Institutions and economic research: a case of location externalities on agricultural resource allocation in the Kat River basin, South Africa

CN Mbatha[1] & GG Antrobus[2]

Abstract

The Physical Externality Model is used to illustrate the potential limitations of blindly adopting formal models for economic investigation and explanation in varied geographical contexts. As argued by institutional economists for the last hundred years the practice limits the value and relevance of most general economic inquiry. This model postulates that the geographical location of farmers along a given watercourse, in which water is diverted individually, leads to structural inefficiencies that negatively affect the whole farming community. These effects are felt more severely at downstream sites and lead to a status quo where upstream farmers possess relative economic and political advantages over their counterparts elsewhere. In the study of the Kat River basin these predictions appear to be true only in as far as they relate to legal and political allocations and use of water resources. In terms of lawful uses of land resources aimed at expanding citrus production, the model's predictions are not met. The status quo is however fully explained by the implications of having adopted formal water scheduling rights by upstream farmers as well as other geographical factors. Hence, the case for investigating the effects of important institutions within general economic research is strengthened.

Keywords: Institutions; water allocation; physical externality; Kat River Valley

1. Introduction and orientation

Ronald Coase (1998) reflected on the direction the discipline of economics has taken since Adam Smith as having become the study of blood circulation without a body. "What this comes down to is that economists think of themselves as having a box of tools, but not the subject matter." Many economists, like Coase, charge that the discipline lacks an interrogation of factor coordination in a complex interrelated structure, which is the whole economy (e.g. Eicher, 1999; Evensky, 2004; Hirschman, 1960). This criticism

[1] *Lecturer and researcher, PhD, Department of Economics and Economic History, Rhodes University, Grahamstown 6140, South Africa; E-mail: nhlanhla.mbatha@gmail.com, tel.: +27 83 670 4287, fax: +27 46 622 5210.*
[2] *Professor of Economics, Department of Economics and Economic History, Rhodes University, Grahamstown 6140, South Africa; E-mail: g.antrobus@ru.ac.za*

has been articulated throughout the 20th century by economists from various sub-disciplines of economics. This is also illustrated in the historical debates in *development economics* between dependency and neoclassical economics theorists[3] (e.g. Barro, 1990; Fei & Ranis, 1964; Hirschman, 1960; Lal, 1983; Myrdal 1957; and others). Within institutional economics the view that this debate was first articulated within what is now referred to as the *old institutionalism*, whose founding fathers include Thorstein Veblen (1904), Wesley Mitchell (1924) and John Commons (1924) is held by many (Coase, 1998; Rutherford, 2001). In recent years what is called the *new institutionalism* (of which Coase, 1998; McCloskey, 1990; North, 1990; Rutherford, 2001; etc. are the greatest proponents) has again emerged. While the *old* school of institutionalists rejects the majority of classical economic theories, *the new* institutionalism seeks to retain what are perceived to be useful elements of neoclassical theories. This, for example, is apparent in the study of public institutions from a *transactional cost* framework by North (1990, 1991). Overall, institutionalism advocates the historical investigation of social and economic rules and the contributions of their transactional costs to development processes. An understanding of these rules and their interactions, institutionalists argue, would provide important economic explanations that formal economic theories are normally unable to offer especially in research (Williamson, 2000).

Hence this paper illustrates the usefulness of a specific institutional understanding to providing economic meanings in a case where formal postulations could only partially explain the *status quo* from empirical data. The case is of citrus irrigators in the Kat River Basin in the Eastern Cape Province, and the formal postulations being tested come from the Physical Externality Model by Bromley (1982) with an application in Vatn and Bromley (1997).

1.1 The framework proposal

The model postulates that the mere physical location of farmers along a watercourse where water resources are diverted individually contributes to economic inefficiencies due to production input misallocations, *ceteris paribus*.

[3] *The development process debate has mostly been confined to the extent to which external agents, such as governments, could or could not involve themselves in the process. Various conditions and requirements (e.g. capital accumulation, human skills, and political climate) for the development process to take off have been proposed and refuted in development economics. While neoclassical economists (e.g. Lal, 1983) have argued for limited interventionist approaches to the development process, the proponents of dependency theories (e.g. Hirschman, 1960; and even Sen, 1982) have advocated an institutional involvement in the process. Hence they have acknowledged the importance of institutions for development processes, however, not exactly in the manner proposed in institutionalism (e.g. North, 1990).*

Along the system the downstream farmers are economically and politically worse off compared to their upstream counterparts.

The production and other business environments within which downstream farmers operate are characterised by heightened uncertainties. In turn, downstream farmers produce a relatively lower level of output; they possess lower levels of economic and political power in local marketing and resource management institutions. However, the evidence of commercial citrus farmers located along the Kat River Valley (KRV) does not fully support the conclusions of the model. Hence, this case provides an opportunity to illustrate the usefulness of investigating institutions for good explanations of deviant evidence. In the discussion, the topical areas used to describe the differential empowerment levels of upstream versus downstream citrus irrigators are the following:

a) Water resources allocations and use
b) Land resources allocations and use
c) Citrus production output patterns

The paper argues that upstream farmers in the KRV are only partially more empowered compared to their downstream counterparts. Such is the case even though they are located at supposedly more advantageous upstream positions along a watercourse (Bromley, 1982). It is shown that their relative economic disadvantage stems from entrenched institutions of the 20th century. These are formal and informal rules, practices and policies of external and internal origin. An understanding of these institutions and their effects provides the most useful supplementary explanations to empirical data, which deviates from the postulations of the Physical Externality model.

The paper is structured in the following manner. Section 2 presents the Physical Externality Model and its postulations formally. Section 3 outlines the research methods. Section 4 presents data to describe patterns of physical settlements, citrus production, water and land resource use and the water management processes in the valley. Section 5 discusses the supplementary institutional explanations of the KRV *status quo*, while Section 6 summarises and concludes.

2. The physical externality model

Put simply, the model proposes that *geographical location* of farm units along a watercourse in which water is *diverted individually* gives rise to technical *inefficiencies* that adversely affect production outputs of downstream farmers to extents *worse than* those of their upstream counterparts, *ceteris paribus*

(Bromley, 1982; Vatn & Bromley, 1997). Evidence from countries like Mexico and some in North Africa also indicate that upstream farm units tend to be bigger in size and their owners tend to possess a relatively strong political influence on decision making institutions governing water allocations and market prices of agricultural outputs.

The inefficiencies in a given production cycle arise because of production decision uncertainties regarding how much water would be available to all farmers. The uncertainties are, however, more pronounced for downstream farmers. An illustration of a prototypical watercourse in which uncertainties intensify as one moves from the most upstream (A) to the most downstream (B) location is presented in Figure 1.

In Figure 1, farmer B is both economically and politically disadvantaged compared to A. His/her decisions with respect to production inputs, especially water resources, are also dependent on how much water is abstracted by A, which then determines the leftover quantities for abstraction. Equally important is that both farmers base their estimates of production inputs for the current cycle on the levels which were available in the previous cycle. In this manner the decision making process is strongly reliant on historical events[4]. Furthermore, it is assumed that all farmers are naturally risk averse. Therefore, given these factors, the model postulates that A's and B's estimates and final allocations of production inputs for the current cycle would be significantly conservative and sub-optimal. But because B is also dependent on A's decisions and actions with respect to water, his/her final water resource allocation is even more inefficient. This in the end economically disadvantages B relative to A. Evidence from previous case studies (Bromley, 1982; Vatn & Bromley, 1997) also shows that this economic disadvantage further translates into a political disadvantage.

[4] *In institutional economics, the concept is called 'historical dependency' (e.g. Williamson, 2000)*

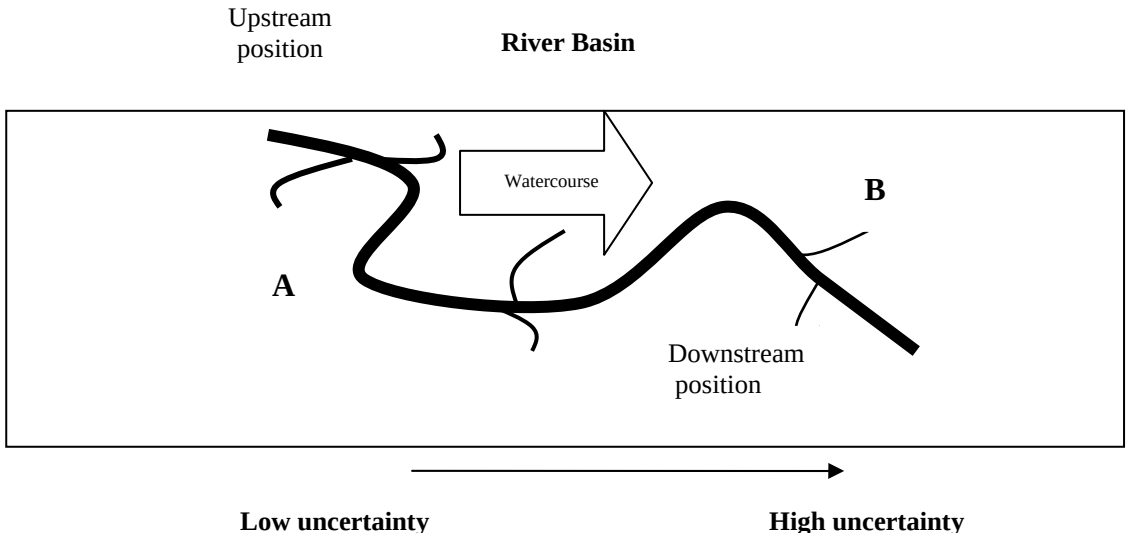


Figure 1: A watercourse with individual water abstractions

Using the conventional *Edgeworth box,* Figure 2 illustrates these relative allocative inefficiencies and power disparities. In an economy of two farmers, two inputs and two levels of output, the horizontal axes represent the amount of finite water resources shared between farmers A and B, and the vertical axes the finite amounts of other inputs (lumped together) shared between the same farmers. The potential production output levels for each farmer are depicted by points inside the box and on various isoquants.

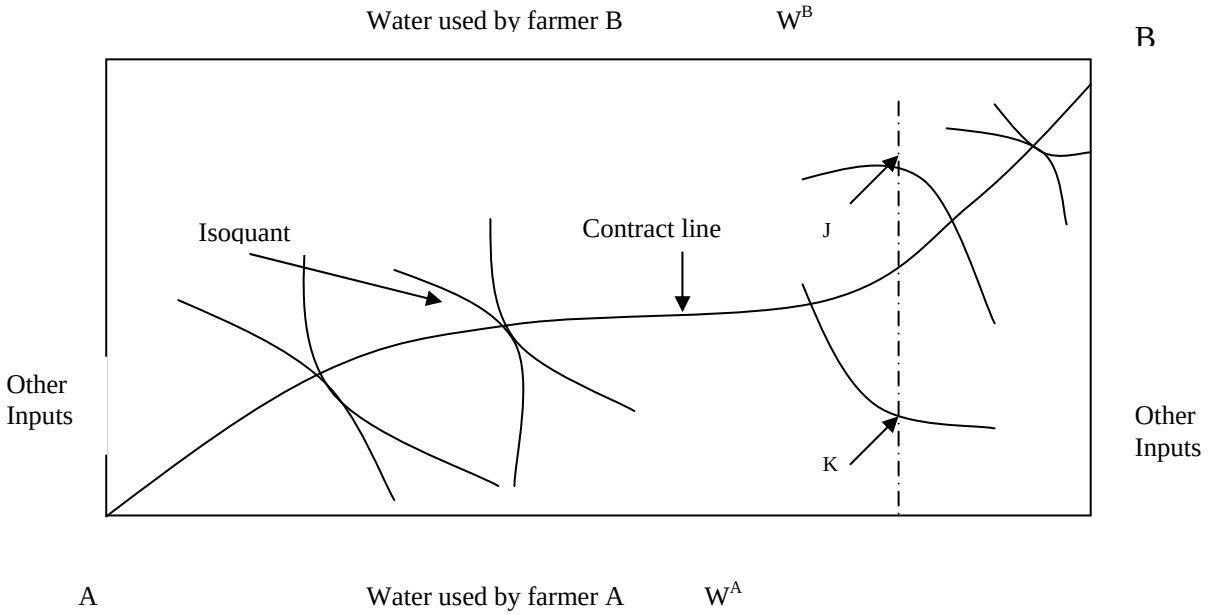


Figure 2: Inefficient resource allocations in agricultural production (Source: Bromley, 1982:13)

All efficient points (or levels) of production for the two farmers would form the contract line inside the box. But because of all the inefficient decision making factors, for example the physical location, uncertainty, and risk averseness, farmers in the system produce outside the contract line. In this case farmers A and B produce at points K and J respectively. At K, farmer A uses more of both inputs and his output level is higher than B's, resulting in relative economic and political dominance over B. In other words the model highlights the negative economic effects of asymmetric information on both farmers, but more so on downstream farmers.

In the following section the research methods used in collecting and analysing data from citrus irrigators in the valley are described. The data will be used to explore the usefulness (or lack thereof) and (in)accuracy of the PE model propositions in Section 4.

3. The research methods

Case study and theme mapping methods were used in collecting and analysing data (see Oosthuizen *et al*., 2005; Williamson, 2000). Meetings of the KRV's Water Users' Association (WUA) were attended during 2004 to 2005. Semi-formal and formal interviews were conducted with farmers from different sections of the KRV. Large farms and irrigation schemes were visited frequently over three years between 2004 and 2007 to observe and document water resource abstraction methods from the Kat River and to understand how water was used and stored on farm reservoirs. Since 2004 a number of water policy workshops organised for large and small-scale water users were attended (and some facilitated) for gathering of data on irrigation water management politics. Formal interviews with officials from the regional Departments of Water Affairs and Forestry (DWAF), Land Affairs (DLA) and Agriculture (DoA) were conducted between 2004 and 2006. Secondary data from archival documents of the former Republic of Ciskei, KRV WUA, DWAF, DLA, etc., were consulted to gather historical data to understand the application and effects of local formal and informal rules as well as the implementation of national and regional official policies. During interviews official and farmer respondents were allowed to recount their versions of historical events related to water use. These were recorded for analysis. Data from scientific reports, e.g. the technical Kat Dam Operating Rules (KDOR, 1989) and Water Quality Research documents (e.g. Lerotholi, 2005) were used to gather quantitative data.

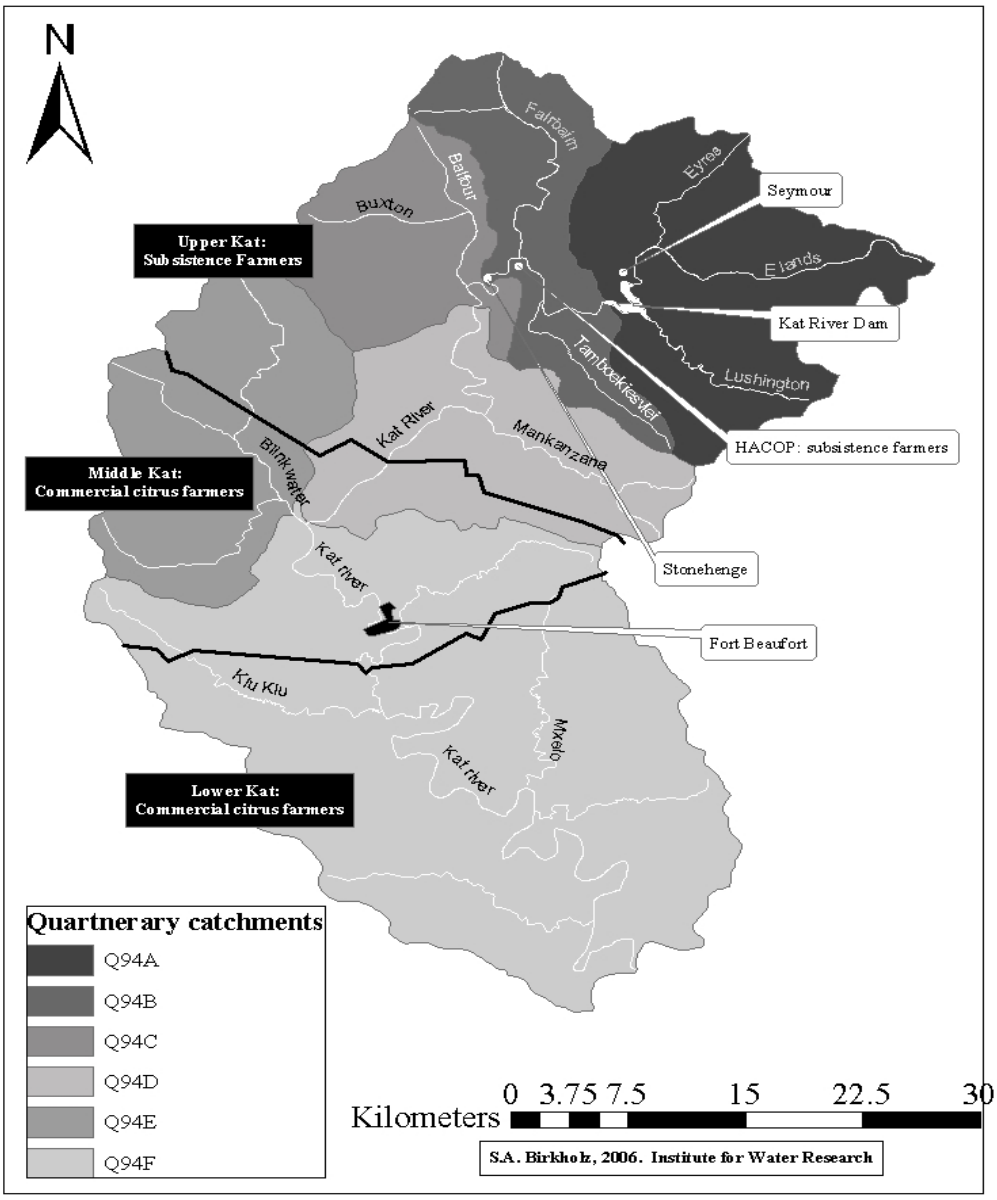
The analysis of the data explored the resource allocations, production patterns, relative economic positions and distributions of political power among

farmers located at upstream versus downstream positions. The data collected was also used to describe the general and specific economy and politics of the valley, which are presented in the following section.

4. The Kat River Valley

The Kat River Valley is located in the Eastern Cape Province of South Africa. With a number of tributaries feeding into the Kat River, the valley has three main sub-catchments and historical settlement areas, which are illustrated in Map 1. These are the Upper, Middle and Lower Kat. Black and coloured subsistence farmers populate the Upper Kat, and the Middle and Lower reaches are mostly occupied by white commercial citrus farmers. The Kat Dam is located near the town of Seymour (North-East location). Fort Beaufort is the main town in the valley and is located in the Middle Kat reach (centre of map). The Kat River runs from the dam through the town of Fort Beaufort to south of the valley.

The current patterns of human settlement and resource distribution in the valley can be traced back to the 19th century frontier wars between the Xhosa versus Coloured people and British settlers. In 1829, the British army forced the Xhosa Chief Maqoma and his subjects out of the valley. Thereafter some parts of the area were designated for coloured settlement to form buffer zones between British settlers and Xhosa natives (Nel, 1998). In the late 19th century, citrus producing white farmers settled on the upper to lower reaches of the valley, roughly between the towns of Seymour and Fort Beaufort (Motteux, 2002:52-62).



Map 1: The Kat River and its tributaries (alternative sources of water)

The enactment of the Natives Land Act (27) (1913) and the Bantu Homelands Citizenship Act (26) (1970) formalised and cemented the racially segregated settlements as depicted on the map. When parts of the Eastern Cape's Stockenstrom region in the Upper KRV were transferred to the former Ciskei (established in 1971) some of the citrus producing white and coloured-owned farms were expropriated for consolidation into the homeland by the South African Development Trust (SADT) (DLA, 1998:1).

An investigation of the three main KRV farming communities revealed that separate formal and informal rules as well as cultural practices governed water allocations, individual and collective use of agricultural resources as

well as types of business transaction activities. The historical and current formal rules for each group were mostly in written form, e.g. in terms of public water policies, business constitutions, rules for the Kat Dam's technical operations, etc. Informal and non-written rules were also followed by all groups but were especially enforced in the Upper Kat. Many of these management rules and practices alongside their developmental implications are discussed within the Physical Externality framework. To ensure that *a similar group* of farmers (located at *different positions* along the watercourse) is compared for the analysis, the discussion deliberately pays more attention to commercial citrus farmers located in the Middle and Lower reaches. The focus on black subsistence farmers, who form a very different social system located in the Upper Kat (previously part of the former Ciskei) is very important but deserves a separate discussion. The different character of the Upper Kat is best illustrated by land ownership disparities found in the valley. While the upper reaches were occupied by communal farming schemes with insecure access to collective land areas of around 30 hectares, some Middle and Lower Kat farmers owned or leased farm land areas in excess of 400 hectares and all with secure land tenure rights.

4.1 A description of physical geography and land cultivation

During the investigation period, large commercial farmers, small irrigation schemes and household users diverted and abstracted water directly from the Kat River system. The water resources flowed from the Kat dam - built in 1969 - with a storage capacity of 24,892 x 10 m^3 and an assured yield of 11.88 x 10 m^3 per annum (Motteux, 2002). This capacity extended water security to approximately 1600 hectares of scheduled[5] land over a three year period (DLA, 1998; Painter, 2005). Other smaller streams, for example the Blinkwater (in the Middle Kat reach, Map 1), were also used as alternative water sources.

Irrigated citrus cultivation requirements formed the largest share of abstracted water resources from the river system. Other irrigation uses were insignificant, especially by small Upper Kat farmers for staple vegetables like cabbages, potatoes, etc. Depending on the total amount of cultivated land (and) under irrigation on each farm or scheme, various amounts of water were abstracted. Table 1 presents these agricultural uses, by land area and position from the most recent and comprehensive study in the KRV (KDOR, 1989).

[5] *Water scheduling is a system of riparian rights under the Water Act (54) of 1956, where access to water rights was given on the basis of land under cultivation. After the rights were conferred to a farmer, s/he was not allowed to develop further land for irrigation.*

Table 1: Areas under cultivation in each river reach (ha)

Reach (Ref. Appendix 1)	Citrus	Tobacco	Vegetables	Pastures	Other	Total
1	4		37	7		48
2	264			37	14	315
3	131			7		138
4	246					246
5	21	185				206
6		127				127
7		47				47
Total	666	359	37	51	14	1127

Source: KDOR (1989)

The reaches in the first column of the table refer to a sectional division of the valley by seven weirs, which are depicted in Appendix 1. As shown in Table 1, citrus cultivation was by far the dominant agricultural activity, with over 60% of total share in 1989. Tobacco was the second biggest crop at over 30%. During the field visits between 2004 and 2007, citrus cultivation had remained the biggest agricultural activity, especially in the Middle and Lower reaches, while tobacco was less extensively cultivated. In fact, some of the citrus farms, which were previously cultivated by White farmers in the Upper reaches, were no longer in operation. This also meant that about 764 hectares of scheduled land lay in waste (KRV WUA, 2004). In contrast, the Lower Kat reaches boasted additional land of around 884 hectares, which was cultivated for citrus without any water guarantees. In any case, Table 1 should be read as an indication of the kinds of potential cultivation suitable for the KRV and their historical extent. The 2005 land cultivation patterns for citrus production are illustrated in Table 2.

Table 2: Estimated land areas under citrus cultivation with and without water scheduling (hectares)

Total land with scheduling	Total land with scheduling but not cultivated	Total land with scheduling and cultivated	Total area under citrus cultivation	Total land without scheduling and cultivated	Communal land and villages with scheduling *not used
1600	**918**	**682**	**1560***	**884**	**764**
Note: The information from various sources (e.g. technical government documents, land register, KRV WUA reports) used in collating the estimated land sizes was not a 100% consistent*, hence the table is only indicative of the magnitudes of types of land used for citrus cultivation with different legal rights.					

Adapted from DLA (1998)

The total amount of land under citrus cultivation almost doubled from 666 hectares in 1989 to 1142 hectares in 2005. Citrus cultivation without water scheduling rights, at 884 hectares, was higher than cultivated scheduled land

at 682 hectares (DLA, 1998). The business and political implications of citrus cultivation without water security are discussed in the following section.

4.2 Water and land allocation rules and conflicts

Scheduling rights and implications

The institutions that governed water resource allocations influenced water and land distribution, political representation and market access patterns. For example, citrus farmers in the Middle to Lower reaches had direct access and representation in the KRV Water User Association (WUA)[6]. These farmers also had access to the only big and privately run packing and marketing cooperatives in the valley, namely, Katco and Riverside SA Enterprises. Access to water management bodies and business support was absent for the Upper Kat farmers (KRV WUA, 2004). The conflicts over access to water resources and its quality, especially among the Middle and Lower Kat commercial farmers, were clearly illustrated in the WUA records of meetings between 2002 and 2004 (DWAF, 2005). These conflicts mainly centred on the lack of access to good quality bulk water resources for Lower Kat farmers and limited potential for land developments in the Middle Kat.

After the construction of the Kat Dam, citrus farmers were given the option of acquiring scheduling rights by the provincial Department of Water Affairs and Forestry (DWAF). These water access rights were meant to be the department's way of ensuring water security to irrigators and Fort Beaufort townspeople. However, farmers who opted for water rights would be restricted from developing further land for citrus cultivation (e.g. Riverside farmers). Those without water rights would face no restrictions with respect to the amount of land set aside for citrus cultivation (Mbatha, 2005; Painter, 2005). While many of the Middle Kat farmers opted for the scheduling, the majority of Lower Kat farmers did not. Due to the geographical nature of the watercourse, some Lower Kat farmers had little choice but not to be scheduled, simply because a farmer who had an upstream neighbour that was not scheduled could not him/herself sensibly choose to be scheduled, since most of his/her water share would be available for illegal abstraction by unscheduled upstream farmers. Hence, during interviews some Lower KRV farmers claimed that they were unfairly treated by the system. Nevertheless, that did not stop them from cultivating land without any legal water security in excess of 800 hectares (refer Table 2). Scheduled farmers in the Middle Kat also pointed out the irony that even with the claims of water vulnerability the Lower Kat farmers had expanded land under trees, which allowed them a big

[6] *The association was transformed from being the KRV Irrigation Board in 2001 (KRV WUA, 2001).*

competitive advantage (Mbatha, 2006). These technical and structural dynamics were a major source of documented water conflicts among commercial farmers in the KRV. The formal scheduling rules provided farmers in the Middle Kat with water security and decision making powers around water allocation and management, but the same rules provided the Lower Kat farmers with *de facto* opportunities for unrestricted land development to produce citrus.

The flows and storage of water resources

The dam's operational rules, laid out in 1979, nonetheless affected the whole valley, including the Upper Kat subsistence farmers. The DWAF, in collaboration with members of the then Kat River Irrigation Board, laid down the rules for allocating water releases to scheduled and unscheduled irrigators (De Villiers, 2005; Painter, 2005). Some of the rules and requirements to meet the full annual irrigation needs for the basin are summarised in Table 3.

Table 3: Monthly water releases (Mm^3) from Kat Dam required to meet full irrigation and domestic requirements

Water releases per month												
Oct	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Year's total**
0.73	0.92	1.81	2.52	1.50	0.91	0.78	0.64	0.54	0.49	0.57	0.61	**12.06**
Other components contributing to total annual flows												
Irrigation water requirement						10.04						
Domestic water requirement						1.72						
River losses						4.36						
River flow below Kat Dam						4.06						

Source: KDOR (1989:14)

The table illustrates that while 10.4 Mm^3 were needed to meet the valley's annual scheduling requirements, 12.06 Mm^3 were released. This indicates an annual excess of less than 2 Mm^3 to irrigation requirements of unscheduled growers, while more than 4 Mm^3 were losses. Nevertheless higher water quantities were released in the early parts of the year, i.e. in January and February. Because citrus harvesting usually takes place between the months of June and August, it is sensible that the lowest releases occurred during that time of the year. However, the releases were kept close to meeting only the requirements of scheduled growers. This conservative water release practice is also supported by readings years later as presented in Figure 3.

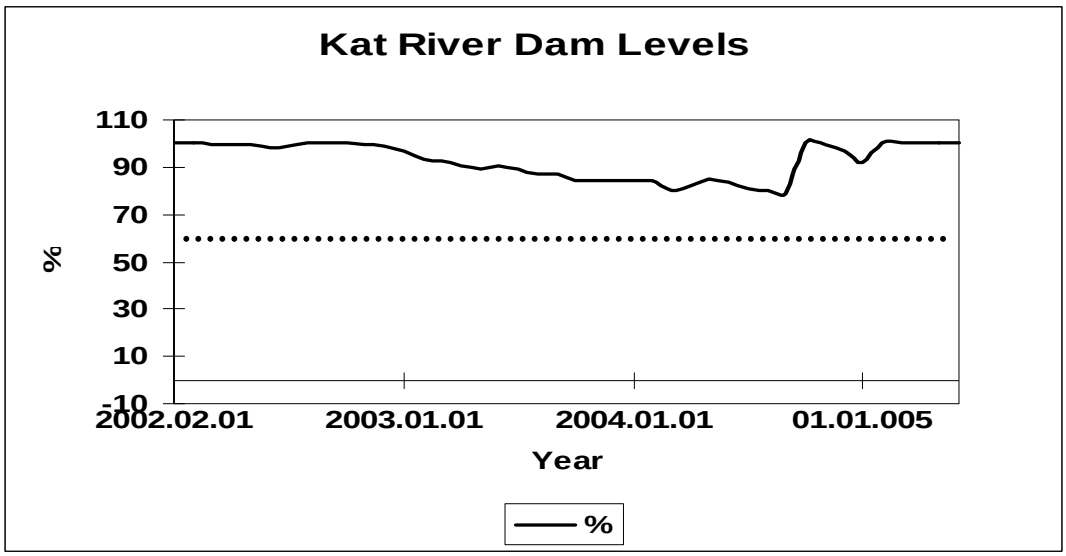


Figure 3: Kat River Dam water readings 2002 to 2005 (Source: DWAF, 2005)

Between 2002 and 2004 the dam's water levels were kept at close to full capacity and way above the minimum levels of 60% (the dotted line), which are specified in official rules. The observations reiterate the conclusion made about the extent of decision making power that the Middle Kat farmers (who also managed the releases) had over the Lower Kat farmers. They kept water levels in the dam way above minimum requirements, which led to a documented stream of complaints during WUA meetings from the Lower Kat farmers. The farmers complained about the low quantity and poor quality of water available from the Kat River. But in response the Middle Kat farmers always mentioned the unrestricted expansion in land cultivation taking place in the Lower Kat as a disadvantage to them.

The relative sizes of the farms in the Middle and Lower Kat reaches, with and without water scheduling, above and below the town of Fort Beaufort as well as water extraction pumps, boreholes and reservoirs are presented for each identified farm in Table 4.

Table 4: Farm ownership and associated water scheduling

Enterprise	Reach	Number of on farm reservoirs	Scheduled hectares	Citrus cultivation	Weirs and pumps	Boreholes
A	Middle Kat	4	337	285.7	8	n/a
B	Middle Kat		61	50	1	n/a
C	Middle Kat	3	5	30	1	4
D	Middle Kat	N/a	24.5	21	n/a	n/a
E	Middle Kat	1	N/a	15 and 19	1	2
F	Middle Kat		11.5	20	0	n/a
G	Middle Kat	2	N/a	0	0	2
Total		**10**	**439**	**442**	**11**	**8**
H	Lower Kat	3	0	111	2	1
I	Lower Kat	N/a	0	0	n/a	n/a
J	Lower Kat	N/a	0	66	2	n/a
K	Lower Kat	N/a	0	63	n/a	n/a
L	Lower Kat	3	0	36	2	1 of 3 is used
Total		**3**	**0**	**276**	**6**	**4**

Source: KRV WUA (2004)

It is clear from the table that while scheduled farmers faced lower risks with regard to water security, the Lower Kat farmers had actively taken the potential risk of investing in developing land for citrus production (e.g. the H enterprise). From these developments it could be fairly concluded that the Lower Kat farmers may not have faced a high enough level of water risks, which warranted their continuous stream of complaints at WUA meetings. Firstly, the scheduling dynamics offered them an unrestricted land development opportunity. Secondly, to actually develop more land for citrus irrigation they had to have relied on alternative sources of water. These would include secondary water streams, indicated in Map 1, boreholes and other sources, which are indicated in Table 4. The irrigation equipment audit of weirs, pumps and reservoirs in the table further confirms the availability of other water sources throughout the valley, including the Lower Kat reaches. In any case, a number of downstream farmers conceded that enough water sources were available to them, especially rainwater resources which were harvested for storage into private reservoirs.

The foregoing discussion of data in Tables 2, 3 and 4 highlight the following points:

a) The Middle Kat farmers were protected from water risks for their citrus production;
b) Not only were their citrus cultivations under legal water guarantees from the Kat Dam, but from the sample in Table 4 they also had a higher reservoir storage potential compared to their downstream counterparts;

c) However, these farmers also faced land development restrictions from their water security;
d) Table 3, alongside Figure 3, indicates that the Middle Kat farmers held the decision making powers with respect to the dam's operations, which they used to further protect themselves against downstream farmers by allowing only very conservative water releases from the dam; but
e) Unconstrained to develop land by the water scheduling rights, to which they were not party, the Lower Kat farmers cultivated relatively more land (around 23% more than the Middle Kat farmers), which they were able to do without strong guarantees of water from the Kat Dam, but with water available from alternative sources.

Regarding citrus cultivation, the performance of the Lower Kat farmers within the Physical Externality framework appears to be extraordinary. In most parts it contradicts the core propositions of the model. From the propositions we would expect to see the Middle Kat farmers, who are geographically located upstream of the valley's primary watercourse and also endowed with exclusive water rights, to be more efficient, bigger and more successful economically and politically. The KRV study, however, has shown that there can be important institutional factors that may lead to unexpected outcomes. In the valley, these allowed, if not encouraged, the Lower Kat farmers to prosper to a level equivalent to or even higher than that of their upstream counterparts. These institutional factors, their implication for the application of the Physical Externality and other similar models, including implications for general economic inquiry are discussed in the following sections.

5. The institutional and research implications

The water scheduling rights in the valley are classifiable as formal intangible institutions. These institutions enabled other formal and informal institutions to influence, with additional implications, the allocation of resources.[7] While the rights provided the Middle Kat farmers with water security and decision making powers for the dam's operations, the same rights limited the land use opportunities of these farmers. Ultimately, the economic advantage of holding scheduling rights proved to be rather limited when compared to their production costs for this group in the long run.

Secondary informal rules which formed from scheduling rights included the responsibility given to Middle Kat farmers to make decisions about the water

[7] *Many institutionalists would perceive this development as conforming to what they call 'path dependency', a self supporting and rejuvenating attribute of dominant institutions, which makes it hard for institutions to be replaced over a short time (e.g. North, 1990; Williamson, 2000).*

releases from the dam. This informal decision making institution offered these farmers a comparative power advantage, which they used effectively over their downstream counterparts. The practice of conservative water releases further disadvantaged the Lower Kat farmers with respect to water quantity and quality abstracted from the Kat River.

On the other hand, however, in addition to being unrestricted to develop more land for citrus, there were alternative sources of water available to the Lower Kat farmers. Hence, the limitations on land development imposed on Middle Kat farmers by scheduling rights plus the availability of alternative water sources for the Lower Kat farmers collectively created a resultant *status quo* that simply defied what are sensible postulations of the Physical Externality model. This particular case highlights:

a) The potential and important real life limitations of research applications of any formal model in a 'conceptual straightjacket' manner (Demsetz, 1969, cited in Rutherford, 2001:186), and
b) The ways in which an understanding of other factors, including key institutional developments could provide crucial explanations of the *status quo,* which in this case was presented by the interplay of formal scheduling rules and informal decision making powers with respect to water and land allocation and availability in the valley.

Among other propositions of the PE model were the high levels of endogenous production externalities intrinsic to the system. These were predicted with a fair amount of accuracy. The Middle Kat farmers' conservative water releases added to the high levels of inefficiencies. Although debatable, among other factors the practice was informally due to selfish strategic decisions of the Middle Kat farmers, but formally acceptable were the effects of memories of droughts of previous years.[8] Moreover, it is clear that the high level of inefficiencies found in the Middle Kat not only affected the use and management of water resources, but were also made worse by formal restrictions over land cultivation. This was an institutional factor stemming from the prerequisites of scheduling rights and was external to the PE model's initial specifications. It is then fair to conclude that the level and extent of inefficiencies, which were experienced in the Middle Kat, were a lot higher than those which could be predicted within all given parameters of the model.

[8] *Prior to 1983, the Kat River Dam's water levels were less restrictive and not as regularly monitored, hence during the reported drought periods the dam's capacity easily dropped to an alarming 5% (Mildenhall, 2004). Thereafter, scheduled farmers agreed that the dam would never be allowed to drop below 60% of its capacity.*

The inefficiencies stemming from the practices in the Middle Kat were also transferred to the Lower Kat. Not only did the Lower Kat farmers complain about the low water flows in the Kat River, but also the quality. Here the PE model was most accurate in its predictions. However, these inefficiencies - in isolation - were not enough to disempower the Lower Kat farmers relative to their upstream counterparts. Instead, the downstream freer access to land for citrus development allowed the Lower Kat farmers to develop more land than upstream farmers while using alternative water resources more efficiently. This availability of alternative water sources was also external to the model's specification. Hence, given the specific geographical factors of the system, institutional and production factors, downstream farmers were ultimately better off in relation to those located upstream. Such could not have been predicted using only the PE model as the framework for the research.

5.1 Implications for general economic research

Without a doubt the Physical Externality model is useful as an initial framework for interrogating the KRV system. It provides a good explanation of water resource allocation from the Kat River and use patterns among the Middle and Lower Kat farmers. But as illustrated by the case study, it fares poorly in providing the most important explanations of land use for citrus production patterns in terms of Middle versus Lower Kat farmer groups. Ultimately, it does not explain how downstream farmers possessed an economic advantage over their upstream counterparts in terms of land use and extent of citrus cultivation. These crucial advantages are better explained by context specific institutional and geographical factors, which are outside the model's specifications.

In that regard the KRV study makes a useful empirical case that a tool box of economic models is not always sufficient in providing meaningful answers to economic investigations. The study provides an illustrative light on Coase's (1998) charge that economics has, without the study of institutions, become an investigation of blood circulation without a body. The KRV study illustrates why an interrogation of institutional and other factors and their coordination are key to understanding and explanation of complex interrelated structures, like economic systems. A word of caution for economic research undertakings from this discussion would be, firstly, to discard any belief that economic models can provide enough or even suitable tools for explaining socio-economic systems, secondly, to always factor and investigate the effects, at least, of the most dominant institutions in their practice on the ground.

6. Summary, conclusion and recommendations for policy

The *old* and *new* institutionalists have always proposed that general economic inquiry has to varying degrees in the last century neglected properly contextualised interrogations of formal and informal institutions. As pointed out by Coase (1998) and Rutherford (2001), among these types of economists were Thorstein Veblen (1904), Wesley Mitchell (1924), and John Commons (1924) in the early 20th century. Later on they included Hirschman (1960), McCloskey (1990), North (1990) and Williamson (2000), who argued primarily along the same lines against the blind use of what they have called economic *tool boxes* - embodied in formal economic models. The argument led to the purpose of this paper, which was to illustrate the usefulness of mapping out an understanding of institutional and other influences within a particular environment, where empirical observation has defied some predictions of what seems like a really sensible formal specification in the form of a Physical Externality model.

The arguments from the KRV study are also specifically important for current economic research on social factors around South Africa's water reallocation policies (National Water Act (NWA) (36), 1998). In similar river basins with respect to geography and history, the study illustrated why time should be devoted to investigating the historical effects of formal policies, local practices, allocation strategies, etc., to obtain understanding on the institutional mosaic at a river basin level and upon which further technical work could be undertaken.

Acknowledgments

The authors would like to thank the reviewers on comments made on an earlier draft, and the Water Research Commission for supporting the study.

References

Barro RJ (1990). Government spending in the simple model of endogenous growth. *The Journal of Political Economy* 98(5):103-125.

Bantu Homelands Citizenship Act (26) (1970). Republic of South Africa. *Government Gazette*. Pretoria: Government Printers.

Bromley DW (1982). *Improving irrigated agriculture: institutional reform and the small farmer.* World Bank Staff Working Paper Number 531. The World Bank, Washington DC.

Coase R (1998). The new institutional economics. *The American Economic Review* 88(2):72-74.

Commons JR (1924). *The foundations of capitalism*. Madison: University of Wisconsin Press.

Demsetz H (1969). Information and efficiency : another viewpoint. *Journal of Law and Economics* 12(4):1-22.

De Villiers J (2005). Personal communication. Lower Kat irrigator and Member of the KRV Water User Association.

DLA (1998). *Mpofu/Stockenstrom District Land Assessment Project.* East London: Department of Land Affairs.

DWAF (2005). *Eastern Cape resource poor farmers irrigation scheme feasibility study. Tamboekiesvlei Final Report*. Cradock: Department of Water Affairs and Forestry.

Eicher CK (1999). *Institutions and the African farmer*. Third distinguished economist lecture presented at the International Maize and Wheat Improvement Centre (CIMMYT). Mexico City. January 15, 1999.

Evensky J (2004). Economics in context. *Journal of Economic Education* 35(2):197-211.

Fei JCH & Ranis G (1964). *Development of the labour surplus economy*. Homewood, Ill: Economic Growth Center, Yale University.

Hirschman AO (1960). *The strategy of economic development*. New York: Yale University Press.

KDOR (1989). *Kat Dam operating rules*. Project No. 13883. Bisho, Republic of Ciskei: Department of Public Works.

KRV WUA (2001). *Constitution of the Kat River Valley Water User Association*. Geography Department, Rhodes University, Grahamstown.

KRV WUA (2004). *Minutes of the executive meeting of the Kat River Water Users' Association* (between 2002 and 2004). Fort Beaufort.

Lal D (1983). *The poverty of development economics*. West Sussex, UK: The Institute of Economic Affairs.

Lerotholi S (2005). The role of salinity as an abiotic driver of ecological conditions in rural agricultural catchment. Unpublished Master's thesis. Rhodes University, Grahamstown, South Africa.

Mbatha CN (2005). A game theoretic perspective for enhanced stakeholder participation in integrated water resources management: a Kat River case study. Unpublished Master's thesis. Rhodes University, Grahamstown, South Africa.

Mbatha CN (2006). A compilation of institutional case studies of irrigation systems from the Kat River Catchment, Eastern Cape Province. Report to the Water Research Commission by the Department of Economics, Rhodes University. *WRC paper no. K8/621/4*. Pretoria.

McCloskey D (1990). Agon and Ag Ec: styles of persuasion in agricultural economics. *American Journal of Agricultural Economics* 72:1124-1130.

Mildenhall B (2004). Personal communication. Lower Kat irrigator and Executive Member of the Water User Association, Kat River Valley, Fort Beaufort.

Mitchell WC (1924). The prospects of economics. In: Tugwell RG (ed.) (1971). *The trend of economics.* Port Washington NY: Kenmukat Press.

Motteux NMG (2002). *Evaluating people-environment relationships: developing appropriate research methodologies for sustainable management and rehabilitation of riverine areas by communities in the Kat River Valley, Eastern Cape Province, South Africa*. Unpublished PhD dissertation. Rhodes University, Grahamstown, South Africa.

Myrdal G (1957). *Economic theory and under-developed regions*. London: Duckworth.

Natives Land Act (27) (1913). Republic of South Africa. *Government Gazette 861.* Pretoria: Government Printers.

Nel E (1998). NGO-facilitated local economic development. *Urban Forum* 8(2):277-293.

North DC (1990). *Institutions, institutional change, and economic performance*. Cambridge MA: Cambridge University Press.

North DC (1991). Institutions. *Journal of Economic Perspectives* 5(1):97-111.

NWA (1998). National Water Act (NWA), No. 36 of 1998. Republic of South Africa, *Government Gazette 26/08*. Pretoria: Government Printers.

Oosthuizen LK, Meiring JA, Botha PW, Grove B, Monkhei MM & Pretorius I (2005). Cost estimating procedures for micro, drip and furrow irrigation systems as well as economic analyses of the relevant irrigation systems for large and small scale farmers in the Onderberg/Nkomazi region. Report to the Water Research Commission by the Department of Agricultural Economics, University of the Orange Free State. *WRC paper no 974/1/05*. Pretoria.

Painter C (2005). Personal Communication. Retired Middle Kat irrigator and executive member of the Kat River Valley Irrigation Water Board, Fort Beaufort.

Rutherford M (2001). Institutional economics: then and now. *Journal of Economic Perspectives* 15(3):173-194.

Sen A (1982). *Poverty and famines: an essay on entitlement and deprivation*. Oxford: Clarendon Press.

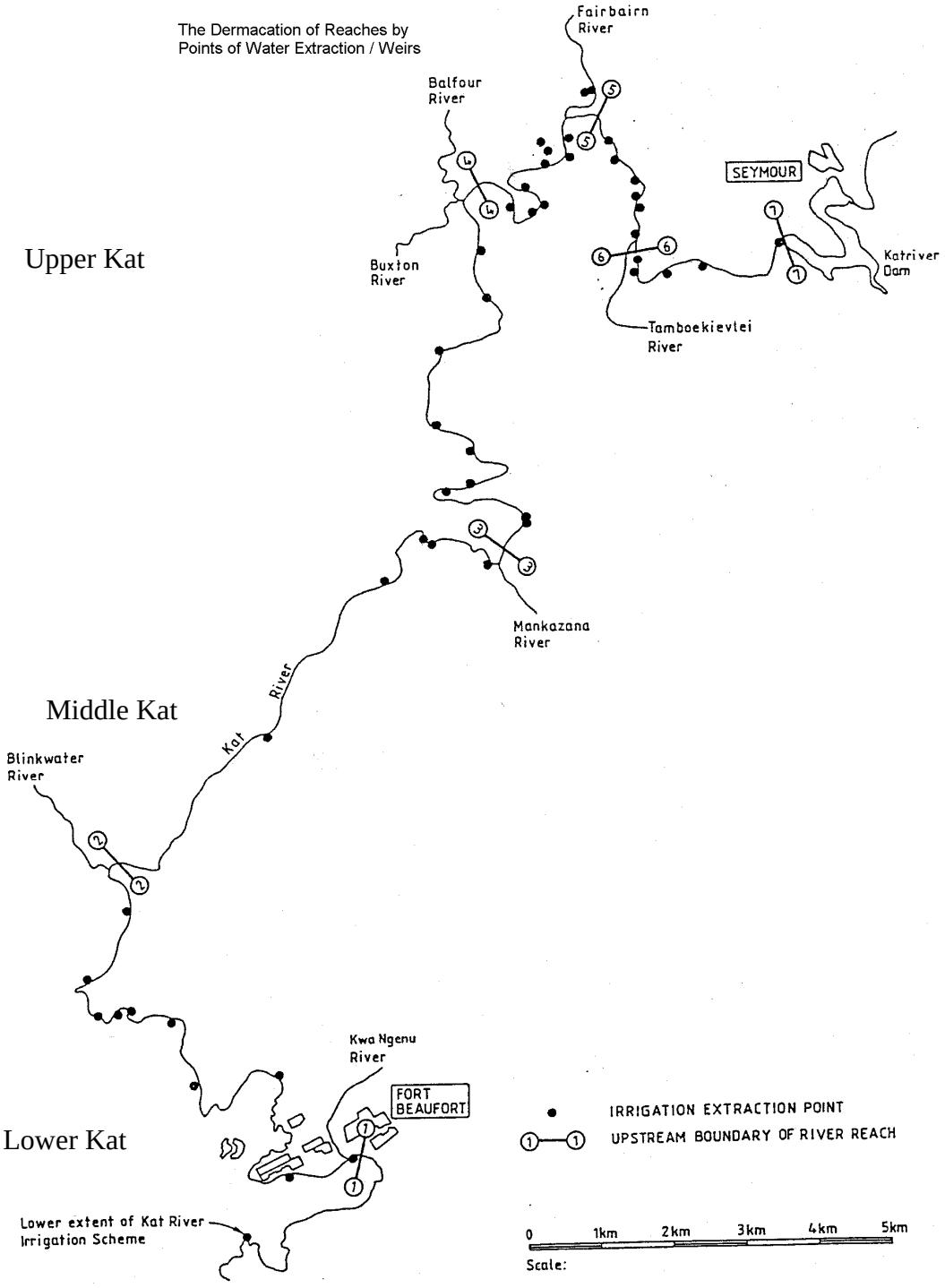
Vatn A & Bromley D (1997). Externalities - a market model failure. *Journal of Environmental and Resource Economics* 9(2):135-151.

Veblen T (1904). *The theory of business enterprise*. Clifton NJ: Augustus M Kelley.

Water Act (54) (1956). Republic of South Africa. *Government Gazette 861.* Pretoria: Government Printer.

Williamson O (2000). The new institutional economist: taking stock, looking ahead. *Journal of Economic Literature* 38(3):595-613.

Appendix 1: KRV weirs and boundary river reaches: seven main water abstraction points are illustrated between the Kat River Dam and the Lower Kat



Source: KDOR (1989)