasing demand for food in the future. In many cases, such suggestions are characterized by the fact that individual influencing factors are considered to be invariable, whereas others are considered to be variable and politically manageable. However, to find an effective research strategy for solving the world food problem, it seems to be expedient to make a reasonable and comprehensible selection of research topics based on the variety of potential approaches. Therefore it has to be considered – among other things – to what extent the individual influencing factors determine the world food situation and how promising their political manageability seems to be.

#### *Comparison of Influencing Factors with Regard to Production and Consumption*

Based on the assumption that it is difficult to reduce the area currently used for settlement and transportation, to minimize the current extent of soil degradation, and to control the future development of the world population, the following issues for alleviating the world food problem have to be addressed:

- development trends of the area used for settlement and transportation
- state and development trends of the area used for cultivation of energy crops
- development trends of soil degradation
- development trends of the productivity per unit area
- state of post-harvest losses
- state and development trends of consumption of animal-derived products

A gross quantitative comparison of the influencing factors regarding production and those regarding consumption reveals that the factors on both sides determine the world food situation to a high degree. Against this background, it seems likely to attach the same importance to both kinds of influencing factors within the framework of research. However, the results of the project indicate that up to now the consumption side has been given relatively little attention and support. Thus, it seems to be promising to consider an increased support of research on the demand side, particularly because dietary habits and post-harvest losses represent research areas of a high social relevance not only due to their significance for the world food situation, but also for health and environmental reasons.

### **3 Productivity Increase: Focusing on Access to Food and Resource Conservation**

Among the possible strategies for increasing the productivity per unit area, mainly two approaches are being discussed: a further high external input intensification of high performance areas as well as a low external input intensification of rather marginal areas in developing countries. The results of the project indicate that both strategies might be helpful and that the decision whether they are appropriate or not depends on the respective context. Here, it has to be taken into consideration that productivity increases are associated with two major challenges: On the one hand, it has to be ensured that through this measure the people most affected by undernourishment have an improved access to food. On the other hand, it is urgent to reduce the current resource consumption (of soil, water, fertilizers) of agricultural practices significantly, last but not least because otherwise global food production would be deprived of its economic basis.

#### *Promotion of Smallholder Agriculture in Developing Countries: Combining Productivity and Access*

A major approach to increase global food production is the improvement of (mostly smallholder) agriculture in marginal areas of developing countries. The yields per unit area obtained there are much lower than the yields per unit area obtained by means of intensive agriculture in favourable ar-

eas. However, there is a potential for considerable increases. For the development of adapted measures aiming at an increase of productivity, it has to be taken into consideration that the respective farmers have almost no financial resources for purchasing external inputs. Therefore approaches trying to increase productivity with only few external inputs (such as Conservation Agriculture, the System of Rice Intensification, Agroforestry Systems as well as Organic Farming) might be promising. At the same time, it is thus possible to face the urgent challenge of preserving and cultivating the agricultural production bases. The advantage of the strategy outlined is not only that it requires only few resources, but also that productivity increases can involve an improved access to food (improved food self-sufficiency as well as improved incomes due to the sale of surplus food). This combination of increased quantities and an improved access seems to be necessary since the agricultural sector represents the primary source of income for the rural population in developing countries.

#### *Intensification of High-performance Areas: Resource Conservation*

In principle, a further intensification of production in high performance areas is appropriate to realize an increase of the productivity per unit area. To achieve an effective and sustainable improvement of the world food situation, such intensification strategies have to meet two challenges: Agriculture must become much more environmentally compatible and resource-conserving than it is today and access to food must be ensured for people suffering from undernourishment and malnutrition. Agricultural practice is considered to be one of the biggest emitters of greenhouse gases and one of the biggest consumers of freshwater and involves severe soil degradation, a serious loss of biodiversity as well as a high consumption of fossil energy sources. Against this background, future world food security has to be realized with the intention of not only ensuring a decrease of the negative impact on the economic bases, but also of improving and sustainably cultivating these economic bases, if possible. Realizing productivity increases and considerable improvements regarding the impacts on resources and on the environment at the same

time is a tremendous challenge, because intensive farming is based to a high degree on high external inputs (synthetic fertilizers and plant protection products, fuel, etc.). If productivity increases in high-yield areas shall result in an alleviation of the world food problem, people suffering from undernourishment and malnutrition must be given better access to food at the same time, i.e., they must have the financial resources required for purchasing food. Theoretically, an increase of the food supply should result in a reduction of food prices and thus should alleviate access to food for the poor. However, it is questionable whether productivity increases will really lead to permanently low world market prices for food, because lower prices for agricultural products also make their energetic and material use more attractive.

#### **4 Developing Research on Global Nutritional Behaviour**

So far, the world food problem is mostly considered to be a problem of quantity or of access. However, it has to be assumed that the “nutrition perspective” is of major significance for solving the problem, notably in order to be able to consider undernourishment and malnutrition as facets of the problem in an adequate way. For this reason, it is obvious to ask which contribution could be made by research focusing on global nutritional behaviour in order to find a solution to the world food problem. Possible topics could be the determinants of individual nutritional behaviour, changes of dietary habits and the consequences involved as well as possible strategies for shaping a more sustainable world food situation. Knowledge of the determinants, changes and consequences mentioned above represents a necessary prerequisite for a policy which aims at successfully supporting an improvement of the world food situation.

To date, only rudimentary research is conducted in the field of global food security in Germany. In this context, a perspective for German research for solving the world food problem should be to strengthen neglected fields (e.g. nutrition research focusing on developing countries) and to further develop them to become a research area called “research on global nutritional behaviour”. The – at least partly – observable conver-

gence of dietary habits in developing and newly industrialized countries towards those of industrialized countries implicates that meanwhile nutrition research referring to industrialized countries seems to be easily combinable with a respective research referring to developing countries. Thus, the outlined research might simultaneously lead to a deeper understanding of our local dietary habits in the context of globalization which also confront society with major challenges (overweight, obesity and other diet-related diseases).

### Reference

*Dusseldorp, M.; Sauter, A.*, 2011: Forschung zur Lösung des Welternährungsproblems – Ansatzpunkte, Strategien, Umsetzung. TAB-Arbeitsbericht Nr. 142, Berlin; <http://www.tab-beim-bundestag.de/de/pdf/publikationen/berichte/TAB-Arbeitsbericht-ab142.pdf>

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## Service-Roboter im Blick der Technikfolgenabschätzung

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### 1 Hintergrund

Service-Robotern wird ein ähnlich bedeutendes Innovationspotenzial wie Industrierobotern vorhergesagt. Hierbei wird zunächst definiert, dass unter Service-Robotern alle „Nicht-Produktionsroboter“ gefasst werden. Heutige Service-Robotersysteme werden v. a. im Bereich Verteidigung, Rettung und Sicherheit, gefolgt von der Landwirtschaft – hier v. a. Melkroboter – eingesetzt. Dies sind Bereiche, in denen die Service-Roboter mit einem menschlichen Experten gemeinsam und unter dessen Aufsicht und/oder in einem geschützten Raum betrieben werden. Solche Anwendungen stellen also einen Übergangsbereich zwischen Industrierobotik und einer allgemeinen Servicerobotik dar. Der Roboter ist zwar nicht mehr in seinem „Sicherheitskäfig“, der üblicherweise aus Sicherheitsgründen in der Produktion errichtet wird, aber er wird nur in Bereichen eingesetzt, in denen gemeinhin kein unbeteiligter Dritter dem Roboter begegnen kann bzw. kein Dienst unmittelbar an und um Menschen herum verrichtet wird. Der Mensch, der mit dem Roboter kooperiert, kann für diese Kooperation geschult werden und wird damit bis zu einem gewissen Grad selbst Roboterexperte.

Viele Dienstleistungen zeichnen sich aber dadurch aus, dass sie in menschenreichen Umgebungen durchgeführt werden müssen bzw. dass sie eine Dienstleistung an Menschen darstellen (Kranken-/Altenpflege). Die Menschen, die hier in Kontakt mit den Robotern kommen, können nur bedingt zu Roboterexperten ausgebildet werden. Diese Dienstleistungen bringen also mit sich, dass Robotiklagen mit Robotern umgehen müssen und dass Unbeteiligte im Umfeld des Roboters anzutreffen sind. Darüber hinaus spielt sich die Dienstleistung in der normalen Lebenswelt ab, die nur sehr bedingt für einen Robotereinsatz angepasst werden kann.