2. Economics and planning for irrigation management using Mahakali
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Course: MSc Agriculture
Software: Mahakali (produced by the World Bank)

The key characteristics of this case study were:

- Successful educational adoption of a package which was designed for specialist commercial training.
- Students were expected to take responsibility for using and exploring the software.
- The module assessment could only be tackled fully if students had used the package.

Introduction
Mahakali has been used successfully in the Department of Resource Engineering at the University of Edinburgh. It was used initially with a combined group of 10 students studying for degrees in either MSc Agricultural Extension/Rural Development, or BSc Agriculture/Crop Science. One optional module is offered in ‘Irrigation Systems and Water Use’, and the module represents approximately one sixth of a student’s time during the term concerned.

The package was originally commissioned and designed by staff at the World Bank as a training aid. It offers a complete simulation environment in which users can explore and test their understanding of production and management decisions in an irrigation scheme. It is based around a case-study of the Mahakali irrigation project in Western Nepal.

Aims and Objectives
The general aim of including this package in the module was to support the technical lecture material with an environment in which scenarios could be tested and ideas explored in the context of a realistic system.

Specifically, the objectives of the use of the package were to allow students to simulate real situations and to explore particular issues, namely production decisions relating to agricultural planning and production decision-making, and operational decisions regarding the effects of different water management policies on the economics and operation of the irrigation system.

Overview of the Project
LTDI was involved in preparing for the implementation of this module in the summer of 1995. Following initial consultations and a review of the content of the Mahakali package, the main activity of the Implementation Support Consultant was to prepare documentation on the use of the package and its integration into the module concerned, in consultation with the lecturer concerned, and his existing lecture notes.

Mahakali is a self-contained package and it comprises all the information required to perform a fairly complete analysis of the agricultural production and irrigation management situations for a realistic project. There is a wide variety of information contained in the case-study, arranged in a menu format, with the user required, and encouraged, to follow through the various sequential activities. Usually some note-taking or printing out of such information is required in order that students keep full account of their progress through the module.

The module tutor used the package at the start of the module. Students were given an initial briefing session by a colleague from the Civil Engineering department, which was then followed by three computer laboratory sessions in labs of 12-14 machines where students were encouraged to explore the various scenarios and produce results for themselves. There was relatively limited supervision of this process, but the main objective was to enable students to frame the
content of the subsequent lecture sessions of the course. This was thought to be particularly important for Masters level students with prior experience of the practice of irrigation management, with the objective of giving relevance to the technical material which followed.

**Evaluation**

Although no formal evaluation was conducted, apart from informal discussions with individuals, students were asked to evaluate the package in the course of their normal module evaluations, following the implementation of the package in the spring term of 1996. General student reactions were very positive, and although there had been minor system problems at certain times (Mahakali is very memory intensive in the MS Windows® environment), students were keen to re-try the scenarios and to work out optimum management scenarios for themselves. They appreciated the variety the software brought to their courses, and the extent to which it enabled them to link together various parts of the overall degree programme, relating to agricultural production decision-making as well as irrigation decisions. Such reactions and the relative success of the exercise mean that it was decided that in following years its use within the course would be retained, but with a greater degree of integration and documentation. The experiment in allowing students access to the software as a precursor to the main lecture material was deemed successful and will also be repeated, with the stated objective remaining - to allow students to 'brief themselves' on the content of the course, and to set the main material in context.

Students were themselves assessed on the basis of their use of the package. An examination exercise was set which involved students criticising a paper relating to government involvement in farmer managed irrigation schemes. They were then asked to comment on the extent that a software package could be used to aid in such planning activities.

**Conclusions**

Mahakali was designed as a training package for irrigation management specialists, and provides detailed simulations of the design and analysis of such systems. It is somewhat lacking in documentation, and was not designed specifically to integrate with University courses. However, the use of Mahakali in the example above has been successful. The comprehensive nature of the package enabled students to experiment with all the main issues relevant to the course, and allowed the lecturer to refer, in the classroom teaching environment, to such issues in a recognised context. The use of Mahakali will continue, with recognition by the teaching staff involved that there needs to be more refined integration with rest of the module, more comprehensive documentation and preparation for the use of the package, and guidelines on which parts of the package are the most relevant - given the fact that a large amount of technical detail is contained within the package, not all of which is covered in the module.