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A Method for the Quantitative Assessment of the Impact and Sustainability of the KCTCS ERP Initiative

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ABSTRACT

This study demonstrates a measure the impact and sustainability of system wide ERP implementations, and details an example of its use. The method is widely applicable and builds on the 4-s (size, scope, scalability, and sustainability) and PIPE (participation, implementation, penetration, and effectiveness) theoretical systems design and evaluation framework of Pronk (2003). Impact is presented as the easily computed product of reach and coupling factors. Sustainability is demonstrated with enrollments viewed as inputs to be transformed, and credentials as outputs to be consumed by the marketplace.

Keywords

ERP, Systems Analysis, IS Sustainability, IS Assessment, IS Evaluation, IS Impact.

INTRODUCTION

The value of ERP implementations has been much debated in the literature (Legate, 2002; Spathis and Constantinides, 2003). Arguments often turn abrasive: for example, "This $1 trillion industry is not founded on any kind of economic justification; large companies invest over $20 million on an ERP system with no mechanism to justify the return on investment." (Hayward, 2003) Without intending to slight a complex issue, it appears that the basic problem is that there is no general agreement on what needs to be measured, when and how, and by whom. This paper seeks to help close the gap with a study of the long term impact and sustainability of a system wide ERP implementation in one vertical industry, education. The aim is to eventually extend the integrative approach used to medical information systems, global electronic voting, and outsourced service and manufacturing environments. In addition, this paper seeks to assess the impact and sustainability of this effort from a quantitative theoretical perspective.

BACKGROUND

The formal assessment described in this study is one aspect of the technology adoption and implementation model presented earlier by Blades, Barnett, Slone, and Kelley (2003) and Thomas, Seiferth and Kelley (2003). Three components of the technology adoption half-cycle are Opportunity, Feasibility, and Sponsorship, while the components of Logistics, Acceptance, and Assessment define the technology implementation half-cycle. Tapp, Hesselden, and Kelley (2003) have earlier examined the acceptance of the Kentucky Community and Technical College System (KCTCS) project into the daily functioning fabric of KCTCS. Hesselden, Tapp, Morefield, and Kelley (in press) have also provided a qualitative assessment of the impact of the KCTCS ERP system.

Sustainability is a metadiscipline that seeks to objectively and quantitatively assess needs among often conflicting economic, technological, environmental, and societal objectives (Mihelcic et al., 2003). To this end, the research literature often differentiates between external and internal views of systems sustainability (Whittaker, Adkins, Phillips, Jones, Horsley, and
Kelley, 2004). In the external view, a sustainable system is one in which the timing and size of perturbations match the changes that the system can absorb (Molnar and Mulvihill, 2003; Sheats, 2000; Whittaker et al., 2004). However, in the internal view, sustainability is defined as the long-term ability to balance the allocation of resources like time, knowledge, and money against the measured value of an accepted sub-system (Whittaker et al., 2004).

**APPROACH**

Pronk (2003) provides a formalized systems design methodology that is adapted here to help measure quantitatively selected aspects of the impact and sustainability of the system wide KCTCS ERP initiative mandated by HB1. The Pronk methodology identifies four orthogonal dimensions that are referred to as the 4-s' of systems design: **size, scope, scalability** and **sustainability**. These terms are defined in a specific sense:

- **Size**: The modality, frequency, and aggregate volume of a programmatic intervention needed to obtain the desired effect on a system.
- **Scope**: The range of operations activated, the number reached within the intended audience, and the extent to which the activities and audiences are touched by the system.
- **Scalability**: The ability of the program to develop the sufficient mass of functioning needed to cover the intended system audience. This factor is a function of the willingness and ability of the target audience to participate in the system, the system cost in the context of the resources available, and the partnership appeal of the system to outside stakeholders.
- **Sustainability**: The ability of the system to continue to deliver on an accepted value proposition that balances allocated resources like time, money, and people against generated benefits.

The Pronk theoretical framework is intended to "support practical application", "optimize the chances for maximum impact," and offer "simple rules for a complex issue." (Pronk, 2003) It is adapted here to measure impact in the context of system wide ERP system implementations. The framework defines impact as the product of four metrics, two measures of program outbound effort (penetration and implementation), and two measures of inbound engagement (participation and effectiveness). These measures are referred to as the PIPE metrics. Penetration and implementation are said to be outbound metrics because they are initiated from within the program to reach into the outside world. Their product measures the reach of the system. Participation and effectiveness are designated as inbound metrics because they are controlled by exogenous decision making. Their product measures the degree of engagement, i.e. the coupling of the system with the audience it is intended to serve. Application of the PIPE metrics thus permits the quantitative assessment of a system in terms of its reach ($R$), coupling ($C$), and impact ($I$):

$$ Reach = Penetration \times Implementation $$  \hspace{1cm} (1) \\
$$ Coupling = Participation \times Effectiveness $$  \hspace{1cm} (2) \\
$$ Impact = Reach \times Coupling $$  \hspace{1cm} (3) $$

The terms in equations (1), (2) and (3) are defined in a specific sense:

- **Penetration**: The invited population ($G_i$) is the subset of the target population ($G_t$) actually reached with invitations to participate in the system. A target population is the population universe that would benefit from the system, in the case of this study, by obtaining a KCTCS educational credential (a certificate, diploma, or associate's degree).

- **Implementation**: The extent to which the system has already been implemented according to plan.

- **Participation**: The ratio of the participant population to the invited population. A participant population is the subset of the invited population that actually takes part in the system. For this study, this would mean enrolling into the KCTCS ERP system for the purpose of being transformed (as an input) by the attainment of a KCTCS credential.
Effectiveness: The ratio of completers to participants. Completers have met the ERP system's production success criteria, i.e. have realized benefits. For this study, completers are those who were output by the KCTCS ERP system with an educational credential in hand.

RESULTS

Calculation of the Penetration Factor

The calculation of Pronk's penetration factor calls for the identification of the number of people who could benefit from a KCTCS credential (the target population Gt) and an estimate of the number of these people who know about the existence and availability of KCTCS credentials (the invited population Gi). The target population of 1,687,740 people was defined from the sum of the number of Kentucky residents age 25 or older who:

1. Dropped out of high-school in the 10th, 11th, or 12th grade without graduating (309,293, 11.7%);
2. Hold a high-school diploma or a GED, but not higher (888,277, 33.5%); and
3. Have completed college coursework but still lack a 2-year college degree (490,170, 18.5%).

All numbers are from U.S. Census (2000). Percentages are based on 2,646,397 = 100%.

The invited population (Gi) was estimated to be 35% of the target population, or about 590,709 people. This estimate is derived heuristically from the following facts for Kentucky:

1. At 37%, Kentucky ranks 31/50 in the high-school to college transition rate, below the U.S. average of 40%. The two states with the highest rates are North Dakota (59%, rank 1) and Massachusetts (54%, rank 2);
2. Kentucky is at the national average of 33% in the rate of Young Adult College Enrollment;
3. At 2.8%, Kentucky ranks 41/50 in the rate of Working Age Adult College Enrollment. The two states with the highest rates are New Mexico (6.0%, rank 1) and Arizona (5.5%, rank 2);
4. The number of college students enrolled in all Kentucky colleges and universities in 2002 was 206,367 students.

All data are from Measuring Up (2002). The penetration factor for the KCTCS ERP system is then fixed at:

\[
\text{Penetration} = \frac{\text{Invited Population}}{\text{Target Population}} = \frac{Gi}{Gt} = \frac{509,709}{1,687,740} = 0.35
\]

Calculation of the Implementation Factor

The key KCTCS restructuring provisions of HB1 became effective on July 1, 1998, so this is used as the start date (HB1, 1997):

1. "Effective 7/1/98, transfer all staff, property, and responsibility of postsecondary institutions in the Kentucky Technical System from the Cabinet for Workforce Development to the Kentucky Community and Technical College System;"
2. "Effective 7/1/98, transfer all staff, property, and responsibilities of the community colleges from the University of Kentucky to KCTCS."

At the close of the Fall 2003 semester, the implementation factor for the KCTCS ERP system can be calculated from the ratio of the months completed (Mc) to months planned (Mp), as follows:
Impact and Sustainability of ERP

Calculation of the Participation Factor

The participation factor is the ratio of the participant population \( (S_e) \) over the invited population \( (G_i) \). KCTCS had a record enrollment of 72,023 students in its various programs statewide in the Fall of 2003 (Table 1 in Tapp et al., in press). The invited population \( G_i \) was estimated above at 590,709. The KCTCS ERP system participation factor is then:

\[
\text{Participation} = \frac{S_e}{G_i} = \frac{72,023}{590,709} = 0.12
\]

Calculation of the Maximum and Actual Effectiveness Factor

The theoretical upper limit for the effectiveness factor for the KCTCS ERP system is 0.40, which is based on the theoretical upper limit of the following assumptions:

1. Associate's degrees require exactly 4 semesters to complete, diplomas 2 semesters, and certificates 1 semester.
2. Every student completes their credential exactly on schedule.

Based on these assumptions, 1/4 of all associate's degree seeking students, 1/2 of all diploma seeking students, and all the credential seeking students would graduate every semester. These numbers double when considered over an academic year, and are calculated here using the data provided by Tapp et al. (in press, Table 2). If these assumed perfect graduation rates held, the theoretical number of KCTCS students enrolled in the Fall of 2002 semester would have been 12,128, the sum of the following:

\[
\begin{align*}
(4,229 \text{ Associates Degrees Awarded} / 2) 	imes 4 &= 8,458 \text{ Associate Students} \\
(1,705 \text{ Diplomas Awarded} / 2) 	imes 2 &= 1,705 \text{ Diploma Students} \\
(3,929 \text{ Certificates Awarded} / 2) 	imes 1 &= 1,965 \text{ Certificate Students}
\end{align*}
\]

Similarly, the number of credentials awarded in the Fall of 2002 would have totaled half the academic year's totals, or 4,933, the sum of the following:

\[
\begin{align*}
4,229 \text{ Associates Degrees Awarded} / 2 &= 2,115 \text{ Associate Students} \\
1,705 \text{ Diplomas Awarded} / 2 &= 853 \text{ Diploma Students} \\
3,929 \text{ Certificates Awarded} / 2 &= 1,965 \text{ Certificate Students}
\end{align*}
\]

The theoretical maximum effectiveness factor for the KCTCS ERP system is then:

\[
\text{Maximum Effectiveness} = \frac{\text{Max Credentials Awarded}}{\text{Max Eligible Students}} = \frac{(2,115+853+1,965)}{(8,458+1,705+1,965)} = \frac{4,993}{12,138} = 0.40
\]

The actual effectiveness factor for the KCTCS ERP system can be obtained from the actual ratio of KCTCS credential completers to participants, that is, the number of students graduating \( (S_g) \) over the number of students enrolled \( (S_e) \). This ratio can be calculated as the average number of credentials awarded in the academic years 2000-2001, 2001-2002, 2002-2003 over the average KCTCS enrollment for the same period.

\[
\text{Actual Effectiveness} = \frac{\text{Graduating Students}}{\text{Enrolled Students}} = \frac{S_g}{S_e} = \frac{(9,863+9,022+6,770)}{(67,812+63,120+52,201)} = \frac{25,655}{183,133} = 0.14
\]
Calculation of the KCTCS ERP System Impact

The KCTCS ERP system impact as of Fall of 2003 is easily obtained from the application of the calculations above to equations (1), (2) and (3), as follows:

\[
\text{Reach} = \text{Penetration} \times \text{Implementation} = 0.35 \times 0.25 = 0.088 \text{ (as of Fall 2003)}
\]

\[
\text{Coupling} = \text{Participation} \times \text{Effectiveness} = 0.12 \times 0.14 = 0.017
\]

\[
\text{Impact} = \text{Reach} \times \text{Coupling} = 0.088 \times 0.017 = 0.0015 \text{ (as of Fall 2003)}
\]

DISCUSSION

Discussion of the PIPE Metrics

Impact

If the penetration, participation, and effectiveness factors remain the same between now (at 25% implementation, Fall 2003) and 100% implementation (in the year 2020), the theoretical impact of the KCTCS ERP system can be calculated from equations (1), (2) and (3) as \((0.35 \times 1.0) \times (0.12 \times 0.14) = 0.0059\). This number is low and invites improvement. For instance, if in the next decade KCTCS succeeds in quadrupling the coupling term by doubling the participation and doubling the effectiveness, as discussed next, by its target year of 2020 the KCTCS ERP system mandated by HB1 will have had a calculated theoretical impact of \([0.35 \times 1.0] \times [(2 \times 0.12) \times (2 \times 0.14)] = 0.024\). This number is about 6 times smaller than the theoretical maximum impact for the KCTCS ERP system of \((0.35 \times 1.0) \times (1.0 \times 0.40) = 0.14\).

Reach

The reach component of KCTCS ERP system impact calculation is likely to improve only slowly. Growth rate of the implementation term is fixed by the time to completion of the initiative. This means any managed improvement in reach would have to come from an increase in the invited population (the already sizeable numerator in the penetration term), or from a decrease in the target population (the large denominator of the penetration term). Decreases in the large denominator would be particularly appealing because of the squaring effect provided by the inverse rate of change law. Unfortunately, in practice the target population in the denominator is changeable, in that it is fixed by long-term demographics controlled largely by statistical life expectancy tables. As shown in Table 2, the KCTCS ERP system target population contains a significantly sized cohort of older poorly educated people whose educational attainment was sadly neglected in previous generations.

Coupling

The KCTCS ERP system coupling term, the product of the participation and effectiveness factors, currently at 0.017, is low. To improve the coupling factor fourfold, to 0.068, a strategic initiative is suggested based on doubling the participation (a measure of inputs) and the effectiveness (a measure of outputs) of the KCTCS ERP system. Figure 1 and Figure 2 show the enrollment growth and credentials awarded projections assuming a doubling of the participation and effectiveness terms of the coupling factor.
As shown in Figure 1, the participation rate could be doubled from 0.14 to 0.28 by roughly doubling the number of students enrolled in the KCTCS ERP system, from 72,023 in Fall of 2003 to 150,000 by the Fall of 2020. The average growth rate needed to reach this target enrollment of 150,000 is of the order of 4.4% per year. This average rate is readily attainable at current growth rates. In the last two years, between the Fall of 2001 and the Fall of 2003, the KCTCS enrollment has grown by an average of 6.8% per year, and has averaged 10.2% a year between 1997 and 2003. The effectiveness rate could be doubled from 0.12 to 0.24 by retaining more students, encouraging them to graduation, and helping them graduate in fewer semesters. Figure 2 shows the growth of the credentials output by KCTCS assuming the effectiveness rate is doubled from the current 0.14 to 0.28 and enrollment targets are met (Tapp et al., in press).

Discussion of the 4-s Metrics
Size

The intervention size identifies the modality, frequency, and aggregate volume of a programmatic intervention needed to obtain the desired effect (Pronk, 2003). All of these parameters are provided in the following stated goal of HB1 (1997):

"(f) [modality:] An efficient, responsive, and coordinated system of autonomous institutions [desired effect:] that delivers educational services to citizens [aggregate volume and frequency:] in quantities and of a quality that is comparable to the national average." (HB1, 1997)

The call for "quantities and quality comparable to the U.S. average" is an imposing one, for only 17.1% of the Kentucky population 25 and over holds a bachelor's degree or higher (see Table 1). This sad statistic ranks Kentucky 47th out of 50 states, ahead only of Mississippi, Arkansas, and West Virginia: the national average is 24.4%. As seen in Table 2, life expectancy demographics related to educational neglect in past generations impede a meaningful form of intervention: 49.6% of the Kentucky population aged 65 and over, and 24.8% of those between the ages of 45 and 64, lack a high-school degree, and so are not eligible for inclusion in the KCTCS ERP system.

Scope

The following stated goal of HB1 (1997) details the scope (Pronk, 2003) of the KCTCS mission: "access throughout the Commonwealth to a two (2) year course of general studies designed for transfer to a baccalaureate program, the training necessary to develop a workforce [...] and remedial and continuing education to improve the employability of its citizens."

Continuing emphasis on access and transfer to baccalaureate programs is statistically justified. As shown in Table 3, state per capita income and the percent of the population with at least a bachelor's degree are highly correlated: \( r = 0.81 \) for the Kentucky benchmark states in Table 3; \( r = 0.83 \) for all 50 U.S. states. There is a weaker correlation (\( r = 0.53 \) for benchmark states, see Table 3) between per capita income and the percentage of the population credentials of the type offered by KCTCS. Still, Kane and Rouse (1999) have shown that education pays: even the average student who enrolls for only one term in a community college like KCTCS earns 9% to 13% more than one who doesn't.

Scalability

Pronk (2003) notes that "the design of programs and interventions should not only address the degree to which a given individual needs to improve [...] but also how a critical mass can be reached that allows the population as a whole to reach the desired endpoint." (pp. 151-152). To help determine this critical mass, the scalability factor was defined earlier as the ability of the KCTCS ERP system to develop the sufficient mass of functioning needed to serve (or cover) all its intended audience. This factor is a function of the willingness and ability of the target audience to participate in the KCTCS ERP credentialing system as an input, the credential cost in the context of the resources available, and the partnership appeal of the certificate, diploma, and degree output to outside stakeholders, the future employers of the credential holder.

Sustainability

HB1 (1997) specifies an assessment of the overall strategic initiative and of the KCTCS ERP system in particular based on the external view of sustainability (Whittaker et al., 2004). The legislation declares the people of the Kentucky Commonwealth as the set of independent outside observers invited "to draw more than one favorable conclusion concurrently" about the benefits of the KCTCS ERP system to their socioeconomic well being:

"(2) The General Assembly declares on behalf of the people of the Commonwealth the following goals to be achieved by the year 2020: [...] educational services to citizens in quantities and of a quality that is comparable to the national average" (HB1, 1997)

HB1 calls for the use of objective benchmarks to establish the attainment of these goals, which include "comparisons of the Commonwealth to other states and the nation." (HB1, 1997, Section 5, a-c) Table 3 lists the benchmark states selected by the CPE for Kentucky for the 2002-04 and 2004-06 KCTCS funding cycles (CPE Budget, 2003). Included in Table 3 are Kentucky, benchmark state, and United States national averages for three measures of interest, per capita income, high-school to college transfer rates, and percentage of the benchmark state's population that holds 2 and 4 year college degrees.
As seen in Table 3, with the replacement of Arkansas and Tennessee with the stronger states of Colorado and Washington for the 2004-06 funding cycle, Kentucky has the lowest numbers of any state in the 2004-06 benchmark group across all categories. Kentucky is below the national average in all categories, including the percentage of the population that holds at least a 4-year college degree, a statistic that correlates strongly with per capita income ($r = 0.83$ in Table 3). At the same time, statistical correlations need to be treated with caution. A high degree of correlation simply means that when one thing is observed, so is the other. The two things could be coupled to something they have in common, and it is this component that should be subject to a cause and effect analysis, and not the relationship between the two observations. Educational attainment is symbiotically self-correlated to "economic development and quality of life." In other words, the incoming tide raises all ships.

The real purpose behind the particular set of benchmark states selected by the CPE (CPE Budget, 2003) is to provide guidelines for adequate funding so as to change the Kentucky numbers of Table 3 in a sustainable fashion to "quantities and of a quality that is comparable to the national average." (HB1, 1997) Given that HB1 also specified an external view of sustainability, for sustainable change to be achieved, the timing and size of external perturbations in the way of mandates and funding cycles for the KCTCS ERP system must be buffered to what the educational system and the taxpayers of Kentucky can absorb. A comparison of the achievement of benchmark provides this buffer, and so helps ensure the sustainability of the HB1 initiative (Table 3).

CONCLUSIONS

This study has also developed a quantitative theoretical framework (Pronk, 2003) for the evaluation of the sustainability of the KCTCS ERP system. Calculations were made for the PIPE metrics of penetration (0.35), implementation (0.25), participation (0.12), and effectiveness factors (0.14). From these metrics, estimates were made for the Reach (0.088), Coupling (0.017), and Impact (0.14) of the current KCTCS ERP system implementation. The findings of this study are:

1. The present coupling factor, a measure of in-bound engagement through the product of the participation and effectiveness factors, must be significantly improved. To improve on this figure, a strategic initiative was considered for KCTCS based on doubling both the participation and the effectiveness factors. The initiative assumes a 4.4% per year increase in enrollments at KCTCS from the current 72,023 (Fall 2003) to 150,000 students by 2020 and is supported by the data elicited in the previous three years (Tapp et al). In addition, the effectiveness factor can be significantly improved from its current value of 0.14 to 0.28 by increasing the number of credentials awarded per academic year to 42,000, up from the present value of 10,000. A previous study of the KCTCS system by Tapp et al (2003) showed a dramatic increased in the number of credentials issued which in part was due to the number of general certificates rather than associate degrees which implies that an increase in effectiveness is attainable. With these initiatives in place the coupling term can be increased fourfold to 0.068.

2. The reach term of the Pronk model was found to be the rigidity of the penetration term, which was found to be limited by the age and education demographics of the populations sought to be served by KCTCS and thus offered little room for improvement.

3. With the current penetration factor frozen by demographic considerations, and a doubling of each of the participation and effectiveness factors, the calculated theoretical impact of the KCTCS initiative advanced by HB1 is predicted to be 0.024 in the year 2020.

4. Overall, the impact of the KCTCS ERP system is most severely limited by the penetration term of the reach factor. The penetration term is frozen by the educational demographic profile of a large segment of the population, one sadly neglected in earlier educational initiatives. Education cuts never heal.

ACKNOWLEDGEMENTS

The authors would like to thank the administration of KCTCS for generous access to the KCTCS ERP Improptu-based Cognos Reporting Data Module for the collection of much of the data used in this work.
REFERENCES


All Internet references were last retrieved on January 25, 2004.
<table>
<thead>
<tr>
<th>Educational Attainment for Kentucky and U.S. Population Aged 25 or older</th>
<th>KY</th>
<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completed less than 9th grade</td>
<td>11.6%</td>
<td>7.5%</td>
</tr>
<tr>
<td>Completed some of grades 9-12</td>
<td>14.2%</td>
<td>12.1%</td>
</tr>
<tr>
<td><strong>Not KCTCS eligible</strong></td>
<td><strong>25.8%</strong></td>
<td><strong>19.6%</strong></td>
</tr>
<tr>
<td>High-school graduate (includes GED holders)</td>
<td>33.6%</td>
<td>28.6%</td>
</tr>
<tr>
<td>Attended college for a year or less</td>
<td>6.5%</td>
<td>7.1%</td>
</tr>
<tr>
<td>Completed 1 or more years of college, no degree</td>
<td>12.0%</td>
<td>14.0%</td>
</tr>
<tr>
<td><strong>KCTCS eligible</strong></td>
<td><strong>52.1%</strong></td>
<td><strong>49.7%</strong></td>
</tr>
<tr>
<td>Associate's degree</td>
<td>4.9%</td>
<td>6.3%</td>
</tr>
<tr>
<td>Bachelor's</td>
<td>10.3%</td>
<td>15.5%</td>
</tr>
<tr>
<td>Master's</td>
<td>4.8%</td>
<td>5.9%</td>
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<tr>
<td>Professional</td>
<td>1.5%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Doctorate</td>
<td>0.6%</td>
<td>1.0%</td>
</tr>
<tr>
<td><strong>Total Bachelor's Degree or Higher</strong></td>
<td><strong>17.1%</strong></td>
<td><strong>24.4%</strong></td>
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<tr>
<td><strong>Total College Graduates (Included Associate's)</strong></td>
<td><strong>22.1%</strong></td>
<td><strong>30.7%</strong></td>
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<tr>
<td><strong>Totals</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
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</table>
Table 2. Comparison By Age Cohort Of The Educational Attainment Of The Kentucky And U.S. Populations. Source: [http://factfinder.census.gov/](http://factfinder.census.gov/)

<table>
<thead>
<tr>
<th>Educational Attainment</th>
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<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of age group without a high-school degree:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-34</td>
<td>15.8%</td>
<td>16.1%</td>
</tr>
<tr>
<td>35-44</td>
<td>17.7%</td>
<td>15.0%</td>
</tr>
<tr>
<td>45-64</td>
<td>24.8%</td>
<td>16.8%</td>
</tr>
<tr>
<td>65+</td>
<td>49.6%</td>
<td>34.5%</td>
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<tr>
<td>Percentage of age group with a high-school degree and without a bachelor's degree:</td>
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<td></td>
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<tr>
<td>25-34</td>
<td>63.4%</td>
<td>56.4%</td>
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<tr>
<td>35-44</td>
<td>64.2%</td>
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<tr>
<td>45-64</td>
<td>57.2%</td>
<td>56.8%</td>
</tr>
<tr>
<td>65+</td>
<td>40.2%</td>
<td>50.1%</td>
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<tr>
<td>Percent of age group with a high-school degree or higher:</td>
<td></td>
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<tr>
<td>25-34</td>
<td>84.2%</td>
<td>83.9%</td>
</tr>
<tr>
<td>35-44</td>
<td>82.3%</td>
<td>85.0%</td>
</tr>
<tr>
<td>45-64</td>
<td>75.2%</td>
<td>83.2%</td>
</tr>
<tr>
<td>65+</td>
<td>50.4%</td>
<td>65.5%</td>
</tr>
<tr>
<td>Percent of age group with a bachelor's degree or higher:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-34</td>
<td>20.8%</td>
<td>27.5%</td>
</tr>
<tr>
<td>35-44</td>
<td>18.1%</td>
<td>25.9%</td>
</tr>
<tr>
<td>45-64</td>
<td>18.0%</td>
<td>26.4%</td>
</tr>
<tr>
<td>65 and over</td>
<td>10.2%</td>
<td>15.4%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2004-2006 Benchmark states for Kentucky</th>
<th>Mean per capita income $ (U.S. rank)</th>
<th>High-school to college transfer rate % (U.S. rank)</th>
<th>Percentage aged 25+ w/ 2-year associate's degree</th>
<th>Percentage aged 25+ w/ 4-year degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecticut</td>
<td>$28,766 (1)</td>
<td>48% (6)</td>
<td>6.6%</td>
<td>18.2%</td>
</tr>
<tr>
<td>Colorado (a)</td>
<td>24,049 (5)</td>
<td>39% (27)</td>
<td>7.0</td>
<td>21.6</td>
</tr>
<tr>
<td>Virginia</td>
<td>23,975 (6)</td>
<td>41% (21)</td>
<td>5.6</td>
<td>17.9</td>
</tr>
<tr>
<td>Minnesota</td>
<td>23,198 (10)</td>
<td>41% (21)</td>
<td>7.7</td>
<td>19.1</td>
</tr>
<tr>
<td>Washington (a)</td>
<td>22,973 (12)</td>
<td>37% (31)</td>
<td>8.0</td>
<td>18.4</td>
</tr>
<tr>
<td>Ohio</td>
<td>21,003 (22)</td>
<td>40% (24)</td>
<td>5.9</td>
<td>13.7</td>
</tr>
<tr>
<td>North Carolina</td>
<td>20,307 (28)</td>
<td>39% (27)</td>
<td>6.8</td>
<td>15.3</td>
</tr>
<tr>
<td>Iowa</td>
<td>19,674 (31)</td>
<td>53% (4)</td>
<td>7.4</td>
<td>14.7</td>
</tr>
<tr>
<td><strong>Average for 8 Benchmark states</strong></td>
<td><strong>$22,993</strong></td>
<td><strong>42.3%</strong></td>
<td><strong>6.9</strong></td>
<td><strong>17.4</strong></td>
</tr>
<tr>
<td><strong>U.S. Average</strong></td>
<td><strong>$20,767</strong></td>
<td><strong>40%</strong></td>
<td><strong>15.5%</strong></td>
<td><strong>17.0%</strong></td>
</tr>
<tr>
<td>Tennessee (b)</td>
<td>19,393 (35)</td>
<td>33% (42)</td>
<td>4.7</td>
<td>12.8</td>
</tr>
<tr>
<td><strong>Kentucky</strong></td>
<td><strong>18,093 (40)</strong></td>
<td><strong>37% (31)</strong></td>
<td><strong>4.9</strong></td>
<td><strong>10.3</strong></td>
</tr>
<tr>
<td>Arkansas (b)</td>
<td>16,904 (48)</td>
<td>39% (27)</td>
<td>4.0</td>
<td>11.0</td>
</tr>
<tr>
<td>Correlations (c)</td>
<td>11 states</td>
<td>0.33</td>
<td>0.53</td>
<td>0.81</td>
</tr>
<tr>
<td></td>
<td>50 states</td>
<td>0.21</td>
<td>n/a</td>
<td>0.83</td>
</tr>
</tbody>
</table>

Notes: (a) Added to 2004-06 benchmark state list; (b) Dropped from earlier 2002-04 benchmark state list; (c) Correlations are based on all 11 states listed.