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The ***Kansas Policy Review***, published by the Policy Research Institute, The University of Kansas, is free and available semi-annually on our Web site. We welcome research studies and reports on contemporary public policy topics, in addition to economic and business issues, relevant to Kansas, the High Plains Region, and the Nation.

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From the Editor

This is the first issue of the *Kansas Policy Review*, a semi-annual, on-line journal published by the Policy Research Institute at the University of Kansas. The *Kansas Policy Review* carries on the tradition established by earlier Institute publications (*Kansas Business and Economic Review*, and *Kansas Business Review*) of providing a forum for articles devoted to policy-related topics relevant to Kansas, the High Plains region, and the nation. It aspires to reflect the best of policy-related scholarship across a broad range of disciplines.

The new title is intended to more accurately reflect the range of topics that articles in this journal will cover. In addition to economic and business issues, we invite articles from all disciplines that address contemporary public policy issues. Articles published in the *Review* will reflect the best current scholarship, while striving to be accessible and interesting to a broad readership.

I invite your comments and reactions to the articles published in this and future issues. I also encourage you to consider submitting your own work for publication in the *Kansas Policy Review*.

Joshua L. Rosenbloom, Editor

The Waters of Kansas, Past and Present*

Donald Worster

*This paper was presented at the *Kansas Economic Policy Conference*, The University of Kansas, October 24, 2003. It is the intellectual property of the author and is not for commercial or profit-making publication in any form.

Water is a short, simple looking word, only five letters long; and in the chemist's language it is even shorter—H_20, a mere three characters. It seems even simpler as it arrives, reliably and daily, into our homes and businesses out of a faucet or out of a plastic bottle reassuringly labeled "pure mountain spring water." Most public discussion of water likewise takes a simple view of the subject: water regarded as a "resource," a "commodity," a means to wealth or poverty, a substance that we use and reuse without deeper thought.

But in fact water has been one of the most complicated forces in human history. Whether in the form of liquid, gas, or solid, it has been a powerful agent in making the earth, spreading over the surface in vast sheets of ice, leaving behind broad outwash plains, cutting river valleys and making levees, eroding topsoil, laying down gravelly deposits and then burying and saturating them with moisture. Yet that same powerful agent has also become more and more vulnerable to human intervention, as we know in this age of dams, pollution, and depletion.

Water has also been very complicated in a cultural sense, although historians have only begun to appreciate the changes in perception, meaning, and value that water has gone through over time. Here in Kansas water has awakened our sense of beauty and symbolized the wildness that lies beyond civilization. It has been a neighbor with whom we have had to learn to live, a part of what we call home. It has given us food and recreation. It has also been an instrument of power and economic production. And at times it has been a threat to property, even to survival .

How in the development of Kansas have we behaved toward water and the water cycle? (I say "water cycle," because far from being a mere thing we appropriate or pump, water is a flow, a process, a cyclical phenomenon in nature, and a cycle of global proportions.)

The history of Kansas water, I am compelled to say, shows something less than a grand, triumphant march of human achievement, *ad astra per aspera*. On the contrary, over the past century or two our relationship with water has often been marred by miscalculations, mistakes, ignorant assumptions, and oversimplifications. Many of those mistakes have been costly, and we are still paying the price. As we review briefly some of that history, we should ask ourselves, what have we learned about water? Are we still making the same mistakes, or are we creating new ones at this very moment?

Begin at the beginning: *Inventing Kansas*. Before the state existed, when this place was dominated by Indian peoples pursuing the bison and the wild onion, eastern mapmakers affixed a name, "Great American Desert," indicating a place of little or no water. The name first appeared in the report of Army major Stephen Long's 1819-20 expedition across the plains to the Rocky Mountains.[1] Granted, "Great American Desert" referred only to the westernmost part of this state, but that made even the eastern part a *near* desert. The name stuck for a generation, and in droughty years it would re-emerge like a curse on our reputation.

We may laugh at such labels, especially in wet years, and point to a long history of successful settlement and population growth. Long's notion of a Great American Desert was the first serious mistake. The more complicated truth about this region would not be revealed for another 60 years and nearly 20 years after statehood. In 1878 another western explorer, John Wesley Powell, published his famous *Report on the Lands of Arid Region of the United States*. He drew a line between "arid" and "humid" America that went right down the 100th meridian, passing through what is now Dodge City. That left the state as a whole neither wet nor dry, but plumb in the middle of the most volatile, unpredictable part of the continent, what Powell called the "sub-humid region." "This will be a region of great agricultural wealth," he predicted, but he did not add

that it would also be a region always plagued by instability.[2]

The founders of Kansas blithely ignored all those mapmakers and scientists when they drew the boundaries of this state. They got out their rulers and made straight lines east and west, north and south, creating an 80,000-square-mile box for which they adopted the name of a banished Indian nation. In crafting that box they completely ignored the flow of water across the land—mistake number two. Look at our most prominent bodies of water, the Kansas River and the Arkansas River: Their headwaters are in Nebraska and Colorado, vital facts that the politicians did not consider, thus assuring a future of protracted litigation.[3] (See Figure 1.)

This same pattern of ignoring the reality of water was repeated when the politicians subdivided the state into counties. They finally settled on 105 smaller boxes, none of which were drawn up with an eye to water. John Wesley Powell warned western legislators that they would create enormous difficulties for their descendants if they failed to acknowledge the patterns of nature; political boundaries, he argued, should conform to watershed boundaries to make the management of our relations with nature more coherent, democratic, and efficient. Divided according to watershed units, rather than into arbitrarily designated counties (named after dead politicians and war heroes), Kansas might have followed a very different path. We might have become more environmentally aware, more mindful of the significance of water and the water cycle, and more conscious of nature's limits (Figure 2).

Figure 1
General Availability of Ground Water and Annual Precipitation in Kansas

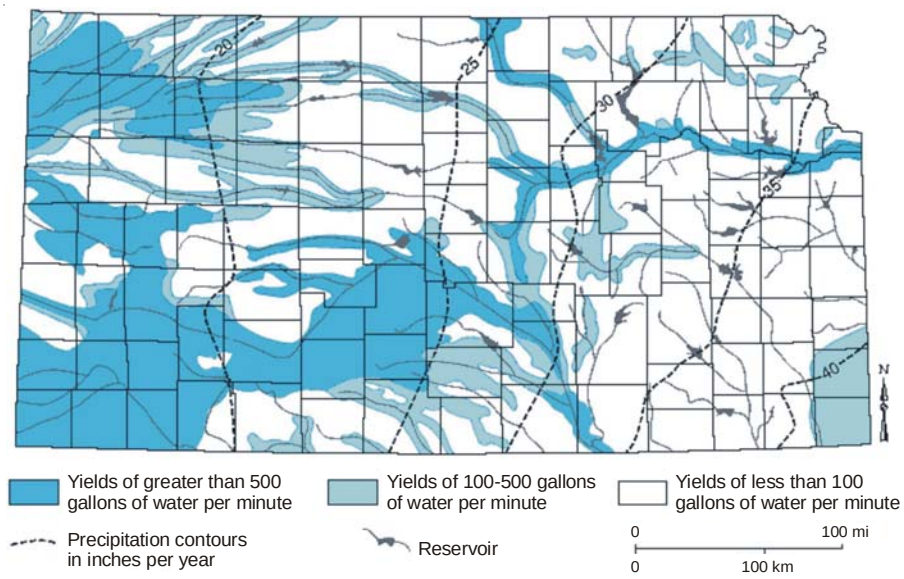
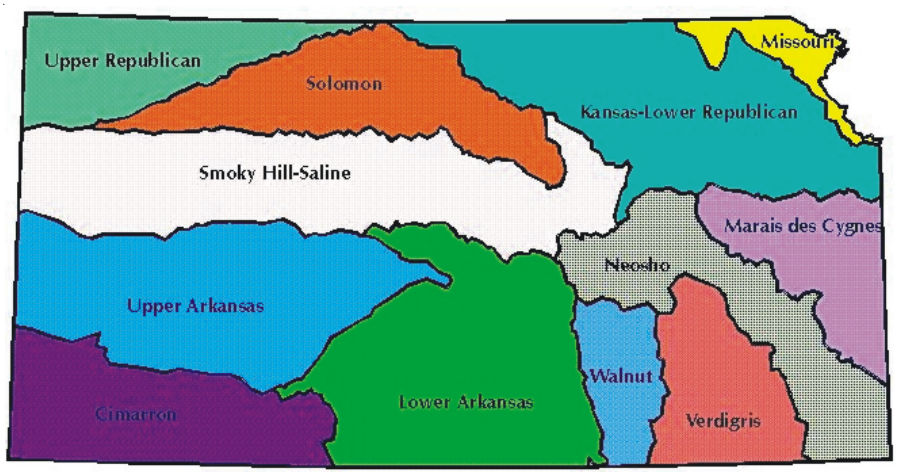


Figure 2
Kansas River Basins



Instead, in a spirit of unwarranted confidence, Kansans set out to turn their big box and all their little boxes into one giant farm. The historian Henry Nash Smith called their dream "the Garden of the World": "the image of a vast and constantly growing agricultural society in the interior of the continent," he wrote, "became one of the dominant symbols of twentieth-century American society."[4] It was a dream of endless increase, of infinite productivity; unfortunately, it had to face the real world of finite resources, especially

water resources, take large risks, and go through big failures. Despite its continuing hold on our imagination, that dream of an ever-bountiful garden of the world can be called mistake number three.

Partly the mistake lay in assuming that droughts could be banished, or nearly so, allowing the garden to flourish year in and year out. In the 1890s, however, and again in 1929-41, 1952-57, 1962-72, 1974-82, 1988, and 2002-3 the water cycle failed the farmer, blighting crops and livelihood. Kansas may not be Stephen Long's desert, but then it is not the garden state either. Modern scientific research has revealed past droughts lasting as long as two hundred years.[5] And the most recent climate studies add that we have entered an era of global warming, which may bring droughts longer and harder than any that humans have ever experienced in this region.[6]

But the misguided thinking behind the garden of the world image goes deeper, right down into the ground where the roots of plants can be found. Agriculture was assumed to require plowing and planting annual crops, which entailed ruthlessly destroying the perennial native vegetation—vegetation that had evolved over eons to meet the variable conditions that water set. Prairie grasses like big bluestem or even the short curly buffalo grass of the High Plains had evolved massive roots that went deep and wide, holding soil against the pounding rains and blasting winds, withstanding droughts. None of the annuals that farmers planted in the newly exposed soil—wheat, milo, soybeans, corn—could compare in efficiency when it came to capturing water and keeping soil in place. The result was a long history of soil blowing and soil washing, sending much of Kansas down river to the Gulf of Mexico, along with repeated seasons of dead or stunted crops in a baked earth.

After World War Two, it is true, the garden of the world gained a new lease on life. It did so in part because enterprising farmers discovered an extraordinary abundance of water in groundwater sources. They became irrigators. In the 1960s a Garden City farmer Clarence J. Gigot introduced the newly invented center-pivot sprinkler to his farm, which pumped water from the Ogallala Aquifer and spread it over large circles of thirsty land. By the eighties there were more than 700 such circles in Kansas, and they were producing as much as 120 bushels of corn per acre.[7] Some experts hailed a new age of "climate-free agriculture." We now realize that was another over-blown promise. Much of the state's agriculture was now precariously based on mining an exhaustible water supply. Now, according to state geological experts, a day of reckoning will inevitably come in 25 or 50 or, in a few fortunate places, 100 or 200 years. The days of the center-pivot garden of the world are numbered.

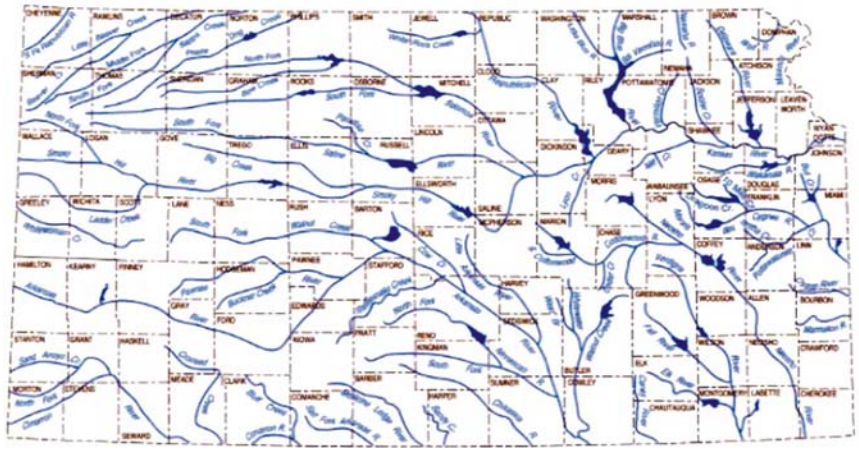
Less well known than the depletion predicament is the effect that intensive withdrawal from underground aquifers has had on surface water. The western half of the state has lost nearly all its perennial streams, as the water table has fallen and the groundwater has been depleted.[8] Ironically, the last forty years of pumping have brought us back to the Great American Desert, for less surface water is now flowing over the land than even Stephen Long saw. This is a man-made desiccation that has spelled doom for plant and animal species that once found habitat along streams and rivers.

Where water still runs in its ancient channels, chemicals leaching from farmland have contaminated it. Again after World War Two, the garden of the world seized on an arsenal of pesticides, herbicides, and inorganic fertilizers, all of which found their way into the water cycle—and into our drinking water. Farmers suffered more than anyone did from this contamination. In some rural areas public officials posted warnings about nitrate poisoning of wells and were forced to import bottled water for vulnerable children and pregnant women. Atrazine, a herbicide used to get rid of wheat stubble on fallow land or to control weeds on corn fields, turned out to be both an endocrine-disrupter and a carcinogen; it was widely applied in Kansas by the 1990s and widely present in surface waters.[9]

The mistake lay not in the idea that the Great Plains should be used to produce more food for humans, which was clearly needed to meet a growing national population. Rather, it lay in the scale and practices of row-crop farming, which were often not well-adapted to the water cycle, or became less well-adapted over time, or were extravagant and arrogant.

Urban people also have transformed the waterscape of Kansas, and in doing so they too have made what now look like mistakes that we might not want to repeat. We can call their mistake *the illusion that nature can be controlled.* It was a mistake written in concrete and funded largely by the federal government.

Figure 3
Kansas Rivers with Reservors Created by Dams



Like droughts, floods have occurred regularly in the long history and prehistory of this place. The entire Missouri-Mississippi river complex, which drains 40% of the United States, is flood-prone and has been so since the retreat of the last continental glaciers. On the whole farmers have managed to live better with floods than with droughts, and indeed have benefited from the rich alluvial deposits that floods make possible. But for cities and towns located in floodplains, floods are nothing but a disruption, and now and then a disaster. Kansas began to write a story of such disasters back in the 19th century, and it continued down through the 20th century—the infamous floods of 1903, 1927, and 1951 to name some of the worst.

Left to their own financial resources, Kansans might have found a modest, inexpensive way to protect themselves against such calamities. But during the 1930s, the federal government began to make available huge amounts of money, through the Bureau of Reclamation and the Army Corps of Engineers, to build large dams on western rivers. In 1944 Congress authorized one of the most elaborate river-control schemes in the world: the Pick-Sloan plan that would turn the entire Missouri River complex, including its Kansas tributaries, into a set of artificial lakes stair-stepping down from the Rockies.

Many farmers protested such dam building, fearing that the dams would back up water over good farmland and force it permanently out of production. A few economists agreed that dams were an expensive solution to a problem that had cheaper alternatives. Restricting urban development in the floodplains was one such alternative, and the most effective over the long term; it would have cost the taxpayer nothing, unless it involved removing floodplain development that went back to the first white settlement of Kansas. But the cheap way was not the way Kansas chose. Maps of the state tell what happened: every large river in the state was dammed, and dammed repeatedly, to stop floods (Figure 3). Even the little Wakarusa was plugged with earth and concrete in 1979, saving, it was promised, south Lawrence from ever being swept away. Farmers who called for smaller upstream impoundments on that stream, which would leave them more soil to cultivate, were overruled. The cities won, the engineers went to work, and taxpayers across the nation footed the bill.[10]

Now, twenty or thirty years later, historians, biologists, and economists have begun to revisit such decisions, made not only in Kansas but all over the United States and throughout the world in the big-dam building era. The control of nature, they argue, was an illusion. Some have concluded that the engineering of levees and dams may make future floods more disastrous than ever. Whether that will prove to be true or not, we now see that every dam with its reservoir has a lifespan. None will last forever. Concrete disintegrates over time, and reservoirs fill with silt. At best we have implemented, at great cost to our pocketbooks and to the natural environment, a temporary solution that cannot be made permanent. Nor can it be repeated somewhere else. Someday, one way or another, rivers will likely find their way unimpeded again to the sea.

We cannot undo the history of water that we have made. No amount of hindsight, regrets, or wishful thinking can alter the path that has brought us to this point in time. We may admit that we have made mistakes, but what can do we do about them? Some decisions about political boundaries, native vegetation, chemical intensive agriculture, or flood-control works might be unmade or reversed, but doing so can be immensely difficult. Consequently, we generally end up living more or less with the history that we have made—and wondering what that history will allow us to do next.

Even the process of deciding what to do next has changed over time. One of the key stories of 20th-century Kansas is how water has increasingly become the responsibility of government—to manage, protect, and allocate. And not one government, but governments at all levels, governments clashing, fragmenting, competing with one another. Counties, despite their ill-conceived boundary lines, have had to take on difficult matters of water supply, urban growth, flood-plain construction, and public health. The state government seated in Topeka, which in strict legal terms owns the waters of Kansas, has likewise taken on new responsibilities and over the past few decades has set up a state water office, a state water authority, and a state water plan. Like other states, Kansas has established new political entities to manage water, including ground-water management districts and, perhaps most promising of all, watershed associations that resemble John Wesley Powell's model for the West. And then there is the growing role of the federal government, which has acquired considerable power over water through the Geological Survey, the Corps of Engineers, the Fish and Wildlife Service, the Department of Agriculture, and the Environmental Protection Agency.

Water is now intensely bureaucratized. Has that growth in government intervention and government authority brought better decision making? Has it left ordinary citizens more involved or less involved in water planning? Do those diverse public agencies reflect changes going on in our attitudes toward water—a shift, for example, away from water as a mere economic resource and toward water as an ecological or aesthetic value? Whose interests does the water bureaucracy serve? What values does it express?

In looking back over the history of Kansas confronting water and the water cycle, of devising economies and institutions, tools and attitudes, we find successes mixed with failures, wisdom mixed with miscalculation, a gain in adaptability mixed with a persistence of blindness. What is hardest to say is whether we also find an over-all growth toward resilience. Resilience is the ability of an organism or a society to recover from mistakes, change, or misfortune—the ability to survive and endure. It is not clear whether, after nearly a century and a half of institutional change, Kansas is more resilient in its relations with water or more liable to catastrophe.

Perhaps we could use a different teacher. My choice would be the native grasses that we have so thoroughly despised and displaced. Before there was us—Indian or white, Anglo or Hispanic, Christian or Muslim—there was the grass. Grass perfected the art of resilience. Water pounded the grass, ran through the grass, seeped down to the roots of the grass; and then water disappeared, leaving the grass parched and dormant but still alive. Grass endured it all, not over mere decades, but over thousands and even millions of years. In contemplating our future relations with water, Kansas might well learn from the grass as a model of resilience.

Notes

1. [Edwin James], *Account of an Expedition from Pittsburgh to the Rocky Mountains Performed in the Years 1819-20* (Philadelphia: H.C. Carey & I. Lea, 1822). This map was subsequently reproduced in a more popular, colorful version in *A Complete Historical, Chronological, and Geographical American Atlas* (Philadelphia: H.C. Carey & I. Lea, 1822-27).

2. Powell, *Report on the Lands of the Arid Region of the United States,* 45th Congress, 2nd sess., House Executive Document 73 (1878), p. 4.

3. See James Earl Sherow, *Watering the Valley: Development along the High Plains Arkansas River, 1870-1950* (Lawrence: University of Kansas Press, 1990).

4. Henry Nash Smith, *Virgin Land: The American West as Symbol and Myth* (Cambridge, Mass.: Harvard University Press, 1950), p. 123.

5. Reid A. Bryson and Thomas J. Murray, *Climates of Hunger: Mankind and the World's Changing Weather* (Madison: University of Wisconsin Press, 1977), p. 44.

6. See http://www.ncdc.noaa.gov/oa/climate/globalwarming.html

7. John Opie, *Ogallala: Water for a Dry Land* (Lincoln: University of Nebraska Press, 1993), p. 143. See also Rex Buchanan and Robert Buddemeier, "The High Plains Aquifer," *Public Information Circular 18*, Kansas Geological Survey, September 2001.

8. Martin Sophocleous and Robert S. Sawin, "Safe Yield and Sustainable Development of Water Resources in Kansas," *Public Information Circular 9,* Kansas Geological Survey, October 1997.

9. Theo Colburn, Dianne Dumanoski, and John Peterson Myers, *Out Stolen Future* (New York: Penguin, 1996); http://www.i-sis.org.uk/atrazine.php; and Judith D. Soule and Jon K. Piper, *Farming in Nature's Image: An Ecological Approach to Agriculture* (Washington, D.C.: Island Press, 1992), pp. 31-50.

10. Dale Nimz. "Rivers That Work: Environment, Engineering, and Policy Change in the Kansas River Basin," Ph.D. dissertation, University of Kansas, 2003. See also Dennis S. Mileti, *Disasters by Design: A Reassessment of Natural Hazards in the United States.* Washington, D.C.: Joseph Henry Press, 1999.

When the Well Runs Dry: The Value of Irrigation to the Western Kansas Economy

John C. Leatherman, Hanas A. Cader and Leonard E. Bloomquist

The authors wish to thank reviewers at the *Kansas Policy Review* for helpful comments that improved the clarity of presentation. Any remaining errors are the sole responsibility of the authors.

Abstract

In western Kansas, irrigated crops production has given rise to one of the world's premier livestock production and food processing industries. Given current usage trends, however, portions of the Ogallala Aquifer will become effectively exhausted for irrigated agricultural use in the foreseeable future. Without irrigation, highly productive farmland in western Kansas will begin reverting to dryland farming. This research provides preliminary estimates of how the loss of irrigated agriculture might affect the western Kansas economy. A social accounting matrix, a system of accounting that comprehensively charts the financial flows of a region, is used to estimate the overall importance of agriculture in the northwestern, west central and southwestern regions of the state. An analysis provides estimates of the impacts of removing the additional value irrigation adds to crops production. Without irrigation, the economy would shrink by an estimated one-half billion dollars in total output and nearly $140 million total value added annually. About 3,300 jobs would be lost. Various scenarios explored associated losses to livestock production and meat processing.

Introduction

Despite a long period of national economic growth and expansion during the 1990s, many rural communities throughout the Great Plains continued to experience population out-migration and economic decline. This pattern has been evident throughout much of western Kansas. Yet, even there, a number of communities such as Garden City, Dodge City and Liberal have thrived and grown. In large measure, the relative prosperity can be attributed to the underground water resources that support irrigated agriculture, and in turn livestock production and meat packing. But, those water resources are finite, leading many to speculate about what lies ahead when pumping water for irrigation becomes financially prohibitive.

In this paper, we offer a glimpse of what may lie ahead by presenting the direct and indirect impacts associated with a scenario wherein the crops production associated with irrigated agriculture is removed from the region's economy and replaced by a dryland production regime. While we know that certain areas of western Kansas still have relatively abundant water supplies and can assume that water use technologies and efficiencies will continue to improve, other areas are at or near exhaustion. Still, this cautionary tale presages what may lie ahead sooner for some areas and eventually for all should current water use trends continue unabated.

The paper continues with a discussion of the dwindling water resources and agricultural crops production in the Ogallala Aquifer region of western Kansas. We provide estimates of the importance of agricultural production through the use of a social accounting matrix of the region, an accounting system that comprehensively models the economy. To estimate the economic impacts of irrigated agriculture, we assume all value associated with the incremental increase in crops production for irrigated lands is lost. The social accounting matrix then projects the combined direct and indirect impacts to the economy.

Background[1]

Overall, the 1990s was a good decade for many nonmetropolitan areas of America (Fuguitt and Beale 1996; Johnson 1999; Johnson and Beale 1994, 1998a, 1998b). While those places having proximity to metropolitan areas or possessing natural amenities experienced population growth, many other remote, agriculturally-dependent, and "amenity-poor" rural communities continued to lose population. In rural areas of the Great Plains, population out-migration has been especially persistent and widespread (Albrecht 1993; Rathge and Highman 1998). For these places, persistent population loss has been associated with growing labor shortages, aging populations, rising poverty, and an increasing deficit of human capital resources necessary to maintain economic viability. Yet, even within these remote regions, some rural communities have experienced stability and growth in recent decades. Such has been the case in certain portions of the Ogallala Aquifer region of western Kansas.

The Kansas Ogallala region includes 32 western counties in Kansas that overlie the Ogallala and other water bearing aquifers. Agricultural production in the region includes both dryland and irrigated crops production and livestock ranching. The groundwater resources have spurred the development of intensive irrigated agriculture in the region. Its high-yielding feed grain production supports a large-scale feedlot industry, which in turn supports one of the world's premier

beef packing industries (Broadway 1995, 2000; Bussing and Self 1981; Drabenstott, Henry and Mitchell 1999; Saito and Yagakaki 1998).

The 2000 census showed that the region had a total population of 209,515 persons, residing in or near 91 incorporated places (Figure 1). Most of these are small farm communities. Three important exceptions are Garden City, Dodge City and Liberal, the major urban centers of the region, whose combined population accounted for just over one third of the region's total. Local businesses also have become increasingly concentrated in these urban centers, to the detriment of both small towns in the nonirrigated areas and in counties with high levels of irrigation but without a large urban center (Williams and Bloomquist 1996).

Over the past several decades, different parts of the Ogallala region have experienced varying rates of population growth and demographic change due to the irrigated agriculture development patterns and the associated value-added industries. During the 1990s, the region as a whole gained 7.5% in population, or 14,649 people. However, 46 of the 91 incorporated places lost population. Population decline was most acute in the smallest communities, with some of them losing as much as 30% over the decade.

Irrigation also appears to be an important factor shaping rural demographic change in the region. Irrigated areas have had faster population growth, lower median ages, and usually more success in retaining local youth. The thriving feedlots and beef packing industries have also attracted a substantial number of Latino and Asian immigrants to places like Garden City, Dodge City and Liberal (Benson 1994; Broadway 1994). In comparison, the non-irrigated areas tend to have experienced persistent population loss and an aging of their populations. The shrinking population in many small towns of the region has created a very difficult situation for the people that remain.

That irrigation plays an important role in sustaining the rural population in the Kansas Ogallala region raises a concern about the long-term economic sustainability of its communities. The saturated thickness of the Ogallala Aquifer and the related usable lifetime of the groundwater vary considerably across the region. Figures 2 and 3 depict the saturated thickness and estimated usable life of the High Plains Aquifer in Kansas. The Ogallala is a substantial and important component of the High Plains Aquifer. In the Kansas portion shown in Figures 2 and 3, the Ogallala comprises the three western lobes of the aquifer. The southeastern lobe is hydrologically distinct from the Ogallala. The primary difference between the Ogallala and additional peripheral water bodies comprising the High Plains Aquifer in that its rate of recharge is much slower and its withdrawal is occurring at an unsustainable pace.

Some areas of western Kansas will have groundwater supplies available for many years to come. In the southwest, in particular, there exists areas with supplies that should last for many decades, and depletion is problematic only around the periphery. In other areas, the economic depletion of the aquifer is complete or rapidly approaching. The future of many communities in the study area and in other parts of the Ogallala Aquifer region may very well hinge upon their ability to adjust to the "planned depletion" of the aquifer.

Figure 1
Incorporated Places in the Kansas Ogallala Region, Kansas

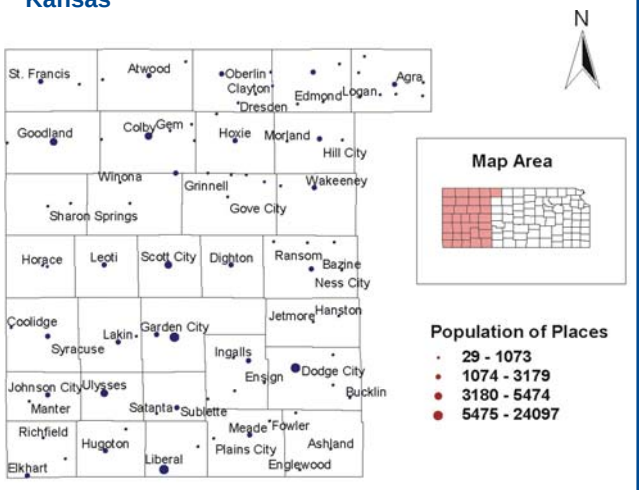


Figure 2
Saturated Thickness of the High Plains Acquifer

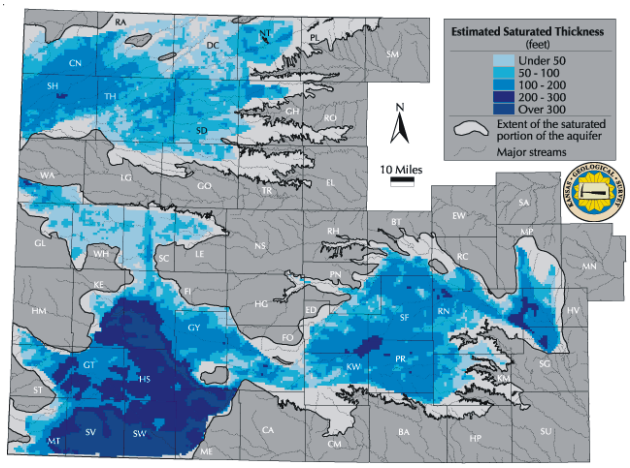
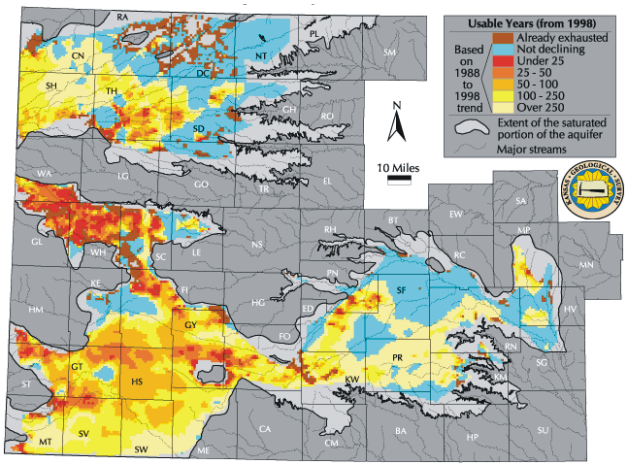


Figure 3
Estimated Usable Lifetime of the High Plains Acquifer*

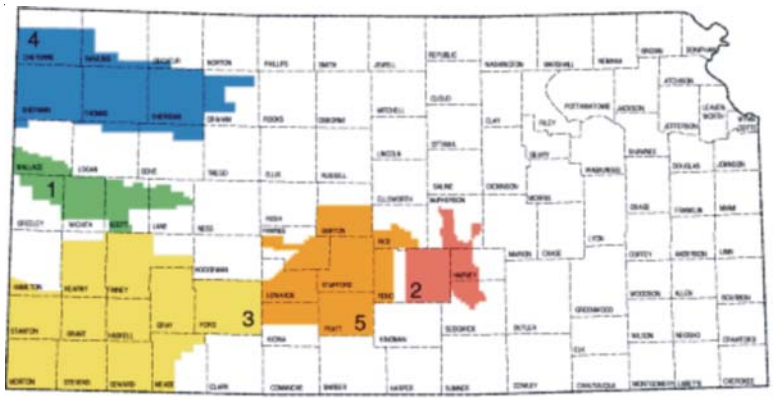


*Useable lifetime is exhausted when saturated thickness is 30 feet or less.

In response to concerns relating to the depletion of the Ogallala and High Plains Aquifers, Kansas has established local units of government, called groundwater management districts, to provide water-use administration, planning, and information. Five groundwater management districts were created in the 1970s in the western and central parts of the state (Figure 4). The primary use of ground water in these areas is irrigation, although several districts also face issues of municipal supply.

For purposes of this analysis, we focus on the area encompassing Groundwater Management Districts 4, 1, and 3. These are part of the Ogallala Aquifer system, and are especially susceptible to depletion because their hydrologic characteristics do not allow replenishment in a time frame conducive to current usage patterns.

Figure 4
Kansas Groundwater Management Districts



Crops Production in the Ogallala Region

For purposes of tracking agricultural production in the state, the Kansas Agricultural Statistics Service divides the state into nine agricultural statistics districts. The three western-most districts correspond closely to the groundwater management districts and serve as the focus for this study (Figure 5).

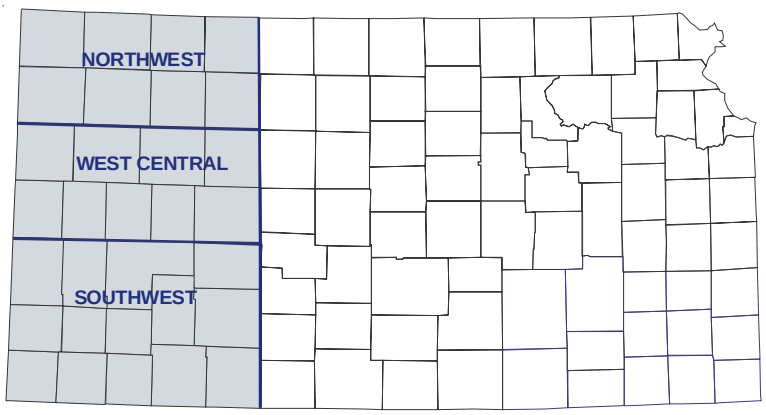
The three western agricultural districts are highly productive crops producers, especially for field corn and wheat. Examination of Figure 6 suggests the most productive areas correspond closely to areas with available groundwater.

Additional detail relating to county and regional commodity production is shown in Table 1. The three districts combined to annually produce about a half-billion dollars worth of corn and another $375 million worth of wheat on average from 1997 through 2001.

A fairly high percentage of this value is directly attributable to irrigation. Estimates of the value of irrigation are provided in Table 2. The values reported are inflation-adjusted five-year averages. This estimation technique assumes that without irrigation, the existing county dryland cropping regime would be substituted on the irrigated acreage after deducting for some percentage of land that would be assumed to go fallow. The share of land going fallow was assumed to be 30 percent in the northwestern region counties, 33 percent in the west central region counties, and 40 percent in the southwestern region counties. The regional shares selected were somewhat arbitrary, but not unreasonable according to farmers familiar with the region.

Assuming the dryland cropping regime, the value of corn production declines dramatically. Approximately 80 percent of the average value of corn production would likely be lost without irrigation, driven by huge losses in the southwestern region. Production of other more drought-resistant crops would increase, but their value would not nearly replace the value of corn production. The substantial reliance of corn production on irrigation suggests that neither livestock production or food processing could be maintained at its current levels without access to groundwater resources.

Figure 5
Western Kansas Agriculture Statistics Districts



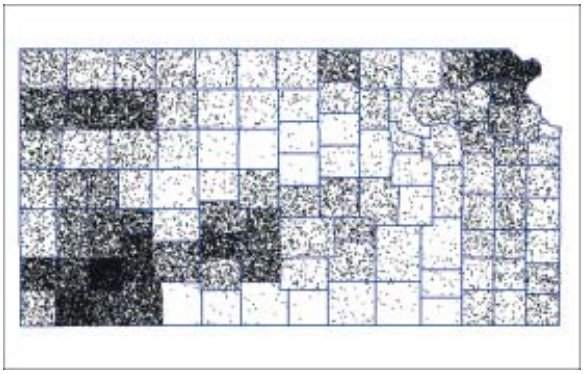
Social Accounting Matrix Analysis

As a descriptive tool, social accounting matrix (SAM) analysis can be thought of as an accounting system that comprehensively accounts for financial flows in a region at a point in time. As an analytic tool, SAM analysis represents transactions between economic sectors and institutions (households, enterprises, government). Given these interpretations, the SAM model can be used to assess the impacts of alternative policies and economic events in the regional economy (Pyatt and Round 1985).

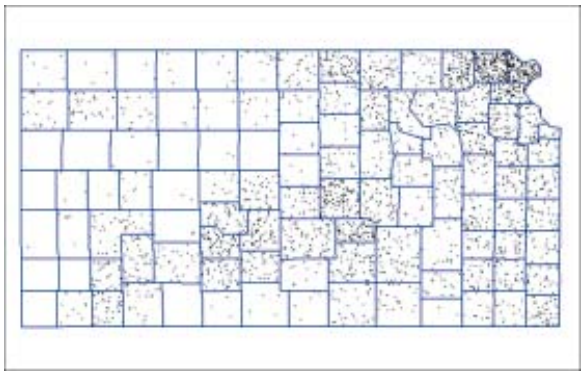
The simplest and most efficient way to represent the interaction between economic sectors and institutions

Figure 6
Selected Kansas Crops Production, 2000

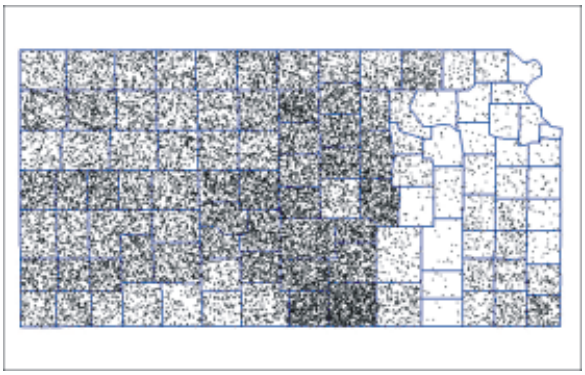
Corn Production



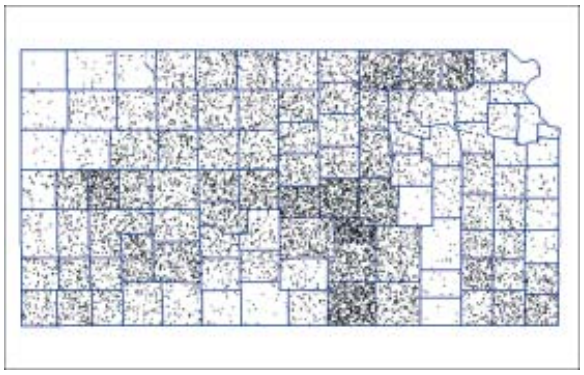
Soybean Production



Wheat Production



Sorghum Production



Note: Each dot represents 15,000 bushels.
Source: Kansas Farm Facts, 2001.

Table 1
1997-2001 Average Annual Value of Production for Selected Commodities in Western Kansas (2001$)

County & District	Corn	Sorghum	Hay & Pasture	Soybean	Sunflower	Wheat
Cheyenne	9,820,580	217,358	1,987,894	581,154	1,655,272	11,737,478
Decatur	9,140,410	2,288,658	2,988,874	442,873	364,280	11,372,549
Graham	4,896,612	4,225,413	2,643,773	0	0	8,520,156
Norton	7,972,000	3,220,886	2,863,977	0	153,069	9,430,047
Rawlins	7,340,574	2,280,305	4,798,314	0	793,650	14,350,013
Sheridan	27,989,640	3,608,232	3,030,917	0	0	12,178,219
Sherman	23,789,353	1,002,926	2,368,010	1,326,966	4,323,669	16,747,363
Thomas	32,428,191	3,945,497	1,674,302	1,967,745	1,448,865	19,317,134
Other Counties[1]	0	1,851,414	0	1,496,809	681,557	0
Northwest	123,377,364	21,082,729	22,356,063	7,186,531	9,290,259	103,352,944
Gove	7,545,985	7,180,313	2,301,636	408,121	0	12,104,978
Greeley	2,783,092	2,189,751	621,681	0	241,855	15,727,063
Lane	2,929,254	5,142,899	526,043	396,659	207,313	11,794,372
Logan	5,751,333	3,481,452	1,075,139	0	326,989	11,158,285
Ness	873,751	4,795,048	2,433,853	0	161,806	13,148,601
Scott	11,560,736	10,032,684	787,350	357,667	107,650	14,974,926
Trego	1,969,453	4,099,466	2,602,662	0	0	9,887,040
Wallace	11,371,705	671,925	1,378,642	0	1,167,036	7,320,303
Wichita	11,148,120	6,134,923	1,933,146	0	468,792	14,514,907
Other Counties	0	3,300,536	0	1,349,862	769,793	0
West Central	57,933,433	44,812,131	13,660,157	2,899,745	3,451,234	110,630,613
Clark	428,404	1,758,892	2,788,695	0	0	5,129,557
Finney	34,249,726	7,509,650	25,119,034	2,213,686	333,525	19,398,837
Ford	18,712,852	8,516,373	8,286,467	1,577,940	52,079	16,454,881
Grant	19,982,356	2,517,066	6,392,146	0	328,763	9,831,729
Gray	40,329,391	7,134,596	13,846,190	2,025,052	0	15,609,334
Hamilton	3,701,389	3,988,647	4,373,724	0	0	13,249,825
Haskell	51,388,290	2,329,235	2,556,758	1,347,035	360,170	12,412,063
Hodgeman	2,641,788	3,681,382	1,994,495	245,173	0	10,547,857
Kearny	17,359,871	3,110,230	13,934,175	297,429	51,320	11,076,483
Meade	30,721,190	3,273,107	3,265,103	1,678,420	25,941	8,562,809
Morton	6,481,157	3,762,358	1,493,816	0	73,655	8,864,593
Seward	20,425,099	2,736,613	7,066,217	1,004,251	28,937	5,634,804
Stanton	25,493,727	3,082,366	2,062,634	0	109,740	12,968,819
Stevens	39,393,494	5,479,105	6,245,217	316,448	273,546	9,242,740
Other Counties	51,908,863	1,691,154	0	646,692	674,270	0
Southwest	311,357,565	60,596,941	99,424,687	13,312,727	2,631,488	158,984,375
Western KS	492,668,189	126,491,801	135,440,437	23,399,003	15,372,981	372,967,932

[1]Other counties includes values that had been suppressed from individual county totals.
Source: Kansas Farm Facts, various years.

within a region and with the rest of the world is through a transactions table. A transactions table is a square matrix that identifies all of the economic entities within a region, including production sectors, households, business enterprises, and governments. It includes accounts to represent their purchases, sales, taxes, savings and trading relationships between each other and with the rest of the world. The SAM describes

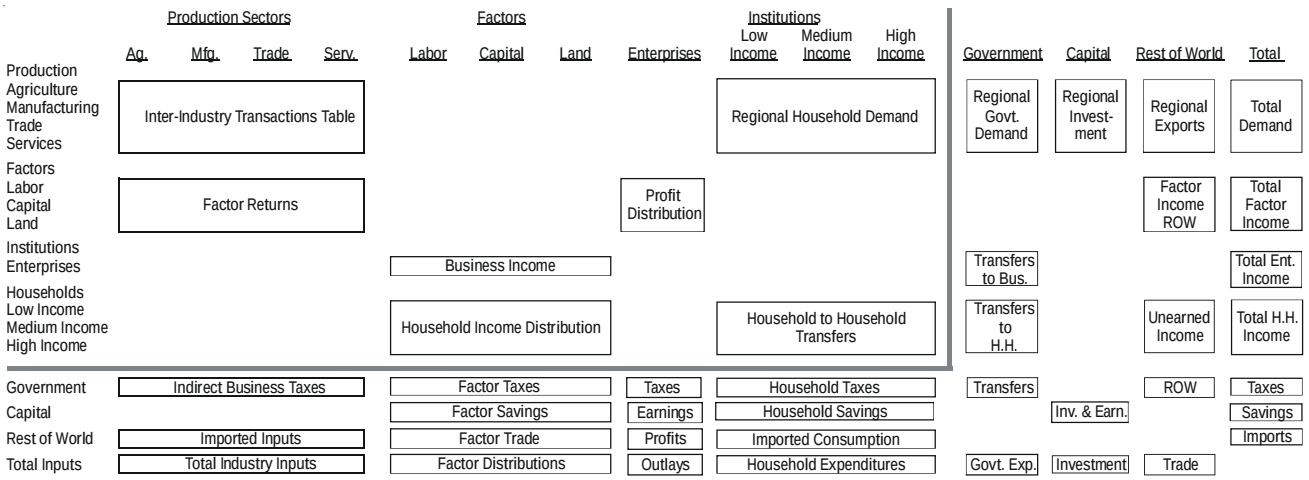
Table 2
Estimated Change in the Total Value of Production by Type of Crop Assuming Only Dryland Production in Western Kansas (2001$)

County & District	Corn	Sorghum	Soybean	Hay & Pasture	Wheat	Sunflower
Cheyenne	-8,462,676	-94,037	-325,199	330,768	1,210,598	5,366,890
Decatur	-2,126,404	-3,443	-242,249	143,735	358,452	15,858
Graham	-1,450,899	-69,071	-37,887	110,409	214,224	0
Norton	-1,561,063	31,426	-85,196	105,078	227,286	5,027
Rawlins	-2,991,840	-7,818	-122,467	247,933	427,424	41,060
Sheridan	-20,151,574	711,996	-522,832	859,865	2,370,403	0
Sherman	-20,987,299	-37,536	-753,535	699,859	1,215,402	1,617,422
Thomas	-24,463,371	425,263	-1,000,873	340,251	2,611,360	289,559
Other Counties	0	323,297	-660,628	0	0	496,410
Northwest	-81,209,364	1,590,576	-6,394,574	3,490,658	9,638,816	1,486,159
Gove	-2,717,283	141,238	-190,674	11,625	301,239	0
Greeley	-3,979,628	-7,491	-51,577	61,116	132,191	21,624
Lane	-2,066,064	-75,127	-221,173	38,906	78,309	15,258
Logan	-3,129,908	27,561	-241,996	59,226	363,508	13,185
Ness	-435,475	-65,655	-62,355	43,777	21,402	2,631
Scott	-7,788,094	302,893	-204,792	116,694	197,750	14,032
Trego	-545,486	-20,091	-83,426	54,041	22,008	0
Wallace	-9,696,019	-51,797	-51,519	379,540	526,943	353,284
Wichita	-9,113,000	-95,323	-233,670	476,307	-488,794	116,564
Other Counties	0	23,467	-215,227	0	0	2,124
West Central	-39,455,940	345,766	-2,577,369	1,440,034	1,459,674	344,854
Clark	-310,254	-32,230	-75,839	98,947	117,301	0
Finney	-33,203,659	1,126,895	-1,293,862	10,364,451	2,464,641	134,409
Ford	-17,812,760	-87,842	-937,530	1,640,850	1,357,056	10,006
Grant	-18,343,462	-459,235	-89,610	3,947,140	-2,870,401	200,437
Gray	-39,339,405	1,650,730	-1,196,205	6,589,396	87,831	0
Hamilton	-3,183,873	-218,420	-63,685	259,975	295,896	0
Haskell	-48,837,437	1,787,600	-727,594	3,893,406	-1,411,239	299,195
Hodgeman	-2,356,479	-306,255	-142,550	188,385	-382,830	0
Kearny	-15,378,880	271,813	-158,997	3,319,416	387,348	-51,320
Meade	-24,047,852	-373,205	-993,968	1,930,106	647,238	80,859
Morton	-6,159,227	-142,154	-28,175	337,300	-1,001,958	14,037
Seward	-15,551,629	-82,618	-584,547	3,634,001	-960,602	151,523
Stanton	-24,180,115	587,763	-40,024	1,387,718	-1,418,939	-109,740
Stevens	-37,852,312	1,715,151	-144,170	4,631,951	-3,351,445	274,631
Other Counties	-10,139,798	1,513,953	-119,080	0	0	118,063
Southwest	-298,068,350	6,147,627	-12,847,520	40,951,883	-6,224,401	1,101,475
Western KS	-418,733,654	8,083,969	-21,819,463	45,882,575	4,874,089	2,932,488

the full circular flow of economic transactions occurring in the economy (Keuning and de Ruijter 1988). It comprehensively accounts for all types of economic transactions, thereby allowing a wide range of impact and policy analyses.

A schematic of a social accounting matrix appears in Figure 7. A SAM can be thought of as consisting of four quadrants. The partitioned quadrant in the upper left depicts the region's economy. Economic activity flows in a counter-clockwise flow. Leakages from the

Figure 7
Simplified Single-Region Social Accounting Matrix



region flow to the lower-left quadrant in the form taxes, savings and imported purchases. Inputs into the region flow from the upper-right quadrant in the form of non-local demand for regional goods and services and from various transfer payments and non-local sources of income. The lower-right quadrant includes a variety of balancing accounts to ensure that all inputs equal outputs.

More formally, following Adelman and Robinson (1986), assuming households are endogenous and using matrix notation and the framework applied in this research, the endogenous portion of the SAM appears as:

$$(1) \qquad A^* = \begin{bmatrix} A00C \\ F000 \\ 0Y00 \\ 00HT \end{bmatrix}$$

where: A^* is the SAM matrix of direct coefficients ($n + f + m + k$, $n + f + m + k$)
A is the matrix of direct coefficients for production activities (n, n)
F is the matrix of factor income (value added) coefficients (f, n)
Y is the matrix of factor income distribution coefficients (m, f)
C is the matrix of household expenditure coefficients (n, k)
H is the matrix of household income distribution coefficients (k, m)
T is the matrix of inter-institutional transfer coefficients (k, k)
n is the number of production sectors
f is the number of factors
m is the number of institutions
k is the number of household income classes

Combining households and institutions, the balance equation for supply and demand can be written:

$$(2) \qquad \begin{bmatrix} X \\ F \\ Y \end{bmatrix} = A^* \begin{bmatrix} X \\ F \\ Y \end{bmatrix} + \begin{bmatrix} ex \\ ef \\ ey \end{bmatrix}$$

where: X is a vector of sectoral supply (n, 1)
F is a vector of factor income categories (f, 1)
Y is a vector of institutional incomes ($m + k$,1)
ex is a vector of exogenous demand for regional commodities (n, 1)
ef is a vector of factor income (f, 1)
ey is a vector of exogenous institutional income ($m + k$, 1)

A SAM inverse multiplier matrix is calculated by inverting the (I-A^*) matrix that related regional sectoral supply, factor incomes, and institutional incomes to exogenous demand. This is of the form:

$$(3) \qquad \begin{bmatrix} X \\ F \\ Y \end{bmatrix} = M \begin{bmatrix} ex \\ ef \\ ey \end{bmatrix}$$

where M is the $(I\text{-}A^*)^{-1}$ inverted coefficients matrix.

The inverted coefficients matrix yields the SAM multiplier table. The model is completely demand driven, with no supply constraints specified. Changes in demand are introduced through the exogenous vectors. In our analysis the exogenous changes take the form of the incremental reduction in crops production value associated with irrigated agriculture.

Economic Analysis and Assumptions

To conduct the analyses of the economic impact of irrigation, the IMPLAN system was used to construct a SAM for each of the three regions calibrated to 2000, the most recent year for which data were available (Minnesota IMPLAN Group 1999). Within the SAMs are a variety of information about the regional economies during 2000. Several descriptive items were extracted from the SAMs and are reported in Table 3.

Industry output serves as the broadest measure of economic activity, and can be thought of as a gross regional product. Output might be roughly interpreted as the total value of net regional sales necessary to accommodate both internal and external demand for regional goods and services. Employment figures represent estimates of total employment, including all full- and part-time jobs. Several measures of regional income are reported. Labor income represents employee compensation (salaries and wages) plus proprietary income from farming and small business proprietorships. Total income is the broadest income measure and includes employee compensation, proprietary income, other property income (dividends, interest, rents, corporate profits, etc.) and indirect business taxes (primarily sales taxes). Technically, total income is called value added and represents the broadest measure of income generated by regional economic activity.

In 2000, the eight northwestern counties accounted for about $2 billion worth of output, 27,000 jobs and nearly $1 billion in total income. The nine west central Kansas counties had about the same total value of output, about 18,000 jobs and over a half-billion dollars total income. The 14-county southwestern region, which includes the major urban cities, is the largest region, by far. In 2000, the southwestern region accounted for nearly $13 billion in output, about 88,000 jobs and $3.5 billion in total income.

Considering the distribution of economic activity across the economic sectors in each of the regions, agriculture plays an important role. Across the regions, agriculture was typically the first or second largest source of sales. Other sectors, however, typically serve as primary sources of income and jobs. Trade, services and government (including schools) are other important sources of economic activity. The importance of meat packing in the southwestern district is observed in the manufacturing sector.

When considering questions relating to the relative contribution of different economic entities, direct measures of output, jobs and income provide one indication. It is well known, however, that different economic sectors, households, and other entities are closely tied such that activity in one area of the economy "ripples" to affect other economic sectors and entities. More precisely, there are two primary sources for the "ripple effect." The first arises from businesses buying and selling to one another during the process of producing goods and services. The second source of impact arises from households spending labor income for typical household goods and services. This household spending tends to broadly distribute the economic impact of an event. For example, if a meat packer gets a new order for $1 million worth of meat, the firm will call in more labor who, in turn, will spend their wages on a wide variety of goods and services.

A SAM can be used to measure the ripple effect of individual economic sectors. This is done by creating economic multipliers for each of the industry sectors. Multipliers are estimated for households, as well, to capture the effects of household spending.

To estimate the total "economic impact" of the industry and household sectors, it is important to distinguish between the various sources of impact. To be fair, distinctions should be made between the impact that arises as a result of interactions between entities exclusively *within a region* and the interactions between regional entities and the *rest of the world*.

For this analysis, we only consider economic activity associated with non-local demand for locally-produced goods and services as well as other income attracted to the region from non-local sources. It's the capacity to draw income/revenue from outside the region that creates impact beyond that which would otherwise exist serving only endogenous demand. Thus, to complete the analysis of the impact of agriculture (and other sectors), we multiply the regional multiplier matrix by a vector representing final demand (money coming from outside the region).

Table 4 shows the share of economic activity associated with various industry sectors and household income groups. Three types of shares are shown: total output, total income (generated from regional production), and household income (income from all sources). Households are split into nine income classes.

To interpret the information in the table, read down the column. For the industry sectors, the values represent the share of total output (total income and household income) associated with external demand for the goods and services produced by that sector. For

Table 3
Structure of the Western Kansas Economy (2000$)

	Industry Output (millions)	Employment (number)	Labor Income (millions)	Total Income (millions)
Northwestern KS				
Agriculture	527.659	4,802	57.989	138.742
Mining	86.414	513	9.977	26.270
Construction	156.369	1,539	46.532	52.816
Manufacturing	110.513	601	15.628	21.628
TCPU[1]	196.984	1,043	39.634	82.318
Trade	226.518	5,709	97.568	156.934
FIRE[1]	207.342	1,342	33.633	141.570
Services	238.884	6,272	121.181	40.238
Government	169.249	5,078	124.919	143.796
Totals	1,918.955	27,008	547.863	903.341
West Central KS				
Agriculture	1,185.386	5,102	70.822	144.880
Mining	25.539	147	2.524	7.010
Construction	75.807	871	18.758	21.933
Manufacturing	77.640	357	9.906	14.271
TCPU	171.607	998	34.357	72.311
Trade	160.133	3,410	69.202	112.002
FIRE	143.812	898	22.265	98.597
Services	118.377	2,883	52.163	64.528
Government	115.236	3,772	85.252	96.959
Totals	2,073.618	18,606	366.510	632.580
Southwestern KS				
Agriculture	2,862.490	9,583	143.538	279.128
Mining	346.191	1,619	43.374	121.316
Construction	568.447	5,721	170.208	195.565
Manufacturing	5,106.7131	4,385	475.014	601.067
TCPU	1,103.779	4,160	180.392	386.911
Trade	798.593	17,524	348.333	562.066
FIRE	639.094	3,778	104.006	440.715
Services	818.606	15,990	367.139	443.197
Government	529.080	15,082	414.214	473.757
Totals	12,769.623	88,425	2,251.053	3,500.371
Western KS Total	16,762.196	134,039	3,165.426	5,036.292

[1]TCPU is transportation, communication, & public utilities; FIRE is finance, insurance & real estate.

the household income groups, the values represent the share of total output (total income and household income) associated with externally-generated income for each household income class.

In the case of northwestern Kansas, about 84 percent of total output were associated with industry production of goods and services. About 16 percent was associated with household income transfers from outside the region. Agricultural production was closely associated with about 40 percent of all output in the region. After taking into account all the direct and indirect linkages, it was associated with about 30 percent of total income from production and 17 percent of all household income in the region.

Table 4
Percentage of Total Economic Activity Associated with Industries and Household Income Groups by Region in 2000

	Northwest Kansas			West Central Kansas			Southwest Kansas		
	Total Output	Total Income	Household Income	Total Output	Total Income	Household Income	Total Output	Total Income	Household Income
Industry									
Agriculture	40.2	30.5	17.2	42.9	26.5	18.7	40.9	30.6	19.4
Mining	5.2	4.3	2.4	0.4	0.3	0.2	0.5	0.6	0.3
Construction	12.1	10.9	7.6	2.4	2.4	2.1	8.6	10.0	7.4
Manufacturing	2.0	1.4	0.9	2.7	2.4	1.8	29.0	23.1	15.7
TCPU	6.5	6.4	3.7	4.8	4.7	3.6	2.4	3.0	1.8
Trade	2.0	2.8	1.7	3.8	4.3	3.2	1.0	2.0	1.3
FIRE	1.3	1.8	0.9	2.5	3.1	2.2	0.5	1.0	0.5
Services	1.5	1.8	1.3	4.3	5.5	4.0	1.1	1.8	1.4
Government	12.9	20.1	14.2	32.1	44.2	33.9	6.5	15.1	11.8
Subtotal	83.7	79.9	49.8	95.8	93.4	69.7	90.4	87.0	59.6
Households									
< $5k	1.6	2.0	4.6	0.3	0.5	2.2	0.8	1.1	3.2
$5-$10k	1.5	1.8	4.2	0.3	0.5	2.2	0.6	0.8	2.3
$10-$15k	3.3	4.0	9.5	0.8	1.2	5.2	1.9	2.5	7.1
$15-$20k	3.2	4.0	9.4	0.7	1.1	4.7	1.6	2.1	6.2
$20-$30k	2.9	3.6	8.9	0.7	1.1	5.0	1.8	2.5	7.4
$30-$40k	1.5	1.9	5.0	0.5	0.8	3.8	1.2	1.6	5.5
$40-$50k	1.2	1.4	4.1	0.4	0.6	3.2	0.9	1.2	4.2
$50-$70k	0.7	0.8	2.4	0.2	0.4	2.2	0.5	0.7	2.6
$70k+	0.5	0.6	2.0	0.2	0.3	1.9	0.4	0.5	2.1
Subtotal	16.3	20.1	50.2	4.2	6.6	30.3	9.6	13.0	40.5
Totals	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Among the interesting findings of the analysis are those associated with the household income column and the household income classes. Reading down the household income column, only about 60 percent of household income comes from regional production activity. This is to say that only about 60 percent of regional household income comes from working within the region. The rest of the income comes from sources outside the region. These sources include Social Security payments, pension payments, non-local investment income and government transfer payments, such as commodity support payments. Few realize the significance of federal government transfer payments to household well-being.

In the area of the table representing household income classes, the share of regional economic activity associated with the receipt of non-local income is shown. Between perhaps five and 15 percent of total regional output is dependent on that income. About ten to 15 percent of all income in the region generated by regional industries is dependent on outside income transfers. And, 30 to 40 percent of total household income comes from non-local sources.

Note the differences observed across the income class groups. The larger percentages observed in the classes in the lower income classes up to about $40,000 or $50,000 suggests these are the income groups that have the largest relative impact on local economic activity. In general, the middle income groups will have the largest relative impact on regional economic well-being, followed by the lower income groups. The highest income groups will typically have a lesser relative impact. This finding is particularly relevant to rural areas where we have observed long-term trends of population out-migration and the bifurcation of the income distribution, where high income households are controlling greater shares of wealth and households tend to be clustering at the low and high ends of the income distribution (Stauber 2001).

In general, the results across the regions confirm the importance of agriculture to the area's economy. Only in southwestern Kansas with its meat packing industry does the impact of another sector approach that of agriculture. Thus, it is appropriate to be concerned about that which threatens the region's economic base. Such is the case with the dwindling supply of irrigation water.

Economic Impacts of Irrigation

To estimate the economic impact of irrigation and imply potential losses should it become economically unavailable, we shocked our multiplier matrix with a vector of changes in the value of production to food grains, feed grains, hay & pasture, and oil bearing crops accounts (Table 2). The value of the changes was established by first assuming that some of the irrigated acreage would go fallow were irrigation eliminated. The share of land going fallow was assumed to be 30 percent in the northwestern region counties, 33 percent in the west central region counties, and 40 percent in the southwestern region counties. On the remaining formerly-irrigated acreage, a crop regime identical to the existing dryland patterns in each county was assumed to exist. The level of production and prices for the dryland crops were established using the 1997-2001 inflation-adjusted averages (2001$). Thus, the economic shock consisted of the incremental value of irrigation, given the methods of valuation and the assumption of an alternative land use. Table 5 estimates the impacts across several dimensions of the private economy.

Reviewing the water depth and availability information presented earlier, recall that the west central region is currently at greatest risk of running out of economically available irrigation water in the relatively near-term. The northwest region is at risk in the relative mid-term, and the southwest region is at risk in the long-term. Within each of these regions, specific areas are at greater or lesser risk. For our analysis, we simply eliminated all of it. This, then, represents a gross worst-case scenario in present terms, and does not take into account any future adjustments in technologies or efficiencies, or the future value of money. While such simplifying assumptions raise legitimate questions regarding analysis validity, we believe there is relatively greater value to raising questions about potential future conditions while there remains time to make rational policy choices. The estimates are only intended to create awareness about the direction of impacts and their potential scale and scope.

Looking first at the west central region, the direct loss of value associated with irrigation was about $38.5 million annually (see Table 2). When all the direct and indirect effects are counted, the total annual loss to the economy was estimated to be about $52 million worth of output, $14 million in all types of income and about 380 jobs. While concentrated in the agricultural sector (including agricultural services where many closely-allied jobs are located), the impacts were widely spread throughout the economy to many interconnected sectors.

In northwestern Kansas, the direct reduction in output associated with irrigated agriculture was assumed to be about $71 million annually. There, total annual output declined by about $99 million, about $35 million in all type of income were lost and the number of jobs declined by about 800. The southwest has the largest irrigation values. The assumed loss was over $298 million annually. The associated impacts totaled an annual reduction of about $375 million in output, nearly $89 million in all types of income, and about 2,200 jobs were lost.

Across the entire region, if all irrigated agriculture returned to dryland farming, the potential impact could exceed one-half billion dollars in total annual output, 3,300 jobs, and nearly $140 million in all types of income lost. For perspective, this would represent a permanent annual reduction of between about two and three percent of the economy, depending whether we are considering levels of output, employment or income.

Potential Indirect Impact of Irrigation

The analysis, thus far, has limited identification of impacts to those directly connected to pre-harvest crops production. It is known, however, that the western Kansas economy consists of a large vertically-integrated food processing system. Abundant feed grains supply livestock feedlots that in turn finish cattle for processing and shipment. An inspection of Kansas ES-202 unemployment compensation tax records for 2000 showed that there were 126 feedlots employing nearly 2,200 people and five major meat processing facilities employing over 12,000 people in the study region.

Assuming a dramatic reduction in the production of feed grains upon which this system rests, it would be reasonable to believe that at least some of this forward-linked activity also would be affected. Indeed, most analysts believe the eventual destination of much livestock production will shift north into western Nebraska where Ogallala water supplies are much more abundant. To gather some sense of the scale of this integrated system of activity, the analysis is extended to incorporate several scenarios involving the simultaneous reduction in livestock feedlot and meat packing activities.

Table 5
Estimated Direct and Indirect Annual Reductions in Regional Economic Activity Associated with Conversion to Dryland Agriculture (2003$)

	Total Output	Employment	Labor Income	Total Income
Northwestern KS				
Agriculture	-77,588,456	-539	-7,431,122	-23,011,876
Mining	-766,822	-4	-80,684	-222,752
Construction	-1,025,126	-18	-597,307	-656,677
Manufacturing	-709,549	-5	-133,663	-183,085
TCPU	-3,990,814	-28	-979,551	-1,699,306
Trade	-7,190,840	-122	-3,035,378	-4,963,307
FIRE	-4,075,530	-31	-610,660	-2,776,316
Services	-2,964,154	-60	-1,344,128	-1,615,744
Government	-743,245	-4	-152,135	-233,277
Totals[1]	-99,067,926	-813	-14,377,997	-35,375,709
West Central KS				
Agriculture	-42,240,796	-274	-3,002,301	-9,117,972
Mining	-233,899	-1	-23,113	-64,205
Construction	-231,498	-5	-119,319	-133,722
Manufacturing	-658,542	-4	-100,56	8-142,288
TCPU	-2,484,483	-19	-611,660	-1,062,577
Trade	-2,937,745	-44	-1,239,368	-2,028,040
FIRE	-1,796,199	-12	-274,791	-1,224,790
Services	-1,101,771	-23	-465,507	-577,308
Government	-293,185	-2	-62,543	-82,853
Totals[1]	-51,987,005	-386	-5,908,077	-14,442,660
Southwestern KS				
Agriculture	-294,002,400	-1,300	-14,320,903	-42,175,356
Mining	-3,769,195	-17	-471,270	-1,319,774
Construction	-3,631,446	-63	-2,060,309	-2,297,625
Manufacturing	-5,549,275	-33	-1,011,701	-1,408,316
TCPU	-17,389,134	-115	-4,400,988	-7,764,570
Trade	-21,966,712	-323	-9,281,238	-15,188,591
FIRE	-17,144,296	-115	-2,707,109	-11,820,909
Services	-11,299,731	-193	-4,903,190	-6,245,681
Government	-2,031,885	-12	-522,406	-741,417
Totals[1]	-376,838,273	-2,178	-39,733,345	-89,016,472
Western Kansas	-527,893,204	-3,377	-60,019,419	-138,864,841

[1]Rows may not sum to totals due to rounding and changes in the value of regional inventories.

Because most of the feedlots and virtually all of the meat processing is located in the southwestern counties, that region was used for the impact analysis. Inclusion of the entire western Kansas region would increase the scale of the resulting impacts modestly.

In the first scenario investigated, labeled 'low impact scenario' in Table 6, we added a reduction of meat processing to the commodity production reduction in our irrigation scenario. Livestock feedlots were left unchanged. Indeed, this scenario has already occurred, when in December, 2000, the ConAgra meat processing facility in Garden City burned. The plant has been shuttered since with no indication it will ever be rebuilt. The figure most frequently cited in the local media was 2,300 jobs lost. Given that the analysis focused on the southwestern counties, the value of crop reductions

Table 6
Estimated Direct and Indirect Annual Reductions in Regional Economic Activity in Southwestern Kansas Associated with Conversion to Dryland Agriculture and Loss of Associated Feedlots and Meat Processors (2003$)

	Total Output	Employment	Labor Income	Total Income
Low Impact Scenario				
Agriculture	-687,728,576	-2,225	-34,147,592	-77,472,088
Mining	-7,181,362	-33	-897,890	-2,514,524
Construction	-8,375,860	-143	-4,706,188	-5,234,925
Manufacturing	-932,668,288	-2,425	-80,548,464	-99,769,602
TCPU	-60,549,844	-412	-15,658,149	-27,769,602
Trade	-68,003,192	-1,114	-28,959,540	-47,172,940
FIRE	-56,253,692	-316	-9,046,196	-38,218,936
Services	-46,327,476	-842	-20,864,786	-25,788,528
Government	-267,259	-42	-1,849,195	-2,570,940
Totals[1]	-1,874,121,722	-7,583	-196,845,419	-326,469,855
Medium Impact Scenario				
Agriculture	-2,122,358,656	-5,046	-108,793,144	-211,379,176
Mining	-14,098,276	-65	-1,762,709	-4,936,446
Construction	-21,400,724	-364	-12,087,414	-13,395,900
Manufacturing	-1,872,254,816	-4,880	-162,132,368	-200,399,888
TCPU	-152,674,832	-1,061	-39,964,604	-71,208,464
Trade	-172,089,840	-2,872	-73,394,152	-119,451,600
FIRE	-138,141,808	-765	-21,893,138	-94,014,800
Services	-120,694,880	-2,223	-54,906,060	-67,333,424
Government	-18,184,558	-111	-4,840,794	-6,834,016
Totals[1]	-4,652,767,558	-17,464	-480,370,164	-789,646,495

[1]Rows may not sum to totals due to rounding and changes in the value of regional inventories.

modeled was limited to only the reductions occurring in the southwestern region.

The loss of this single facility adds substantially to the impact scenario. Total regional output declined by over $1.8 billion. Job losses exceeded 7,500 and total income declined by nearly one-third of a billion dollars. The combined loss of commodities production and this single processing facility would reduce total economic activity (output) by nearly 15 percent of total activity in the southwest.

In the moderate impact scenario, the reduction in commodity production is coupled with the loss of 40 percent of regional livestock feedlots (1,109 jobs) and two meat processing facilities (4,600 jobs). These figures are arbitrary given that we have no indication of what would actually happen as irrigation declines. The analysis method employed deducts not only the direct and indirect impacts associated with production, but also assumes the newly unemployed leave the region. Therefore, the household spending impacts associated with labor income and household income transfers also are deducted from the regional economy.

In this scenario, the value of regional economic activity declines by over $4.6 billion in output. Over 17,000 jobs are lost and total regional income declines by nearly $800 million. For perspective, this represents about 36 percent of regional output, 20 percent of employment, and 23 percent of total income in 2000.

It should be pointed out that the impact estimates are somewhat over-stated given the analysis technique employed. The analysis assumes all labor associated with the negative shock leaves the region. More realistically, many of the people affected would likely find alternative ways to make a productive living within the region. Indeed, following closure of the ConAgra facility in 2000, meat processors throughout southwestern Kansas and the lower Great Plains heavily recruited these workers. Certainly, some would have stayed. Still, some portion of the reported impact would be realized.

Discussion and Conclusions

In this research project, we reviewed information relating to the declining supply of underground water resources in the Ogallala Aquifer region of western Kansas. These resources currently support a highly productive irrigated crops production system which, in turn, provides the basis for a very valuable food processing industry. This crops-livestock-food processing system has in many ways helped several areas of western Kansas combat long-term trends toward the decline of Great Plains rural communities. Thus, it is hard to overstate what these resources have meant to the region.

We know, however, that current usage patterns will eventually lead to a situation where it will become economically infeasible to pump water for agricultural irrigation. The time frame wherein that will occur ranges from the relative near term to many, many years away, depending where in the region the activity is located. Nevertheless, there is considerable and justifiable concern for what it will mean to the region to lose access to this resource. This analysis attempted to provide general estimates of what the agricultural sector and irrigation in particular contribute to regional economic activity. Further, it attempted to provide preliminary estimates of what might happen should irrigated crop land be converted to a dryland cropping system.

Utilizing an economic accounting system of the region, we estimated that the overall agricultural sector is closely associated with about 40 percent of gross regional product, about 30 percent of income generated through regional production and about 20 of total household income. By most standards, this is an extraordinary level of dependence on an industry sector. It might be better were the region more economically diverse, but such things are not readily altered.

We analyzed a scenario where the incremental additional value of irrigated crops was removed from the economy. Such a scenario involved the simplifying assumption that all of the value was instantly lost. Measuring the impact, we estimated the loss to the economy to be about three percent in total regional output, two percent of employment, and two percent of household income. This translates into about $500 million in total output, 3,300 jobs, and about $140 million in regional income. These are permanent annual reductions.

These estimates may be considered conservative insofar as we did not take into consideration possible interactions with livestock production or food processing. Nearly 80 percent of the value of corn production in western Kansas is closely tied to irrigation. It's certainly possible that as livestock feed availability declines, the cost of obtaining it increases, and the cost of producing meat animals increases. This could place the region at a relative competitive disadvantage with other crops/livestock-producing regions, and the level of processing activity could stagnate or decline.

Certainly, the impacts we identified should not be interpreted as portending the demise of western Kansas communities. But, several things do become clear. The declining productivity of irrigation wells should provide individual irrigators sufficient time to adjust to altered production strategies and household income flows. Thus, the transition for individual crops producers should not be too traumatic. That will not necessarily be true for other types of business activities.

In the long-term, however, the overall economy will shrink. The gradual loss of irrigation represents the continuing squeeze on many agricultural support industries as markets for fertilizers and chemicals, well drilling and irrigation system maintenance, and grain transport and processing continue to decline. As these firms decline, regional household income also will drop, spreading the effect throughout the economy. Thus will continue the ongoing negative trends leading to the decline of many Great Plains communities.

This leaves only consideration of what might be done about the situation. One alternative is to simply allow economic forces to continue the resource withdrawal until it becomes economically infeasible to use for irrigation purposes. This strategy facilitates the economic transition. Alternately, public policy my seek to provide incentives toward resource preservation in the effort to prolong resource-dependent economic activities. But, given the reality that these resources are finite and use levels exceed replenishment (trends that seem likely to continue), the transition is only delayed and not averted. And, whether the costs of preservation policies yields a net societal benefit is an open question.

Even while such debate may continue, one thing remains certain. Change for many western Kansas communities is inevitable. While opportunity yet remains, those communities might be advised to prepare. Among the few alternative within local control are to aggressively pursue strategies of economic investment and diversification. Obviously, this point is not lost on local leaders and such a solution defies easy remedy. Still, leaders should maintain their sense of urgency in their efforts to foster new opportunities for regional economic growth.

Notes

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College Students and Debt: Credit Cards and Student Loans in Western Kansas

Charles J. Gnizak, Robert Meier, and Jerrold Stark

Introduction

College students use student loans to finance their education. The more recent trend is the build-up of credit card balances along the way. Credit card debt in the U.S. increased from $195 billion in 1993 to $531 billion in 2000 (Schevitz, 2001). Card issuers target college students because they have a higher earning potential than non-students (General Accounting Office, 2001). A dozen states are working on laws to curb credit card solicitation on campus, but this approach runs into problems because of the credit card lobbying clout (Kiplinger Washington Editors, 2002.)

Consider the new graduate with a new job, a new place to live and bills to pay. Add in the student loan and credit card payments and you have an increasingly stressful money situation. How do college students in western Kansas compare to students nationwide regarding credit cards and student loans? This article presents answers to that question by comparing national results (Nellie Mae, 2002) to those obtained in a western Kansas student survey.

Survey

A survey questionnaire was given to a convenience sample of 217 undergraduate students at a university located in western Kansas. (This group will be referred to as either 'western Kansas' or 'local.') The questionnaire was given to students taking a business course in the spring of 2002. Fifty-one percent of the students were female and 49% male. The three most prevalent business majors were accounting (24%), marketing (14%) and management (11%). Twenty-six percent of the students were non-business majors. Additional demographic information is presented in Tables 1 and 2. The freshmen and juniors in the sample do not exhibit the same proportion by classification (Table 1) as they do for the university, but most business courses are not available to freshmen. When compared by age brackets (Table 2), the proportion in the 20-21 bracket in the sample is larger than it is for the university and vice versa for those 19 and under. Presumably freshmen are the younger students.

Table 1
Students by Classification

	Sample		University	
	N	%	N	%
Freshman	17	8%	808	22%
Sophomore	38	18%	863	23%
Junior	77	35%	681	19%
Senior+	85	39%	1,343	36%
Total	217	100%	3,695	100%

Table 2
Students by Age Range

	Sample		University	
	N	%	N	%
19 and under	30	14%	949	26%
20-21	112	52%	1,377	37%
22-23	46	21%	776	21%
24 and older	29	13%	593	16%
Total	217	100%	3,695	100%

Table 3
Students with Credit Cards

	National*		Western KS
	2000	2001	2002
Percent with credit cards	78%	83%	100%
Average number of credit cards	3	4.25	1.6
Percent with 4 or more cards	32%	47%	5%

*Source: Nellie Mae (2002).

Findings Related to Credit Card Use

All students in the western Kansas survey had at least one credit card (Table 3), but it could have been a bank card or gas/store card. The encouraging findings are that 1) the local students have an average of only 1.6 cards compared to 3 or more nationally and 2) only 5% of the local students have 4 or more cards compared to 32% and 47% nationally. It is encouraging only on the assumption that fewer cards mean less total debt.

In Table 4, all findings for the survey are lower than national: The average credit card balance is only 62%

Table 4
Credit Card Balances

	National*		Western KS
	2000	2001	2002
Average credit card debt	$2,748	$2,327	$1,440
Median credit card debt	$1,236	$1,770	$580
Percent with balances from $3,000-$7,000	13%	21%	8%
Percent with balances exceeding $7,000	9%	6%	1%

Table 5
Credit Card Usage by Grade Level

	Average		Median	
	National*	Western KS	National*	Western KS
Freshmen	$1,533	$174	$901	$100
Sophomore	$1,825	$900	$1,564	$350
Junior	$2,705	$1,363	$1,872	$540
Senior+	$3,262	$1,859	$2,185	$850

*Source: Nellie Mae (2002).

of the national result ($1,440/$2,327) and the median is only 33% of the national median ($580/$1,770).

When credit card usage is tracked through the grade levels (Table 5), the pattern in western Kansas follows the national pattern. As the students progress, their average balances and median balances both advance. Although the usage climbs steadily, the seniors in western Kansas show an average credit card balance at 57% of the national average ($1,859/$3,262) and the median balance is only 39% of the national median ($850/$2,185).

When credit card use is tracked by age (Table 6), the pattern of steady increase mirrors the results obtained from tracking by grade level. Compared to national, the youngest survey students seemed unaware of credit cards. But, as they age, the local students close in on the national results, especially in the '24 and older' bracket: $3,240 and $3,329, respectively.

Possible explanations: The older students are closer to their exit from college and start 'spending before earning.' The older students move out of the dormitory and living expenses increase. The older students exhaust their savings (or their parents' savings) used in the first few years of college. The older students find a reliable automobile a necessity. Whatever the reason, the low debt enjoyed in their teens is replaced by a debt level comparable to the national average and median as they age.

Findings Related to Student Loans

In this section, the focus turns to student loans and away from credit card use. Of the 217 students in the survey, 119 (55%) of them said that they have student loans outstanding. Fifty-three percent of students with loans are female and 47% male. This is comparable to the gender division of the whole survey (51% female and 49% male).

Table 7 shows a steady increase in debt as the students advance through the grade levels. This would seem to be a likely outcome: years in school related positively to amount of debt. The current amount of debt in the 'Senior+' category is only 56% ($9,568/$17,140) of the national amount. If students' projections are accurate, their debt at graduation is approximately 76% ($13/$17 thousand) of national. Average student loan amounts were computed by age ranges and the results were similar to amounts by class rank.

Median student loan amounts were also computed. The median expected student loan amount is $10,000 for sophomores through seniors, but only $5,000 for the freshmen. This compares favorably with a national survey that reported a median amount of $15,375 at public institutions and $17,250 at private colleges and universities in 1999-2000 (American Council on Education, 2001).

Conclusions

In credit card use, the western Kansas students compare favorably to the national results in many areas: the average number of cards is 1.6 versus 3 nationally, the average credit card debt is $1,440 versus $2,327 nationally and only 1% have balances exceeding $7,000 compared to 6% nationally. The western Kansas students' credit card balances increase as they progress through school, but their debt levels were lower than national when tracked by grade levels. However, when their credit card debt was tracked by age bracket, the students who were '24 and older' caught up to the national results. This should be related to the make-up of the sample: 85 (39% of 217) of the local students are seniors, but only 29 (13%) are '24 and older.' The difference in number may be skewing the results.

In student loan levels, the western Kansas students compare favorably to national in all aspects: the

Table 6
Credit Card Usage by Age

	Average		Median	
	National*	Western KS	National*	Western KS
19 and under	$1,505 - $1,561	$205	$901 & $1,319	$68
20 - 21	$2,264 - $2,984	$1,075	$1,362 - $1,677	$500
22 - 23	$3,487 - $3,229	$1,584	$2,183 - $2,147	$650
24 and older	$3,329	$3,240	$2,424	$2,000

*Source: Nellie Mae (2002).
*Nellie Mae reported by specific ages: 18, 19, 20, 21, 22, 23, 24.

Table 7
Average Student Loan Debt by Grade Level

		Western KS	
	National*	Currently	Expected at Graduation
Freshman	$1,617	$733	$3,600
Sophomore	$5,596	$5,401	$12,956
Junior	$10,166	$7,327	$11,919
Senior+	$17,140	$9,568	$11,676

*Source: Nellie Mae (2002).

average student loan amount is less than national at each grade level and especially at the senior level ($9,568 vs. $17,140) and the median amount expected at graduation ($10,000) is below the national median of $15,375 (public). The U.S. average student loan debt for a young household is $15,700 (Purdy, 2002).

Various factors might explain the overall debt disparity: The tuition at this university, roughly $2,200, was comparable to other, similarly-sized regent's institutions in 2002. The national average was $3,379 for academic year 2001-2002 (Trombley, 2003). Additionally, the cost of living in small, Midwestern college towns is presumably less than in big cities.

The results obtained were large enough that it is unlikely they were due entirely to sample selection. The national results were based on a sample of 600 compared to our sample of 217. Seventy-nine percent of the national sample was in the 18-21 age range compared to 66% in our sample.

With credit card debts piled on top of student loans, students would surely benefit from a little on-campus education regarding the responsible use of credit. Educating freshmen regarding interest rates and the use of credit was also a recommendation of Rahimian and Adcock (2000). In visits to universities, the General Accounting Office (2001) found the presence of voluntary financial education programs, but officials expressed an interest in making that education mandatory. As a step in the right direction, this western Kansas university has recently added a personal finance class as an option among its general education courses.

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Broadband Deployment in Kansas 2004[1]

Mark Bannister and Kevin Shaffer

Introduction

Overview

We must be aggressive about the deployment of broadband.

President George W. Bush, June 13, 2002

We know that broadband deployment is important to Kansas's future.

Kansas Insurance Commissioner and future Governor of Kansas, Kathleen Sebelius, September 27, 2001

"Broadband" is a buzz word that policy makers, business people, economic development specialists, academics, and journalists all speak of as a necessity for communities, regions, states, and even nations. The purpose of this article is to examine: the value of broadband, the primary methods of deployment, international and national broadband deployment levels compared to those in Kansas, pricing levels compared to national and international levels, and finally, policy implications and options at the federal and state level. This article finds that Kansas high-speed Internet deployment is ahead of the United States average, but geographically substantial portions of rural areas of the state currently are without broadband service. A variety of options for accelerating deployment are available for policy makers, but current regulatory structures, the market, and technological innovations appear to be filling the void in delivering high-speed Internet in the state. However, ubiquity of access with sufficient bandwidth is a moving target as user expectations, technical needs, and competitive pressures demand greater capacities.

Background

A general sense of the terms "broadband" and "high-speed" are needed to initiate the discussion. The Federal Communications Commission defines broadband as:

> a descriptive term for evolving digital technologies that provide consumers a signal switched facility offering integrated access to voice, high-speed data service, video-demand services, and interactive delivery services (FCC 2004b).

In effect, broadband is a high-speed pipe for pieces of data or "bits." Broadband technologies move these bits in the same general manner irrespective of their nature as text, graphics, sound, video, or software programs. There are public policy debates as to how large or fast this pipe must be to constitute "broadband." Frequently the terms "broadband," "high-speed," and "advanced services" are used interchangeably. The Federal Communications Commission defines these later two terms with differing meanings[2]:

> "high-speed" are services that provide the subscriber with transmissions at a speed in excess of 200 kilobits per second (kbps) in at least one direction.
>
> "advanced services," which provide the subscriber with transmission speeds in excess of 200 kbps in each direction, are a subset of high-speed services (FCC 2004b).

There are other definitions and schools of thought. For example, researchers on telecommunications, information technology and rural development from the University of North Carolina have defined "high-speed" as 256 kbps and upward (Luger 2002, p. 17). Kansas legislators statutorily defined "broadband" in the state's 1996 Telecommunications Act as 1.5 Mbps (KSA 66-1,187(a)). The standard adopted by the International Telecommunications Union as constituting broadband is also 1.5 Mbps (ITU 2003, p. 6). This is a capacity more than seven times as fast as the FCC designated "high-speed." Corporations and universities dependent upon data and information may have 100 Mbps or 1 Gbps local area networks and connections to the Internet. The importance of these definitions is that over time business, education, medical, and even consumer applications have and will require greater amounts of bandwidth. Many computer users who were thrilled to move from dial-up modems with 9600 baud to those with 14 kbps speeds in the early 1990s, today find 56 kbps dial-up modems unacceptably slow. For example, a common need, such as downloading a 15 Mb patch to fix an identified bug in a personal computer operating system takes hours at 56 kbps. Business needs to move data in a timely manner continue to demand more bandwidth. Future consumer recreational desires such as high definition television on demand will likely cause re-evaluation of what consumers consider acceptable bandwidth. For example, HDTV requires 20 Mbps per second per channel (Ferguson 2002, p. 4).

Primary Methods of Consumer and Small Business Broadband Deployment

The primary methods of high-speed Internet delivery, their speeds, geographic limitations, advantages and disadvantages are summarized in Table 1.

Value of Broadband

Bob Metcalfe, the founder of 3Com and one of the inventors of the Ethernet networking technology is the originator of "Metcalfe's Law." This law states: "The value of a network grows quadratically more valuable as more individuals are connected to it" (Gilder 1993, p. 160). The more Kansans that are connected to the Internet and specifically broadband, the more valuable the network is to each. Families can share photos only if other family members have the network capacity to receive them. If broadband penetration is substantial, businesses can conduct business with each other and with consumers. Governments can provide services to Kansas citizens efficiently and conveniently. Medical personnel can exchange patient records and medical images such as x-rays. A multitude of other services and transactions can be performed in ways that are both timely and more economical than traditional means as the pool of users expands.

The Office of Technical Assessment of the United States Department of Commerce states that broadband will enable applications and services that will transform the "economy, education, health care, R&D, homeland security, military effectiveness, entertainment, government and the quality of life for citizens around the world. The deployment and usage of broadband will significantly impact the global competitiveness of nations and businesses in the future" (U.S. Dept. of Commerce 2002, p. 3). This same office states "there may be no element more critical today than ubiquitous and affordable high-speed Internet–broadband. The deployment and usage of broadband networks will significantly impact the global competitiveness of nations and businesses in the 21st Century" (U.S. Dept. of Commerce 2002, p. 4) Research on information technology and economically distressed communities has concluded that technologies including broadband "will become a necessary, but never a sufficient, condition for companies, communities, and states that will emerge as winners in the new economy" (Luger 2002, p. 5).

Futurists such as Peter Drucker suggest that the most successful economies in the early twenty-first century will be those with a strong knowledge base (Drucker 1993, p. 8). Innovative capacity depends upon ideas and the ability to access knowledge. New

Table 1
Primary Methods of High-Speed Internet Delivery

Type of Service	Typical Range of Speeds	Geographic Limitations	Advantages	Disadvantages
Cable	128 kbps-3 Mbps upstream; up to 3 Mbps downstream	Typically within city limits	Existing cable infrastructure used for much of the needed network.	Data services are shared, potentially reducing speed and security.
DSL	128 kbps-1.5 Mbps upstream; up to 1.5 Mbps downstream	18,000 feet from central office or DSLAM equipment pedestal	Greater privacy and security than other broadband methods.	Maximum capacity falls as the distance to the customer premise increases.
High-Speed Fixed Wireless	256 kbps-512 kbps upstream; up to 1 Mbps downstream	Typically 10-12 miles from tower. Some systems reach 35 miles.	Cost-effective deployment method: costs of easements and many infrastructure. expenses are bypassed.	Hills, trees, and tall buildings can restrict access. Some housing developments restrict external antennas.
Satellite	128 kbps-512 kbps upstream; up to 1.5 Mbps downstream	Limited only by the presence of a contractor/dealer serving the area.	Available anywhere in a satellite's "footprint."	Small transmission delays due to the distance from the satellite from the earth can affect services such as live voice or video.

industries such as life sciences, biosciences, nanotechnologies, and alternative energy development are information dependent industries. Existing industries such as agriculture, manufacturing, petroleum production, and even services such as hospitality and tourism are also dependent upon the development of new ideas and products. Linkages to markets, development and applications of tools to enhance processes are critical to increased productivity and increases in wages necessary for rising standards of living. Information is vital for entrepreneurs to succeed in creating new businesses. Information and training on-demand as well as linkages to businesses through on-line job placement websites are vital to workers starting or shifting careers or who have been displaced (Luger 2002, p. 23).

From a less abstract standpoint, a realistic vision for the typical household in America in five years is that it will contain at least one personal computer per household member.[3] These computers will be networked–likely wirelessly to a secure access point. These computers will be used for communicating with family and friends by text and voice, and for exchanging digital photos, possibly even video. They will be used for school and professional work, personal banking, bill paying, finance and investment, interacting with government (watching city and legislative meetings, accessing documents, paying taxes, obtaining permits), seeking health information, and accessing entertainment (movies, music, games, and live or recorded sporting and special events). Services like booking airline tickets and reserving hotel rooms will be almost entirely on-line. Networked systems will monitor the health of chronically ill or older family members and will allow for in-home consultations with medical providers. Special computers and networks will monitor security, carbon monoxide, and fire alarms. Appliances will be networked to monitor their efficient operation and utility consumption. In early adopter households, these applications are used today.

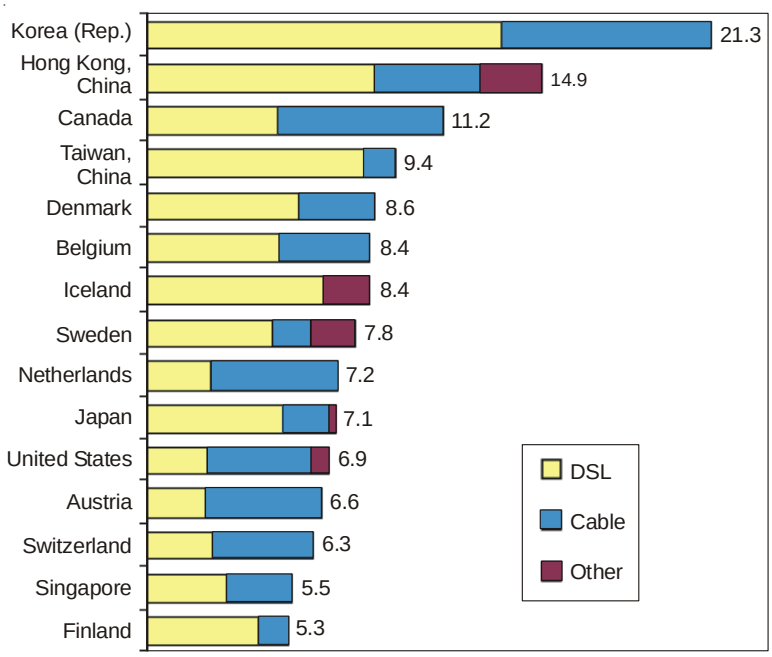
The impact of broadband can be quantified. Crandall and Jackson in a study published by Brookings Institution estimated in 2001, that widespread, high-speed access will increase the United State's Gross Domestic Product (GDP) by $500 billion annually by 2006 (Crandall 2001, p. 58). In contrast, a later study, published by the same organization and authored by Ferguson, projected that "Failure to improve broadband performance could reduce U.S. productivity growth by 1% per year or more, as well as reducing public safety, military preparedness, and energy security" (Ferguson 2002, p. 1). It is clear that cost-effective deployment of broadband is valuable to individuals, families, businesses, health care, and educational and governmental organizations.

Deployment of Broadband–An International, National, and Kansas Perspective

International

An international and national comparison of the deployment of broadband is important in benchmarking the progress of the United States and, later in this article, Kansas. International data collection lags behind national and state collection; however, in 2002, the International Telecommunications Union estimated that approximately one in every ten Internet subscribers worldwide had a dedicated broadband connection. Leading the world in broadband subscription percentage was the Republic of Korea (South Korea) where more than 70 percent of households are subscribers (Lee 2003, p. 30). Figure 1 illustrates broadband (200 kbps) penetration per 100 inhabitants.

Figure 1
Broadband Penetration, Subs per 100 Inhabitants, by Technology, 2002



Source: ITU, 2003, p. 5.

This table shows that the United States lags behind many developed countries in high-speed Internet implementation. It should be noted that approximately 40% of South Koreans live in large apartment buildings very suitable for offering broadband services. This geographic characteristic has made deployment easier and less costly than more dispersed housing (Lee 2003, p. 30). The United State's large land mass makes deployment more geographically expensive; however, geography cannot be the only explanation. In 2002, Canada with vast, sparsely populated areas had almost twice the adoption level of the United States.

National

The International Telecommunications Union points out that in the United States, broadband is likely to reach the 25 percent penetration mark more quickly than either personal computers or mobile telephones did in the past (ITU 2003, p. 18). It is clear that broadband use is growing rapidly. Unfortunately, the methods of measuring broadband deployment vary greatly. Industry groups, the Federal Communications Commission, and research organizations are among those who track broadband deployment. The metrics frequently do not correspond. For example telephone companies report on whether they offer broadband in incumbent service areas. Cable companies identify whether they provide service in a city and rarely serve surrounding rural areas. The FCC identifies whether broadband is available in a Zip Code. And surveys of consumers ask whether they have access where they live. This article will provide a selection of the more applicable recent statistics at the national level and will provide data and maps of Kansas coverage.

Federal Communications Commission Report December 2003

In Section 706 of the Telecommunications Act of 1996, Congress directed the Federal Communications Commission to encourage deployment of advanced telecommunications capability in the United States on a reasonable and timely basis. Pursuant to this statutory directive, the FCC began gathering standardized data on "High-speed" deployment–initially on an annual basis and more recently on a semi-annual basis. The FCC gathers data from wireline telephone companies, cable providers, terrestrial wireless providers, satellite providers, and any other facilities-based providers of advanced telecommunications capability[4] (FCC 2003c, p. 1).

The December 2003 study based upon June 2003 data, shows national "subscribership to high-speed services for Internet access increased by 18% during the first half of 2003, to a total of 23.5 million lines in service. The presence of high-speed service subscribers was reported in all 50 states... and in 91% of the Zip codes in the United States" (FCC 2003c, p. 1). Nationally, the FCC reports:

- Subscribership to high-speed services increased by 18% during the first half of 2003, to a total of 23.5 million lines (or wireless channels) in service. The rate of growth during the second half of 2002 was 23%.

- High-speed ADSL lines in service increased by 19% during the first half of 2003, to 7.7 million lines. High-speed connections over coaxial cable systems (cable modem service) increased by 20%, to 13.7 million lines.

- High-speed connections to end users by means of satellite or fixed wireless technologies increased by 12% during the first half of 2003, and reported fiber optic connections to end-user premises increased by 5%. These technologies, together, accounted for about 0.9 million high-speed connections at the end of June 2003 (FCC 2003c, p. 2).

For Kansas, the FCC reports:

- Subscribership to high-speed services increased by 29% during the first half of 2003, to a total of 248,796 lines (or wireless channels) in service. The rate of growth during the second half of 2002 was also 29%.

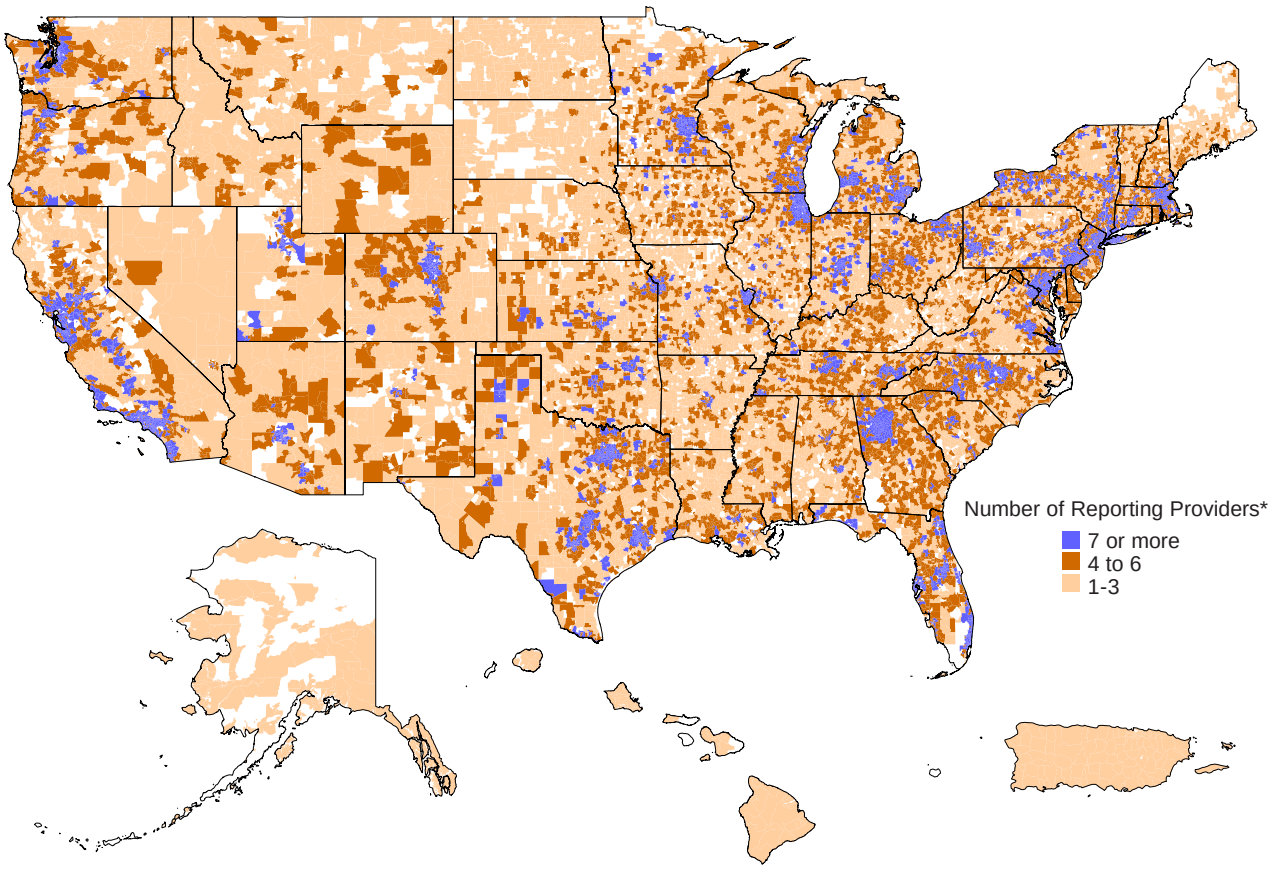
- High-speed ADSL lines in service increased by 29% during the first half of 2003, to 50,839 lines. High-speed connections over coaxial cable systems (cable modem service) increased by 27%, to 181,437 lines (FCC 2003c, tables 8-10).

The FCC does not provide a state-by-state breakout of satellite, fixed wireless, or fiber optic connections by technology.

The FCC data illustrates that Kansans rely more heavily on cable and less on DSL for high-speed services than the national average. This is likely due to aggressive deployment by cable providers in Kansas's metro areas and the fact that some Kansas independent telephone companies provide a variety of communications services including cable Internet access.

Applying the FCC data and the United States 2001 Census Population estimates, we find the Kansas average of 9.23 lines per hundred people is substantially more than the national average of 8.24 lines per hundred people. The FCC data also illustrates that

Figure 2
High Speed Line Deployment in the U.S. by Zip Code



*Provider has at least one customer in a Zip Code. Service may use ADSL, other wireline, coaxial cable, fiber, satellite, or fixed wireless technology.
Source: FCC.

high-speed line growth in Kansas for ADSL, cable, and overall services was more rapid in the first half of 2003 than national growth.

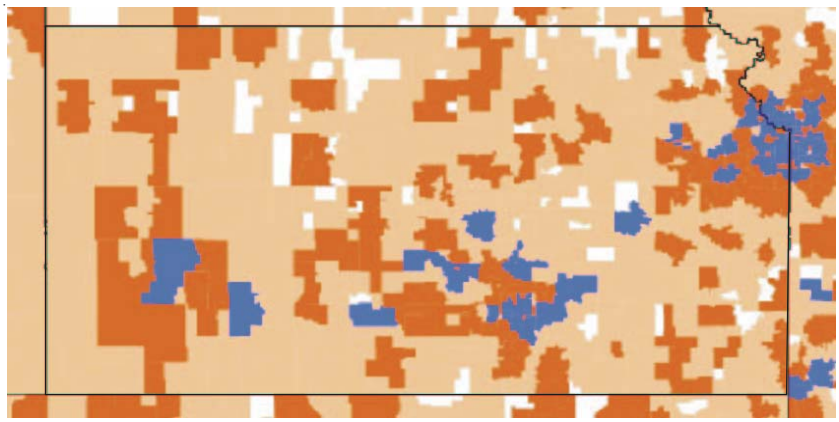
Figure 2 is a map of the United States developed by the FCC showing the availability of high-speed service nation-wide by Zip Code. It and the close-up of Kansas in Figure 3 show that most Kansas Zip Codes have high-speed services somewhere in the area (FCC 2003c). This does not mean the complete Zip Code has service. Service may end at the city limits or at the extent of DSL reach from telephone central offices or DSLAM (Digital Subscriber Line Access Multiplexer) which is typically less than 18,000 feet.

The FCC map shows that the areas in Kansas that do lack coverage are rural areas. In contrast, some large and mid-sized Kansas communities have multiple providers. They not only have service, but they also have a competitive climate with service options.

Cable Deployment

As of the end of 2003, the National Cable & Telecommunications Association reported that over 90 million U.S. households live in areas that are capable of receiving cable modem broadband access. Nationally, these households translate into 15 million high-speed Internet subscriptions (NCTA 2003, p. 1-2). In Kansas, cable operators provide 181,437 high-speed Internet subscriptions (FCC 2003c, p. 7). The Kansas Cable Telecommunications Association reports 285 total Kansas communities are provided high-speed Internet services through cable companies. One hundred twenty-three of these communities have a population of 1500 or less and 82 have a population of 500 or less (KCTA 2004, p. 1-3). At this point, no map exists specifically reflecting the service areas served by Kansas Cable Telecommunications Association members. Appendix A includes a listing of communities served. The association expects

Figure 3
High Speed Line Deployment in Kansas



Source: FCC.

to gather additional data from its membership and to compile a map by the end of 2004.

Independent Telephone Companies

The National Telecommunications Cooperative Association (NTCA) is "a national association of approximately 560 local exchange carriers in 44 states that provide service primarily in rural areas. All NTCA members are small carriers that are "rural telephone companies" as defined in the Telecommunications Act of 1996" (NTCA 2003, p. 4). This organization represents most independent telephone companies in Kansas. In 2003 the NTCA surveyed its national membership on provision of broadband services and Internet access to their members/customers. The survey found that 97% of respondents, representing more than 200 members, indicate they offer broadband service to at least some part of their customer base. This is a substantial increase from the 74% who reported providing services in 2001 (NCTA 2003, p. 9). Figure 4 shows deployment of high-speed services by independent telephone companies in Kansas. Combined, the independent telephone companies provide broadband to a significant portion of the geographic area of Kansas. It is worth noting that while some of these companies now provide services in mid-sized and even large Kansas cities as competitive local exchange carriers, almost all began their broadband deployment in their rural incumbent service areas.

SBC

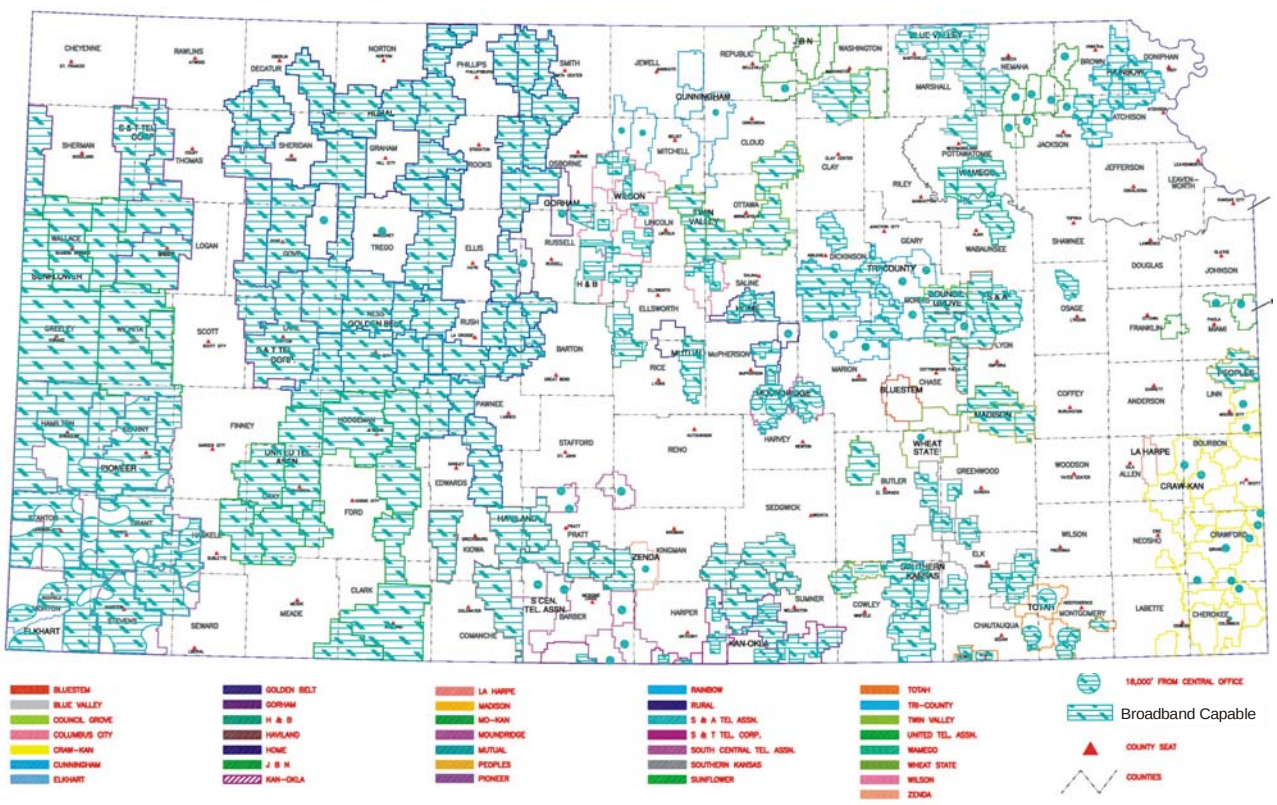
SBC is the largest telecommunications provider in Kansas. The level of service that SBC provides substantially impacts Kansans. Nationwide in August 2002, SBC reported broadband availability to 26 million customer locations, making up approximately 64% of its wireline customer locations (U.S. Dept. of Commerce 2002, p. 5). In Kansas, SBC and the Kansas Corporation Commission (KCC) staff agreed in 1999 to "Project Pronto" as part of a significant multi-faceted settlement involving several issues (KCC 1999, pp. 1-4). Under this agreement, SBC committed to providing DSL ubiquitously in eight communities and to deploy DLS "as technically feasibly" in sixteen communities by August 1, 2003. In early 2000, the KCC issued an order accepting this agreement (KCC 2000, pp. 7-10). (*See* Appendix B for a listing of communities).

In April 2003, SBC notified the Kansas Corporation Commission that it would not be able to fully implement "Project Pronto" by its committed deadline and sought an extension for this roll-out. In January 2004, the KCC issued an order approving a "Joint Motion for Approval of Stipulation and Agreement" reached between the KCC staff, SBC, and the Citizens Utility Rate Board (CURB). This motion approved extension of the time deadline for deployment of DSL as committed in the 1999/2000 agreement and approved an agreement to expand SBC's DSL deployment to all communities in SBC's service territories with a population of 1000 or more. This deployment will provide service to an additional 81 central office locations which will include an additional 76 communities by December 31, 2004 (*see* Appendix B for a listing of central offices and communities). The KCC also provided SBC the option of deploying in smaller communities without DSL service if some of those communities with population greater than 1000 already have DSL service. The switch of communities is to be approved by KCC staff (KCC 2004, pp. 1-8).

Sprint

Sprint is the second largest local exchange carrier in Kansas. Sprint is an important international company with world headquarters in Overland Park, KS. Despite its metropolitan corporate staffing and world

Figure 4
Kansas Independent Broadband Deployment Map



stature, Sprint's local exchange territories in Kansas are largely rural and are scattered in eastern to central Kansas. Figure 5 illustrates that Sprint has deployed DSL in about half of its service territories as of October 2003. Two additional service areas, Russell and Riley, are to be added in 2004.

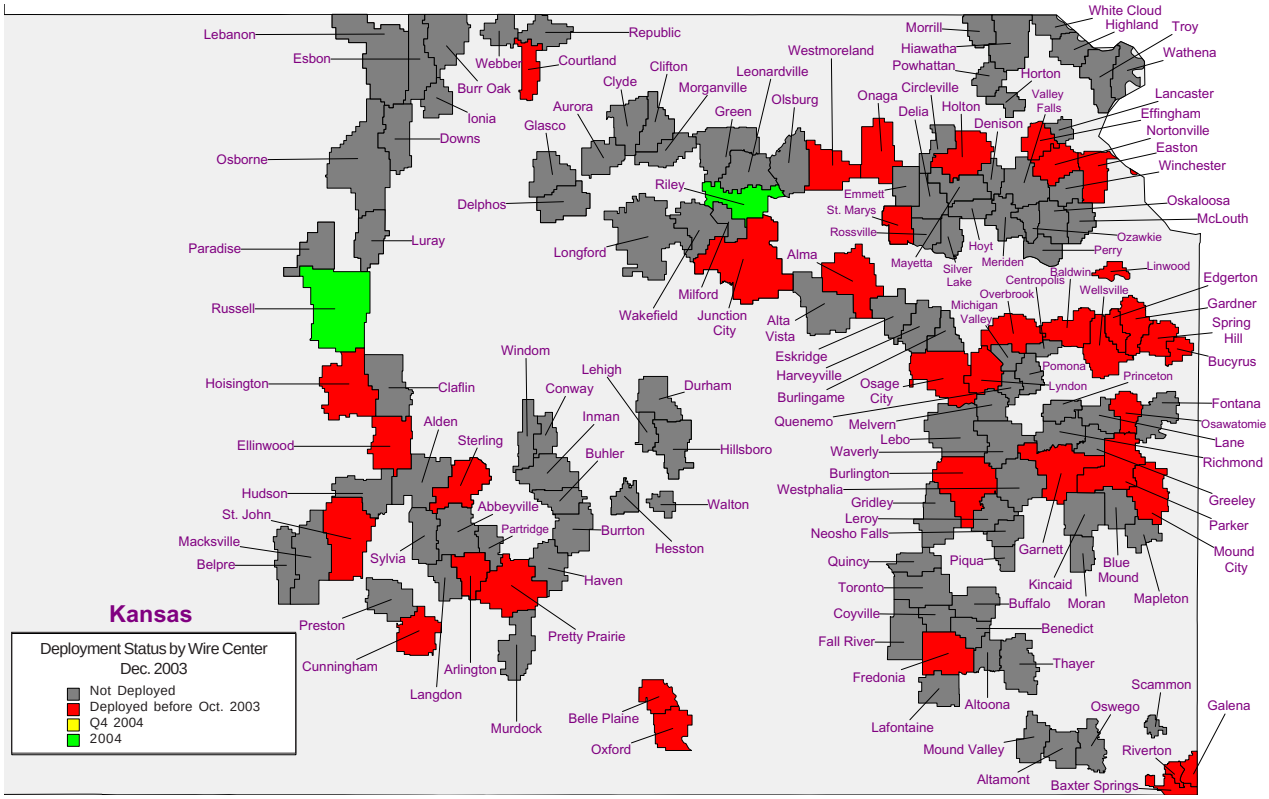
Wireless Internet Service

A relatively new means of providing high-speed Internet services is fixed wireless service. Wireless Internet Service Providers (WISPs) are using a variety of tools with varying reaches, frequencies, and costs. Some of the independent telephone companies have begun to use wireless tools to reach the countryside to avoid the need to build an expensive wire or fiber infrastructure. Some WISPS have also begun to use wireless tools to compete in medium and large cities in order to avoid having to lease lines and services from the incumbent telephone provider and to avoid the high costs of building a new wire line or fiber infrastructure. Pixius Communications is the Kansas WISP which has garnered substantial attention–because it is primarily a wireless Internet company, not a phone company using wireless as an ancillary tool. Pixius also appears to have the largest wireless service area in Kansas at this time–claiming more than 15,000 customers. Pixius offers a variety of service packages which range from 250 kbps to 1.5 Mbps. Its current range is 10 miles from an access point. Pixius emphasizes that the Motorola technology that it uses encrypts the user data over the air using 128 bit DES encryption (Pixius 2004a). Figure 6 displays Pixius' current service areas.

Satellite

Satellite delivery of Internet services has been available for several years in a hybrid form. Vendors such as DBS initially required the user to have a dial-up landline for upstream communications and provided satellite to earth high-speed Internet speeds only for downstream communications. In theory, all of Kansas is covered by this type of service. Traditionally, there were three major limitations to this type of service. First, it did not provide a consumer a high-speed upstream connection–thus providing little value to a business or

Figure 5
Sprint DSL in Kansas



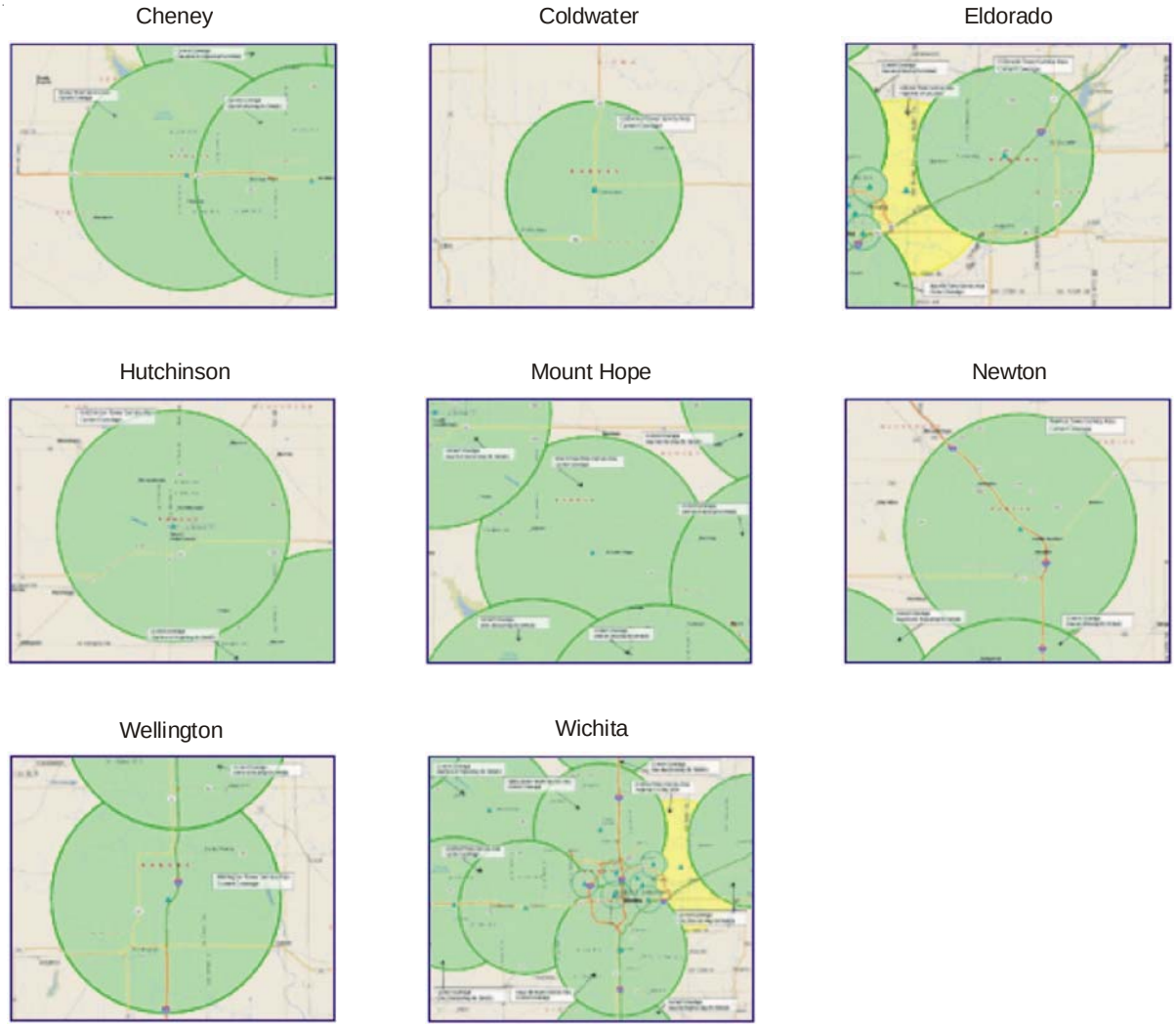
consumer wanting to host or to provide data. Second, satellite service was costly. Subscription fees exceeded $100 per month. It required an additional dial-up service which typically cost $15.95-$19.95 per month and for some users, dial-up Internet service required a long distance charge. An additional disadvantage is that satellite services have a .2 second delay due to the time for a signal to travel to a satellite from earth and back–this produces the hesitation effect that television viewers saw during the Gulf War when remote correspondents lagged in responding to questions from news anchors in the United States. As of 2004, technology and competition have overcome the first two disadvantages. Providers such as DIRECTWAY® partnership between Hughes Satellite and DBS are offering 50 kbps up-stream and "up to 500 kbps" downstream services ending the need for dial-up Internet service. Prices have also fallen and will be discussed in the section on pricing (DIRECWAY®, 2004).

In October 2003, Rural Telephone and its subsidiary Nex-Tech announced the intended deployment of two-way upstream, downstream satellite Internet service under a license agreement with Wild Blue. Service is to begin in 2005 for high-speed delivery with 1.5 mbps upstream and 3.0 mbps downstream (Sevier, 2003). Rural Telephone intends only to serve the northwest and central areas of Kansas; however, other licensees could serve other areas of Kansas and make broadband ubiquitously available. Satellite services can serve urban or the most rural user equally well. The continuing apparent weakness of satellite technology will be the time delay from earth to satellite and back that be problematic for a few uses such as voice over Internet protocol (VoIP) telephony. Pricing for these two-way satellite services is higher than cable or DSL, but not substantially different.

Consumer Data

The Pew Internet & American Life project has conducted a number of studies on adoption and use of the Internet. One of its 2003-2004 projects focused on rural areas and the Internet. The Project surveyed users of the Internet. The findings show:

Figure 6
Pixius Service Areas in Kansas, March 2004



From 2000 through 2003, the use of cable modems, DSL connections, and other broadband connections grew quickly in each community type (urban, suburban and rural), but rural areas hold significantly smaller proportion of broadband users. In a survey in the spring of 2003, we found that 31% of those who use the Internet from home had a broadband connection. Here is the big picture about broadband adoption in different community types from 2000 to mid-2003:

- In urban communities, the number of home broadband users grew from 8% to 36% of the online population.
- In suburban communities, the number of home broadband users grew from 7% to 32% of the online population.
- In rural communities, the number of home broadband users grew from 3% to 19% of the online population.
- Additionally, in October 2002 about 25% of rural Internet users said they did not think that a high-speed connection to their home was available. Only 5% of urban users and 10% of suburban Internet users said broadband is unavailable (Bell, Reddy, and Lainie 2004, p. iii).

Figure 7
Internet and Broadband Adoption in the United States

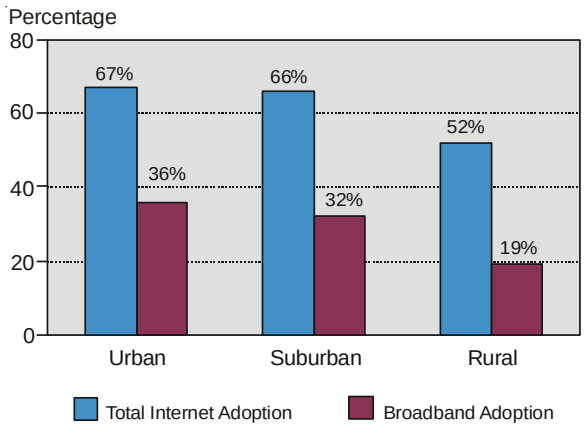


Figure 8
Broadband Use for Home Users

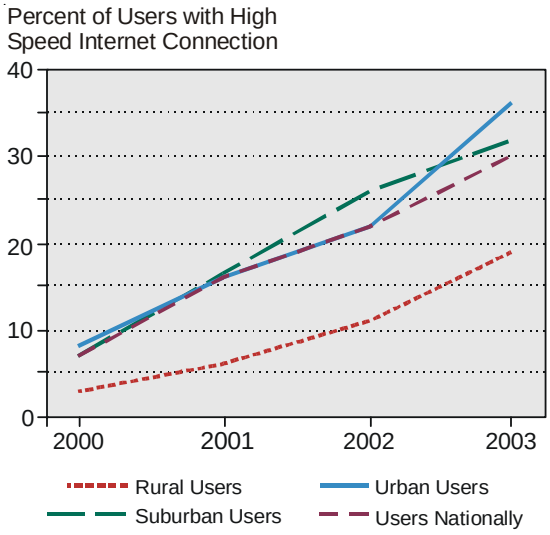


Figure 7 visually demonstrates the difference in adoption.

The Pew findings show that rural consumers are much more likely to believe that broadband is not available to them. This perception and other factors such as an older, less educated, and poorer population on-average nation-wide have slowed adoption (Bell, Reddy, and Lainey 2004, pp. 17-19). Figure 8, from the Pew study, shows that nationally, urban and suburban use of broadband has consistently grown at a faster pace than rural use.

The Pew findings are not broken down by state, but are very relevant to Kansas as a significant portion of the state's population live in rural areas. Based upon the FCC Kansas data on adoption of high-speed Internet, Kansas rural areas may be better situated than the national average. However, no specific data exists for Kansas urban, suburban, and rural use.

Kansas Broadband Coverage

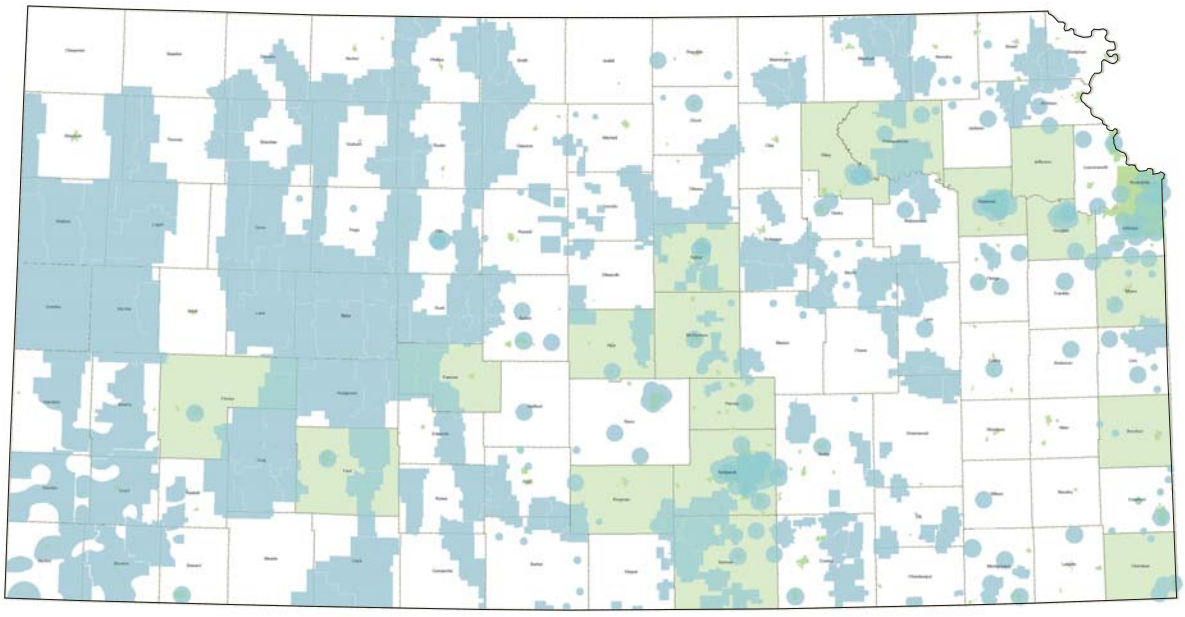
As of early 2004, no completely comprehensive map of Kansas broadband coverage exists. The Kansas Corporation Commission staff, at the urging of the Joint Committee on Utility of the Kansas Legislature, has assembled the most complete map to date. This map does include data from incumbent local exchange telecommunications carriers and cable companies. It includes voluntary data from wireless Internet service providers and competitive local exchange carriers, but has data gaps and does not reflect municipal and non-profit Internet service providers. This map shows that exclusive of satellite coverage about one-third of the geography of Kansas is currently served with high-speed Internet (Figure 9).

Pricing

The price of broadband or high-speed services is generally believed to affect its adoption. An International Telecommunications Union study of adoption found: "Prices play perhaps the most important role in promoting broadband demand. Successful broadband economies are characterized by low prices—typically as a result of flourishing competition and innovative pricing schemes that attract a wide variety of customers" (ITU, 2003, p. 14). The Office of Technology Policy points to an August 2002 survey by the Yankee Group asking dial-up consumers why they were not upgrading to broadband networks. The survey found 72% of respondents complaining broadband was "too expensive" (U.S. Dept. of Commerce 2002, p. 14). Ferguson from the Brookings Institute, points out that "[A]t current prices, one year of ADSL costs as much as a home PC, and one year of T1 service costs as much as five business PCs (Ferguson 2002, p. 5).

The International Telecommunications Union provides sampling of broadband prices worldwide (Table 2). Using 2002 pricing, the study shows that the subscription per month for service in the United States is comparable to the subscription rate in many developed countries sampled; however, some countries such as Japan offer significantly lower average monthly prices. The Republic of Korea (South Korea), which has the world's highest penetration rate, offers substantially lower price per bandwidth than the United States. The average United States rate is almost 40 times the price per kbit/s of the average Korean rate (ITU 2003, p. 20).

Figure 9
Cable Broadband and DSL Service Available



This map is based in information provided by the incumbent Local Exchange Carriers in November and December 2003. Cable data is from the Kansas Cable & Telecommunications Association December 2002. The KCC makes no guarantee to accuracy or completeness.

DSL Estimate
Cable Broadband

Source: Kansas Corporation Commission Information Resources, GIS Section 4 Feb. 2004

The typical Korean subscription rate is higher in absolute cost and as a percentage of monthly income. However, Korean services provide substantially more bandwidth that a standard 256 kbps subscription in the United States. For example, the highly popular Korean "lite" subscription provides 2 Mbps downstream speeds and the "premium" subscription provides 8 Mbps downstream speeds. Newly built apartment complexes are wired with Ethernet providing 10 Mbps and even wireless services in Korea are providing up to 12 Mbps downstream speeds (Lee 2003, p. 31). Therefore, an average Korean subscription provides between 10 to 120 times the United States Federal Communications Commission defined "high-speed" rate.

Comparison data suggests that high prices may have slowed the rate of demand in the United States. However, as researchers, we will note that an analysis of the ITU country price and subscription data finds no statistical significant correlation between subscription as a percentage of monthly income and lines per 100 inhabitants.

If price is a factor that affects demand the growth of subscriptions in Kansas may partially reflect that fact that the price of broadband has fallen substantially since its introduction. Early cable Internet, DSL, and until recently, satellite subscriptions cost more than $100 per month. Prices have fallen substantially. Like personal computers, the effectiveness of Internet equipment continues to improve and costs of Internet equipment continue to fall. Additionally, market competition is pushing down prices. As of early March 2004 the price of cable Internet service from Cox Cable, Kansas's largest cable service, was $29.95 for its cable or telephone subscribers who provide their own modem (Cox 2004). SBC announced in February 2004, that it will offer Internet with provide speeds of up to 384 kbps for $29.95 per month or $26.95 per month for subscribers to SBC's local, long distance or Cingular (an SBC partnership) wireless service. SBC's 384 kbps-to-1.5 Mbps service will cost $44.95 per month for the first year and $49.99 per month after the first year (Hu 2004. p. 1). These prices are similar to the DSL prices offered by other telephony companies in Kansas. The pricing of Pixius wireless services with two-year contracts and $100 installation charges include residential 256/256 kbps (downstream/upstream) for $39.95 per month, 512/256 kbps (downstream/upstream) for $44.95 per month and business options of 512/256 kbps (downstream/upstream) for $74.95 per month and 1 mbps/512 kbps (downstream/upstream) for $89.95 per

Table 2
A Sampling of Broadband Prices Worldwide

Country	Subscription/ Month ($US)	Price per 100 kbit/s ($US)	Subscription as Percent of Monthly Income	100 kbit/s as Percent of Monthly Income
Japan	$24.19	$0.09	0.87%	<0.01%
Korea (Rep.)	$49.23	$0.25	5.95%	0.03%
Belgium	$34.41	$1.15	1.78%	0.06%
Hong Kong, China	$38.21	$1.27	1.85%	0.06%
United States	$52.99	$3.53	1.81%	0.12%
Singapore	$33.18	$2.21	1.92%	0.13%
Netherlands	$51.55	$2.26	2.58%	0.17%
Canada	$32.48	$3.26	1.75%	0.17%
Norway	$46.16	$6.56	1.46%	0.21%
Macao, China	$38.34	$2.56	3.20%	0.21%
Germany	$33.93	$4.42	1.80%	0.23%
New Zealand	$40.61	$2.71	3.55%	0.24%
Austria	$45.20	$5.89	2.23%	0.30%
United Kingdom	$32.59	$6.37	1.55%	0.30%

Source: International Telecommunications Union, 2003, p. 20.

month (Pixius, 2004b). Kansas satellite costs show that DIRECWAY charges include a one time fee of $599.98 for installation and $59.99 per month or $99.99 per month for the first fifteen months and then $59.99 per month (DIRECWAY® 2004). NexTech's satellite offering will be $49.95 a month with yet to be determined installation and equipment costs (Sevier 2003).

Regulatory Tools & Policy Implications

Michael Powell, Chairman of the FCC speaks glowingly of the wonders of broadband and the importance it has to business, health care, education, and even entertainment. In June 2001, he spoke at SuperCom, the major telecommunications industry tradeshow in Atlanta. In taking questions and answers from the audience, he seemed somewhat surprised when asked how policy makers could be assured that broadband would reach lightly populated rural areas (Powell 2001). In contrast, in February 2004, he participated in the Broadband and Telemedicine Summit at the Dole Institute at the University of Kansas where he affirmed the importance of broadband reaching users throughout the country and particularly in rural states like Kansas. Powell acknowledged that tools need to be deployed and partnerships established to assure broadband coverage. He stated "Although I believe many of our policies help build connectivity for rural America, we have also established a more targeted set of programs designed specifically to assist with rural deployments. This Commission has put a high priority on making sure that Americans living and working in rural communities have access to the same kind of high quality infrastructure that is available in urban and suburban America" (Powell 2004a, p. 5).

Deployment of broadband depends upon several factors. Market factors such as consumer and organizational demand and effective technology tools for delivery are prerequisites for deployment. Policy, regulation, subsidization, and purchasing are governmental tools available for encouraging broadband deployment.

Federal Policy

The Federal Telecommunications Act of 1996 was the first major legislative restructuring of the telecommunications regulatory system in over 60 years. The Act passed before the concept of home and small business broadband access was a technical and economic possibility. Therefore, a limited statutory framework exists. Section 706 of the Act calls for states and the Federal Communications Commission to encourage deployment of advanced telecommunications capability to all Americans on a reasonable and timely basis

(§706, Pub.L. 104-104). The Act also included subsidy programs for schools, libraries, and hospitals which have become known as the "e-rate" (§245, Pub.L. 104-104). Beyond these tools, a limited statutory framework exists. The opportunity for national leadership has fallen to the FCC. The agency has worked to encourage broadband deployment through both regulatory action and forbearance. "Absent clear Congressional guidance, the FCC formulated its own Internet policy within the legal constraints of the 1996 Act. The FCC avoided imposing traditional telecommunications regulation on Internet-based services through a careful process of decisions and non-decisions" (Werbach 2002, p. 42).

The FCC defines its strategic goal for Broadband as: "to establish regulatory policies that promote competition, innovation, and investment in broadband services and facilities while monitoring progress toward the deployment of broadband services in the United States and abroad" (FCC 2004a).

> The FCC acknowledges:
> "All will benefit as broadband's technologies are developed and deployed. Nonetheless:
>
> • The infrastructure is not yet ubiquitous,
> • Relative costs of deployment remain high compared to narrowband,
> • Access is limited in underserved areas, and
> • Adoption rates remain low relative to availability.
>
> The FCC's established broadband objectives are to:
>
> • Promote the availability of broadband to all Americans.
> • Conceptualize broadband in a way that includes any platform capable of providing high-bandwidth intensive content.
> • Clarify and stabilize the regulatory treatment of broadband services.
> • Encourage and facilitate an environment that stimulates investment and innovation in broadband technology and services.
> • Harmonize regulation of competing broadband services that are provided via different technologies and network architectures.
> • Dutifully enforce market-opening requirements.
> • Monitor social and economic developments in order to provide ongoing national and international policy leadership and consumer education in the emerging broadband arena" (FCC 2004a).

The FCC has issued a series of rules on unbundled network elements pursuant to §251 of the Telecommunications Act of 1996. These rules address the requirements that incumbent local exchange carriers (ILECs) who provide local telephone services are mandated by law to provide wholesale services to competitors known as competitive local exchange providers (CLECs). CLECs resell these "unbundled" services at rates set by state regulators. The battle over each order revolves around which services and infrastructure must be resold and the cost at which it must be resold. This battle starts at the FCC and moves as litigation to the Federal Court of Appeals system. The most recent set of rules were issued as part of the FCC's Triennial Review in 2003.

On Feb 20, 2003 the FCC announced a four-page preliminary summary signaling its direction and the future framework (FCC 2003a). This was followed with an August 21, 2003 order 576 pages in length which created rules and provided specificity. The rules eliminate the mandatory resale of specific services and infrastructure that are primarily used for providing high-speed Internet access. For example, the order eliminated the prior requirement that packet switching–including switching, routers, and DSLAMs must be unbundled. It excludes hybrid services involving fiber and copper and full fiber-to-the-home from unbundling (except for voice service where there is no copper loop). (FCC 2003b). Unbundling of some other services such as DS-1's used to provide high-speed services to businesses was to be phased out over a three year period on a presumptive finding by state public utilities commissions of no impairment (FCC 2003a, p. 1). The rules were appealed, with the Federal Court of Appeals for the D.C. Circuit issuing a decision on March 2, 2004. While a portion of the FCC order was vacated and remanded back to the FCC, the rules regarding broadband facilities were upheld. The court vacated and remanded the FCC's decision that wireless carriers are impaired without unbundled access to ILEC dedicated transport (United States Telecom Association v. Federal Communications Commission 2004, p. 62.).

Commissioners Powell and Abernathy who have supported deregulated market oriented approaches applauded the court's action (Powell 2004b, p. 1). Commissioner Abernathy, summarized her position on the FCC's action and the court's decision in a press release stating:

> Today, the D.C. Circuit Court of Appeals upheld the Commission's decision to refrain from unbundling next-generation broadband facilities. This is a big victory for American consumers. The Commission's framework will help promote greater investment by removing regulatory barriers to broadband deployment. Telecommunications providers already have stepped up their deployment in the wake of the

> Commission's Order, and I hope that the Court's decision upholding our framework will further accelerate investment (Abernathy 2004, p. 1).

Commissioners Copps, Martin, and Adelstein who made up the FCC majority in developing the order, expressed only their disappointment about the court's decision to eliminate the commission's rules requiring incumbent carriers to open their legacy voice networks to competition (Copps 2004, p. 1).

In effect, the FCC has established a largely free-market framework for broadband facilities and has generally refrained from regulation in the hopes that marketplace demand and profits will lead to investment and competition. It has largely exempted broadband services from unbundling requirements. Such exemption is designed to spur facilities based competition and profitable returns on investment in broadband.

In addition to market forces, FCC Chairman Michael Powell pointed out in his Kansas speech that the FCC does have tools that are assisting with deployment of broadband in rural areas. He pointed to the FCC's rural health, schools, and libraries universal service programs which were created as part of the 1996 Telecommunications Act. According to Powell, "In Fiscal Year 2003, schools and libraries in Kansas received funding commitments of more than $13 million. Rural health care providers in Kansas received funding commitments of approximately $48,000" (Powell 2004a, p. 1). In the same speech, Powell pointed to the FCC's current inquiry on "broadband over power line" and to wireless and satellite policies that may encourage technologies that will assist in broadband deployment in rural areas (Powell 2004a, p. 5-6). On March 11, 2004 the FCC initiated a notice of inquiry into whether

> "advanced telecommunications capability," or broadband, is being deployed to all Americans in a reasonable and timely fashion. As broadband networks become vital to the economy, healthcare, education, and other areas impacting the American public, the Notice of Inquiry (NOI) adopted today will analyze the various market, investment and technological trends of broadband deployment. (FCC, 2004c).

The Kansas Rural Broadband and Telemedicine Summit VIP presenters included not only Powell, but also Hilda Legg, Rural Utilities Service Administrator. Legg stated that the Rural Utilities Service administers several loan and some grant programs that assist with broadband and advanced services deployment. These include: "the 'traditional' infrastructure loan program, consisting of hardship, cost of money, Rural Telephone Bank, and guaranteed loans. … Since 1995, every telephone line constructed with RUS financing has been capable of providing broadband service using digital subscriber loop (DSL) technology" (Legg 2004). The RUS also administers a small grant and substantial loan program supporting distance learning and telemedicine development in rural America (RUS Website 2004).

Powell and Legg emphasized the cooperation between these two federal agencies. Powell described one component of the FCC's Rural Outreach plan as a "comprehensive outreach program to foster communication and coordination among all stakeholders on rural broadband deployment" (Powell 2004a, pp. 5-6). This stakeholders' list includes the FCC, RUS, state public utility commissions, state and federal lawmakers, provider companies, and consumers.

The Telecommunications Act of 1996 maintains differing regulatory regimes for differing types of carriers or platforms. Traditional telecommunications (common carriers, Title I), cable television (Title VI), and satellite and radio/wireless platforms (Title III) are largely regulated in differing manners based upon their traditional services. Each has differing regulatory burdens and advantages. For example, telecommunications providers are subject to unbundling and resale requirements, 9-1-1 emergency service, and taxation requirements from which cable companies are exempt. Cable companies will point out that they invest in infrastructure without the state or federal universal services support which telecommunications companies receive. Telecommunications companies are regulated at the state and federal level while cable companies are almost solely regulated at the federal level.

Competing communications platforms are developing the capabilities to delivery services that substantially overlap each other's traditional services. For example, cable systems can delivery not only video content, but also high-speed Internet, traditional telephone services through voice over Internet protocol (VoIP) and broadband services such as home security and fire monitoring. Fiber-to-the-home offered by telecommunications companies can provide the same services. Kevin Werbach, Douglas Sicker, and Joshua Mindel, among others have suggested models for regulation of services based upon the type of service as opposed to the type of infrastructure used to provide the service (Werbach 2002, p. 37 and Sickler and Mindel 2002, p. 69). These models suggest regulating the provision of voice, video entertainment, high-speed Internet, and other related services uniformly without regard to the method of delivery. During Michael Powell's break-out question and answer session at the

Kansas Broadband and Telemedicine Summit he stated that he expects a migration to this type of regulatory structure. It will take years to form a consensus on a new telecommunications act, but according to Powell, "it will come and it should be technologically neutral" (Powell 2004a).

Kansas Policies

According to the FCC's June 2003 statistics, Kansas has 34 high-speed Internet service providers serving at least 250 lines each–a substantially larger number of companies per population than most states (FCC 2003c, p. 12). Affordable upstream and downstream high-speed satellite services are on the horizon. The reach of wireless data services is growing as technology advances. And a majority of the state's population is covered at least partially by a high-speed provider using cable or DSL services or both.

What should the state's role be in further advancement of broadband where there are gaps? The FCC has largely pre-empted "command" regulation of broadband by state regulatory bodies and Kansas acknowledged this pre-emption in its Telecommunications Act (K.S.A. 66-2011(e), 2003). However, the state does have some tools, options, and perhaps responsibilities. First, there are regulatory powers and statutory tools that Kansas has used.

Regulatory Persuasion. The KCC staff has used its negotiating abilities, persuasion, and forbearance in other regulated areas to encourage providers to expand high-speed Internet coverage. The two SBC Stipulation and Agreement orders discussed earlier are significant examples of this (*see* KCC 2000, KCC 2004).

Kansas 1996 Telecommunications Act. The Kansas Act offers a limited carrot and stick approach to some limited deployment of broadband and a critical backbone infrastructure conducive to broadband. Its requirements of upgrades to voice systems made switches and lines DSL suitable. The act established a set of "enhanced universal services" that are community oriented. SBC helped to spur this concept with its promise in the proposed 1994 TeleKansas II program which offered fiber optic connections to state high schools, community colleges, and universities as well as hospitals in SBC's exchanges in return for regulatory forbearance (SWBT 1994, p. 6). As enacted by the Kansas Legislature, Kansas enhanced universal services include: "full fiber interconnectivity, or the technological equivalent between central offices, broadband capable facilities to all schools …, hospitals …, public libraries, and state and local government facilities which request broadband services." (Kansas Session Laws Chapter 268, 1996, Section (2)(q)). These enhanced services are among the services supported by the state's Universal Service Fund. Enhanced service requirements guarantee broadband to state and local public institutions. Enhanced services, as well as digital switching, required as part of the act, help to establish a backbone network capable of high-speed services. This backbone network is vital for not only telephone company services, but also for cable companies to attach to in order to link their local Internet services to the larger Internet.

Anchor Tenant. For years, the State of Kansas has used its buying power through its state telecommunications contract for state agencies, the KANSAN contract, to push services forward. If provider consortiums can meet state contract requirements to provide services to state offices in rural communities, they can have a substantial anchor tenant in the state. Once services are available in a community, it behooves providers to sell the services to as many businesses and other potential users as possible. At the local level, schools and libraries have used funding from the FCC's School and Library Universal Service fund to purchase services and often were the first users of dial-up and later high-speed Internet in their communities.

Educational, Library, and Hospital Networks. In the late 1980s and early 1990s school districts, community colleges, and universities have worked together regionally to develop first interactive television (ITV) and then data networks. These could be linked together for video as needed though the Division of Information Services of the Kansas Department of Administration, Fort Hays State University, and CODECs owned by some of the networks. These networks later connected to the Internet through private telecommunications providers. In a similar time frame, Kansas Regents Educational Network (KANREN) has used aggregation of demand supplemented with federal grant as a cost-effective means of connecting higher educational institutions in Kansas with high capacity bandwidth and to Internet2. Since 1992, hospitals and the University of Kansas Medical Center have worked to create networks for telemedicine. In 2001, a centralizing effort, Kan-ed was authorized by the Legislature with a mission that overlapped many existing efforts. Kan-ed is intended to aggregate demand in order to provide "basic network connectivity for all K-12 schools, institutions of higher education, hospitals, and libraries" (Kan-ed 2003, p. 5). Kan-ed has a legislative mandate to connect not less than 75% of schools, libraries, and hospitals who have applied by July 1, 2004 (K.S.A. 75-7224). This network was first funded in 2003 with $10 million appropriated by the Legislature from the Kansas Universal Service Fund (Kan-ed 2003, p. 5).

Tax Policy. The Kansas Constitution establishes different classes of property which are taxed at higher

and lower rates based upon policy and political decisions. Utilities have the highest property tax assessment rates in Kansas due to the political belief that property taxes can be passed through to ratepayers. In 2000, the Kansas Legislature passed an income tax credit that can lower the effective rate of for-profit telecommunications companies for property acquired and placed into service in Kansas after January 1, 2001. Telecommunications companies pay the 33% utility rate and receive a credit against Kansas income tax in order to lower the effective rate to the 25% commercial rate paid by most businesses on property (K.S.A. 79-32,210, 2003). The tax credit provides an incentive to invest in new facilities and equipment. This provision benefits SBC, Sprint, and for-profit independent telecommunications companies. It does not benefit cooperative telecommunications companies as cooperative companies do not have income, but rebate any excess earnings back to cooperative members. SBC and Sprint may argue that cooperatives have access to low-interest USDA funding and other advantages which are not available to for-profit companies and that this tax policy helps to even out the playing field.

There are other policy options and tools that the State of Kansas can consider if it decides that ubiquitous deployment of broadband is a state priority. Any programs created should be extremely carefully crafted to avoid stifling competition as a subsidized provider will have a cost advantage over later entrants to the market. Any program should avoid subsidizing development which market forces might otherwise offer without incentive. Programs should focus on the end services provided and should be technologically neutral.

Carrier of Last Resort Model. Kansas could legislatively expand the purpose of the Kansas Universal Service Fund to support broadband deployment. One model would be to create "Carrier of Last Resort" services for unserved high-cost areas. This model would mirror current voice line telecommunications service model. Carriers would bid on the amount of subsidy they would require to serve a designated area and meet minimum quality of service and ubiquity of deployment metrics. Low bidders would be selected for designated areas lacking service.

Voucher System. Another model using the Kansas Universal Service Fund would be to create a voucher system. Subscribers in designated unserved high-cost areas would receive vouchers reducing their cost. There are a number of ways this could be administered. Voucher payments could be paid to users whose costs for unsubsidized services cross a designated threshold for specified high-speed Internet services. The threshold might be 112%, 125%, 150%, or other designated rate above state averages. The voucher system would lower the cost to the user to a rate comparable to the average state rate. It would allow competition for consumers in the designated areas.

Preservation of Kansas Universal Service Fund. Increasing, phasing out, or maintaining current levels of Kansas Universal Service Fund support are all policy options for consideration. The network initially established for voice communications serves also as the system for DSL services and for interconnecting other types of providers such as cable and wires services to the larger Internet. With current technologies, the quality of Internet services is dependent upon the quality of the voice telephony system. In sparsely populated areas the viability of the voice system is dependent upon state universal service fund support. The legislative record of the establishment of the Kansas Universal Service Fund contains no evidence that the fund was intended as a transitional fund. With current levels of embedded costs, ending or phasing out the Kansas Universal Service Fund would dramatically disrupt rural telecommunications services. Independent telephone companies serving extremely low density areas express that ending or phasing out the fund would literally bankrupt their companies. Ending the fund's support might also encourage SBC and Sprint to withdraw from sparse areas as U.S. West (now Qwest) did in the 1990s in rural Colorado. Increasing the fund will require consensus that state-wide benefits accrue. Maintenance of the general existing level with adjustments and reallocations reflecting both embedded costs and variable cost economic realities may provide regulators some funding to work with to encourage broadband–if given legislative authority.

Expanded Tax Incentives and TIF Financing. Much like the tax credit established in 2000, a similar credit could be targeted specifically to broadband and could be used to further lower the property tax rate on broadband facilities and equipment. An alternative would be the state could statutorily define Internet services outside the definition of utility services, thereby defining such Internet services as commercial activities. Justification for this strategy would be that broadband services are generally not price regulated and providers cannot pass through taxes to rate payers as regulated utilities do with regulated services. Unlike an income tax credit that only benefits for-profit companies who have substantial taxable income, a clarification such as this would benefit all providers.

Another option would be to amend the Kansas Constitution to allow exemption of broadband infrastructure from property taxes for a set period of time after deployment in order to incent its implementation. Currently communities and the state can jointly offer

property tax incentives to specified types of businesses such as manufacturing, warehousing, and research and development to encourage economic development. A similar model could be developed to encourage broadband service in specified areas lacking service. Constitutional amendments are difficult to pass and administration of property tax exemptions would have to be narrowly tailored in order to avoid giving away tax revenues without accomplishing the end goal.

Another tax oriented option would be to establish a tax increment financing (TIF) system. This could be done statutorily and allow the diversion of the state and local share of property taxes paid on broadband infrastructure and equipment in designated non-served low density areas to be used to retire bonds or to reduce the overall cost structure of the deployment of services. Eligible cities or counties would initiate the process with an interested provider who would contractually agree to provide service in return for the rebate.

Grants. Federal agencies such as the Economic Development Administration and the National Telecommunications Infrastructure Administration of the United States Department of Commerce offer highly competitive grant programs for non-profit organizations for innovative telecommunications projects with eco-nomic development, educational, health care and other public goals. Several successful non-profit models exist in Kansas. A non-telephone organization, the North Central Kansas Planning Commission has provided Internet service to several otherwise unserved rural communities using wireless technologies. Several Kansas telecommunications cooperatives have received low-interest funding from the U.S.D.A. to assist in broadband deployment. Kansas could establish a state grant program limited toward non-profit and coopera-tive organizations willing to serve areas lacking broadband.

Monitoring and Bully Pulpit. Legislators have taken a keen interest in broadband deployment in Kansas. Legislative committees have sought periodic data and updates. The FCC is now gathering data on national and state deployment on six month intervals. The KCC has been helpful in extracting Kansas data and in over-laying geographic information available to the KCC from regulated providers. Industry associations representing differing types of providers have been excited and competitive in seeking to respond to legislative requests showing deployment. The expressed interest of lawmakers to have nearly ubiquitous deployment and to have a level playing field for competition appears to be spurring development and deployment as providers seek the good graces of the legislature on other policy matters. Legislators could statutorily require annual reporting by all broad-band providers specifying areas served as a requisite for doing business in Kansas. If the legislature considers this option, it may want to establish a sunset in order to prevent the creation of a system which collects data long after its necessity has passed.

Analysis and Recommendations for Kansas Policy Makers

At this point, it appears that emerging technologies including satellite, wireless, and long-reach DSL technologies will likely allow providers to reach all areas of Kansas and to provide a level of service consistent with or exceeding the current FCC standards for high-speed Internet within the next few years. KCC persuasion and Legislative monitoring will likely add momentum to this process. Expansion of state Universal Service Fund, expansion of tax credits or reducing tax rates, or even establishment of a grant program to support broadband may speed this process, but do not appear to be necessary to reach the FCC standard. Continuing the combined state and federal support of anchor tenants such as schools, libraries, and hospitals as well as visionary requirements for state contracts will help provide public services and to expand private investment and services. Maintenance of the Kansas Universal Service Fund does appear to be a vital component in the foreseeable future. Despite the 1990s popular phase and book name, distance is not yet dead. Today's technologies and those of the foreseeable future scale most efficiently when serving populous areas. Kansas policy makers should continue to monitor deployment of broadband to assure that Kansas roll-out becomes ubiquitous and adoption continues to exceed national rates.

A warning for Kansas policy makers—the speeds and services that are valuable and acceptable today; will become obsolete. Historical and current evidence will reinforce this concept. Historically, the 1996 Kansas Telecommunications Act included an innovative mechanism assisting citizens of the state to obtain dial-up Internet access from any community (Kansas Session Laws Chapter 286, 1996, Section 12). It appeared that an Internet solution had been found. Kansas policy makers had found a means of assuring that all Kansans could access the Internet at a reasonable price regardless of location. Within a decade, newer technologies like DSL created new services and demands and over time the value and demand for the initial dial-up solution declined due to the limitations of this technology. Currently, a group of 300 technology company CEOs known as the Technology Network or TechNet are expressing their opinion that the FCC's definition of high-speed Internet is not broadband and

argue that 200 kbps is insufficient to meet the nation's needs. TechNet has called upon the Federal Government to create a national policy that would bring 100 Mbps connections to 100 million American homes by 2010 (Pappalardo and Mears 2002, p. 87). TechNet advocated bandwidth is 500 times the FCC definition of "high-speed." This type of change in technological standards could significantly change the technological landscape.

The other major warning flag—a significant change in the form of federal regulation of Internet and communications platforms will likely come within the decade. Just as Kansas restructured its telecommunications statutory system in conjunction with federal changes in 1996, Kansas legislators, the executive branch, and KCC will likely need to anticipate, coordinate with, and respond to a new federal act. Change is constant in the information technology world; guiding change to benefit Kansas citizens must be a constant goal of Kansas policy makers.

Appendix A
Communities Served by Kansas Cable Telecommunications Association Members

Abilene	Cable
Albert	DSL
Almena	Cable
Altamont	DSL
Alton	DSL
Andover	Cable
Arcadia	DSL
Arkansas City	Cable
Arma	Cable
Assaria	DSL
Atchinson	Cable
Atlanta	DSL
Auburn	Cable
Augusta	Cable
Baldwin City	Cable
Bel Aire	Cable
Belleville	Cable
Beloit	Cable
Big Bow	Cable/DSL
Bison	DSL
Bogue	DSL
Bonner Springs	Cable
Bourbon County	Cable
Brewster	DSL
Brooksville	DSL
Burden	DSL
Burdett	DSL
Burlingame	Cable
Burlington	Cable
Burrton	Cable
Bushton	DSL
Butler County/Andover	Cable
Butler County/Augusta	Cable
Butler County/ El Dorado	Cable
ButlerCounty/ Rose Hill	Cable
Caney	Cable
Carbondal	Cable
Cedar Creek	Cable
Cedar Vale	Cable
Chase	Cable
Cheney	Cable
Cherokee	Cable
Cherryvale Chicopee/ Crawford	Cable
County	Cable
Cimarron	DSL
Claflin	Cable
Clay Center	Cable
Clearwater	DSL
Coffeyville	Cable
Concordia	Cable
Coolidgde	Cable/DSL
Copeland	DSL
Countryside	Cable
Courtland	DSL
Cowley County/Ark City	Cable
Cowley County/Winfield	Cable
Damar	DSL
De Soto	Cable
Deerfield	Cable/DSL
Delphos	Cable
Derby	Cable
Dexter	DSL
Dighton	DSL
Dodge City	Cable
Dorrance	DSL
Douglas County	Cable
Downs	Cable
Eastborough	Cable
Edgerton	Cable
Edmond	DSL
Edna	DSL
Edwardsville	Cable
El Dorado	Cable
Ellis	Cable
Elwood	Cable
Ensign	DSL
Erie	Cable
Eudora	Cable
Fairway	Cable
Finney County	Cable
Ford	DSL
Ford County	Cable
Fort Leavenworth	Cable
Fort Riley	Cable
Fort Scott	Cable
Franklin	Cable
Frontenac	Cable
Galena	Cable
Galva	DSL
Garden City	Cable
Gardner	Cable
Garfield	DSL
Gas	Cable
Gaylord	DSL
Geary/County Geary Uninc.	Cable
Girard	DSL
Glasco	Cable
Glen Elder	Cable
Goddard	Cable
Goessel	DSL
Goodland	Cable
Gorham	DSL
Grandview Plaza	Cable
Great Bend	Cable
Grenola	DSL
Gridley	Cable
Grinnell	DSL
Halstead	Cable
Hanston	DSL
Harvey County	Cable
Hays	Cable
Haysville	Cable
Healy	DSL
Hesston	Cable
Hiawatha	Cable
Highland	Cable
Hill City	DSL
Hoisington	Cable
Holcolmb	Cable
Holyrod	DSL
Horton	Cable
Howard	Cable
Hugoton	Cable/DSL
Humboldt	Cable
Hutchinson	Cable
Ingalls	DSL
Iola	Cable
Jardine Terrance	Cable
Jefferson County	Cable
Jennings	DSL
Jewell	Cable
Johnson	Cable/DSL
Junction City	Cable
Kanorado	DSL
Kansas City	Cable
Kechi	Cable
Kendall	Cable/DSL
Kingman	Cable
Kingman County	Cable
Kinsley	Cable
KSU Dorms	Cable
Lake Quivira	Cable
Lakin	Cable/DSL
Lansing	Cable
Larned	Cable
Lawrence	Cable
Leavenworth	Cable
Leavenworth-Tanglewood	Cable
Leawood	Cable
Lebo	Cable
Lenexa	Cable
Lenexa	Cable
Lenora	DSL
Leon	Cable
Leroy	Cable
Lewis	DSL
Liberal	Cable
Lindsborg	Cable
Little River	DSL
Logan	DSL
Longton	DSL
Lorraine	Cable
Louisville	DSL
Lucas	DSL
Lyndon	Cable
Lyons	Cable
Maize	Cable
Manhattan	Cable
Mankato	Cable
Manter	Cable/DSL
Marysvillle	Cable
McConnell AFB	Cable
McCracken	DSL
McCune	DSL
McPherson	Cable
McPherson County	Cable
Merriam	Cable
Miami County	Cable
Milford	Cable
Mission	Cable
Mission Hills	Cable
Mission Woods	Cable
Moline	Cable
Montezuma	DSL
Morland	DSL
Moscow	Cable/DSL
Moundridge	DSL
Mulberry	DSL
Mulvane	Cable
Sumner County	Cable
Munjor	Cable
New Strawn	Cable

Newton	Cable
Nickerson	Cable
North Newton	Cable
Norton	Cable
Norton	Cable
Norwich	Cable
Offerle	Cable
Ogden	Cable
Ogden Outside City	Cable
Olathe	Cable
Osage City	Cable
Osawatomie	Cable
Osbourne	Cable
Oswego	Cable
Otis	DSL
Overland Park	Cable
Palco	DSL
Paola	Cable
Park	DSL
Park City	Cable
Pauline	Cable
Pawnee County	Cable
Pawnee Rock	Cable
Phillipsburg	Cable
Pittsburg	Cable
Plainville	Cable
Pottawatomie County	Cable
Pottawatomie County	Cable
Prairie Village	Cable
Pratt	Cable
Ransom	DSL
Reno County/Hutchinson	Cable
Reno County/ South-Hutchinson	Cable
Rice County	Cable
Richfield	Cable/DSL
Riley County	Cable
Roeland Park	Cable
Rolla	Cable/DSL
Rose Hill	Cable
Rozel	DSL
Rush Center	DSL
Russell	Cable
Sabetha	Cable
Salina	Cable
Saline County	Cable
Satanta	Cable/DSL
Scandia	Cable
Scott City	Cable
Scranton	Cable
Sedg Co/Derby/ Rose Hill	Cable
Sedgwick	Cable
Sedgwick County	Cable
Sedg County/Goddard/ Sedgwick City/ Valley Center	Cable
Selden	DSL
Seneca	Cable
Severy	Cable
Shawnee	Cable
Shawnee	Cable
Smolan	DSL
South Hutchinson	Cable
Speaville	DSL
St. George	Cable
St. Mary=s	DSL
Sterling	Cable
Sublette	Cable
Syracuse	Cable/DSL
Timken	DSL
Tonganoxie	Cable
Topeka	Cable
Towanda	Cable
Troy	Cable
Tyro	Cable
Udall	DSL
Ulysses	Cable/DSL
Utica	DSL
Valley Center	Cable
Viola	DSL
Wamego	DSL
Washington	Cable
Wathena	Cable
Wellington	Cable
Wellsville	Cable
Westwood	Cable
Westwood Hills	Cable
Wichita	Cable
Willowbrook	Cable
Wilson	DSL
Winfield	Cable
Winona	DSL
Woodston	DSL
Yates Center	Cable

Appendix B

Communities to be Provided Ubiquitous DSL Service by SBC as Part of "Project Pronto" in Accord with 1999 Stipulation and Agreement and 2000 KCC Order

Hays	Lawrence	Topeka
Hutchinson	Manhattan	Wichita
Kansas City	Salina	

Communities to be provided DSL by SBC "where technically feasible" as part of "Project Pronto" in accord with 1999 Stipulation and Agreement and 2000 KCC Order

Arkansas City	Garden City	Newton
Bonner Springs	Great Bend	Ottawa
Coffeyville	Independence	Parsons
Dodge City	Leavenworth	Pittsburg
El Dorado	Liberal	
Emporia	McPherson	

Metropolitan Central Offices to provide DSL Service by SBC in accord with 2003 Stipulation and Agreement and KCC 2004 Order before December 31, 2004

1. Topeka Lecompton	6. Wichita Benton	11. Wichita Rose Hill
2. Topeka North	7. Wichita Colwich	12. Wichita Valley Center
3. Topeka South (Carbondale)	8. Wichita Goddard	13. Wichita Whitewater
4. Topeka West (Auburn)	9. Wichita Kechi	14. Wichita Sedgwick
5. Wichita Augusta	10. Wichita Mulvane	

Communities to be DSL Service by SBC in accord with 2003 Stipulation and Agreement and KCC 2004 Order before December 31, 2004

1. Abilene	24. Greensburg	47. Oakley
2. Anthony	25. Halstead	48. Oberlin
3. Atchison	26. Harper	49. Paola
4. Atwood	27. Herington	50. Phillipsburg
5. Belleville	28. Holcomb	51. Plains
6. Beloit	29. Hoxie	52. Plainville
7. Blue Rapids	30. Humboldt	52. Plainville
8. Caney	31. Iola	53. Pratt
9. Chanute	32. Kingman	54. Sabetha
10. Chaney	33. Kinsley	55. Scott City
11. Cherryvale	34. LaCrosse	56. Sedan
12. Clay Center	35. Lansing	57. Seneca
13. Colby	36. Larned	58. Smith Center
14. Concordia	37. Lincoln	59. St. Francis
15. Cottonwood Falls	38. Lindsborg	60. Stockton
16. Desoto	39. Lyons	61. Sublette
17. Douglass	40. Marion	62. Tonganoxie
18. Ellsworth	41. Marysville	63. Washington
19. Erie	42. Meade	64. Waterville
20. Eudora	43. Medicine Lodge	65. Wellington
21. Eureka	44. Minneapolis	66. Winfield
22. Fort Scott	45. Neodesha	67. Yates Center
23. Goodland	46. Norton	

Notes

1. Copyright 2004.

2. Network speeds are measured in bits per second (bps). Kilobits per second (kbps) are thousands of bits. Megabits per second (Mbps) are millions of bits. Gigabits per second (Gbps) are billions of bits. This document without graphics is a little over 250 kilobits in size and would take about five seconds to download over a 56 kbps dial-up modem. In contrast, graphics intensive websites, audio, video, or soft-ware downloads may be several megabits and may take minutes or even hours to download for a user who does not have a high-speed or broadband connection.

3. Highly functional computers can be purchased on-line from Dell, Gateway and other sources or from discount retailers such as Wal-Mart for as little as $300-350. The falling cost and greater ease of use is continuing to enhance the percentage of computer ownership.

4. The FCC requires a facilities-based provider of high-speed connections to end users in a given state to report to the Commission basic information about its service offerings and customers if the provider has at least 250 high-speed lines (or wireless channels) in service in that state. Some independent telephone companies, cable companies, and competitive local exchange carriers in Kansas may fall below this threshold leaving gaps in Kansas service data.

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