

FROM AID FUNDED RESEARCH TO COMMERCIALISATION: THE WHOLE CROP HARVESTER

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The Project

The Whole Crop Harvester (WCH) was developed by the Overseas Division of Silsoe Research Institute, it is intended for use in countries in which wheat is a major crop and where the finely broken straw is an important animal feed. The WCH's ability to process straw differentiates it from conventional combine harvesters. The machine is tractor mounted and intended for use in small, banded fields with limited access. Between 1985 and 1989 the Pakistan Desk of ODA funded the design and construction of several prototypes and their testing in Pakistan. A Pakistani company which was interested in manufacturing and marketing the WCH was identified. Silsoe acted as the research contractor. Testing in Pakistan was carried out by Silsoe in cooperation with the Farm Machinery Institute (FMI), Islamabad, Pakistan. Funding by the Pakistan Desk ceased in 1989 when the Desk and the ODA technical advisers considered that funding further development in Pakistan would not improve the chances of the machine being produced commercially. The UK-based MacAntar Engineering Ltd took out a licence for the technology in 1987. It now expects to market the WCH in the Middle East. MacAntar has been reluctant to cooperate with Pakistani companies due to the fear of counterfeiting. It is unlikely that the machine will be marketed in Pakistan.

The Evaluation

This evaluation was commissioned by the Evaluation Department of ODA to assess the actual and potential impact of the WCH development, in the UK and Pakistan; and to learn lessons concerning ODA support for the development and commercialisation of agricultural technology. The evaluation team comprised an agricultural engineer (Team Leader), a commercial engineer, and an economist. The findings of this report draw on the ODA files on the Whole Crop Harvester project. A field visit to Pakistan was made by the agricultural engineer and the economist. Key stakeholders were interviewed in the UK and Pakistan.

Overall Success Rating

The project was *largely unsuccessful*. The WCH is unlikely to be either manufactured or sold in Pakistan. Simple financial analysis strongly suggests that the economic net present value for the anticipated sales in the Middle East will be negative. The project's

major shortcoming was its failure to anticipate the reactions of potential commercial partners and hence to manage the relationship between ODA, Silsoe and these partners. Despite this the project might have succeeded if MacAntar and Millat Tractors had been able to come to a legally binding agreement to prevent Millat Tractors copying the MacAntar machine and then entering the Middle Eastern markets.

The Main Findings

Project Identification

The need was first identified in Egypt. Based on its experience Silsoe believed that demand for this machine would extend to all those semi-arid wheat growing areas in which straw is a vital source of animal feed. The focus on Pakistan was a result of the availability of funds from ODA's Pakistan Desk.

Appraisal

The original request to ODA was for funding for one year. This request was supported by a desk study of the possible socio-economic impact. Agreement for ODA funding was made conditional on further assessment of the possible impact on farm labour displacement. This assessment was to be carried out concurrently with the field testing of the machine in Pakistan. ODA policy objectives do not appear to have been explicitly stated in the mid-1980s. The proposal was seen by both ODA Social Development and Economic Advisers. There is no evidence that they regarded the project as unacceptable. There was no discussion of the expected project outputs, duration or the conditions and assumptions that were used by Silsoe in planning the project. A shortcoming of the appraisal was the absence of consideration of the management of the transition to a commercial machine and the attendant risks.

Design

The Pakistan Desk funded the project on an annual, renewable basis. Silsoe believed the project would proceed in the following manner:

- Silsoe would design and arrange construction of a prototype suitable for manufacture and use under Pakistani conditions.
- FMI would facilitate import of the prototypes into Pakistan and provide the basic support facilities for field testing and be rewarded with training and possibly a new machine; the collaboration of a Pakistan engineering company would be sought to take the machine on to commercial production, once the prototype had been proven.

The transition from prototype to a commercial machine was seen as neither risky nor resource-intensive. The extent to which this plan of action was discussed informally

either with ODA or FMI is not known.

Prototype Development

Between 1985 and 1987 ODA funded construction of four versions of the WCH to be tested in both Pakistan and the UK. Prototypes were designed at Silsoe but constructed by a specialist UK firm. This increased the input from commercial engineers in the machine's design. Silsoe engineers had no experience in commercial engineering and recognised this as a deficiency.

Silsoe & FMI Collaboration

The relationship between FMI and Silsoe was good, despite the lack of a formal agreement between the two institutions.

Commercialisation

It was always assumed that the WCH would be manufactured and sold by a commercial company. Management of the process of commercialisation and the requirements of these companies were not discussed between ODA and Silsoe. Within Silsoe, consideration of commercialisation started immediately after the patenting of the idea through British Technology Group (BTG). Initially, Silsoe believed that there would be no conflict between the BTG's commercial objectives, the needs of a UK manufacturer, and the development orientation of the WCH project in Pakistan. In general, agricultural engineering companies view R&D as being costly, risky and skill-intensive. Attempts to interest UK manufacturers in developing the WCH were largely unsuccessful. The experience in Pakistan was similar, with only one potential manufacturer, Sayyed Machinery, showing real interest. Sayyed proved unable to develop the WCH for Pakistani conditions without support. Silsoe responded by changing its strategy and from 1986 sought a UK manufacturing partner which would be responsible for product development. It believed that Sayyed would support the field testing and act as a marketing agent in Pakistan for the UK company. The inability of the UK licence holder, MacAntar, and Pakistani companies to reach agreement demonstrated that this belief was false. ODA funded technical support for Sayyed from 1987. This ceased in 1989 when it was apparent that Sayyed was incapable of developing the WCH. Further progress by Sayyed and FMI was impossible after the departure of FMI's principal engineer to the UK for study. Sayyed has proved incapable of building reliable prototypes for testing.

Communication on Objectives

At no stage was a set of common objectives and priorities agreed upon by all the stakeholders. All the stakeholders, including Silsoe and ODA, believed a common set of

project objectives had been agreed. Discussions between the stakeholders and the evaluation team show that this belief was fallacious.

Monitoring

Procurement and finances were both well managed, which suggests that the monitoring of these key areas was good. Monitoring of machine testing was also of a very high standard, with detailed reports on performance produced. There was no formal system for monitoring project progress towards its objectives. This did not mean that no effective monitoring took place. The less structured approach to monitoring that was common practice at the time was successful in alerting the Pakistan Desk to the weakness of Sayyed and enabling a response to be made. Monitoring, however, did not highlight the implications of what a UK company might want, or the resources required to move the WCH from a prototype machine to a commercial product.

Efficiency of Implementation

It is arguable that annual funding was not the most efficient way to finance a research programme that needed time to achieve anything worthwhile. No attempts were made to explore alternative methods of working, such as buying in expertise, or using another contractor to undertake research. It is only possible to speculate whether alternative approaches would have provided a more effective means of translating activities into results.

Cessation of Funding

Funding ceased in 1989. It is not clear from ODA files what led ODA to decide to cease funding. What evidence there is suggests that ODA formed the view that the project was not progressing satisfactorily. The decision to cease funding took all other stakeholders by surprise. ODA did not make a clear statement or discuss the decision with key stakeholders, either before or after the event. Given the lack of progress by Sayyed and ODA's unwillingness to devote greater resources to strengthening Sayyed's capabilities it is arguable that ODA funding should have ceased in 1987.

Impact & Sustainability

To date there have been no commercial sales of the WCH. Project impact has been confined to the strengthening of FMI's capabilities in managing research projects. There will be a sustainable impact if MacAntar produce and sell the WCH in the future. For ODA the investment in the WCH has been unsuccessful. The impact will not be on the intended beneficiary group. Break-even analysis also indicates that projected sales will not produce a return that will cover all the development costs. This suggests that the project's economic net present value will be negative. The decision to fund development

of a prototype WCH was justifiable. In Pakistan there was no commercial uptake of the idea by the major manufacturers because product development did not fit into their business strategy. When considering such an investment, questions that ODA should have asked include:

- what is the minimum investment necessary to demonstrate the concept satisfactorily to potential commercial partners?
- will the concept fit into the strategy of potential commercial partners?
- for a commercial company, what is the size of investment necessary and the degree of risk involved? What are the implications of this size and risk for ODA, in terms of minimising the manufacturer's commercial risk?

MacAntar invested in the WCH due to a fortuitous set of circumstances. Its access to Middle Eastern venture capital, to Massey Ferguson's overseas marketing system and to an engineer experienced in harvester design distinguished MacAntar from other UK agricultural engineering companies. MacAntar pursued a strategy of selling the WCH for a high price. This made the Pakistan market commercially unattractive. MacAntar was willing to manufacture the WCH in partnership with Millat Tractors for sale in Pakistan and in the Middle East. Unfortunately Millat Tractors refused to sign a legally binding agreement that it would not copy the MacAntar machine and then under-cut MacAntar in the Middle Eastern markets. Such commercial negotiations between companies are not amenable to ODA influence. Simple market information at the project appraisal stage would have allowed ODA to judge whether the intended beneficiaries would be an attractive market and would also have enabled ODA to influence commercial companies' choice of markets. There is no evidence that the actions of BTG hindered commercialisation of the WCH in Pakistan. Companies seek exclusive licences for technologies to prevent competition from other developed country companies.

Lessons

Management of Research Projects

- Research projects need clearly stated aims, objectives, assumptions, indicators, outputs and monitoring and evaluation procedures. The assessment of progress will be difficult where this is not the case. The respective roles and responsibilities of stakeholders also need to be established at the outset.
- The use of procedures and tools, such as logical frameworks will not, on their own, ensure consideration of commercial issues during the planning process. The lack of commercial experience within ODA and most research contractors means that commercial issues will probably continue to be viewed as peripheral to the project's success.
- Technology research and development requires both time and expertise. The WCH illustrates the length of time it can take to overcome technical problems. The short time horizons associated with annual funding for the WCH probably

discouraged the development of a planned programme of work.

- Communication between stakeholders is important, especially in commercial projects in which ODA will not wish to fund the entire research process. The WCH case shows the confusion which is possible. Stakeholders still hold divergent views on the rationale for funding the work with Sayyed between 1986 and 1989.

From Aid Funded Research to Commercialisation

- If aid funded research is to result in commercialisation of a technology, then this process is better managed than left to chance. Strategic guidelines on the type of funding and the institutional and contractual arrangements for collaboration between ODA and a specified commercial firm are required.
- Project appraisal needs to consider the profitability and risk of the R&D investment from the point of view of potential commercial collaborators. The stage at which commercial funding of the research should be expected to take over should also be identified.
- If ODA is to fund research which is intended to be commercially exploited, persons with a commercial background need to be involved in appraising the research before it commences.

Technology Research & Dissemination

- The conventional 'Transfer of Technology' approach can successfully develop technology for commercial producers with relatively high levels of resources. It is less likely to be effective for producers with limited resources in developing countries. The experience of the WCH and the Silsoe institute's Stripper reinforces this contention.
- Participative approaches to technology development are advocated as an alternative to the 'Transfer of Technology' model. 'Participation' has to be not only with end users but with potential manufacturers. Institutional approaches to involving commercial companies in technology development might include: inviting commercial companies to compete for ODA research funds; and offering the possibility of matching funds to commercial companies carrying out research which is aimed at ODA priority country markets.