is part of the reality we have to deal with. However, we have a duty to ensure that this does not spill over and affect the quality of advice that decision makers receive. We need to support the creation of strong and independent capacities for policy analysis that can prepare for a future that will be as uncertain as it is today.

Notes:
1. This section draws on the work of Yaron (1992).

References


The processes of both irrigation development and policy formulation are influenced by complex interactions and environmental changes. A holistic, systematic description and analysis indicates a gradual shift of emphasis from individual to co-operative to public irrigation schemes. For all schemes, variable availability of water and quality of soil presented limitations. The adaptation of extensive or intensive farming practices, viable sizes of farming units, and unrealistic expectations reflected in high land prices, created problems. Following a learning process, it is clear that attention to marketing opportunities, managerial ability and access to capital must be stressed. These factors must definitely be incorporated in current reform initiatives for land settlement. In the case of small-scale irrigation farming, priority must be given to improved utilization of existing schemes, preceded by feasibility studies and accompanied by investment in human capital. Entrepreneurial initiative in the market process must therefore be supported and facilitated by government authorities.

LESSONS FROM THE ECONOMIC HISTORY OF IRRIGATION DEVELOPMENT FOR SMALLHOLDER SETTLEMENT IN SOUTH AFRICA

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In the period up to 1873, water resource development for irrigation was done on private initiative. Small-scale utilization was undertaken without government assistance. This first phase of individual well-division or pump schemes is characterized by a subsistence economy, limited and distant markets; and little incentive for capital investment in waterworks. Where natural circumstances were favourable, water was abstracted from rivers. Government decisions and actions, i.e. public policy, influenced this process by initially considering irrigation as a concession and later as private economic activity. Conflict regarding apportioning and transfer of water rights was resolved through local forums (the "hemraad") and later on the basis of common law principles of the riparian doctrine as well as rulings of court cases (Backeberg, 1994a:99-100).

2. Phases of irrigation development

2.1 Individual diversion schemes

In the period up to 1873, water resource development for irrigation was done on private initiative. Small-scale utilization was undertaken without government assistance. This first phase of individual well-division or pump schemes is characterized by a subsistence economy, limited and distant markets; and little incentive for capital investment in waterworks. Where natural circumstances were favourable, water was abstracted from rivers. Government decisions and actions, i.e. public policy, influenced this process by initially considering irrigation as a concession and later as private economic activity. Conflict regarding apportioning and transfer of water rights was resolved through local forums (the "hemraad") and later on the basis of common law principles of the riparian doctrine as well as rulings of court cases (Backeberg, 1994a:99-100).

2.2 Co-operative flood diversion schemes

An active policy with the objective to promote irrigation
started in the Cape. A twofold strategy of obligatory collaboration between producers, and provisions to grant unburdened loans for individual or co-operative water-developments, was followed in the second phase. This was facilitated by means of legislation promulgated in 1877, and this year is accepted as the beginning of modern irrigation in South Africa (Linscott 1924:52; Van Romen 1925:22-23 and 1929:4). Although irrigation schemes were initiated on private initiative, development of co-operative flood schemes progressed slowly. This was caused by suspicion and fear for imposition of water taxes by government as well as high transaction costs for appropriating, protecting and enforcing water rights. Moreover, in individual spirit and lack of economic alternatives probably also prevented group action (Kanthak 1922a:101). Although measures were taken to make loans more attractive, irrigation development only gained momentum after 1906, following an economic improvement brought about by the demand for ostrich feathers as a fashion article. Ostriches are adapted to a dry climate and require permanent pastures such as lucerne under irrigation. The considerable expansion of co-operative flood irrigation schemes was facilitated because of declining market prices between 1914 and 1916. This coincided with a severe drought and as a result not all scheduled land was cultivated, which culminated in an inability to repay irrigation loans (Kanthak 1919:3-4 and 1922:16-17; Van Romen 1925:22-23).

2.3 Public storage schemes

At the beginning of the third phase it was explicitly recognized that variable rainfall and variable river flow necessitate water storage for regular irrigation of crops. Included were a range of field, industrial and horticultural schemes. Policy during 1920. However, it is specifically considered essential on co-operative flood irrigation to stabilize livestock production, to intensive cultivation of land and the development of staple crops, contributed towards a change in location in respect of markets, the success of farming was dependent on the managerial ability of entrepreneurs. As irrigation was clearly dependent on surface water run-off which can be stored, which culminated in an inability to repay irrigation loans (Kanthak 1994a:101). Although measures were taken to make loans more attractive, irrigation development only gained momentum after 1906, following an economic improvement brought about by the demand for ostrich feathers as a fashion article. Ostriches are adapted to a dry climate and require permanent pastures such as lucerne under irrigation. The considerable expansion of co-operative flood irrigation schemes was facilitated because of declining market prices between 1914 and 1916. This coincided with a severe drought and as a result not all scheduled land was cultivated, which culminated in an inability to repay irrigation loans (Kanthak 1919:3-4 and 1922:16-17; Van Romen 1925:22-23).

These different phases of irrigation development and changes in policy are related to the phases of economic development: Private irrigation schemes were dominant during the agricultural-mining phase; and government settlement schemes below public storage dams coincide with the agricultural-mining-industrial phase. This confirms that irrigation development is inseparably a part of economic development and that irrigation to stabilize livestock production, to intensive cultivation of land and the development of staple crops, contributed towards a change in location in respect of markets, the success of farming was dependent on the managerial ability of entrepreneurs. As irrigation was clearly dependent on surface water run-off which can be stored, which culminated in an inability to repay irrigation loans (Kanthak 1994a:101). Although measures were taken to make loans more attractive, irrigation development only gained momentum after 1906, following an economic improvement brought about by the demand for ostrich feathers as a fashion article. Ostriches are adapted to a dry climate and require permanent pastures such as lucerne under irrigation. The considerable expansion of co-operative flood irrigation schemes was facilitated because of declining market prices between 1914 and 1916. This coincided with a severe drought and as a result not all scheduled land was cultivated, which culminated in an inability to repay irrigation loans (Kanthak 1919:3-4 and 1922:16-17; Van Romen 1925:22-23).

3. Common problems

A number of obstacles were experienced and also documented at an early stage (cf. Kanthak 1919 and 1922; irrigation Finance Commissioner 1925, Van Romen 1925). The problems can be conveniently grouped on a scheme- and farmer level.

3.1 Irrigation scheme level

It was stated that because of constraints of topography and hydrology, large-scale irrigation schemes were not realistic. Therefore was made available which was actually noticed early in the water storage and settlement policy, priority ought to be given to a program of improved utilization and rehabilitation of existing schemes. For this reason factors have to be examined in the farmer support approach (Singiri and Van Rooyen 1995:4-9). These factors are also reflected in the current efforts towards a national level to broaden access to irrigation (Department of Agriculture 1995).

All these aspects must be considered in the integrated planning of land and reform projects. In the case of smallholder settlements in irrigated agriculture, three overall issues must be singled out:

5.1 Exploitation of unused potential

In terms of plans for execution of a new national irrigation policy, priority ought to be given to a program of improved utilization and rehabilitation of existing schemes. For this purpose projects must be undertaken which are specific to particular farmers and provide the necessary management of irrigation schemes within catchment areas. It also entails consolidation, improvement and contribution by stakeholders on a local level.

3.2 Irrigation farming level

In a situation of uncertain water supply, varying soil conditions, and flood damage, it was decided that the irrigation strategy of setting aside communal land and changing the location in respect of markets, the success of farming was dependent on the managerial ability of entrepreneurs. As a result, social factors were found to be influential in irrigation decisions, and those factors that led to irrigation decisions were considered:

- Income and employment opportunities
- Access to credit and inputs
- Access to markets
- Government policies
- Social networks and community support

These factors were found to be interrelated and influenced the decision-making process of farmers. Therefore, a comprehensive approach that considers social and economic factors is necessary for successful irrigation farming.

3.3 Management

Irrigation systems require constant maintenance and management to ensure efficient water use and crop production. Key management issues include:

- Water allocation and scheduling
- Crop management
- Soil conservation
- Pest and disease control
- Irrigation system maintenance

Effective management practices can help farmers overcome challenges and increase yields. This includes the use of modern irrigation technologies, such as drip irrigation, and adopting sustainable agricultural practices.

3.4 Challenges for the future

Despite the successes of irrigation farming, several challenges remain:

- Access to water: The availability of water is a critical factor in irrigation farming.
- Financial constraints: Farmers may face difficulties in accessing finance for irrigation and associated inputs.
- Technological limitations: The adoption of modern irrigation technologies may be limited by farmers' access to information and training.

Addressing these challenges requires a holistic approach that involves stakeholders, including governments, communities, and industry players.

4. Lessons from experience

Economic circumstances in areas where irrigation schemes are located in South Africa were repeatedly ignored. In this regard, four interrelated economic considerations were neglected:

- Access to markets
- Access to capital
- Access to information
- Access to support services

These factors play a critical role in the success of irrigation farming. Addressing these issues can improve the sustainability and profitability of irrigation farming operations.

5. Challenges for the future

The major challenges for irrigation farming in South Africa include:

- Water availability and quality
- Economic viability of farms
- Access to markets and inputs
- Government support and policies

Addressing these challenges requires a coordinated effort among stakeholders, including government, farmers, and other relevant actors.

6. Conclusion

Irrigation farming is a viable option for addressing food security and promoting rural development in South Africa. However, it requires a holistic approach that considers social, economic, and environmental factors. Further research is needed to develop effective strategies and policies for sustainable irrigation farming.

References

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Acknowledgments

[Include any acknowledgments here]
Programmes and smallholder settlement in irrigated areas are used on small to medium sized farms with special reference to South Africa.

5.2 Performing feasibility studies

In order to prevent repetition of past mistakes, the degree of government involvement and level of expenditure of public funds must be preceded by feasibility studies. Based on multi-disciplinary participation, financial profitability of farming must be determined on a local, regional level, the multiplier effect and fiscal, social as well as ecological impact must be assessed on at least a regional level, and the economic viability must be evaluated on a national level. Completed reports for projects must be published, findings debated and reasons given for government decisions and actions or inactions.

5.3 Capacity building

There is no doubt that the limitations of topography and rainfall were to a large extent overcome by engineering expertise. From 1920 to about 1985, there was a tendency of high capital investment in water storage and distribution schemes. In comparison relatively few financial resources were spent on applied agricultural research as e.g. decision analysis, as well as on training and extension of people.

Future government involvement in irrigation schemes must give precedence to capital investment in human resources who conserve and allocate water resources. Corrective action because of past injustices of unequal access to water resources must therefore be linked to human resources. This will first of all still require selection based on managerial ability, followed by informal and formal training and targeted extension programmes. Simultaneously selective and temporary aid can be provided by means of e.g. grants to obtain rights to land and water resources and/or payment of subsidy allowances for the first two to five years after starting with farming. A delicate balance will necessarily have to be maintained between achieving individual independence and relying on continued government assistance (Backeberg 1994a:146-147 and 331-333, 1994b:231-239).

Numerous examples can be given of existing irrigation schemes with unused potential in catchment areas of the north-eastern coastal and coastal areas. Amongst these one particular scheme which deserves special attention is the Makhatini Scheme. The reason is that despite many detailed studies, less than 10 per cent of the potential area has been utilized after 30 years. Many opportunities therefore exist for smallholder settlement but careful attention will have to be given to all of the elements specified above (Department of Agriculture 1994).

6. Conclusion

Currently an estimated 83 per cent of the 1,231 million hectares and 78 per cent of the 9 700 million cubic metre agricultural water, are used on small to medium sized private or co-operative schemes in irrigated agriculture (Backeberg 1994a:44 and 248). It is significant that success and failure of irrigation development in the past can be related to marketing potential of agricultural products and the level of profitability of farming. In this regard the sources and financing of capital as well as managerial ability for different sizes and types of farming enterprises are of particular importance. These facts must be recognized and included in supporting services for land reform programmes and smallholder settlement in irrigated agriculture.

For the purpose of policy formulation in the present mature phase of the water economy, it must be accepted that the driving force in the market process is productive activity of individual entrepreneurs. Individuals take decisions within an institutional framework. Transactions and exchange of property rights is the fundamental interaction in economic life (Backeberg 1994a:239-240). Therefore tenure and legal security of property rights to land and water resources must be protected and enforced by legislative and judicial government authorities. In order to promote economic efficiency and equity on the operational level, the preferred strategy of executive government authorizations for re-allocation of land and water rights must be facilitation of individual decision-making in the market process. Corrective action through negotiations and institutional influencing of transactions, rather than intervention through use of exclusive powers must be emphasized to achieve economic objectives of increased social welfare.

Note:

1. Based on a PhD thesis by Gerhard R Backeberg at the University of Pretoria.

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5.2 Performing feasibility studies

In order to prevent repetition of past mistakes, the degree of government involvement and level of expenditure of public funds must be preceded by feasibility studies. Based on multi-disciplinary participation, financial profitability of farming must be determined on a local level, the multiplier effect and fiscal, social as well as ecological impact must be assessed on at least a regional level; and the economic viability must be evaluated on a national level. Completed reports for projects must be published, findings debated and reasons given for government decisions and actions or inactions.

5.3 Capacity building

There is no doubt that the limitations of topography and rainfall were to a large extent overcome by engineering expertise. From 1950 to at least 1985, there was a tendency of high capital investment in water storage and distribution schemes. In comparison relatively less financial resources were spent on applied agricultural economic research as e.g. decision analysis, as well as on training and extension of people.

Future government involvement on irrigation schemes must give precedence to capital investment in human resources who conserve and allocate water resources. Corrective action because of past injustices of unequal access to water resources must therefore be linked to human resources. This will first of all still require selection based on managerial ability, followed by informal and formal training and targeted extension programmes. Simultaneously selective and temporary aid can be provided by means of g.e. grants to obtain rights to land and water resources and/or payment of subsistence allowances for the first two to five years after starting with farming. A delicate balance will necessarily have to be maintained between achieving individual independence and relying on continued government assistance (Backeberg 1994a:146-147 and 331-333, 1994b:231-239). Numerous examples can be given of existing irrigation schemes with unused potential in catchment areas of the north-eastern and eastern escarpment and coastal areas. Amongst these one particular scheme which deserves special attention is the Malakalins Irrigation Scheme. The reason is that despite many detailed studies, less than 10 per cent of the potential area has been utilized after 30 years. Many opportunities therefore exist for smallholder settlement, but careful attention will have to be given to all of the elements specified above (Department of Agriculture 1994).

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