Water justice: exploring the social dimensions of new irrigation technologies in northern Victoria, Australia

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Abstract

Water resource management is one of the most pressing human and environmental challenges of the 21st century. Technological approaches to improving the management of water feature prominently, with technology positioned as the solution to issues of competing interests and the achievement of water savings. This paper analyses the social dimensions of a regional-level irrigation technology, examining the piloting of Total Channel Control\textsuperscript{TM} technology in northern Victoria, Australia, as a case study. Water savings, organisational efficiency, on-demand ordering, occupational health and safety improvements, and many other benefits were anticipated to flow from this ‘world first’ technology. Drawing on semi-structured interviews with stakeholders and participant observation of an irrigation committee, this paper examines stakeholder accounts regarding piloting of the technology. We argue that in order to achieve justice and fairness in implementing regional irrigation technology, three essential criteria must be met: genuine consultation, participation and negotiation; responsive and respectful dialogue and communication; and mutual information exchange. As society shifts towards greater reliance on technological intervention to solve some of the most pressing dilemmas of the modern era, a more holistic approach focusing on the complexity of human interaction with the technology is vital.

Keywords: Channel automation; Equity; Fairness; Irrigation modernisation; Social justice; Technology

Introduction

Water management is one of the greatest environmental challenges currently facing Australia. As the driest inhabited continent in the world, Australia experiences the lowest percentage of rainfall as run-off, has variable river flows, and is renowned for floods and droughts. Fresh water scarcity is a major issue due to decreasing precipitation levels, drought, climate change, and growing population pressures, as well as increasing demands for water across all sectors (Beeton \textit{et al.}, 2006), placing greater emphasis on claims of right between competing water users.

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In Australia, agriculture generally consumes between 50 and 70 per cent of the nation’s consumed fresh water resources (Australian Bureau of Statistics, 2004, 2012), and over past decades has come under scrutiny as policy makers consider options to recover water. Heightened recognition of environmental decline has culminated in the widespread belief that the use of water in agriculture comes at the expense of the environment (Wentworth Group of Concerned Scientists, 2002). Connell & Grafton (2011) describe how the over-extraction of water resources for irrigation during the 19 and 20th centuries led to a decline in the health of many rivers and ecosystems. Furthermore, successive droughts are posing greater challenges to the sustainability of agricultural enterprises, and have led to significant developments in state and national water resource management.

One technology that has been of particular interest in Australia and internationally is Total Channel Control™ (TCC) technology. TCC is a telemetry system for the management of water in gravity-fed irrigation systems (Luscombe 2004; Koech et al., 2010; Spencer, 2010). It is the most current example of a historical trend of exploiting water systems via technology for irrigation purposes. TCC is at the forefront of technological design, incorporating algorithms for water measurement, operating by solar energy, and utilizing wireless communication networks, all of which are integrated by sophisticated computer software systems. It consists of a series of stand-alone, water-controlling gates, communicating by wireless communication systems, and offers centralised control and full automation of gravity-fed irrigation channel systems.

TCC, or more generically ‘channel automation’, was introduced as a pilot into an irrigation channel in northern Victoria, Australia, in 2002 to test the functionality of the technology. It was the first end-to-end channel automation system in the world. Since 2002, the technology has been introduced into other irrigation systems throughout Australia and internationally. In northern Victoria, TCC forms a key plank in the plans of irrigation managers as they seek to modernise gravity-fed irrigation systems and recover water as part of Australia’s water reform process. Among other things, TCC is replacing manually operated structures in the main irrigation areas of the Goulburn Murray Irrigation District (GMID) in Victoria.

Despite its anticipated benefits, the introduction of TCC brought about a wide range of unanticipated effects and consequences, including communication breakdown, mechanical malfunction, and water measurement inaccuracies. There were ‘teething’ issues associated with the new irrigation technology such as technical malfunctions, and while many of these issues have since been resolved, this paper examines the social or human dimensions of irrigation modernisation at a particular point in time. The focus of the paper is on the processes associated with irrigation modernisation. Drawing on research conducted between 2006 and 2010, we examine perceptions of justice and fairness among key communities of interest, and argue that there are important lessons to be drawn from this particular case study. Specifically, we contend that in order to achieve justice and fairness, three essential criteria must be met: genuine consultation, participation and negotiation; responsive and respectful dialogue and communication; and mutual information exchange. In other words, the paper underscores the importance of investment in the human dimensions associated with the introduction of a new technology to respond to a major resource dilemma.

The paper is divided into three parts. The first section will provide a theoretical framework on social justice, which will guide the analysis for the remainder of the paper. This section will also include a discussion of the ways in which social scientists are increasingly using social justice frameworks to understand natural resource dilemmas. The second section describes the developments in water technologies in Victoria leading to the eventual introduction of TCC as a pilot in the Central Goulburn Number
Two Channel (CG2). This narrative of change is essential for understanding the complexities surrounding the transition to a new technology and the politics of water governance, as well as the social justice issues that have arisen as a result of irrigation modernisation. The third section then draws on semi-structured interviews with stakeholders, participant observation of an irrigation committee, and document analysis in order to identify the essential dimensions to achieving social justice in water governance.

Social justice: a framework for water policy and practice?

Justice has been described as ‘the first virtue of social institutions’ because ‘[e]ach person possesses an inviolability founded on justice that even the welfare of society as a whole cannot override’ (Rawls, 1971: 3). Justice is a deeply profound, sacred, and universal expectation that is shared by all; an expectation that not only will wrongs be rectified, but that persons will be treated with equal dignity, fairness, and respect. Justice (or the idea of justice) fundamentally underpins our entire neo-liberal political, legal, and economic system, characterised by an ideology of rights, equality, and liberty. Indeed, Douzinas & Gearey (2005) write that: ‘From Plato to Kant, from Aristotle to Marx and from Augustine to Rawls, justice has been the single most debated topic of philosophy, the ultimate aim of social thought and political action.’ Justice, then, is deeply personal and individualised, but also public, political, and culturally contingent. And yet justice has also been described as ‘clouded in uncertainty and disputation … [with] … little agreement as to its nature and action’ (Douzinas & Gearey, 2005: 107–108). In other words, what is just and unjust is perpetually in dispute, but nonetheless justice is an expectation that drives and underpins all social action.

Rawls’ (1971) theory of justice as ‘fairness’ brings together both values of equality and of liberty. According to Rawls, in a liberal society of free citizens with equal basic rights there are two guiding principles of justice: each person must have the same claim to basic liberty (e.g. the right to vote, freedom of speech); and any social and economic inequalities can only exist under two conditions: first, that the inequalities benefit the least-advantaged members of society; and second, that offices and positions are open to everyone (fair equality of opportunity). Rawls’ theory of distributive justice encompasses both formal and substantive equality, seeking to solve the problem of unequal or unjust distribution of goods within society. Social justice is often used interchangeably with distributive justice – individuals have an entitlement to certain things by virtue of their membership of a society (Boucher & Kelly, 1998). However, social justice is more than just economics. Contemporary critical theorist Fraser (2007) argues that justice requires three interrelated dimensions: recognition (i.e. acknowledging another’s rights, status and what they have achieved); redistribution (i.e. how a fair distribution of benefits and burdens to members of society can be achieved); and representation (i.e. the way in which language symbolically represents political voices).

How can social justice guide thinking about water issues in a contemporary context? Syme & Nanocarrow (2001: 343) argue that frequently in natural resource and environmental management ‘justice issues are ignored, or policy outcomes are assumed [or, where] justice researchers and evaluators have provided input, their findings have not seemed to have resulted in marked changes in policy.’ They further state that equity, equality and fairness are central to decision-making in natural resource management, yet these concepts are ‘ubiquitous’ and ‘taken for granted’. Despite this reticence in practice, there is a growing body of literature focusing on water rights and water justice (see, for example, Freyfogle, 1986; Gleick, 1998; Bruns & Meinzen-Dick, 2000; Sultana & Loftus, 2012). More
specifically, over the past two decades there has been increasing scholarly interest in social justice and how it relates to irrigation community perceptions of fairness (Syme & Nancarrow, 1997; Syme et al., 1999; Nancarrow & Syme, 2001; Tisdell, 2003). For instance, Syme et al. (1999) demonstrate the importance of social justice issues for irrigation communities in relation to water allocation decisions. They found that local procedural justice issues were key factors in judgements about the fairness of decisions, particularly when public involvement for local people was at stake.

Scholarly literature on social justice in irrigated agriculture has also focused on the capacity of water markets as a mechanism for the re-allocation of water from irrigation to the environment (see McKay & Bjornlund, 2001; Crase et al., 2004; Lane-Miller et al., 2013). For instance, McKay & Bjornlund (2001) observe that water markets alone do not lead to social justice outcomes. They argue that education, community involvement and partnerships are necessary at all times, as well as a system that ensures the application of the law is fair.

A social justice approach to examining issues pertaining to water use (e.g. in particular, distribution and decision-making associated with water allocation) is invaluable to water policy and practice, yet little research to date has specifically examined the social justice ramifications of automation in irrigation systems. Much of the literature on TCC, for instance, consists primarily of descriptive technical reports (see Luscombe, 2003; Luscombe, 2004; Luscombe & Court, 2004) or engineering papers on the technical development of TCC (see Mareels et al., 2005; Choy & Weyer, 2008). There are, however, two social science studies of TCC. One is the research carried out by the practice change research team from the Department of Primary Industries in Tatura, Victoria (Cowan et al., 2006). They interviewed 14 irrigators to understand the impacts of channel automation, finding that the irrigators were concerned about the fairness of the implementation process and that extension services (i.e. organisations working with irrigators during the implementation process) should be offered to help ease the transition to the new technology. The second study was conducted by Race et al. (2006), who interviewed 70 irrigators in the TCC pilot and explored whether interviewees believed the technology had resulted in fairer water allocations. Among other things, the researchers found that irrigators did not consider themselves key partners with the water authorities in water management. Like Cowan et al. (2006), they argue that communication and extension support are crucial to offset any teething issues or negative impacts associated with the technology. Although both studies investigated the social implications of TCC technology in rural communities, they did not adopt a social justice model for analysing irrigation modernisation.

Drawing on the social justice framework discussed here, in the section below we describe the development of channel automation in Victoria, Australia. In the third section, we analyse interviews conducted with irrigators regarding achieving social justice. The focus of this analysis is on procedural justice in line with other social justice theorists on water (e.g. Syme & Nancarrow, 1997; Syme et al., 1999; Nancarrow & Syme, 2001; Syme & Nancarrow, 2001; Tisdell, 2003), taking into account Fraser’s (2007) three dimensions of justice – recognition, redistribution and representation.

The last spin of the wheel: towards an automated system

One key challenge facing Australia in the management of rural water is maintaining productive irrigated agriculture while also arresting environmental degradation due to human influence in water systems. This section charts the development of irrigation systems in northern Victoria, Australia, which went largely unimpeded until the 1960s when questions emerged over the economic wisdom
of using public money in the development of irrigation systems (Davidson, 1969). Understanding this narrative of change helps to contextualise the social justice ramifications that later emerged in the TCC pilot.

Victoria holds a unique place in the history of irrigation in Australia as the location of the mainland’s many early irrigation developments and policy. The northern irrigation regions of Victoria have been described as ‘the cradle of large irrigation schemes in the continent’ (Rutherford, 1974: 116) and, as such, Victoria was the first Australian colony/state to actively change institutional arrangements to promote water resource development in order to safeguard against drought (Harris, 2006).

Partly as a response to the powerful influence of the environmental lobby, which ‘had become a political entity within the decision-making process at the highest levels’ (Smith, 2003: 60), in the mid-1980s deliberate steps were made to improve the operation of the water delivery system through the application of sophisticated technology, perceived to have far-reaching benefits in the operation of the regional irrigation system. Langford et al. (1998) describe how the Rural Water Commission initiated a ‘Channel Systems Project’, which aimed to reduce the cost of delivering water services. From this project came the concept of Central Communication and Planning. This was premised around surveillance, control and data acquisition systems technology, which was believed to be able to enhance the capacity of the operations staff to respond promptly to changing demands for water and changed flow patterns. Additionally, improving the channel capacity constraints (recognised as a key limiting factor in the irrigation system) would improve the opportunities for water trading across the regional irrigation system. Moreover, water resources for irrigation were fully exploited, so irrigation system managers had to seek ways to make better use of the existing supplies of water.

The understanding at this time was that the application of technology in the distribution system could ‘reduce losses and allow better economic utilisation of existing supplies’ (Langford et al., 1998: 54). Inaccuracies in the measurement of water meant that irrigators had historically received more water than they were actually allocated. As discussed below, this was a point of contention when TCC was introduced since irrigators in this pilot scheme had been used to receiving anywhere up to 20 per cent above their water allocation (Gutteridge et al., 1970). There were other anticipated benefits. For example, improved integration of data systems was expected to deliver better information on performance and costs. Also, there was ‘the potential to introduce more commercial customer focussed values to an organisation’ (Langford et al., 1998: 54).

A world first: TCC

Irrigation technology remained virtually unchanged for nearly three-quarters of a century in Victoria, and indeed in Australia (Smith, 1998) and many other countries throughout the world (Plusquellec, 2002; Schultz & De Wrachien, 2002). Water was gravity-fed over the majority of the irrigation districts of northern Victoria (Malano & Patto, 1992). Water control structures were manually operated, and farm water usage was measured by a water wheel containing a metering device, known as the Dethridge wheel. It was not until 2002, with the introduction of TCC, that the Dethridge wheel began its shift towards obsolescence. The background to this major shift was the 1999 Victorian state election, which marked a significant change in sentiments around the protection of the environment, and a general public desire to see political action in the management of water resources. While this was by no means the start of environmentalism in Victoria (see, for example, Robin, 1993), it was significant in that the elected government aimed to improve the health of these rivers by acquiring water through
water-efficiency projects using TCC. The belief was that just outcomes could be attained by utilising technology as a means to achieve what was perceived as a fairer allocation of water between the environment and irrigators.

The recognition of an urgent need to recover water for the environment led the Victorian government to seek ways to redistribute water from the largest users. The agriculture sector has historically consumed between 65 and 70 per cent of the consumed fraction of water used annually by humans in Australia (Australian Bureau of Statistics, 2000, 2006), and therefore became a target for opportunities to recover water. However, because water entitlements were privately owned property, this presented a problem: water use in irrigation sustained communities and the economy, and the government could not simply step in and take water from entitlement owners. Other water recovery methods were thus necessary.

An alternative approach that policy makers considered was to introduce technology as a way to ensure ‘water savings’. The emergence of a technological solution was anticipated to return water to the environment as well as overcome many other problems associated with the existing irrigation infrastructure. As such, the technology had the potential to address important social justice issues such as the fairer reallocation of water; more equitable distribution of irrigation water among irrigators; and improved customer service. In other words, it could be used to reallocate water to the environment while also offering a fairer system of distribution and an improved level of service in the delivery of water to farms: a win-win situation all around.

Investigations into the distribution efficiency of open and piped irrigation systems in northern Victoria found that the irrigation distribution system was losing approximately 990 gigalitres per annum, of which about 225 gigalitres remained unaccounted for (Harding, 2000). Consistent with the international literature on water accounting and efficiency in irrigation systems (see for example, Molden, 1997; Seckler et al., 2003; Perry, 2007), the report contained a clear warning that, under the existing conditions, the water was potentially beneficial in a variety of ways and care was needed in any water recovery projects due to the potential for unanticipated impacts. As such, the water accounting framework used in the report distinguished between beneficial and non-beneficial uses of water. It recognised and stressed that in order to avoid deleterious effects elsewhere in the river basin, strategies to save water had to be taken at the river basin level (Harding, 2000).

A major problem impeding the reporting of water losses in distribution systems was a lack of accurate, comprehensive and reliable data, meaning that data was based on estimates. As will be described in the section below, the disagreement over the nature of water loss and the rhetoric of water savings was to be a major source of contention, raising issues of fairness once the technology was introduced.

In August 2001, Rubicon™ took a proposal to Goulburn-Murray Water promoting their new technology, which used a novel mathematical approach of applying algorithms to manage water flows, and which they argued would provide sizable benefits to the irrigation sector. It was claimed that their technology would offer the benefits of a piped system at a fraction of the cost. The appeal of TCC was that it bundled together many of the attributes of other technologies and could overcome many of the historical constraints of the irrigation distribution system, such as those identified by Foley (1997) and Harding (2000) (see Table 1).

A pilot commenced in 2002 with a change from Dethridge wheels to TCC gates for all service points. It is important to note that the change to TCC was a compulsory one (another source of contention discussed in further detail below). The pilot was an ambitious and significant undertaking for the Water Authority because the technology was largely untested in the field and this presented many barriers
to its implementation (see for example, Luscombe, 2004). Numerous limitations were revealed in the early years, and while many were technical in nature, the ‘social’ type issues were more often than not the principal cause of problems.

The emergence of TCC as a seemingly viable option for improved water management was appealing to the Victorian government, which was investigating opportunities to achieve its election promise of returning 282 gigalitres of water to the environment through a joint government enterprise. Thus, a deal was struck to introduce TCC as a pilot in the CG2, a small channel near Murchison in the Goulburn Valley with approximately 50 customers drawing water from the channel.

The CG2 pilot should not be seen as an isolated project aiming to test a technology. TCC, or more generally channel automation, is the centrepiece of water reforms in Victoria’s GMID and is being rolled out in irrigation areas throughout Australia and other countries of the world. The $2 billion modernisation project, initially known as the Northern Victorian Irrigation Renewals Project, and more recently as the Connections Project, is based around channel automation. The Connections Project aims to modernise the GMID through rationalisation of infrastructure by reducing the extent of distribution channels and the number of service points, and by replacing Dethridge wheels with channel automation (see for example, Goulburn-Murray Water, 2013). Moreover, the parties to the National Water Initiative had agreed to a requirement for a national meter standard in which non-urban water meters had a maximum permissible error limit of ±5 per cent (Commonwealth of Australia, 2009). The Victorian government has followed the policy direction of modernisation as part of its overall water reform process. Using public money for modernisation has been an alternative and highly contested approach compared to market intervention, i.e. buying water on the water market (Davidson & Malano, 2012: 51–54; Wheeler et al., 2013), yet supporters of modernisation claim it to be a less disruptive process because it does not create unsustainable pockets of irrigation as is said to be the case with market intervention.

### Social justice dimensions of irrigation modernisation

In this section, we focus on the piloting phase of TCC. We draw on case study research, using data collected from semi-structured interviews with stakeholders, including CG2 irrigators and Water Authority staff. We also use data gathered from participant observation during the meetings of an irrigation customer committee. This data yields important insights into the social justice ramifications that resulted from the introduction of TCC.

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<thead>
<tr>
<th>Benefits for the Water Authority</th>
<th>Benefits for the irrigators</th>
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<tr>
<td>Optimised channel performance</td>
<td>A new level of service through an ability to precisely control their water environment</td>
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<tr>
<td>Reduced water loss</td>
<td>Water availability on demand</td>
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<tr>
<td>On-demand supply capability</td>
<td>Water supplied at rates that match crop needs</td>
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<tr>
<td>Minimal channel fluctuations</td>
<td>No fluctuations in flow</td>
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<td>Reduced operation costs</td>
<td>Ordering through the internet or mobile phone</td>
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<tr>
<td>Reduced occupational health and safety risks</td>
<td>Improved environmental management</td>
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<td>Precise measurement</td>
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**Methods**

Case study research is a common social sciences method frequently applied where inductive theory building is the approach used (Eisenhardt, 1989; Stake, 2000). This approach was identified as the most appropriate research procedure to explore the social dimensions of irrigation modernisation. Relative to laboratory experiments, which isolate phenomena from their context, the strength of case studies is their emphasis on the real-world context: they draw on a variety of data sources and deliver empirical descriptions of the phenomenon under study (Eisenhardt & Graebner, 2007: 25). Case study research allows for an intensive examination to engage and explain the complexity surrounding the ‘case’ (i.e. TCC). Consistent with this, a grounded theory method of analysis approach was used that was premised on building a better theory of technology through inductive, as opposed to deductive, methodologies (Glaser & Strauss, 1967).

The research conformed to the University of Melbourne human ethics guidelines and was part of a wider study which included the following research questions: (1) How do different communities of interest adapt to the implementation of channel automation? and (2) How can the implementation of channel automation technology be better managed to improve water resource management? Between March and August 2007, one-on-one semi-structured interviews with 11 CG2 irrigators were carried out. Digital recordings were made that were subsequently transcribed. The interviews lasted between 45 min and 3 h, and were conducted with the irrigator at the farm, typically over the kitchen table. The interviewees were all adult males aged between 30 and 70, who were owners of the farm in each case. All were family businesses. In several interviews, the female partners also made comments. Although there were approximately 50 irrigation customers on CG2, the majority of the irrigation water was used by about half of them. They used water as a primary input to a farm business and were considered ‘genuine irrigators’, whereas the others were generally considered ‘lifestyle’ or ‘hobby’ farmers without financial dependence on water, using only very small volumes of water on an annual basis (this was the language used by the irrigators). Only genuine irrigators were selected for the interviews, and a range of opinions and attitudes towards TCC and the irrigation organisation were sought. Only 11 irrigators agreed to take part in the study; others declined on the basis that they had experienced ‘research fatigue’ and did not want to partake in any further interviews about TCC.

Follow-up interviews with nine of the original 11 irrigators were conducted over the phone between April and May 2009, with two respondents being unavailable for interviews. Following the principles of theoretical sampling (Morse, 2007; Corbin & Strauss, 2008), these interviews were carried out with the specific aim of filling holes in knowledge, resolving ambiguities and testing the concepts that had emerged in the earlier phases of analysis.

The second major source of data collection was derived from observations of the Central Goulburn Water Services Committee (CG WSC) meetings. Water Services Committees in Victoria were established to advise and assist the Water Authority. Membership is through election and the board of the Water Authority vets members. Members must be irrigators, and committees typically have seven to 10 members (see Collett & Nettle, 2008). The CG WSC was chosen as a key source of data because it was considered as one of the main sites of activity around TCC. The Central Goulburn WSC is a formal interface between irrigators and Goulburn-Murray Water, where the negotiation of irrigation

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1 In the GMID, each irrigation district is represented by a WSC.
technologies occurred. For this reason, the discussions that took place in this committee were considered useful for understanding the manifestation of emerging (as well as conflicting) perspectives on the introduction and roll-out of the new technology.

The methods used for this second set of data were partly derived from ethnographic techniques, described as ‘participant observation’ by Bryman (2004: 291–317). Voice recordings of CG WSC meetings were made with the permission of the WSC, and notes were also taken. Some committee documentation was shared, but the minutes of the meetings were only provided for one meeting. Voice recordings of meetings were transcribed using transcription and voice recognition software. In total, 29 h of meeting time were recorded, and transcriptions were made of discussion relevant to TCC

All data was entered into qualitative research software (NVivo™) and the constant comparative method of analysis was carried out, involving coding, memo-writing, axial coding and theoretical sampling (Charmaz, 2005; Morse, 2007). Concepts were derived from the data, with social justice, fairness and equity identified as the major concepts to emerge in this process. This paper draws mainly from interviews with CG2 irrigators, but the WSC data is used to corroborate the comments of the individual CG2 irrigators and to confirm emerging findings.

What were the issues?

Many issues emerged with the piloting of the technology on CG2. One set of issues was largely technical in nature, for example, flume gate malfunctions, meter inaccuracies and problems providing continuous, reliable feedback in real-time to the office-based planners (see also Race et al., 2006). While these issues certainly contributed to perceptions of disadvantage among CG2 irrigators, this paper does not specifically analyse the technical problems associated with TCC (for a discussion of these issues, see Luscombe (2004)). Instead, in this section, we focus on the social interactions between key stakeholders in the process of implementing the technology. We argue that it is crucial to examine the social justice dimensions of technological intervention, particularly in responding to a natural resource dilemma where emotions are heightened and livelihoods are at stake. Due to a fixation on the technological artefact, these social dimensions are often neglected and misunderstood.

Borrowing from McDonald and colleagues, social justice in water policy and practice relates to: equality of access to positive benefits; equality of protection from negative outcomes (e.g. poor water quality; water hazards); and equality of influence in decision-making (McDonald et al., 2011). This aligns with Tyler’s (1996) notion that there are three important determinants of people’s judgement about procedural fairness: participation (how individuals affect outcomes); dignity (how people are treated); and trust (how people respect authority). Above all, we argue that it is crucial that future implementation of new technologies in irrigation incorporates social justice research and perspectives in order to harness the technical, environmental, economic and social benefits of these technologies.

In line with distributive, procedural and symbolic forms of justice as described earlier in the paper, four key issues emerged from the data: lack of consultation and participation; perceptions of disadvantage relative to other irrigators; communication breakdown; and the potential for punitive measures. Each is discussed in turn below.

2 Reference to WSC meetings is presented showing the date of the meeting as follows: (WSC dd/mm/yy).
First, in relation to consultation and participation, the analysis of the data revealed significant shortcomings in the way CG2 irrigators and other key stakeholders were engaged in the process, particularly during the early phases of development. The irrigators on the CG2 channel had been excluded from the planning processes around introducing TCC into the channel. A document entitled ‘Criteria determined appropriate for selection of an area’ was circulated to the operations managers of six irrigation areas to help establish a suitable location for the pilot. Operations managers were then invited to nominate a system they had identified as meeting the criteria. All managers provided nominations for one to three sites. During evaluations by the Goulburn-Murray Water team, consultations were carried out in conjunction with area management, Goulburn Bulk Water Services, and Rubicon. The decision was made to invest in CG2 as it fulfilled the appropriate criteria for the pilot (Luscombe, 2004). To provide an irrigation customer perspective, the CG WSC were active as participants in the pilot in their role of advising and assisting the Water Authority. However, WSC members were not CG2 irrigators and, as such, they were disconnected from the daily reality of operating a farm connected to the TCC system.

In the interviews conducted with CG2 irrigators, a number of participants expressed their concern over the process of engagement in the TCC pilot. This process was of a nature where irrigators were treated as passive recipients and benefactors of the technology. While some CG2 irrigators were satisfied with this role, others resented the lack of participation around the introduction of TCC. The following quote typifies how irrigators interviewed in this project felt excluded from the process:

‘The decision had been made, we just all received a letter in the mail to be at the Murchison Football Club rooms and when we arrived there, there was a flume gate on the back of a ute, and we went in and they told us what was going to happen and the processes that would take place … All the plans had been done by them prior to meeting with us, Rubicon and Goulburn-Murray Water. The Rubicon flume gates that were going to fit inside a Dethridge wheel were already made up. Everything was all done ready to go. So the consultative process, it just wasn’t there. ‘This is what’s going to happen.’ We don’t think it’s right the way it happened. There was nothing in the trial for losses incurred by the people trialling this. There was nothing mentioned about that. We were told it was funded by DSE [Department of Sustainability and Environment]. That’s how it started.’

Once the pilot was in process, the options for engaging CG2 irrigators and working on-farm to resolve issues were limited. The traditional methods had included Water Authority staff, called water bailiffs, who had manually operated the irrigation system and managed irrigators’ water orders. The bailiff also played a brokering role, reporting irrigator concerns back into the organisation, and carried out many informal practices to ensure irrigators gained a high level of service. In automating the distribution system, the role of the bailiff was effectively rationalised and irrigators were now required to communicate with the organisation over the telephone with an office-based planner who could manage irrigation gates using computer software. Furthermore, the Water Authority had rationalised its farm extension services years earlier, reducing its capacity to effectively engage with its customers.

Another option for engaging with CG2 irrigators would have been the Goulburn Broken Catchment Management Authority (GBCMA) and Department of Primary Industries (DPI), both of which had strategic interests in the CG2 pilot. However, from the outset, the CMA was not engaged in the process and, at best, was reactive to issues in the CG2 pilot (personal communication with K. Sampson, Shepparton Irrigation Region Executive Officer, GBCMA, 2/12/2007). The DPI also had a vested interest, because
the organisation delivered extension services to irrigators. While the DPI had a minor role in interviewing landowners (Cowan et al., 2006) when teething problems associated with the technology were continually arising, this was largely the extent of the DPI involvement up until 2007 when a decision was made to send people out to discuss and document outstanding CG2 on-farm issues (WSC 19/12/07).

During 2007, the pressure to finalise the CG2 pilot mounted. The government had provided the necessary funds to embark on the next stage of the project and the expectation was that CG2 would be completed (WSC 17/10/07). Automation was to be introduced in other channel systems, initially the CG134 channels and then across the entire GMID irrigation system. However, CG2 continued to be a sticking point and the Water Authority staff came to recognise that they could not introduce TCC beyond CG2 until the issues of CG2 irrigators had been resolved (WSC 19/12/07). Yet many CG2 irrigators were not engaged and were openly hostile towards the Water Authority. An example of the sentiments held by many of the CG2 irrigators was evident during a meeting in Murchison to discuss this final stage of the CG1-4 project. At this meeting, an irrigator spoke angrily about how CG2 irrigators were ‘browned off’ with the Water Authority and TCC, stating how from an irrigator’s perspective they were ‘sick of them’ (CG2 pod meeting 30/11/07). The CG2 irrigators at this meeting questioned why they should cooperate in any way with the Water Authority.

Early in the pilot process, many of the CG2 irrigators had collectively taken matters into their own hands by forming an independent customer committee: the CG2 irrigators’ committee. From the perspective of many of the CG2 irrigators interviewed, communication lines with the Water Authority were flawed, and consultation and engagement over the introduction of the TCC pilot was lacking. One member of this CG2 committee expressed his frustration at trying to communicate with the Water Authority through the formal channel of the Water Services Committee:

‘… irrigators who are trialling this [TCC], tried to go through the Water Services Committee and just got brick walled. It was the same trying to go through Goulburn-Murray Water. There was no feedback from the Water Services Committee back to the irrigators.’

This committee, consisting of over 20 CG2 irrigators, was established to facilitate direct engagement with the Water Authority and to ensure that their concerns were adequately responded to. One outcome of this collective action was that TCC meters were sent to Sydney to be independently tested for accuracy.

The second key issue as identified in the data relates to the perceptions of disadvantage among CG2 irrigators. The CG2 irrigators were now receiving what was referred to as a ‘true’ or new megalitre measurement, because the TCC flume gate had a higher degree of accuracy than the Dethridge meter. In other words, they were operating their farms with a smaller megalitre of water than farmers outside of CG2 who used the Dethridge meter. This difference fuelled perceptions of inequity and disadvantage among many CG2 irrigators.

A message conveyed to CG2 irrigators at the outset of the trial was that no farm would be disadvantaged; if anything, they could expect improved flows to the farm. Several irrigators, however, described being disadvantaged through slower irrigation times. One irrigator explained that for this reason it took him three seasons of muddling through the issues before recognising the problem and making on-farm alterations to improve on-farm flow rates. For example, good on-farm flow rates depended on channels being clean and wide, with large culverts and on-farm regulating gates. Anything that slowed down flow
rates magnified TCC problems. Had the necessity of these changes been communicated at the start of the TCC pilot, and irrigators adequately resourced to implement them, it would have likely made a large difference.

During interviews, irrigators reported strong feelings of disadvantage relative to the circumstances of other irrigators not on the CG2 channel. This suggests that the introduction of TCC was very much an issue of equity (defined as a subjective perception of fairness in relation to others). This has important implications for investment in technology, especially if the technology is compulsorily introduced. An example that highlights this feeling of disadvantage was the CG2 customer committee (consisting of 21 irrigators) taking out a class action against the Water Authority on the basis of being disadvantaged relative to non-CG2 irrigators. Individual irrigators argued that TCC had contributed to specific on-farm problems leading to them becoming class action claimants. They felt this was a necessary course of action because they had exhausted other avenues and had not achieved the change they desired. Eventually in 2008 the claimants achieved a successful settlement (Hunt, 2008).

A third key issue relates to communication between key stakeholders. As mentioned previously, the pilot was established without including CG2 irrigators as partners. Moreover, the traditional ways of engaging irrigators had changed. Overall, the communication space had been significantly redefined with the introduction of the new automated system. With the water bailiff no longer carrying out the daily rounds on the CG2, irrigators had to find alternative avenues of communication. Water Authority staff and CG2 irrigators both described communications with the other as being problematic, as an Operations Manager explains here:

‘The most challenging thing I think would be the type of communications that we’ve had. [Irrigators have] been fairly aggressive at times and it’s been difficult for me as a manager to continue to say that everything’s going to be okay and we’re going to fix it when in my own mind I know full well that it hasn’t been okay.’

Likewise, most irrigators were extremely frustrated in their dealings with the Water Authority, with many reporting feeling excluded from the pilot process which diminished their capacity to engage with the Water Authority. For instance, many irrigators described the Water Authority staff as not listening to their issues or acknowledging their concerns, telling irrigators they had to assume responsibility for any changes necessary to align their farm with TCC themselves. This gave irrigators an ever-increasing sense of frustration and helplessness. As one irrigator made clear:

‘It’s just the way they handled it. It was just a shmozzle. I don’t know who was behind it, whether the government were behind it or whether it was just the blokes we were dealing with were dickheads. I don’t know. The biggest thing was they were right and we were wrong. That seemed to be the crux of it … We were just a mob of whinging farmers.’

Or in the words of another irrigator:

‘The main problem was, they just wouldn’t listen at the start. ‘No, nothing’s wrong with it’ … They just wouldn’t listen. It was as simple as that.’
Irrigators described the Water Authority as uncooperative and unsympathetic, which appeared to be partly a manifestation of the alienating characteristic of automated technologies. Irrigators reported a sense of isolation. A number of irrigators described feeling like there was a less compassionate environment, particularly in response to their needs. They felt there was an injustice in the implementation of policies and procedures, and placed the blame squarely with the Water Authority. What appeared to be at the core of these particular problems were flawed systems of communication. Irrigator concerns often only got as far as the irrigation planner, and the planner was not resourced to assist irrigators to resolve the significant issues they were confronted with. There were no professional support people with adequate resources to both engage irrigators and assist them to make a transition to the new operating environment.

Finally, a fourth issue that emerged from the data in this research relates to the potential for the irrigation technologies to be used in a panoptic manner with the effect of fostering a culture of distrust and alienation, rather than one of community and solidarity. Monitoring forms an important part of water management; it is carried out by the irrigation planner, in conjunction with field staff, to reduce losses and ensure that the water delivery service functions to an acceptable standard. Irrigators are also relied upon: they monitor the irrigation distribution system and report things such as leaks to the Water Authority. Monitoring is defined here as keeping track of orders, ensuring the water is delivered on time, watching that gates have opened and closed as per the order, reducing outfalls, and ensuring that the physical meter and online water-use figures correlate. This was observed as the daily practice of the planner (Irrigation Planner 30/08/07).

In contrast to monitoring, surveillance is defined as ‘an aspect of the disciplinary power through which societies control and regulate their populations’ (Scott & Marshall, 2005: 650). Based on observation of WSC meetings during 2007, it became evident that TCC technology was increasingly being utilised as a tool of surveillance, at least for a period of time. For example, automated metering increased the level of information on channel flows that had previously been unavailable to the Water Authority, allowing for an increased capacity to target, document and measure water theft (i.e. irrigators taking water without authorisation). A staff member described its simplicity: ‘you just point to the [computer] and say, listen, we can [now] see what is going on’ (WSC 17/10/07). Using TCC as a tool of surveillance became apparent in a number of compliance activities, such as establishing a compliance team; ‘night runs’ (staff going out at night to check irrigators’ gates); a ‘zero tolerance’ approach to abuse of staff; and the exploration of legal avenues for prosecuting water theft.

When reporting to the WSC during the year, the Water Authority staff consistently pointed out their aim of minimising staff numbers to reduce operational costs. Yet ironically there was an increase in the activity of staff taking part in compliance activity to catch irrigators engaged in theft (WSC 17/10/07). However, this strategic approach to reduce water losses by targeting suspected theft did not logically correspond with the espoused knowledge of water losses. The estimations of losses in the irrigation distribution system typically factored theft at approximately 1 per cent of overall water loss, or not at all. Indeed, in the Harding (2000) report, theft was considered minor, and the Food Bowl Draft Report for Public Comment also factored theft as a minor component of water loss. Instead, losses were attributed

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Note that these night runs were across the whole Central Goulburn irrigation area. However, we would suggest that the introduction of a new technology that enabled presumably greater detection of ‘sneaky’ irrigator activity may have helped to push Water Authority staff in this particular direction.
to meter inaccuracy and channel leakage (Department of Sustainability and Environment, 2007: 25). In the same vein, the WSC Chairman stated that water theft was inconsequential (WSC 21/03/07).

Regardless of knowledge about water loss and where it was occurring, the objective of TCC had never been to intervene in theft incidents. For instance, the report ‘Modernising Victoria’s food bowl’ stated that the ‘CG2 Project was conceived as a means to trial channel automation technology and to generate water savings through a reduction in delivery losses caused by seepage, leakage, meter inaccuracies and out-falls’ (Department of Sustainability and Environment and Department of Innovation, 2007: 13). Yet, surveillance was being carried out with TCC because it was ‘easy’ (WSC 17/10/07). This demonstrates a potential danger with automated technology: the operator becomes removed from the user and thus becomes increasing ambivalent due to a decrease in face-to-face meetings where there is a need to explain and justify actions. Nevertheless, compliance activities tend to multiply. The WSC members were advised by the Operations Manager, for example, to lock their Dethridge wheels when not in use for their ‘own protection’. This was in case a disgruntled irrigator should attempt to set them up by opening their gate, which might subsequently be found by the compliance team that was operating a zero tolerance policy (WSC 19/09/07; 17/10/07; 21/11/07). The situation had deteriorated to such an extent that mutual trust and cooperation were significantly reduced between stakeholders.

While this surveillance activity may have been relatively short-lived, what this compliance trajectory illustrates is not only the disintegration of stakeholder relationships as a result of lack of consultation, participation and negotiation around TCC, but also the ways in which new technologies have unintended consequences, and may be used for purposes other than those which were intended. This is of course a typical feature of human innovation with technology and its increasing panoptic capacity, and highlights the importance of transparent and ongoing dialogue and discussion among all stakeholders before, during and after the introduction of a new technology to address a pressing resource dilemma.

A social justice model for irrigation modernisation

What lessons can be learned from the case study presented in this paper? Drawing on an inductive grounded theory approach that enables theory to emerge from abstracting data grounded in concrete action, we propose a social justice model for irrigation modernisation that is based on three essential criteria or features. First, genuine consultation, participation and negotiation must be prioritised at all stages of technological development and implementation (Leeuwis, 2000; Mostert, 2003). The lesson learned from the TCC trial in the northern region of Victoria in Australia is that irrigators must be active participants from the outset. This is not only essential for avoiding the potential disenfranchisement of thousands of irrigators in the modernisation process, it also ensures that the goals of the new technology, including returning water to an over-stressed natural environment, are given priority.

Second, responsive and respectful dialogue and communication will help facilitate a smooth transition to the new technology and reduce productivity losses, particularly when users are becoming acquainted with it (Leeuwis, 2004). One trap with automation is to assume that in automating the distribution system it is possible to reduce labour costs. While this may be an eventual goal, staff should be retained during the transition period and extension services utilised to ensure assistance is made available to irrigators so they can adapt to a new operating system (Cowan et al., 2006; Race et al., 2006). The transition from manually operated to automated irrigation systems is a crucial time to distinguish between expected teething issues and the more intractable issues as described in this paper. This
settling-in period is a time when engagement will be most valuable. Irrigators could be supported by people working in a specialised role of ‘TCC transition officers’, or possibly in an innovation broker role (Klerkx & Leeuwis, 2009; Klerkx et al., 2010; Oakes, 2012), to work with irrigators in directing farm trajectories on a positive course.

There is a tendency among policy makers and others to frame the issues around technology through an engineering lens, and in this research it was obvious that stakeholders from water management and governance organisations at times struggled to gain an appreciation of farmers’ experiences in the CG2 pilot. The further implementation of TCC requires an alternative framing of the place of irrigators as stakeholders in the process. Irrigators must not be seen or treated as passive recipients of new irrigation technologies, but rather need to be engaged as active agents from the outset. There is an opportunity for organisations to work together with irrigators at the farm level to better address change wrought by technological implementation (Geels, 2004; Nettle & Paine, 2009).

Third, mutual information exchange, or ‘feedback loops’, is also essential for ensuring that innovative technological interventions are harnessed to meet the needs of key stakeholders. In CG2, irrigators familiar with TCC were a valuable but underutilised resource. They not only had a unique perspective of what needed to be done to make TCC work on-farm, they also had developed and refined farming practices under the reality of the new megalitre. Channel automation implementation means reduced volumes of water on-farm. This, and diminishing rainfall through climate change, has led irrigators to explore opportunities to maintain or improve crop productivity, partly by changes to their farming practices. This represents an opening to work with irrigators to learn, improve and share new techniques and practices. Again, opportunities abound for irrigation communities to work together, whether through individual extension, staff sharing knowledge, broader social learning approaches, or some sort of mix where knowledge can be shared and social justice negotiated (Blackmore, 2007; Klerkx et al., 2009; Eastwood et al., 2012; Kilelu et al., 2013).

This current study is limited in that only a small number of interviews were conducted with irrigators on the pilot and, as such, the views expressed do not necessarily reflect consensus among irrigators during the piloting stage of TCC. Second, the study presents mostly one side of the story. Moreover, this paper has not explored the experiences of irrigators with the actual day-to-day operation of the technology. Although these limitations should be acknowledged, the point of the paper was to examine the views of a small selection of stakeholders in order to explore the processes associated with change or transition at the outset of the implementation of the technology. As we argue, a social justice approach to irrigation modernisation will ensure that all stakeholders are treated according to principles of distributive justice, characterised by equality of treatment among competing stakeholders and the fair and equitable distribution of goods (e.g. water). Any resulting inequalities can only be justified, as Rawls (1971) maintains, if they benefit the least-advantaged members. Moreover, social justice is more than redistribution; social justice is also about the process, which must involve the three key components of participation, trust and dignity (Tyler, 1996).

Conclusion

It is crucial that future implementation of new technologies in irrigation incorporates social justice research and perspectives in order to achieve the technical and social benefits that such technology aims to produce. As an investigation into the social dimensions of technology, this paper provides an insight into the social relations involved in implementing technological solutions (i.e. channel
automation) as water management policy, as well as the implications of over-investment of resources into hardware and limited investment in supporting the social transitions involved. Of all the stakeholders involved in the TCC pilot, the irrigators had an epistemologically unique position, and their understanding of the practice of irrigation farming offered opportunity for insights into TCC that could not be gleaned elsewhere. The methodology allowed for the close observation of the process by which the technology and its implementation and impacts were negotiated at the regional level through the workings of the Water Service Committee. The data reveals the reality of people’s differing social constructions about the success or otherwise of channel automation technology.

New and innovative technology can bring great hope to stressed irrigation communities as a way of reducing environmental degradation by returning water to the environment while also maintaining productive irrigation communities. However, the way in which these new technologies are harnessed (namely, the process by which the technology is implemented) in the routine of daily work has a significant bearing on perceptions of fairness, equity and social justice in water governance. We thus advocate for water management organisations to augment promising new technologies with priority attention being paid to complex social relationships among key stakeholders. Above all, we argue that the failure to address the human and social dimensions of technological innovation will have adverse implications, including not only potentially creating perceptions of injustice, but also serving to undermine the technology itself.

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