

# **GOWN-TOWN SCIENCE TRANSFER IN RETROSPECT: SUMMARY AND APPRAISAL OF THE UNIVERSITY OF OKLAHOMA-CITY OF OKLAHOMA CITY URBAN TECHNOLOGY SYSTEM EXPERIMENT**

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The University of Oklahoma and City of Oklahoma City for the past three and one-half years have been participating in a significant and successful national experiment in technology transfer to local government. The experiment has been jointly funded by the National Science Foundation and city, industry, and university participants which have included, among others, the University of California, Exxon, Grumman Aerospace and the Battelle Memorial Institute in Columbus. The University of Oklahoma-City of Oklahoma City activity, totaling twenty-two projects, has been the most broadly executed and active of the city-university UTS programs, and, significantly, the activity has been effectively self-supporting. The City has realized in excess of \$500,000 savings based upon \$60,000 invested while the university, in return upon a \$90,000 investment, has realized close to \$85,000 in city contracts, in addition to considerable unaccounted city staff assistance in academic programs.

## **INTRODUCTION**

The University of Oklahoma - City of Oklahoma City Urban Technology System Experiment has been one element in a nation-wide experiment known as the Urban Technology System (UTS). The national UTS has been a three and one-half year, \$10,000,000 experiment in technology transfer to local government partially funded by the National Science Foundation's program in Research Applied to National Needs and managed by Public Technology, Incorporated. The experiment was concluded in November, 1977.

The national UTS experiment began its operational phase in July, 1974, with the assignment of a "Technology Agent" (TA) in each of twenty-seven medium-size American cities. Each TA generally served directly under his city's chief administrative officer. Each city also was assigned a "Back Up Site" (BUS) to serve as a technology resource to the TA. Fifteen BUS — including six universities, one federal agency, four nonprofit or not-for-profit consulting firms, and four for-profit firms — supported one or more cities. The University of Oklahoma was paired with Oklahoma City. The authors of this paper were respectively the BUS Representative and TA in the local experiment.

## **METHODS**

Within broader national UTS objectives, the University of Oklahoma - City of Oklahoma City experiment initially had one principal objective: to mobilize University faculty resources to address relatively small scale operational problems of Oklahoma City government. Problem scale was constrained by a national program limit of ten faculty days of consulting (i.e., \$1,000) on any one problem. These ten man-day efforts were nominally called "Mode 1" projects within the experiment. Faculty compensation was to be provided by the University as an element of its contributed match to the experiment.

The first-year activity of the local experiment followed the prescribed national format. The TA surveyed and gave priority to thirty-four city problems as identified by city management staff. With the aid of the BUS Representative, two Mode 1 problems were selected and faculty were identified to address them. The problems addressed are numbers 1 and 2 in Table 1. First-year activity, however, failed to meet program expectations. The TA was frustrated by a perceived lack of responsiveness by the University's BUS Representative to City problems presented to him; and the BUS Representative and University faculty

were frustrated by what were perceived as ill-defined problem statements drafted by City staff. University faculty were also disappointed in the lack of City recognition and University compensation for their time and effort. Morale was at a low point here and elsewhere in the national experiment.

The local experiment was significantly reorganized the second year: a new University BUS Representative (co-author, Charles Barb) was appointed and the objectives of the local program were significantly modified. The new objectives cast the University in an active research role. The revised objectives, reported in a paper to the Oklahoma Academy of Sciences at the time (1), included:

- (1) testing alternative University faculty support mechanisms aiding City staff, including:
  - (a) formally structured, decision-oriented, problem-focused workshops;
  - (b) a structured, question-specific telephone quick query service;
  - (c) informal, open-ended, relationship-building administrator-faculty luncheon series; and
  - (d) informal, informational, technology awareness seminars;
- (2) examination and reflection upon institutional mechanisms in the University and receiving cities for technology support to urban public agencies; and
- (3) as before, practical agency application of new technology on a project basis.

Underlying redefinition of the local program was a recognition that projects and support mechanisms had to be structured in a way to offer adequate "payoff" to all participants in forms not limited to Mode 1 consulting. The narrow national program objective of program benefits accruing primarily to the cities was also essentially rejected. The following discussion reports progress toward the above objectives and insights drawn during the process.

## **DISCUSSION**

### **Examination of Alternative Mechanisms**

In summary, three of the four mechanisms identified above were tested. Two problem reconnaissance workshops were conducted (Table 1, items 3 and 5) and were deemed successful. Both workshops brought together a mix of University faculty and officials from different levels of government to evaluate an individual vendor's technology as to its applicability to a specific City problem. During workshop discussion University faculty were particularly effective in tempering vendor claims and identifying what wasn't known or resolved in the proposed technology. Other State and Federal government agency staff who participated in the workshop further defined acceptable programmatic use of the technology to City staff. In both cases the workshops proved to be an effective format which offered a useful one-day intensive examination of a prospective technology and the steps that city staff would have to take to further adaptation of the technology.

Three half-day "technology awareness" seminars were held (Table 1, item 6) organized around the visit of experts to the University campus. Topics included geographic information systems, social indicators, and paratransportation. The seminars were held in Oklahoma City and were well attended by City staff; one seminar also attracted considerable press coverage. While University faculty were involved in the seminars, no follow-up activity by City staff or faculty was observed. The seminars were deemed nonproductive because they did not elicit faculty and City staff response and because they did not adequately relate to immediate City problems.

The "quick query" telephone consulting service was conceived to be a rapid response mechanism providing informal faculty appraisal of topical Oklahoma City government issues which surfaced in City Council or department head meetings. The BUS Representative was to canvass faculty opinion and relay it in memorandum form to the TA. The service was never formally initiated by the TA and the mechanism was subsequently deemed unattractive due to the time required of the BUS Representative to conduct a canvass and the lack

of immediate or potential compensation to the faculty consulted.

The most successful mechanism has proven to be faculty-administrator luncheons. Two luncheon series have been initiated involving the City's Departments of Community Services and Traffic Engineering. University faculty were drawn from the University's Schools of Civil, Industrial, and Electrical Engineering. Each luncheon series included approximately four luncheons held three weeks apart which were hosted by the UTS program and held in the University's Faculty Club on the Norman campus. During the luncheons City departmental staff and faculty became acquainted, City departmental staff operations were described, and prospective faculty assistance projects were identified. One project (Table 1, item 20) resulted in a \$70,000 faculty contract with the City to examine solid waste collection productivity. The luncheon program was deemed most successful; due to the low investment in time and cost, the positive tone and sense of compensation to the participants, and the relationships and follow-on contracts that materialized. The problem reconnaissance workshops were deemed less cost effective because they required one to two weeks planning by the BUS Representative and TA and cost about \$300 apiece for a room reservation fee, a buffet working lunch for twenty-five participants, and faculty honoraria for a full day of their time.

In review of the project activity, however, these structured mechanisms accounted for only about half of the means by which University support activities were initiated. About a third of the projects were initiated by the BUS Representative as a faculty consultant (at no fee) in areas of urban information systems technology. In this case, the BUS Representative's interests and expertise closely matched a principal responsibility of the TA.

### **Application of Technology to City Problems**

Table 1 summarizes twenty-two recognizable University assistance projects. Review of the initiating project problems reveals that they generally involve "low" rather than "high" technology and that they were productivity or cost-savings oriented. Not entirely biased by the BUS Representative's interests, improved productivity was often sought through application of the computer and data processing. This is similar to project activity found in other UTS activity research initiated by the authors (2).

A principal characteristic of the UTS experiment is a technology transfer paradigm predicated upon City "pull" rather than BUS "push" of technological solutions. Several technology "pushes" (represented in Table 1 by blank "City Problem" statements) were attempted by the BUS Representative but these produced little or no response from City staff. In only one instance was an unsolicited faculty idea adapted (Table 1, item 10).

As noted earlier, local UTS activity was broadly conceived after the first year of the experiment. Table 2 summarizes the range of potential University-City activity that came to be recognized during the research, and, local occurrence of the activity. (This model of the potential range of joint University-City interaction is a significant contribution to the research). Faculty consulting, City staff training in University courses, and computer time grants proved to be the principal University contributions to the City. The City's contribution to the University were principally faculty contracts, and staff enrollment and instructional support in University courses. University support projects to the City were not innovative *per se* but rather reinforced and assisted the City in exploring technology alternatives already recognized by them. Also in about twenty per cent of the cases University faculty advised against adaptation of a technology.

A feet of local UTS projects is possibly better obtained through selected examples drawn from Table 1. Item 2, analysis of an alternative to flaring of sewer plant methane gas, was a standard "Mode 1" economic analysis which identified the market price of natural gas at which it was economically feasible for the City to process sewer methane gas for sale. The study found that the market price had to be considerably higher than it was at that time and the City subsequently and independently decided to close the particular sewage treatment plant under analysis. In effect, this was an "academic" exercise with no savings realized by the City.

TABLE 1. *University of Oklahoma - City of Oklahoma City Urban Technology System Experiment Activity July 1974 - November 1977*

City problem	University assistance	Result/Status	Savings to City
1. Improved management of data processing	IE faculty drafted d. p. project mgmt. manual and trained City staff in procedures.	Specific procedures not accepted or being implemented	-----
2. Flaring of sewer plant methane gas	Chem. Eng. faculty analyzed economics of processing gas for sale	Gas processing not found to be economically feasible; plant to be abandoned	-----
3. Sewer lagoon effluent processing to meet EPA requirements	CE and Fish Biology faculty, in inter-agency workshop format, examined potential of raising fish in sewer lagoons as a biological treatment alternative	Technology found to be risky and administratively troublesome	-----
4. Solid waste disposal	CE faculty provided selected literature for alternative technologies	Energy recovery proposal under active consideration	-----
5. Deteriorating sewer lines	CE faculty, in inter-agency workshop format, examined polyethylene sliplining as an alternative to replacement	Technology found to have limited application, beginning to be used by City	\$4,000 in one 360° job
6.	Visiting faculty experts conducted City staff seminars in (a) land info. system development (b) social indicator development (c) paratransportation	No immediately discernible result	-----
7. Staffing City internship program	CE, IE and Pub Admin faculty publicized program and solicited student applications	An increased number of student interns were hired	No net dollar savings
8. Individual staff training needs/interests in a. geographic info. sys. b. paratransportation c. public works admin. d. innovation	Regular University course offerings provided training to 13 City staff	No immediately discernible result	-----
9. Staffing personnel selection panels	BUS Representative served on panels for City planning dept. staffing	Positions filled	-----
10. Broader and lower-cost personnel selection process	University loaned conference telephone device for long-distance personnel selection panel interviews	Process deemed feasible, but personnel staff turnover retarded ongoing applications	\$800/selection
11. Improved clerical word processing productivity	University word processing center forwarded reference materials and informal advice on equipment	Two centers and miscellaneous equipment installed and operating	Not evaluated
12. Location of police briefing station	IE faculty supervised student class project in developing an optimal location	Report confirmed City staff plans	-----

<p>13. Failing planning based information system</p>	<p>(a) BUS Rep implemented computer analysis/mapping package to complement/expand system capability          (b) BUS Rep informally advised TA on merits and alternatives          (a) CE Department acquired UTPS package and provided University computer time in exchange for City staff operationalizing package and developing local files (CE faculty also has intent to use package in teaching)          (b) CE Department acquired and installed PLANPAC and RUCCU packages (CE faculty intends to use package in teaching)</p>	<p>Package operational, not utilized by City staff (used in University classroom instruction)          System failed due to staff departure and inadequate sustaining resources          City successfully used package in bus system analysis (faculty use pending); student intern hired to assist</p>	<p>\$1,500 computer time</p>
<p>14. City transportation planning staff use of computer simulation packages</p>	<p>(a) CE Department acquired UTPS package and provided University computer time in exchange for City staff operationalizing package and developing local files (CE faculty also has intent to use package in teaching)          (b) CE Department acquired and installed PLANPAC and RUCCU packages (CE faculty intends to use package in teaching)</p>	<p>Examination of potential applications and use pending (faculty use pending)</p>	<p>\$6,000 computer time (budgeted)</p>
<p>15. Acquisition of a replacement computer-based traffic signal control system</p>	<p>CE faculty informally participated in City staff research into available systems and advised in drafting the City's system solicitation</p>	<p>Solicitation made; system selection pending</p>	<p>Contributed faculty time not computed</p>
<p>16. Broader development of data processing</p>	<p>BUS Rep set up City d.p. staff liaison with Tulsa d.p. department</p>	<p>Ongoing liaison deemed desirable, but no system transfer to date</p>	<p>-----</p>
<p>17. Feasibility of roll-a-way home trash receptacle</p>	<p>IE faculty helped design and performed evaluation on contract</p>	<p>Alternative not found to be cost effective</p>	<p>-----</p>
<p>18. Program planning and monitoring in human resources department</p>	<p>BUS Rep drafted system development proposal and demonstrated potential programmable pocket calculator applications</p>	<p>After presentation/demonstration, no City response</p>	<p>-----</p>
<p>19.</p>	<p>BUS Rep explored and developed basic LANDSAT satellite data analysis capability for urban analysis</p>	<p>City staff briefed and undergoing advanced training under other UTS program</p>	<p>-----</p>
<p>20. Solid waste collection productivity</p>	<p>IE faculty, on contract, conducted comprehensive study of existing system and proposed alternative routing</p>	<p>Unbilled service uncovered, report not timely for system re-routing</p>	<p>Potentially \$35,000 per year revenues through additional billing</p>
<p>21.</p>	<p>Through CE/EE faculty familiarization luncheon, faculty developing unsolicited research proposal to Federal government to build micro-computer-based traffic monitoring equipment</p>	<p>Proposal in planning</p>	<p>-----</p>
<p>22. Oil well drilling in city</p>	<p>CE and Petroleum Engineering faculty informally reviewed issue and proposed environmental assessment</p>	<p>City response pending</p>	<p>-----</p>

Item 5, examination of polyethylene slip lining as a sewer rehabilitation alternative to excavation and replacement, was an example of University support of an already existing City interest in the technology. The project was structured in terms of a problem reconnaissance workshop which validated the technology as applicable in instances where few branch connections were involved. Subsequent City follow-through adaptation of the technology has been slow due to limited staff time and financial resources.

Item 15, acquiring a replacement computer-based traffic signal system, represents an informal faculty support project of uncalculated dimensions and without specific project products for evaluation. The project evolved from an administrator-faculty luncheon series and is but one element in a broader City-University working relationship that has matured in the area of transportation and traffic engineering.

Item 20, a general productivity study of solid waste collection procedures, represents a large dollar service contract occasionally available from the City particularly in the area of productivity analysis. The project's productivity recommendations, however, were submitted too late and the City implemented its own reorganization plan. This illustrates the often time-critical nature of these types of service contracts with a city; information and recommendations must be timely presented or full practical utilization of the research is lost.

Item 14, installation and use of the Urban Transportation Planning System computer package, illustrates a "mutual pay-off" activity representing an ideal University-City project. The project involves joint City-University project development and joint use of the products as an element of an ongoing working program. Not reflected in this summary, however, is the basis of mutual trust that must be formed between City staff and faculty in order to make such programs work, and the frequent challenges to that trust that occur. Loss of mutual trust is commonly the result of conflicting personal objectives and institutional goals, and tenuous communication between the participants.

### **Critical Dimensions to a University-City Program**

The above illustrates several dimensions to a university-city technology transfer program that were recognized as critical during the experiment. Three warrant underscoring.

Time is a critical factor in transfer programs from three perspectives: alternative institutional cycles of operations, faculty and city staff response, and the perceived term of the relationship. Examination of the underlying budget and activity cycles of both the University and the Oklahoma City government reveals a significant mismatch. Basically City staff are most responsive to new ideas during the early and midfall—the period during which faculty are busy organizing a new school year. There is also often a significant mismatch of faculty response and City staff expectations. Faculty are principally teachers who measure and who must fit nonclassroom activities around their primary classroom responsibilities. City staff response to faculty often lags due to similar competing responsibilities. And finally, the effect of

TABLE 2. *Potential Interactions Between Universities and City Governments*

#### *University-Based Activities*

##### Educational and training services

###### Regular degree programs

- Special enrollments in specialty courses
- Extension courses, short courses, and workshops
- Public lectures

##### Facility usage

- Computer
- Library
- Laboratories

##### Staff (faculty and nonacademic) assistance

- Telephone consultations — free advice
- Spin-off application of other research
- Standing or *ad hoc* panels and boards

##### Student assistance

- Theses and dissertations
- Class projects/studies

#### *City-Based Activities*

##### Educational program support

- Student internships and employment
- Classroom lectures by city staff
- Site visits and demonstrations
- Course resource materials

##### Facility usage

- Computer
- Laboratories

##### Funded research

- City-funded analysis/service project
- Participation in third-party-funded research
- City as test bed or laboratory resource

- = OU-OKC UTS experiment

the limited duration of the local experiment, minus summer breaks, was only marginal for developing and demonstrating a potential City-University working relationship. The considerable accomplishment reported here, however, should elicit an optimistic response, particularly when most university benefits appear to mature in the longer term.

The second critical factor in a University-City program is the lack of familiarity and the traditional prejudices that exist in both institutions toward the other. Significant lack of familiarity exists in areas of institutional goals and objectives, and points of access and procedures in utilizing institutional resources. Generally, faculty are not familiar with city operations and have an unflattering opinion of city staff, and, although most city staff have attended universities, they similarly lack an adequate understanding of university operations and also possess an unflattering view of faculty. The local experiment revealed, however, that common stereotypes and prejudices can be significantly dispelled through familiarity.

One significant problem did materialize in the area of contracting procedures. The City, to a great extent, is required to solicit competitive bidding on service contracts, which limits its ability to consummate working relationships with faculty. On the other hand, University grant and contract administration staff, principally dealing with Federal grant programs, are generally unfamiliar with the idiosyncrasies of city contracting. At the same time the City generally requires closer contract supervision than is typical in a *laissez-faire* faculty research environment. It is unclear by whom and how systematic substantive review and overview supervision of faculty contracts can be effected within a university.

The third critical factor in a university-city program is the breadth of perspective with which both city and university managements view the relationship and its respective benefits. Cost-reimbursing, contract-based projects are difficult to secure in a short term and many of the prospective program benefits listed in Table 2 are non-monetary and are only realized over a longer term.

### EVALUATION

In terms of the locally stated objectives, the experiment must be considered a considerable success. Examination of effective mechanisms for initiating and reinforcing faculty support to local government has identified a simple and effective approach: the faculty club lunch. The University-City experiment can also be touted a success from the narrow prospective of costs and benefits that have accrued from experimental activities. The City invested approximately \$15,000 (one quarter of the TA's time) in University-associated projects and has realized about \$47,000 in savings to date as documented in Table 1. (The TA, in nonuniversity-affiliated projects, has documented an additional \$500,000 a year savings to City operations.) The University invested approximately \$90,000, principally in staff time. University faculty have received three City contracts totaling \$82,500, thirteen City staff have enrolled in University courses, and there has been additional untabulated University classroom and program support provided by City staff.

The third program objective, examination of institutional mechanisms within the University for technical support to urban public agencies, was also successfully pursued. The immediate research was generalized and adapted to classroom instruction through a graduate seminar entitled "Technological Innovation in the Local Public Sector" offered by the authors. More significantly, progress has been made in defining an effective basis for institutionalizing a university program of assistance to cities in the form of a university-city "cooperative". The cooperative concept is discussed elsewhere (3); however, it is schematically illustrated in Figure 1 and generally includes the following necessary dimensions:

- (A) recognition and appraisal of exogenous factors, some preexisting to the program, that will significantly shape any university-city relationship;
- (B) definition of initial program objectives which must include:
  - (1) establishment of expanded interinstitutional communication,

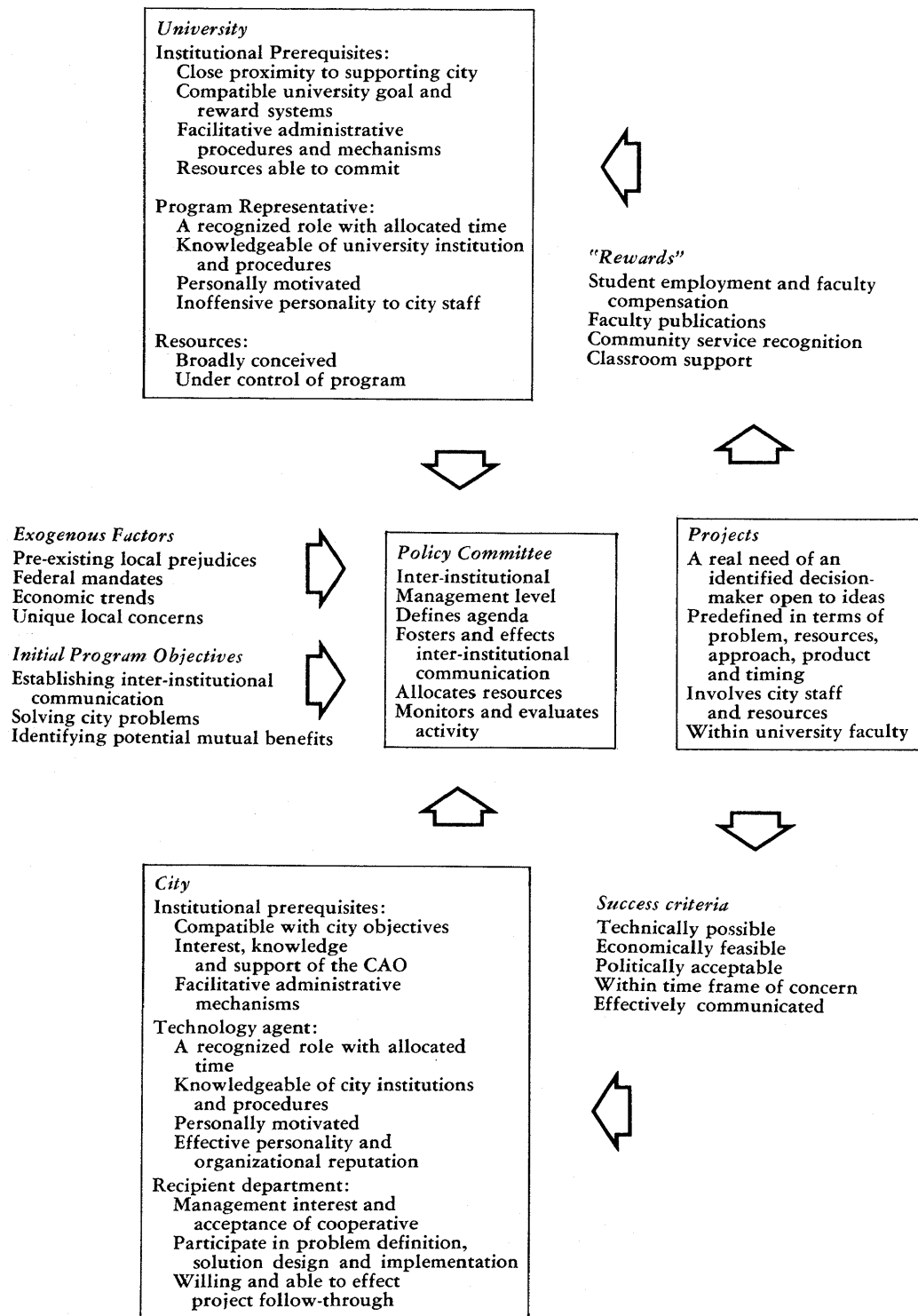


FIGURE 1. Model of a University-City Cooperative



- (2) the practical solving of city problems, and
- (3) identifying mutual program benefits to both the city and university;
- (C) formal impaneling of a joint management-level policy committee to direct and evaluate program activity;
- (D) within the university, reconciling prerequisite institutional mechanisms to the activity, allocating staff, and delegating control over program resources;
- (E) within the city, reconciling prerequisite institutional mechanisms to the activity, allocating staff, and assuring follow-through capabilities on the part of participating city departments;
- (F) drafting project selection criteria;
- (G) drafting project success criteria; and
- (H) developing project reward mechanisms for university participants.

In summary, the outlines and potential *quid quo pro* benefits of a university-city cooperative are clear. The model fundamentally creates an extension-type service activity within a university. It is yet to be seen whether the University of Oklahoma or any of its sub-entities will invest in such formal extension activities.

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