Regional partnerships to assist public–private investments in irrigation systems

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Abstract
Public–private partnerships have been implemented throughout the world since the 1970s with mixed results. This is mainly due to the lack of long run commitments from governments and other parties involved, lack of scientific understanding regarding clear short term and long-term potential biophysical and socio-economic, policy and legal consequences, and lack of trust between the partners. We present a Regional Irrigation Business Partnership (RIBP) model, which is capable of efficiently utilising research output and government policies for sustainable public–private irrigation planning and investment.
Unlike other public–private partnership models, the RIBP is based on robust assessment of biophysical, hydrologic, socio-economic, political and legal aspects of water management. The RIBP model provides a crucial link between research and infrastructure investments while minimising short-term and long-term risks. The business investment framework involves iterative feedback from research and policy for identifying markets, defining products and establishing a legislatively and institutionally acceptable route to market as part of the feasibility assessment process. The RIBP model is based on the principle that sharing risks, rewards, and responsibilities coupled with sufficient investment incentives will motivate actors in water management to invest in irrigation infrastructure that saves water and generates better outcomes for the environment. We describe application of the RIBP model in the Coleambally Irrigation Area in New South Wales, Australia.

1. Introduction

Irrigation and environmental sustainability have to date been managed as two competing enterprises under separate and divergent control. This approach has often translated into polarised approaches to resource management, to the detriment of both production and environmental sustainability.

Current policies of economic globalization and privatisation are exacerbating environmental problems, and ecologically sustainable development requires environmentally responsible solutions (Barlow, 2001). There is an increasing need and support for a harmonised business approach, which identifies business opportunities for irrigators to become part of an expanding environmental services industry, and in doing so, support the expansion of a truly sustainable and diversified irrigation business environment. Irrigation is first and foremost a business. Therefore, the interaction

between irrigation and its natural resource base needs to be undertaken within a business context to deliver sustainable improvements in economic, social and environmental water productivity. The key challenge facing the irrigation industry is to increase water productivity for all purposes to attract an ongoing flow of capital that supports coordinated investments in on-farm and off-farm infrastructure (Khan, 2007). Without this, the environmental management of working rivers, the socialcultural diversity of many regional areas, and a substantial component of many national economies are at risk.

The relationship between research output and the development of an improved water management business plan is crucial. The outputs from a research program run the risk of delivering only dry academic tomes if the outputs are not utilised in a meaningful fashion. Investments in regional partnerships and processes are required to realise the value of environmental and social dividends which can be achieved through integrated river basin management. Without this, onfarm and off-farm investments in single-purpose water productivity improvements will struggle to produce an adequate return on investment. This requires policy and institutional arrangements that can support regional partnerships aimed at new businesses delivering sustained water productivity gains.

We propose a Regional Irrigation Business Partnership (RIBP) model to effectively seize business opportunities, by attracting new investments and guiding them toward successful regional businesses. The aim of the RIBP is to assist in optimising the potential of investment opportunities in a way that facilitates environmentally sustainable development. The core features of the RIBP model are its crucial links with stakeholder, research and policy aspects. It is centred on appreciation of biophysical, socio-economic, political, and legal assessments. In this arrangement, the RIBP directly links regional business opportunities with more sustainable natural resource management.

2. Experience and lessons of sustainable business partnerships

Public–private investment experiences have shown mixed results since their introduction in the 1970s. While some public–private partnerships (PPPs) have proceeded smoothly, others have been highly controversial. Reasons for such mixed results include:

- a lack of scientific understanding regarding short-run and long-run potential consequences;
- a lack of trust between partners, and complex decision making;
- poorly defined sector policies;
- inadequate long-run commitments from the parties involved.

Hall et al. (2002), Shams and Rabadi (2003), Williams (2003), Heiler (2002), Colman (2002) and Harris (1996) examine a range of public–private partnership arrangements around the world and conclude that such arrangements have achieved their efficiency goals. Dunkley (2003) presents a win–win case for Regional Australia, where partnership building was needed to ensure the sustainability of regional towns.Williams (2003) discovers that privatisation allows for greater efficiency and cost savings by bringing private sector discipline to new areas of project construction, operation, and financing. The Department of Prime Minister and Cabinet (2006) demonstrates a successful

business investment in the Yanko Creek, Australia. With limited public sector funding available, the Yanco Creek community sought private sector investment in a major works program that resulted in water savings representing more than 20% of the total water allocation in the community.

Heiler (2002) reviews public and private sector partnerships in developed and developing countries. He observes strong interests among private sector players to be involved in PPP projects in irrigated agriculture, as long as the investment climate is supportive. According to Heiler the key to a successful PPP is the allocation of the project's risks between the public and private sectors according to each party's ability to manage and bear risk, without destroying the economic balance of the project. Watson (2003) and Lilley and De Giorgio (2004) identify necessary conditions for the success of PPPs in the context of this paper as value for money and need to deliver project infrastructure on time. Fried (2008) identified public authority as a key factor for ethical governance in public–private partnerships.

By contrast, Zhang (2005), Hartwich et al. (2005), Spielman and von Grebmer (2004), Mckay (2003), and Prefol et al. (2006) document the failure of public–private partnerships. Zhang (2005) argues urgently for a workable and efficient procurement protocol for improved practices in future PPP projects. Hartwich et al. (2005) and Spielman and von Grebmer (2004) find that many agents enter into partnerships without having a clear picture of the potential benefits. Rather, agents seem to enter into partnerships on an ad hoc basis, and limited emphasis is placed on how partners will interact effectively. Public–private partnerships often suffer from the lack of trust and commitment, failing to achieve their potential. Mckay (2003), while analysing the regulatory structures in water sector utilities in Australia, stresses that government must monitor the licence operating conditions and establish protocols to ensure water quality. Prefol et al. (2006) use a four-box analytical framework to understand the risk and opportunities of public–private partnerships in the irrigation and drainage sector. They conclude that the important point for success of a partnership is not so much to find an "absolutely private" partner but rather a professional "third party" in addition to farmers and government, whether it be public or private.

The World Bank (2006) has investigated underlying policy problems in water services and the challenge of achieving successful private participation in several countries. Major challenges include the provider's ability and the need for incentives to make good operating and investment decisions. This means giving the provider enough freedom to make decisions and exposing it to the related business risks. This will ensure that the provider gains when making correct decisions and loses when making wrong decisions. This also protects operators from the risk of losing when the government changes the rules of the game, rather than from bad operating and investment decisions. The World Bank (2006) and Zhang (2005) provide reasons why many partnered infrastructure projects have been delayed:

- wide gaps between public and private sector expectations;
- lack of clear government objectives and commitment;
- complex decision making;
- poorly defined sector policies;
- inadequate legal/regulatory frameworks;

- poor risk management;
- low credibility of government policies;
- inadequate domestic capital markets, lack of mechanisms to attract long-term finance from private sources at affordable rates;
- poor transparency;
- lack of competition (Asian Business, 1996).

Zouggari (2003), and Al-Jayyousi (2003) discuss the obstacles in implementing public–private arrangements, and recommend that donors (i.e. World Bank, Asian Development Bank) assist in building local knowledge and learning from the experience of others, prior to making decisions regarding partnerships in the Middle East. Spielman and von Grebmer (2004) find that public–private partners inadequately account for the costs and risks of partnerships. They argue that partners are operating without sufficient information on existing partnership experiences, lessons, and models, potentially contributing to a persistent or widening gap between sectors. Forsyth (2005) argues that successful public–private partnerships between investors and communities depend on minimising transaction costs, strengthening collaborative (or assurance) mechanisms, and in maximising public trust and accountability of partnerships.

Ogunlana (1997) and Abdul-Aziz (2001) describe build, operate, and transfer (BOT) projects in Thailand and Malaysia's privatized national sewerage projects as possible failures due to the lack of competition and transparency in the selection of the concessionaire, low equity–debt ratios, overgenerous ''safety nets'' extended to the concessionaire by the government, inefficiencies and management blunders of the concessionaire, frequent changes of ownership of the concession company in a short period, and strong public opposition.

3. Regional Irrigation Business Partnership Business model

3.1. Components of the model

Unlike other public–private partnership models in which feasibility information is an important ingredient in determining investment priorities, the Regional Irrigation Business Partnership model is based on robust assessment of biophysical, hydrologic, socio-economic, political, and legal aspects of water management. The development of RIBPs provides a crucial link between research outcomes and investors to target risk-free and potentially viable investment opportunities.

The proposed RIBP model provides revamped institutional and business arrangements together with innovative research models and tools to support the investments required by the irrigation industry to meet both industry and community commercial and environmental water productivity targets. The RIBP model combines Research and Policy outputs with the Business Investment framework at the irrigation system level to guide research and investment opportunities (Fig. 1). The key elements and their roles in the business model are described in the following paragraphs.

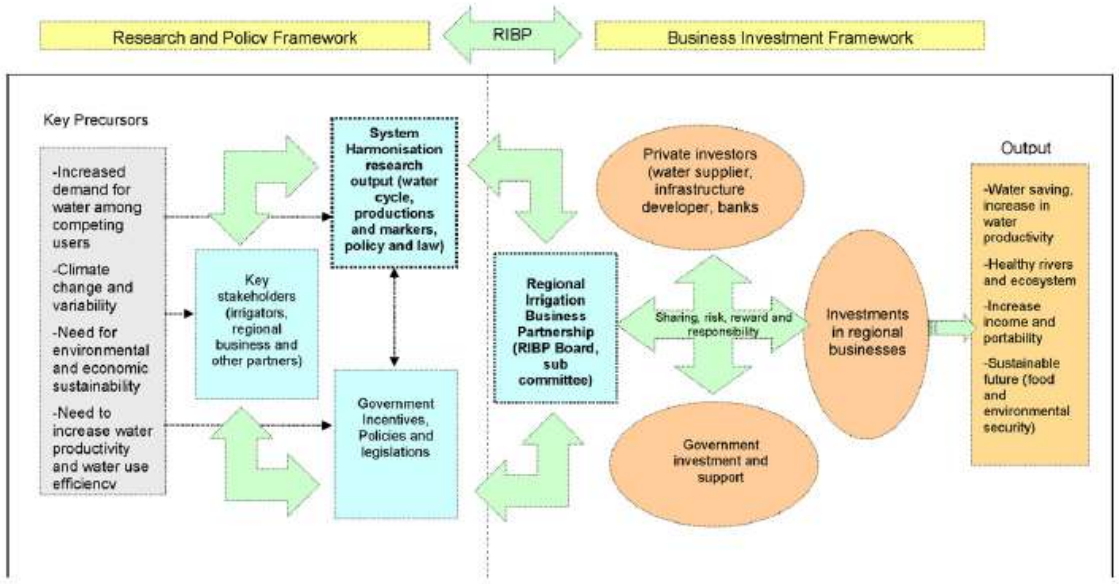

Fig. 1 – Regional Irrigation Business Partnership (RIBP) research and investment model.

The Regional Irrigation Business Partnership includes irrigators, regional industry, water suppliers and other partners, enthusiastic to explore alternative business approaches for enhancing their profitability and environmental productivity for long-term sustainability. The RIBP is a new concept developed by the Cooperative Research Centre for Irrigation Futures (CRC IF) under the System Harmonisation research project (Khan et al., 2008) to explicitly recognise the importance of engaging business in delivering improvements in multi-purpose irrigation water productivity in a catchment context.

The RIBP provides a vehicle that directly links regional business opportunities with more sustainable natural resource management. The main role of the RIBP is twofold:
(1) to provide necessary feedback to different research programs to identify the obstacles (hotspots) that slow business growth and possible intervention to boost business, and (2) to describe output of research projects in a sustainable and responsible fashion to attract business investment for implementation of regional business plans. These solutions need to be customised for any irrigation region to take advantage of its unique characteristics to develop a comparative advantage.

3.2. Research and policy framework

Water resource systems involve many subsystems, which are intrinsically linked to one another through physical, environmental, economic and social interfaces. In addition to physical or biophysical restraints, economic, environmental and social elements present key recourse pressure points in the system. In particular, these relate to the capacity to optimise on-farm and near-farm irrigation system performance and water demand patterns to deliver productive and environmental dividends. The focus of the research framework is to develop a better understanding of the water asset and its multiple values at a catchment scale, and to implement practices that return economic, social and environmental benefits to the region through improved cross organisational communication. For example, the System Harmonisation program (Khan et al., 2008) has developed robust hydrologic, market, environment, political and legal frameworks

for understanding critical links involved in improving water management. The in-depth knowledge of various critical decision points helps to effectively manage the irrigation systems in an ecologically sustainable manner, based on iterative feedback with research programs such as System Harmonisation, government policies, key stakeholders, and RIBPs (see right hand size of Fig. 1). The research priorities for each regional irrigation business area are determined after detailed consultations with the stakeholders such as irrigators, regional business and other partners and government programs such as the National Water Initiatives (NWI) and National Water Security Plan for irrigation modernisation.

The research components of the System Harmonisation program such as water cycle management, markets and productivity, and institutional and policy frameworks help identify opportunities including on-farm and off-farm system level investment opportunities in water saving and new cropping patterns for better use of irrigation water, improved yield productivity, and improved ecosystem services. The RIBP will connect these opportunities and turn them into successful business partnerships to ensure better irrigation, a better environment and a better future for regional and wider communities.

A comprehensive hydrologic-economic assessment of water management opportunities can lead to legislatively and institutionally acceptable infrastructure water investments. The role of the RIBP is to develop local capacity to carry out such investments to make irrigation areas more competitive under ever increasing water scarcity in arid environments.

4. An example from Australia

In Australia four Regional Irrigation Business Partnerships have been selected by the Cooperative Research Centre for Irrigation Futures and its partners (Fig. 2).

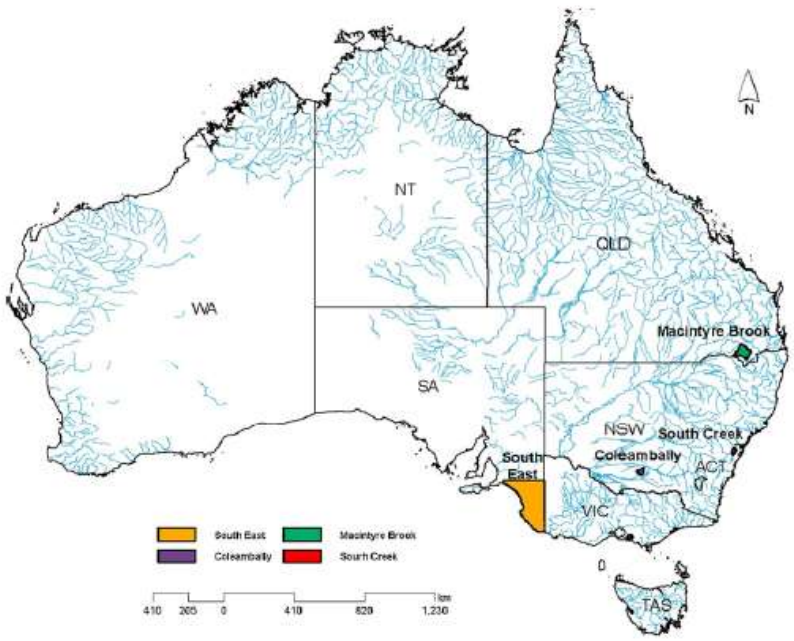

Fig. 2 – Locations of the four Regional Irrigation Business Partnerships in Australia.

The key characteristics of these four RIBPs are:

- The Limestone Coast of South Australia is an RIBP focussed on sustainable irrigation development potential of groundwater while minimising the impact of current and future risks.
- The Coleambally RIBP in New South Wales is focussed on regional surface and groundwater management outcomes through multi-scale demand management.
- Western Sydney is an RIBP focused on substituting freshwater use with recycled water while improving downstream environmental quality.
- Macintyre Brook in the Southern Border of Queensland is an RIBP pursuing innovations in water sharing arrangements and optimising the security of supply and catchment dividends.

These RIBPs are made up of businesses (primary and value added), irrigation supply and service interests, government agencies and natural resource management interests. The CRC IF has been initially facilitating their development but ultimately the RIBP itself will be responsible for its structure, business development and associated research and resourcing. To illustrate the type of water management partnership opportunities being pursued by the RIBPs, we examine salient features of the Coleambally RIBP.

The Coleambally Irrigation Area is located in the Murrumbidgee River catchment of New South Wales (Fig. 3). Surface water resources for the project area are supplied from Burrinjuck and Blowering Dams and are diverted in to the area from the Murrumbidgee River. Water entitlement in the project area is approximately 800,000 ML of surface water (Coleambally Irrigation Cooperative Limited (CICL)— 640,000 ML, Yanco Creek System—160,000 ML) and approximately 70,000 ML of groundwater entitlement. Water is used to irrigate crops on 450 farms in the Coleambally Irrigation District and approximately 120 farms in the Yanco/Billabong Creek system. The irrigated area is approximately 100,000 ha. The gross value of production from irrigated crops in the project area is estimated to be more than AU$120 million per year measured at the farm gate with significant economic and social impacts to the national economy.

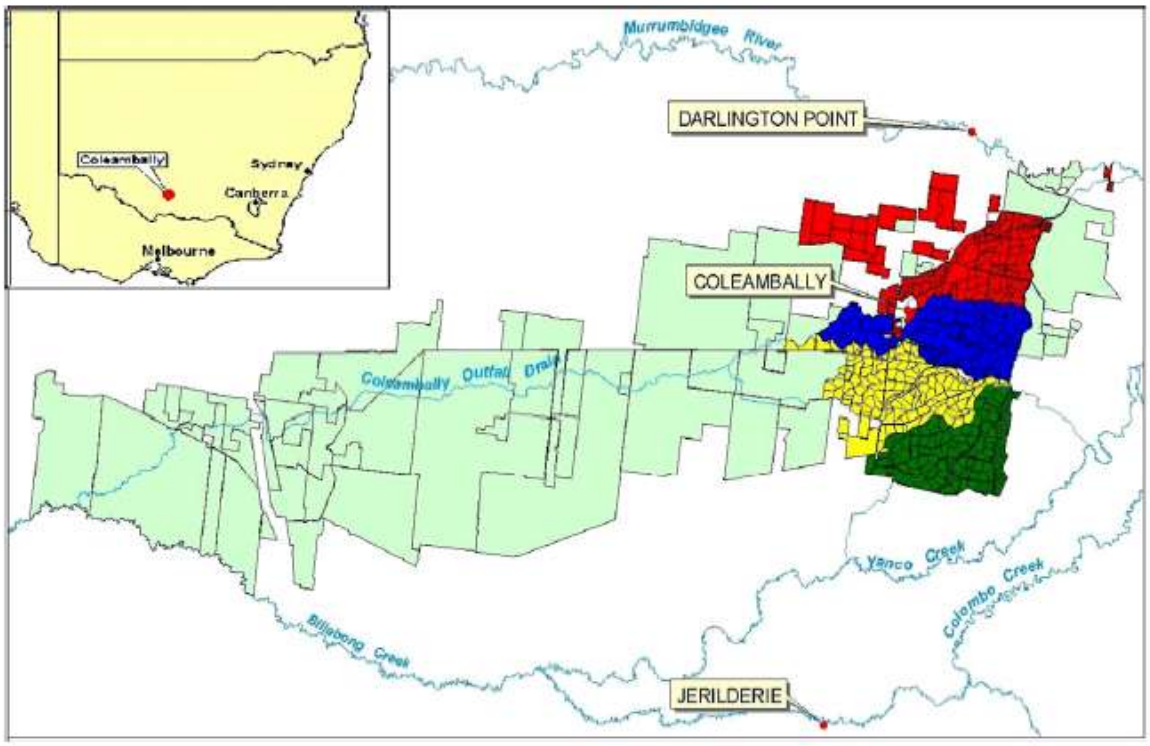

Fig. 3 – Location of the Coleambally Irrigation Area in South-East Australia (different shades show different management ones).

Keeping in view the regional business opportunities, the following eight water management opportunities were defined by local stakeholders:

- Net recharge management and sustainable groundwater extraction to achieve zero net recharge in the shallow aquifer, while avoiding mining and salinisation of deep aquifers—total aquifer management.
- Flexibility of irrigation season to understand technical, socio-economic and environmental implications of changes in the irrigation season.
- System metering, monitoring and accounting to identify real losses in the system with different flow regimes for better planning, assessing and managing supply with the demand.
- Improved environmental management to improve the image of the irrigation business by providing evidence of the environmental benefits from irrigation, and assessing the true needs of the environment in the Coleambally region.
- Farm viability to devise strategies and tools for risk management to remain viable under volatile water supply conditions.
- Water trading to understand the outcomes of permanent and temporary (in and out) trading (and water trading policy) on the eco-social-environment sustainability of irrigation in Coleambally.
- The real cost of food to estimate the environmental costs of production by evaluating the impacts of water prices (variable and fixed) and the risks and costs of importing food on production of commodities—supply chain effects.
- Better stakeholder participation to address public mistrust and connect the general public to policymakers, applied research, regional businesses and community groups.

These opportunities are currently being analysed by water scientists in association with local stakeholders for possible public–private investments using the model presented in this paper.

One of the opportunities is the Coleambally Water Smart Australia (CWSA) project which is aimed at increasing the return per unit of water and reducing the environmental impacts of irrigation in the project area through precision irrigation systems that allow irrigators to match water applications with crop water needs. This project is based on a public–private investment involving an irrigation company and the Australian Commonwealth Government with a total cost of $26.22 million, with $12.53 million from the Australian Government Water Fund and $9.7 million from Coleambally Irrigation Cooperative Limited and its irrigators (Australian Government, 2008). Remaining funds are from third party sources with interests in the project. The farmers are required to return a certain volume of their water entitlements in return for this investment.

The project will achieve water saving through the following infrastructure investments:

- soil moisture and climate sensors to monitor water balance in their soils and crops and make decisions about when to irrigate and how much and at what rate to apply water to their fields; and
- control systems and storage to provide users with greater control over the rate and timing of irrigation applications.

The anticipated benefits of the project (Australian Government, 2008) are to:

- "generate approximately 23 GL per year of water savings,
- result in a 10–20% reduction in salt interception through reduction of on-farm recharge,
- enable public communication of real time data, and
- complement the System Harmonisation research work being undertaken under the Regional Irrigation Business Partnership program which aims to maximise return of irrigation investment and reduce the environmental footprint of irrigation activities."

This project aims to achieve water savings by providing farmer capital costs to help with large up-front costs of equipping farms with precision irrigation equipment. This project has a strong scientific underpinning with a training and education component for irrigators in the use of precision irrigation technologies and providing water balance and crop information in a user-friendly format.

5. Discussion

To date the experience with the RIPBs in Australia indicates that the involvement of the private sector in water systems is dependent in part on the ability to generate commercial returns in the target market. A key feature for attracting new investments and business requires demonstration of sound criteria for investment and relevance. The relevant criteria include: (1) sound economical and financial analysis such as internal rates of return, net present values, breakeven analysis and payback periods, (2) sound technical analysis such as quantification of water saving, appropriate on-farm and off-farm technology, and hotspots for interventions, and (3) environmental and social assessment such as changes in environmental quality, community preferences, and protection of

flora and fauna. The System Harmonisation research sub-area – water cycle management, markets and productivity, and institutional and policy frameworks – would provide the above mentioned evaluation criteria.

The main role of RIBPs is to convert the new opportunities, identifying barriers to new industries/ businesses starting up in regional areas, into successful business by attracting new regional business partners. The right hand side of Fig. 1 presents the business investment framework in which the RIBP and its local stakeholders, private investors and government investment and supports could potentially develop public–private partnerships. Local stakeholders and established industries could potentially take the opportunities for more profitable and sustainable businesses such as irrigation water supply providers, financiers and merchant banking organisations and infrastructure developers and construction firms. In cases where priorities and net benefits are high but require considerable investments, state and local government agencies, such as the treasury, business development, and natural resource management departments can become regional business partners.

Although the System Harmonisation program provides robust scientific information about new business opportunities, which reduces the likelihood of serious risk and uncertainly associated with the investment, the allocation of risk between public and private sector partners remains crucial for success (Zhang, 2006; Hodge, 2004; Quiggin, 2005). The risks inherent with a capital-intensive water sector are compounded by other financial, regulatory, and political risks, some of which are particularly challenging. The proposed business model is based on the principle that sharing risk, rewards, and responsibility, coupled with sufficient investment incentives, will motivate key players in water management to invest in water saving irrigation technologies and ecosystem services.

6. Summary

Public–private partnerships aim to achieve the best outputs by mobilizing private sector funds, technologies, managerial skills, and operational efficiency and facilitating innovations by transferring some of the risks and responsibilities to the private sector. There are worldwide increasing trends in PPP across a wide range of industries and sectors including power, transportation, water supply and disposal, telecommunications, oil and gas, mining, schools, and hospitals. The PPP experience has shown mixed results; while some of the projects have been successful, others have suffered very negative consequences.

The main reasons for such mixed results are a lack of long run commitment from governments and other involved parties and lack of scientific understanding regarding shortterm and long-term potential biophysical and socio-economic, policy and legal consequences to aid complex decision making. Successful partnerships require sound scientific understanding that can rationally share risks, responsibilities and rewards. Partnerships are not merely created by the PPP contract but by the attitude and understanding of the people who implement them. Success requires a climate of mutual respect, trust and ‘‘give and take’’. Where this exists, both sides benefit.

The proposed RIPB model is based on a better understanding of biophysical, hydrologic, socio-economic, policy and legal aspects of irrigation water management in a catchment context under the System Harmonisation program. The System Harmonisation program

provides robust scientific information regarding new business opportunities, which reduce the likelihood of serious risk and uncertainties associated with the investment. Spreading risk, responsibility and reward allows business partners to optimally share the risk. The RIBP approach could be implemented in other regional irrigation areas that have on-going research programs involving multilevel stakeholder engagement.

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