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Planning for a High Tech/Biotech Research Park Start-up

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ABSTRACT. THIS PAPER EXPLORES THE USE OF SCIENTIFIC APPROACHES WHEN PLANNING FOR THE DEVELOPMENT OF A NEW HIGH TECH/BIOTECH RESEARCH PARK. WE ARGUE THAT THE GEOGRAPHIC SCALE OF ANALYSIS IS A CRITICAL FACTOR. WE USE A NEW DATA SET DEVELOPED BY IMPLAN WHICH REPORTS DATA AT THE ZIP CODE/POSTAL CODE SCALE. USING THIS DATA SET WE CAN CONDUCT INPUT-OUTPUT ANALYSIS OF RESEARCH PARK IMPACTS AND CONTRIBUTIONS AT THE MICRO (ONE POSTAL CODE) SCALE, AT THE METROPOLITAN SCALE, AT THE STATE SCALE, AND FINALLY AT THE US SCALE. WE ALSO RECOGNIZE THAT DIFFERENT I/O METRICS "TELL DIFFERENT STORIES," WE DO ANALYSES USING EMPLOYMENT, OCCUPATION, AND WAGE DATA. FURTHER, WE REPORT FINDINGS BY THE MINIMUM REQUIRED EDUCATIONAL ATTAINMENT FOR APPROPRIATE OCCUPATIONS.

1. INTRODUCTION

The purposes of this paper are straight-forward. First, we intend to generate measurable results of future economic impacts of a high tech/biotech research park start-up using an Input-Output approach (IMPLAN [1] Model) that are relevant for local, regional, and national stakeholders. Second, we will translate our findings so that that can be effectively used by policy makers and planners.

This paper builds on a series of previous works translating findings of Input-Output analysis into readily deliverable pieces to community leaders for local economic development (Lay J. Gibson, V. Pavlakovich-Koichi, R. Gruener, and B. Wright, 2008, 2009, 2010). The task of planning for a high tech/biotech research park is involved but sometimes underestimated is the need to "sell" the research park to constituencies in the local area, the metropolitan region, and beyond. The research park will certainly bring a variety of benefits to local and regional populations but it might also displace residents, compete with other projects for planning dollars, and place new demands on physical infrastructure. Further, it will mean different things at different geographic scales. In a competitive environment it is naive to assume that the benefits of a new research park will be self-evident. In this paper we identify constituencies at four different geographic scales. Further, we review the direct, indirect, and induced impacts of a high tech/biotech research park using employment, occupation, and wage metrics.

We draw heavily on a new data set developed and made available by IMPLAN.

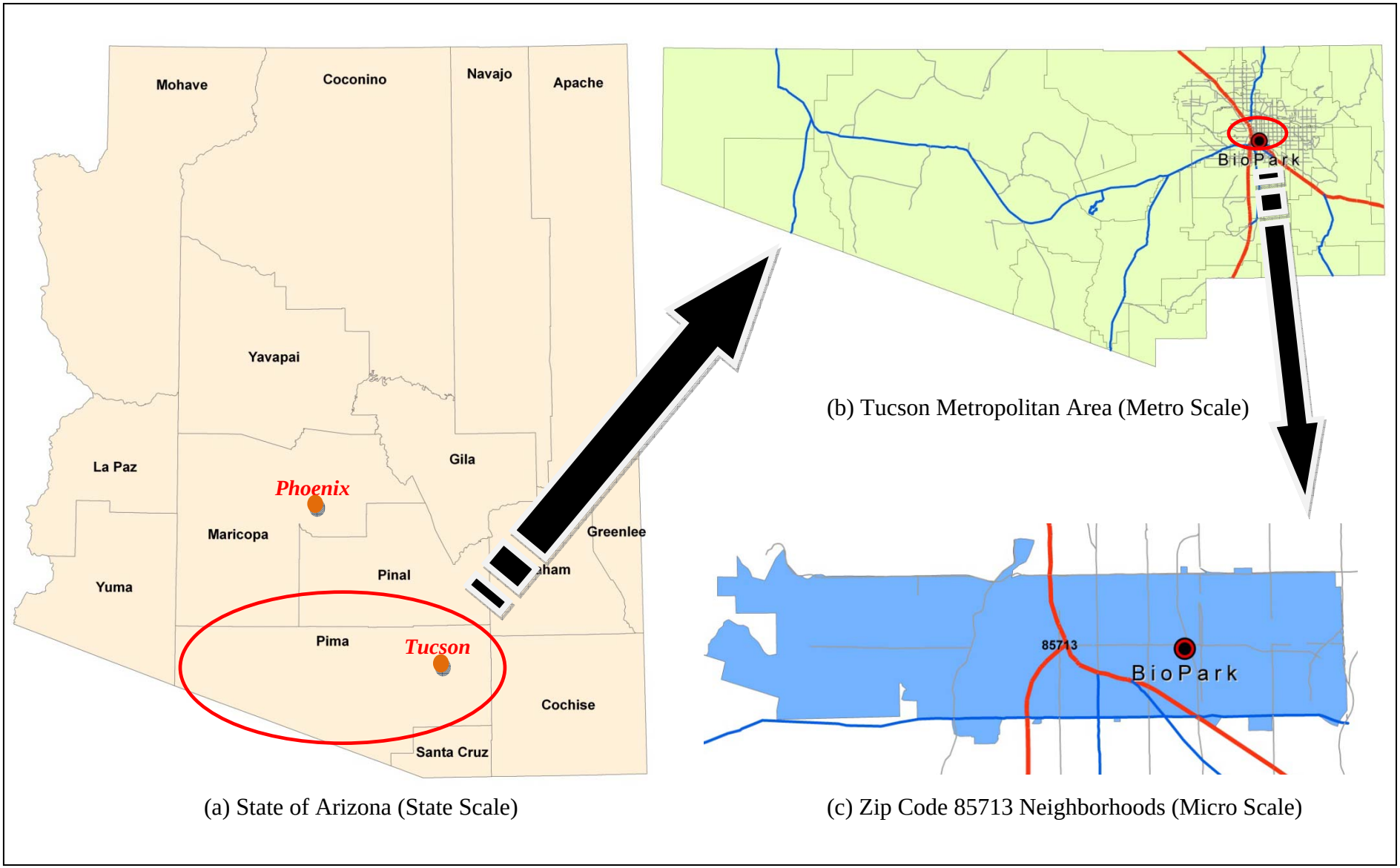
[1] This study uses Social Accounting Matrices (SAM) of IMPLAN® Professional developed by Minnesota Implan Group, Inc.

1.1 Scale

Thanks to the new data set produced by IMPLAN we are able to focus on four geographic scales (Figure 1). The largest scale is the micro or neighborhood scale. This scale is just one zip code/postal code in size. We have selected the zip code which contains the new University of Arizona Biotech Park. Somewhat large in area is the Metropolitan Tucson Scale; the data described here are the sum of the data for the 54 zip codes which are found in the Tucson Metropolitan Statistical Area. Larger yet is the state scale--the sum of all zip codes in the state of Arizona. Finally, the smallest scale reference area is the National or US Scale which is composed of all zip codes in the United States.

IMPLAN data allow us to provide economic profiles, race and demographic profiles, and educational attainment profiles for the four geographic scales.

Economic variables (Table 1) suggest that economic distress is most pronounced at the micro/neighbor scale and that as the map scale gets smaller economic well being increases. Labor Force Participation Rates, Per Capita Incomes, Median Household Incomes, and Per Employee Incomes are all lower at the Micro/Neighborhood Scale whereas unemployment rates and population share below the poverty level are higher at the micro or neighborhood scale than they are at the National/U.S. scale.



(a) State of Arizona (State Scale)

(b) Tucson Metropolitan Area (Metro Scale)

(c) Zip Code 85713 Neighborhoods (Micro Scale)

Figure 1. Study Area Maps

Table 1. Economic Profiles at Four Geographic Scales

Metric	Micro/ Neighborhood Scale	Metropolitan/ Tucson Scale	State/ Arizona Scale	National/ U.S. Scale
Labor Force Participation Rate	50.5%	60.3%	61.1%	63.9%
Unemployment Rate	10.0%	5.3%	5.6%	3.7%
Per Capita Income (1.)	$16,000	$25,910	$26,550	$28,270
Median Household Income (2.)	$35,210	$48,140	$53,110	$55,000
Per Employee Income (3.)	$43,810	$46,040	$47,210	$52,500
Share of Population Below Poverty Level	27.2%	14.7%	13.9%	12.4%

(1.) 2010 US Dollars
(2.) 2010 US Dollars
(3.) 2008 Data in 2010 US Dollars
Source: 2000 Decennial US Census and 2008 IMPLAN Regional Data

Race and demographic variables (Table 2) show that the Micro Scale is heavily Hispanic - the Hispanic population in the Micro area is approximately five times as common as it is in the US as a whole. Similarity, both the Metropolitan Scale and the State Scale way heavily toward the Hispanic population.

Table 2. Race/Demographic Profiles at Four Geographic Scales

Metric	Micro/ Neighborhood Scale	Metropolitan/ Tucson Scale	State/ Arizona Scale	National/ U.S. Scale
Hispanic as % of Population	62.1%	29.3%	25.3%	12.5%
Black as % of Population	6.2%	3.0%	3.1%	12.3%
Median Age	33.2 years	35.7 years	34.2 years	35.3 years

Source: 2000 Decennial US Census

Finally, Educational Attainment data (Table 3) suggest that the levels of educational attainment are generally low. The portion of the population with no high school is considerable higher than at other geographic scales. The portion with high school only is slightly higher at the Micro

Scale than at other Arizona Scales but it is lower at the National or US scale. Percentages of the population with some college, with BA and BS degrees, and with graduate degrees are also consistently lower at the Micro or Neighborhood Scale than at the other Arizona Scales or at the US/ National Scale.

Table 3. Educational Attainment Profiles at Four Geographic Scales

Metric	Micro/ Neighborhood Scale	Metropolitan/ Tucson Scale	State/ Arizona Scale	National/ U.S. Scale
% with No High School	36.5%	16.6%	19.0%	19.6%
% with High School Only	26.3%	23.3%	24.3%	28.7%
% with Some College	26.0%	33.3%	33.1%	27.3%
% with BA/BS Degree	7.0%	15.9%	15.2%	15.5%
% with Graduate Degree	4.2%	10.9%	8.4%	8.9%

Source: 2000 Decennial US Census

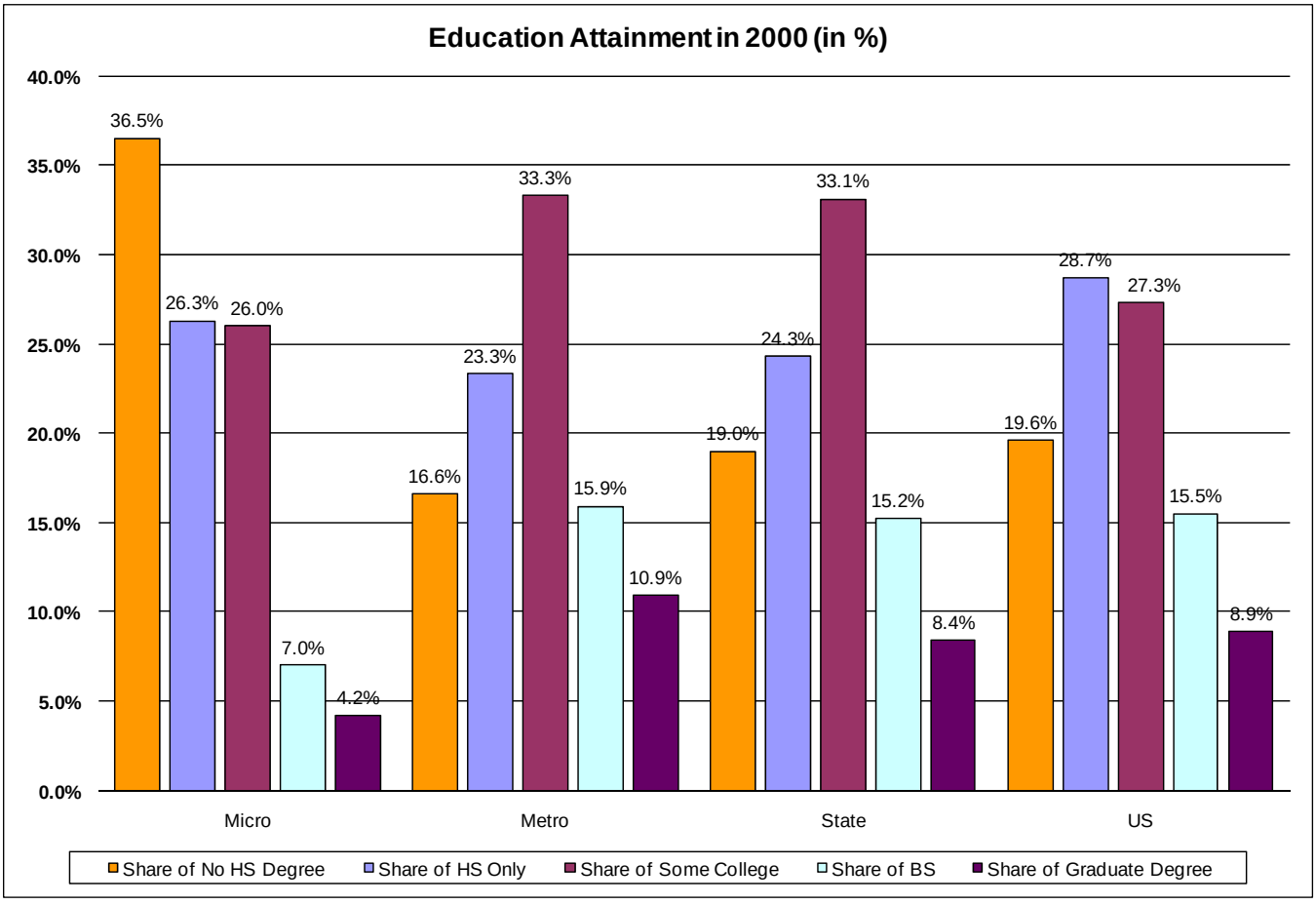


Figure 2. An Education Metric

To summarize, the new University of Arizona Biotech park is located in an area that is economically distressed, has levels of educational attainment that lag behind the metropolitan area, the state, and the nation and that has a large "minority" (Hispanic) population.

2. INPUT/OUTPUT FINDINGS

As previously noted, the input/output analysis has been conducted at four geographic scales--the micro or neighborhood scale, the Metropolitan Tucson scale, the State of Arizona scale, and the US or National scale. We have also conducted the I/O analysis at four points in time, the initial stage, the intermediate stage, and the maturity stage. In this paper we will present our findings at the micro or neighborhood scale for 2012 and for the US or National scale for 2030. The discussions of micro and neighborhood scale findings for 2012 emphasize developments at the University of Arizona's Biopark at the local level in the short-term. In other words the focus is on the Park itself before it adds additional activities and before the initial firms start to grow. Findings for the year 2030 recognize that the Biopark will grow and expand over time but better yet, the Park will generate indirect and induced jobs and income as the Park per se increasingly interacts with firms and government agencies in the Tucson Metropolitan Area, elsewhere in the State of Arizona, and even elsewhere in the US.

Further, we describe our findings in terms of employment and wages by minimum required educational attainment for occupations required at each stage. The idea here is to establish that high tech/bioparks provide opportunities for a variety of citizens. Certainly the opportunities for those which advanced university degrees are substantial and significant but there are also

abundant opportunities for those who have achieved only modest levels of educational attainment and even for those who have failed to complete their high school diplomas. In other words, the public perception might correctly be that high tech/bioparks are an environment for an educated elite but we demonstrate that they provide a wide range of opportunities for citizens of all levels of educational attainment. Further, they offer pathway jobs which allow upward-mobility for those with high school diplomas, some college or specialized training, BA or BS degrees, and even those with a graduate degree. Even the non-pathway jobs allow those with no high school diploma to enter the work force, perhaps for the first time, in positions that offer substantial wage income.

2.1 Baseline/Start-up: The Micro/Neighborhood Scale during the Initial Stage, 2012

Table 4 paints a picture of the University Biopark itself in its initial year of operation. As can be seen, we assume that there will be six major employers in the Biopark in the initial stage-- 2012. The bulk of the employees will be in research a development firms or in a hospital which could be tied to drug trials, or it could simply serve traditional patients. Smaller numbers of workers will be in office administration and laboratory and medical instrument manufacturing activities. Two other employers which start small and stay small are the high school and university housing. The university housing would be for university (graduate) students and families who are employed in the park. The high school would have a high tech/biotech focus and would be designed to meet the needs of both university bound students who wish to focus on biotech and medical careers and those who have a more vocational focus but also in the biotech/medical areas.

Table 4. Direct Employment Composition

IMPLAN Sector (Code)	Initial Stage (2012)	Maturity Stage (2030)
Research &Development (376)	180	900
Hospital (397)	180	900
Office Administration Service (384)	40	200
Hotel (411)	0	200
Lab & Medical Inst. Manufacturing (305)	20	100
High School (391)	30	30
University Housing (360)	10	10

The employment picture in the Maturity Stage in 2030 has change in two ways. First, we assume that between 2012 and 2030 a new activity will join the mix in the Biopark--a hotel. The hotel would meet the needs of a variety of potential customers including visiting researchers, vendors, hospital patients and their families, those attending conferences, and members of the general public attracted to the hotel's, brand, location, and price point. Secondly we assume that during the 28 years between the Initial State and Maturity there will be substantial employment growth in the research and development, hospital, and office administration sectors and more modest growth in the laboratory and medical instrument manufacturing sector.

Other perspectives on the baseline or start-up phase are shown on Table 5. Direct employment is shown as 460 in both Table 4 and Table 5. Table 5, however, shows the share of the start-up direct employment available to different educational cohorts. Whereas the number who hold graduate degrees is likely to be modest there will be abundant opportunities for high school and college graduates and for those with levels of educational attainment somewhere in between. As shown in Table 5, the local annual wage bill is estimated to be over 32 million dollars during the initial stage and the direct wage per employee is estimated to be over $81,000 per year for college graduates and slightly less for those with graduate degrees; the latter group includes "post-docs" who have pay rates that are slightly reduced to reflect the fact that they are still

students. Even those with no high school diploma are assumed to have a per employee direct wage of over $57,800 per year.

Table 5. Employment at the Micro/Neighborhood Scale during Initial Stage (2012)

Minimum Required Educational Attainment for Occupation	Direct Employment		Direct Wage (aggregated)		Direct Wage (per Employee)	
	Number	%	Number	%	Number	Ratio (%)
Graduate Degree	10	2.2%	807,690	2.5%	79,292	111.2%
BS/BA Degree	161	35.1%	13,095,037	39.9%	81,148	113.8%
High School and Some College or Specialized Training	99	21.5%	5,905,230	18.0%	59,663	83.7%
High School Only	149	32.5%	10,663,925	32.5%	71,461	100.2%
No High School Diploma Required	40	8.7%	2,314,910	7.1%	57,801	81.1%
Total	460	100.0%	32,786,793	100.0%	71,305	100.0%

Finally, it should be noted that we assume only direct employment at the Micro/Neighborhood scale during the initial stage (2012). The reason is simple--there are very few local businesses at the Micro or local scale--businesses that might do business with Biopark based firms, or for that matter, with employees who live in the local neighborhood. At some point in the future we can hope that localized firms will be established to serve the needs of Biopark based businesses and local residents. In the meantime it is safest to assume that localized demands for goods and services will be met by out-shopping which sees local firms and individuals make their purchases in the greater Tucson area, elsewhere in the State, or even elsewhere in the US. Given the fact that the Micro/Neighborhood scale is economically disadvantaged, in the short term it will need

to be satisfied with direct employment which will start at 460! Overtime it can be expected to see the expanded economic benefits that come with the indirect and induced impacts tied to the multiplier process.

2.2 Input/Output Findings at the Metropolitan Scale during the Initial Stage, 2012

As was the case at the Micro/Neighborhood Scale all of the direct employment in the Tucson Metropolitan Area is in the Biopark--the direct employment data in Table 6 are the same as the direct employment data in Table 5.

Table 6. Employment in Tucson Metro Area during Initial Stage (2012)

Minimum Required Educational Attainment for Occcupation	Direct Employment		Indirect Employment		Induced Employment		Total Employee Numbers in All Categoreis of Employment	
	Number	%	Number	%	Number	%	Number	%
Graduate Degree	10	2.2%	4	2.9%	4	1.8%	19	2.2%
BS/BA Degree	161	35.1%	26	17.8%	29	12.1%	217	25.6%
High School and Some College or Specialized Training	99	21.5%	3	2.4%	20	8.4%	123	14.5%
High School Only	149	32.5%	60	40.6%	77	31.8%	286	33.7%
No High School Diploma Required	40	8.7%	53	36.3%	111	45.9%	204	24.1%
Total	460	100.0%	147	100.0%	242	100.0%	849	100.0%

The important news carried in Table 6 has to do with the indirect and induced employment. Whereas we do not think that there will be multiplier impacts at the Micro or Neighborhood

Scale we do estimate multiplier impacts at the Metropolitan Scale. Expenditures by firms and the 460 employees based in the Biopark will lead to the creation of additional employment in the Tucson Metro Area. Specifically, the expenditures by Biopark firms (the firms that employ 460 workers) will support another "indirect" 147 employees. Better yet, direct and indirect activities will support an additional 242 induced employees. When we add together the direct, indirect, and induced impacts a total of 849 new jobs will be created in the Tucson Metropolitan--all because of the Biotech firms that employ the "Baseline 460 direct employees."

Table 7. Wage per Employee in Tucson Metro Area during Initial Stage (2012)

Minimum Required Educational Attainment for Occupation	Direct Wage (per Employee)		Indirect Wage (per Employee)		Induced Wage (per Employee)		Total Wage in All Categoreis (per Employee)	
	$	Ratio	$	Ratio	$	Ratio	$	Ratio
Graduate Degree	79,292	111.2%	50,884	120.2%	42,864	117.3%	64,347	114.1%
BS/BA Degree	81,148	113.8%	53,662	126.7%	40,318	110.4%	72,306	128.3%
High School and Some College or Specialized Training	59,663	83.7%	42,984	101.5%	55,908	153.1%	58,572	103.9%
High School Only	71,461	100.2%	43,905	103.7%	43,430	118.9%	58,165	103.2%
No High School Diploma Required	57,801	81.1%	34,298	81.0%	26,955	73.8%	34,916	61.9%
Total	71,305	100.0%	42,339	100.0%	36,528	100.0%	56,378	100.0%

Total wages also jump--from the $32,786,793 in direct wages to a new total of $47,839,364 in direct, indirect, and induced wages in the Tucson Metro Area. The Biopark itself will still be the leader in terms of wage per employee at $71,305 because even the poorer jobs here will still be "top of the line" given Tucson standards. But having said that, the "worst" indirect jobs in the

Tucson Metro Area will still average $34,298 per employee for those with no high school diploma and $26,955 per employee for induced employees with no high school diploma; the average indirect wage per employee is estimated to be $42,339 whereas the average wage per induced employee is estimated to be $36,528 (Table 7).

2.3 Input/Output Findings at the Metropolitan Scale at the Maturity Stage, 2030

Direct employment at the Biopark is expected to get off to a solid start in 2012 and that employment plus indirect and induced employment in the Tucson Metro Area is expected to provide and impressive baseline which will be a foundation for future growth.

Table 8. Employment in Tucson Metro Area during Maturity Stage (2030)

Minimum Required Educational Attainment for Occcupation	Direct Employment		Indirect Employment		Induced Employment		Total Employee Numbers in All Categoreis of Employment	
	Number	%	Number	%	Number	%	Number	%
Graduate Degree	51	2.2%	22	2.9%	22	1.8%	95	2.2%
BS/BA Degree	727	31.1%	134	17.6%	149	12.1%	1010	23.3%
High School and Some College or Specialized Training	487	20.8%	17	2.3%	103	8.4%	607	14.0%
High School Only	763	32.6%	308	40.5%	390	31.8%	1462	33.8%
No High School Diploma Required	312	13.3%	279	36.7%	563	45.9%	1154	26.7%
Total	2340	100.0%	761	100.0%	1227	100.0%	4328	100.0%

We estimate that some 18 years after the park takes off in 2012 it will enter its "mature stage." Tables 8 and 9 describe estimates of employment and wages per employee in the Biopark in 2030. Table 8 establishes that we expect substantial gains in direct, indirect, and induced employment. Whereas the total metro area employment in 2012 was estimated to be 849 (Table 6), we estimated the 2030 figure to be 4,328 (Table 8). We see the total wage bill generated by the Biopark's direct, indirect, and induced employment going to $242,720,501 (from $47,839,364 in 2012). In other words, the absolute growth in employment and wage bill is expected to be substantial. Equally, important we see continued strong growth in all educational attainment categories and in average wage per worker, too.

Table 9. Wage per Employee in Tucson Metro Area during Maturity Stage (2030)

Minimum Required Educational Attainment for Occcupation	Direct Wage (per Employee)		Indirect Wage (per Employee)		Induced Wage (per Employee)		Total Wage in All Categoreis (per Employee)	
	$	Ratio	$	Ratio	$	Ratio	$	Ratio
Graduate Degree	79,317	112.0%	50,895	120.2%	42,865	117.3%	64,190	114.5%
BS/BA Degree	86,822	122.6%	53,776	127.0%	40,319	110.4%	75,580	134.8%
High School and Some College or Specialized Training	60,192	85.0%	43,020	101.6%	55,909	153.1%	58,974	105.2%
High School Only	70,720	99.9%	44,215	104.4%	43,430	118.9%	57,841	103.1%
No High School Diploma Required	48,721	68.8%	34,100	80.5%	26,955	73.8%	34,561	61.6%
Total	70,792	100.0%	42,354	100.0%	36,529	100.0%	56,075	100.0%

2.4 Multiplier by Education Attainment Level in Tucson Metro Area (Maturity Stage 2030)

At the Micro or Neighborhood level there is no multiplier, or at least no measurable multiplier. As discussed previously there will be direct employment but at the micro level there are very few firms which provide either business services or personal services. Biotech firms will need to leave the local area for goods and services as will employees of those Biotech firms. Further we expect this to be the case into the future. There will be multiplier benefits experienced at the Tucson Metropolitan Scale (and at the State and National scales). Whereas there are small differences in our estimates of multipliers at the Tucson Metro Scale in 2012, 2020, and 2030 the differences are small and they appear to be of a "technical" nature.

Table 10. Employment Multiplier in Tucson Metro Area during Maturity Stage (2030)

Education Attainment	Multiplier Decomposition	Direct Job Share of Multiplier	Indirect + Induced Job Share of Multiplier
Graduate Degree	0.04	0.02	0.02
BA/BS Degree	0.43	0.31	0.12
Some College	0.26	0.21	0.05
High School Only	0.62	0.33	0.30
No High School Degree	0.49	0.13	0.36
Total	**1.85**	**1.00**	**0.85**

In Table 10 we show the estimated employment multiplier for the Tucson Metro Area in 2030. Further we show the "decomposition" for direct employment and for indirect and induced employment for "unity," the direct employment "piece" of the multiplier and for the additional indirect and induced employment which is supported by the direct employment in the Biotech Park. All of this is done by level of educational attainment. To summarize: every 100 direct jobs at the Biopark will lead to the creation of an additional 85 indirect and induced jobs within the Tucson Metro Area. For every 100 direct jobs at the Biopark 33 will be available for those

with "high school only" and 13 will be available for those in the "no high school degree" group. Additionally, for every 100 direct jobs at the Biopark there will be another 30 indirect and induced jobs for those with "high school only" in the Tucson Metro Area and 36 indirect and induced jobs for the "no high school degree" cohort. In short, 100 new direct jobs in the Biopark will see 85 indirect and induced jobs created for a Metro Area total of 185 jobs.

2.5 Input/Output Findings at the National Scale at the Maturity Stage, 2030

When the Biopark reaches maturity its impacts will be enormous. Still, we assume that it will take 28 years (2012-2030) for the full effects of the Biopark to be felt. We have already discussed that the Biopark itself will grow from 460 direct employees in 2012 to 2,340 in 2030.

Table 11. Employment in the US during Maturity Stage (2030)

Minimum Required Educational Attainment for Occcupation	Direct Employment		Indirect Employment		Induced Employment		Total Employee Numbers in All Categoreis of Employment	
	Number	%	Number	%	Number	%	Number	%
Graduate Degree	51	2.2%	30	2.8%	53	2.0%	134	2.2%
BS/BA Degree	727	31.1%	187	17.2%	383	14.1%	1297	21.1%
High School and Some College or Specialized Training	487	20.8%	18	1.6%	162	6.0%	667	10.9%
High School Only	762	32.6%	439	40.2%	907	33.5%	2108	34.4%
No High School Diploma Required	312	13.3%	417	38.2%	1200	44.4%	1929	31.4%
Total	2340	100.0%	1091	100.0%	2705	100.0%	6136	100.0%

But even more impressive will be the growth in direct and induced employment. Some of these indirect and induced employees will be based in Metropolitan Tucson whereas others will be based elsewhere in Arizona or even elsewhere in the US. By 2030 we estimate that the total employment generated by the Biopark will be 6,136 including the 2340 direct employees who will be based at the Biopark (Table 11). In the year 2030 Biopark will support 4,328 direct, indirect, and induced employees in the Metropolitan Tucson Area and an additional 1,808 indirect and induced employees elsewhere in Arizona and the US. Further, as was the case during the early years of the Biopark it will support opportunities for a wide variety of citizens both in the Tucson Metropolitan Area and in other parts of the US. Over two-thirds of the total employment in 2030 will be in so-called pathway jobs but almost one-third of the total employment will be in the non-pathway jobs that do not typically require a high school diploma.

Table 12. Wage per Employee in the US during Maturity Stage (2030)

Minimum Required Educational Attainment for Occcupation	Direct Wage (per Employee)		Indirect Wage (per Employee)		Induced Wage (per Employee)		Total Wage in All Categoreis (per Employee)	
	$	Ratio	$	Ratio	$	Ratio	$	Ratio
Graduate Degree	91,003	115.4%	72,768	127.5%	61,688	131.5%	75,286	123.6%
BS/BA Degree	92,960	117.9%	75,549	132.3%	58,316	124.3%	80,227	131.7%
High School and Some College or Specialized Training	64,652	82.0%	50,102	87.8%	56,895	121.3%	62,379	102.4%
High School Only	80,513	102.1%	61,791	108.2%	56,973	121.5%	66,488	109.2%
No High School Diploma Required	62,142	78.8%	43,024	75.4%	33,656	71.8%	40,290	66.2%
Total	78,840	100.0%	57,086	100.0%	46,907	100.0%	60,895	100.0%

Aggregate wages put into the national economy are estimated to be $373,632,905 in 2030 including $242,720,501 into the Metropolitan Tucson Economy. Further the average wage per employee promises to be substantial for all levels of educational attainment (Table 12). Those with college degrees are expected to earn $80,000 or more per year in 2030 but even those in jobs where no high school diploma is required are expected to average over $40,000 per year.

2.6 Multiplier by Education Attainment Level in the US (Maturity Stage 2030)

The local multiplier (Table 10) was impressive but as the Biopark grows and becomes increasingly integrated into the US economy so too will the multiplier grow (Table 13). We estimate that by 2030 when the Biopark is mature the average multiplier will be 2.62. This means that every 100 direct jobs at the Biopark will create another 162 indirect and induced jobs somewhere in the US. And consistent with the assertion that the Biopark will offer opportunities for a wide variety of individuals we can estimated that 100 direct jobs will include 33 jobs for those with "high school only" and jobs 13 for those with no high school degree.

Table 13. Employment Multiplier in the US during Maturity Stage (2030)

Education Attainment	Multiplier Decomposition	Direct Job Share of Multiplier	Indirect + Induced Job Share of Multiplier
Graduate Degree	0.06	0.02	0.04
BA/BS Degree	0.55	0.31	0.24
Some College	0.29	0.21	0.08
High School Only	0.90	0.33	0.58
No High School Degree	0.82	0.13	0.69
Total	**2.62**	**1.00**	**1.62**

3. SUMMARY AND CONCLUSION

Input/output analysis is a well established technique for addressing economic impact and development type problems. But we argue that the usefulness of I/O can be enhanced when it is recognized that multiple audiences want answers to the questions asked about project impacts. In this paper we work at different geographic scales, with multiple variables, and with a variety of metrics to help assure that we reach several appropriate audiences. As H.H. McCarty once observed, each change in geographic scale brings with it the need to re-frame the research questions asked. We base our analysis and approach on our experience in Tucson Arizona. Tucson is in some ways an ideal laboratory given that it faces may economic challenges and has large minority populations which are not well integrated into the national or even regional economies. In sharp contrast are the relatively well educated and affluent individuals and families tied to the University of Arizona which is a ranking National research university. In other words, Tucson has a wide range of economic development needs and the Biopark will help to meet these needs.

Obviously some people are curious about a variety of questions but our work with the University of Arizona's Biopark suggests that at the local or neighborhood scale the first question asked is who will my new neighbors be? Specifically what types of firms will be based in the Biopark and what sorts of new job opportunities will open-up? To address these questions we offer a look at the direct employment that we expect to be based in the Biopark. Further, we disaggregate this employment by levels of educational attainment to help answer the question of employment opportunities.

Certainly the Biopark will employee college graduates and those with graduate degrees but especially welcome news inasmuch as local or Micro Scale households tend to be economically disadvantaged with low levels of educational attainment is the fact that there will be abundant opportunities for those with only a high school diploma and even those with no high school diploma. We can also estimate the dollar amount of wages paid to direct employees and the average wage per employee by level of educational attainment. Neighborhood scale data are also valuable to those who will pay for new and improved transportation infrastructure, schools, and other hard and soft infrastructure.

Neighborhood activists will want to know about the park per se but they will also want to know about the impacts on the larger metropolitan scale. Data about the Biopark itself tell only part of the story inasmuch as it will reach out into the large community for workers and for goods and services. Local political leaders are consumers of data that describe the employment and income benefits that will be available to their constituents through direct, and indirect, and induced mechanisms. Indeed, we anticipate that indirect and induced impacts will be limit or non-existent at the neighborhood scale but they will be important at the Metropolitan Area Scale. These data give local leaders "bragging rights" but they sometimes help justify the use of local resources to make the Biopark a reality. Leveraging has become an important element in many economic development projects and data on Metropolitan wage generation, employment generation, and opportunities for various socioeconomic cohorts supports the assertion that there are broad community building benefits tied to Biopark investments.

Finally, we report I/O findings at the US Scale. University leaders and both state and metropolitan leadership all want evidence that the University of Arizona and its Biopark have a national impact and are integrated into national scientific networks and the national economic

system. Further, the documented role of the Biopark on generation of employment opportunities and wages becomes an important part of the record that supports the use of Federal and state loans or grants in the development of the Biopark.

The fact that the Biopark takes on a life of its own over time is demonstrated by data which describe the park during its initial start-up period and subsequent data which describe the park during maturity. We use 2012 and 2030 as these years for infancy and maturity. The Biopark is initially impressive but it becomes even more impressive as it matures and becomes integrated into the state and National economic and scientific systems.

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