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A systematic approach to project portfolio selection for economic development in municipalities: a case study in Vienna, Missouri

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A SYSTEMATIC APPROACH TO PROJECT PORTFOLIO SELECTION FOR ECONOMIC DEVELOPMENT IN MUNICIPALITIES: A CASE STUDY IN VIENNA, MISSOURI

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ABSTRACT

Economic development is essential for the survival of all municipalities in the United States. Economic growth, created through project implementation, brings new capital into municipalities by increasing the tax base. Smaller municipalities often struggle to implement projects that promote economic growth. These municipalities run into problems because they lack resources to hire an economic consultant and capabilities to independently complete the strategic planning process.

This thesis describes an easy-to-use and easy-to-implement systematic ten-step approach to project portfolio selection for economic growth within smaller municipalities. The ten-step approach utilizes the scoring method and the Analytical Hierarchy Process as portfolio selection techniques as well as using the Benefit to Cost ratio method for determining the acceptability of public projects. Developed from considerable research in the areas of community development, economic analysis, and project portfolio selection, the ten-step approach takes into account the unique needs, possible limited subject knowledge, and possible technological constraints of these communities. By taking into account these considerations, this process makes it possible for smaller municipalities to independently develop a strategic planning process.

The ten-step approach was employed in a case study performed in Vienna, Missouri. The case study involved eight taxpayer-owned projects ranging in budget from three hundred dollars to over one-million dollars. A group of sixteen community members were involved in the application of the ten-step approach. By following the systematic approach, these community members developed a project portfolio for the City of Vienna aimed at promoting economic development.

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1. INTRODUCTION

Economic development is essential for the survival of all municipalities in the United States. Economic growth, brought on by economic development plans, brings new capital into municipalities by increasing the tax base and providing local businesses for consumers to support. Without adequate economic growth, municipalities will no longer be able to support the needs of the community, thus causing community members to leave the municipalities in order to fulfill their current need. This cycle of events can be found in many smaller municipalities in the United States. Over the last six years in Missouri alone, 43% of municipalities with a population of less than 3,000 had a negative population growth (Population Division 2006). The average decrease in population of these municipalities was 3.7% (Population Division 2006). In order for these smaller municipalities to survive they must develop strategic plans that are aimed at maintaining their current populace and promoting growth.

Strategic planning plays a vital role in future success of any organization (Gray & Larson 2006) by "establish[ing] the mission, objectives, goals and strategies for where an organization wants to go in the future" (Cleland 1999). The strategic planning process is made up of four sequential activities: reviewing and defining organizational mission, setting long term goals and objectives, analyzing and formulating strategies to reach the objectives, and implementing strategies through projects (Gray & Larson 2006) As defined by Gray and Larson (2006), "A project is a complex, nonroutine, one-time effort limited by time, budget, resources, and performance specifications" (p. 4). They also state that there are five main characteristics of a project (1) an established objective, (2) a defined life-span with a beginning and an end, (3) the involvement of several departments

and professionals, (4) doing something that has never been done before, and (5) specific time, cost, and performance requirements. It is in the first characteristic, an established objective, that the projects help obtain a company's strategic plan. When a company chooses to implement a project, the objective of that project should coincide with an objective of the strategic plan. If the objectives do not match, implementation of the project would be a waste of resources and would not help the company reach its long term goals.

Many smaller communities have developed mission statements and have set long term goals for the community, but fall short of reaching their goals because they fail to complete the final two activities in the strategic planning process. Even if communities develop strategies that will help them meet their objectives, they seldom implement those strategies through projects. This shortcoming is not only inherent in communities; businesses also find the final stage of the strategic planning process to be the most difficult step (Gray & Larson 2006) As Gray and Larson (2006) stated, "the key is selecting from the many proposals those projects that make the largest and most balanced contribution to the objectives and strategies of the organization" (p. 12). They suggested using a project portfolio system to select proposals. In such a project portfolio system, projects are prioritized so the organization's resources are assigned to projects that will best help the organization implement its strategies.

According to Gray and Larson (2006), three problems occur when projects are assigned without a prioritizing system. The first problem is what is known as "The Implementation Gap." This gap refers to the misunderstanding of the organization's strategy by top and middle management. This misunderstanding causes confusion when

middle mangers implement projects that they feel would be best for the company, but go against the strategy developed by upper management. This leads to an inefficient use of valuable resources and strife between levels of management. The second problem deals with organization politics. When organizations have a poorly defined project selection system, projects can easily be implemented based not on the benefits they produce, but, rather, on the persuasive ability of the project champion. The third problem deals with resource conflicts and multitasking. When a project's priority is not clear and resources are limited, conflicts arise when trying to obtain the resources to complete it. Multitasking is also a problem in organizations that have reached their resource limit. Multitasking adds delays and costs to projects and reduces worker efficiency. All three problems can be avoided by assuring that the organization has a published project portfolio system that uses "a set of integrative criteria and a process for evaluating and selecting projects that support higher-level strategies and objectives" (Gray & Larson 2006). By implementing a set prioritizing system, all levels of management will know which projects are important to the strategic goals of the company, eliminating "The Implementation Gap." With a prioritizing system in place, it will also be less likely for projects to be implemented based solely on the persuasiveness of the project champion. Another important outcome of a prioritizing system is that by understanding the priority of the projects, managers can allocate resources accordingly and avoid multitasking. In communities, the problems that arise due to the lack of a prioritizing system often lead to the failure of projects and the discouragement of citizens.

Many organizations, including smaller communities, do not implement a project portfolio system. Failure to do so results in communities failing to meet their long term

goals which, in many cases, include economic growth and increase of quality of life. Many communities have the desire to implement a strategic planning process, but are unable to do so because they lack the funding to hire an economic consultant. This is especially true in smaller communities with an extremely small tax base. Communities that try to implement a project portfolio system without outside help often fail because they a lack an easy-to-understand and easy-to-implement project portfolio process. This thesis describes an easily understood and implemented systematic ten-step approach to project portfolio selection for economic growth within smaller municipalities. Developed from considerable research in the areas of community development, economic analysis, and project portfolio selection, the ten-step approach takes into account the unique needs, sometimes limited subject knowledge, and possible technological constraints of these communities, making it possible for smaller municipalities to independently develop a strategic planning process. The approach was developed for use within municipalities with populations of less 3,000, which by definition is the maximum incorporation population for fourth class cities (Salsich 1990).

Figure 1.1 shows the ten-step process developed for project portfolio selection in smaller municipalities.

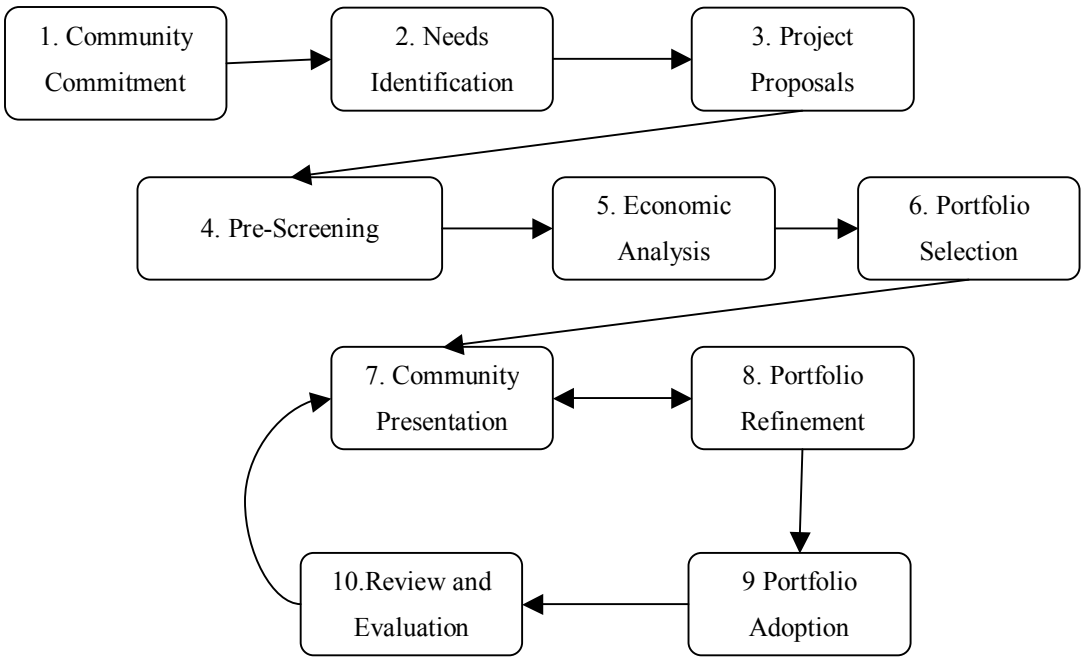


Figure 1.1. Ten-Step Process for Economic Development

To ensure that the ten-step process works effectively within the community, a case study involving the city of Vienna, Missouri, was performed. The results of the case study are discussed in Chapter 4.

This thesis is organized as follows. Chapter 2 is a literature review of previous studies completed in the fields of community development, economic analysis, and project portfolio selections. Chapter 3 proposes the ten-step systematic approach and fully describes the implementation of each step. Chapter 4 details the results of the case study, and Chapter 5 outlines the conclusions made during this process and proposes areas of further research.

2. LITERATURE REVIEW

Little research has been done on the formulation of a systematic approach for project portfolio selection in municipalities. However, the specific areas involved in the selection process have been the focus of many research projects. The following Chapters detail important work relevant to the formulation of the ten-step process.

2.1. COMMUNITY DEVELOPMENT

2.1.1. Strategic Planning Model. John M. Lang (1975), of the University of Missouri-Rolla developed a strategic planning model for implementing community development block grant programs from his research experience working with the city of St. Joseph, Missouri. The model consisted of a five stage process that was used to develop a strategic plan for the community. The stages of Lang's model included Community Commitment, Needs Identification, Program Development, Management System Design, and Application Process. Although not all five stages are relevant to project portfolio selection and economic development, the first two stages, Community Commitment and Needs Identification, are important factors in any community project.

According to Lang (1975), there are three separate groups from which to gain Community Commitment: political and administrative, city taskforce, and citizens' organization. He states that during the political and administrative commitment step, information regarding the proposed activity needs to be presented to the political and administrative staff of the city. The staff members must understand the benefits and requirements of the proposed activity before the decision to commit to the activity can be

made. Lang (1975) suggests that such committee decisions be voted on at regularly scheduled meetings in order to insure proper recording of the action and eliminate any misunderstanding between council members, administrative staff, and citizens.

The second step in gaining community commitment in Lang's (1975) model is to assemble a city taskforce. This taskforce should be made up of both technical and administrative personnel and should be granted sufficient power by the city administrators to operate autonomously. Lang (1975) expressed the importance of setting guidelines and planning feedback sessions in order to properly monitor the organization's progress.

The third step in gaining community commitment in Lang's (1975) model is to form a citizens' organization to work in conjunction with the city taskforce. The first step in creating such an organization would be to adopt a procedure for selecting members. Lang (1975) suggests that the mayor select committee members from a list of names submitted by community members and the city council, two citizens from each census district or political ward, if such categories exist. The citizens selected should represent a variety of interests, such as retail trade, industry, financial, housing, health, education, news media, religion, social service, elderly, youth, women, and minorities. Lang (1975) states that once members of the citizens' organization are chosen, their responsibility is to adequately represent the needs and requirements of their respective geographical areas.

The next stage in Lang's (1975) model is Needs Identification. This stage consists of four steps: preliminary identification of needs by city taskforce, citizens' input on needs, public hearing on needs, and refining and adopting needs. In the first step,

preliminary identification of needs, the city taskforce should collect data such as census data and city records through available city resources to help identify the community's needs. Once the city taskforce has conducted this research, they should meet with the citizen's organization who will have collected data through neighborhood meetings and public surveys. Through their combined efforts, the two organizations should come to an agreement about the city's needs. Lang (1975) notes that it is important to express the needs in "broad and sweeping concepts, covering general areas rather than specific things" (p. 31).

The next step in Lang's (1975) Needs Identification stage is to hold a public hearing on the needs identified in the previous step. During this session community members should be allowed to ask questions and voice their opinions about the agreed upon needs. After the public hearing, the needs should adjusted to take into account concerns that developed during the public hearing, then the needs should be prepared for final submission to the city council. The city council then votes on whether or not to accept the proposed needs as the official needs of the community. Once accepted, the proposed needs become the official needs of the city and a corresponding plan of action will be developed to address them.

2.1.2. Ground Rules for Effective Groups. Schwartz, Davidson, Carlson, McKinney and contributors (2005) published The Skilled Facilitator, which outlines nine ground rules for effective groups. These Ground Rules describe the specific type of behavior that contributes to group effectiveness. The nine rules are (1) test assumptions and inferences; (2) share all relevant information; (3) use specific examples and agree on what important words mean; (4) explain reasoning and intent; (5) focus on interests, not

positions; (6) combine advocacy and inquiry; (7) jointly design next steps and ways to test disagreements; (8) discuss undiscussable issues; and (9) use a decision making rule that generates the level of commitment needed. Following these ground rules is very important in all group environments, including communities.

Rule one of Schwartz et al.'s (2005) ground rules, "test assumptions and inferences," expresses the importance of not assuming information without verifying if the assumption is correct. This guideline is very important in community settings because of community members' diverse backgrounds. Different cultures and working environments have their own style of non-verbal communication. When intermixed, these non-verbal cues can easily be misunderstood.

"Share all relevant information" is the second guideline of the ground rules (Schwartz et al., 2005). In group settings it is important that all knowledge of the particular subject matter be presented, even if that knowledge contradicts a personal cause. This action generates commitment and allows the group to make a "free and informed choice" (Schwartz, Davidson et al. 2005).

"Using specific examples and agreeing on what important words mean" is the third guideline in Schwartz et al.'s ground rules (2005). When dealing with communities or groups with diverse backgrounds, even the simplest words may have different meanings. If, for example, the city council was deciding what color to paint the city hall and had the choices of either blue or navy, every city council member would develop their personal image of the colors and would vote according to their personal image, unless the colors were specifically defined by using color swabs. Not ensuring all members are imagining the same colors could lead to misunderstanding between group

members when the building is painted a color that does not match everyone's personal image.

The fourth guideline in the ground rules is to "explain reasoning and intent" (Schwartz et al., 2005). This guideline focuses on the importance of not having hidden personal agendas present in group meetings (Schwartz et al., 2005). By following this guideline, individual strategic plans can be seen and the opportunity to examine different point of views becomes available, increasing the likelihood of group success.

The fifth guideline of Schwartz et al.'s (2005) ground rules says groups should "focus on interests, not positions." This guideline explains that people choose a particular position because of their interests. When group members divulge the interests behind their positions, the group can decide what interests the group will focus on and can develop an appropriate course of action.

The sixth guideline in the ground rules, "combine advocacy and inquiry," describes the process by which group members should present their particular point of view, divulging the interests behind their position and then accepting questions about and comments on their idea openly and without judgment (Schwartz et al., 2005). This guideline also states that individuals should feel free to ask any question about any idea without fear of repercussions(Schwartz, Davidson et al. 2005).

The seventh guideline of Schwartz et al.'s (2005) ground rules is to "jointly design next steps and ways to test disagreements." This guideline proposes that when current progress has been stalled because of a disagreement, the group should jointly decide on how best to solve the dispute instead of engaging in unproductive conversation. This may mean that members need to take time to collect data to support their position

and then reconvene at a later date, or that the decision may have to be made by a third party.

"Discussing undiscussable issues" is the eighth guideline of the Ground Rules (Schwartz et al., 2005). This guideline informs groups that, even though certain topics are not pleasant to discuss, the group must address them. Examples of unpleasant topics include disagreement with the group leader, unfair workloads or treatment of group members, and failure of the group to meet standards.

The final guideline in Schwartz et al.'s (2005) ground rules is to "use a decision making rule that generates the level of commitment needed" (Schwartz et al., 2005). This guideline states the importance of having the group committed to their actions. If the group members have made a free and informed choice to participate in the group, they are more likely to be personally committed to the group's goal.

2.2. ECONOMIC ANALYSIS

2.2.1. Difficulties in Economic Analysis. Sullivan, Wicks, and Luxhoj (2006) define public projects as projects that are authorized, financed, and operated by federal, state, or local government agencies to protect health, protect lives and property, provide not-for-profit services, and provide jobs. These public projects are funded through taxes, loans, bonds, and subsidies and their project life is relatively long (20-60 years). They are often difficult to analyze because the nature of their benefits are often nonmonetary, difficult to quantify, and difficult to equate to monetary terms.

Sullivan, Wicks, and Luxhoj (2006) state that private projects are commonly evaluated using methods such as Internal Rate of Return (IRR) and Present Worth (PW). In the IRR method, the interest rate that equates the equivalent worth of cash inflows to cash outflows is computed, thus determining the IRR of a project. If the IRR of the project is greater than the Minimum Attractive Rate of Return (MARR) then the project is acceptable. In the PW method, equivalent worth is determined by discounting all cash inflows and outflows to a base time using a set interest rate. A positive PW represents the dollar amount of profit over the minimum amount required by investors. In both the IRR and PW methods, equivalent worth is determined using both cash inflows and outflows. Public projects often do not produce cash inflows, thus making the IRR and PW methods unsuitable for evaluating them. The benefit-to-cost (B/C) ratio method is normally used for evaluating public projects (Sullivan et al., 2006). This method has its roots in federal legislation, the Flood Control Act of 1936, and requires that, to justify a public project, the benefits of the project outweigh its cost. Sullivan et al. (2006) state that "Rather than allowing the analyst to apply criteria more commonly used for evaluation private projects (IRR, PW, etc.), most governmental agencies require the use of the B/C method" (p. 466-467).

According to Sullivan et al. (2006), the first step in analyzing public projects is to determine project ownership. Because many public projects rely on taxpayer's money for funding, the taxpayers are the owners of the project. After ownership is determined, the project's benefits and costs must be determined. Project benefits are defined as favorable consequences of the project for the public, while project costs represent the monetary disbursement required by the government to complete the project. Projects often have

negative consequences that affect a segment of the public. Because these negative consequences are borne by only a segment of the public, they cannot be considered either a benefit or a cost. Sullivan et al. (2006) refer to a project's negative consequences for the public as disbenefits.

Determining the benefits, costs, and disbenefits of a pubic project is often difficult. In Table 2.1, Sullivan et al. (2006), describe the eight main difficulties inherent in public projects.

Table 2.1. Difficulties in Evaluating Public Projects

1	There is no profit standard to be used as a measure of financial effectiveness. Most public projects are intended to be nonprofit.
2	The monetary impact of many benefits of public projects is difficult to quantify.
3	There may be little or no connection between the project and the public, which is the owner of the project.
4	There is often strong political influence whenever public funds are used. When decisions regarding public projects are made by elected officials who will soon be seeking reelection, the immediate benefits are stressed, often with little or no consideration for the more important long-term consequences.
5	The usual profit motive as a stimulus to promote effective operation is absent, which is not intended to imply that all public projects are ineffective or that managers and employees are not attempting to do their jobs efficiently. But the direct profit stimuli present in privately owned firms are considered to have a favorable impact on project effectiveness in the private sector.
6	Public projects are usually much more subject to legal restriction than are private projects. For example, the area of operations for a municipally owned power company may be restricted such that the power can be sold only within the city limits, regardless of whether a market for and excess capacity exist outside the city.
7	The ability of governmental bodies to obtain capital is much more restricted that that of private enterprises.
8	The appropriate interest rate for discounting the benefits and cost of public projects is often controversial and politically sensitive. Clearly, lower interest rates favor long-term projects having major social or monetary benefits in the future whereas higher interest rates promote a short-term outlook whereby decisions are based mostly on initial investments and immediate benefits.

One of the problems Sullivan et al. (2006) described was difficulty in assigning an appropriate interest rate to public projects. In the private sector, interest rates help businesses choose projects that will maximize their profits, but in the public sector there are no profits, so the goal of the interest rate is to maximize the social benefits. Social benefits include activities that cannot be easily monetized, such as the ability of families to enjoy lunch at a picnic table under a pavilion, for senior citizens to exercise safely on a walking path, and for citizens to improve the environment they live in. Public projects are developed to provide these social benefits the same way private projects are developed to produce profits, so insuring the interest rate maximizes these social benefits is a key part in the implementation of public projects. Sullivan et al. (2006) identify three considerations that must be taken into account when deciding what interest rate to use for public projects: the interest rate on borrowed capital, the opportunity cost of capital to the governmental agency, and the opportunity cost of the capital to the taxpayers.

According to Sullivan et al. (2006), to determine the interest rate on borrowed capital, it is appropriate to use the interest rate for cases in which money is borrowed specifically for the project. To determine the opportunity cost of capital to a governmental agency, a review of previously accepted projects should be conducted. Sullivan et al. (2006) state that if projects are selected such that the estimated return of benefits of the accepted projects exceeds the estimated return on the rejected projects, then the interest rate used in the economic analysis would be that of the best opportunity that was forgone. Critics of this philosophy state that, because of the diverse nature and

varying funding rates of governmental agencies, interest rates between them will vary even though they share a common source of tax funding (Sullivan, Wicks et al. 2006).

The third consideration Sullivan et al. (2006) describe, opportunity cost of capital to the taxpayers, works according to the philosophy that money should not be taken from the taxpayer and invested in a project that would earn less than what the taxpayer could have earned by personally investing the capital. This interest rate is often the largest of the three considerations and the philosophy behind it was mandated by a U.S. Office of Management and Budget Directive (Office of Management and Budget, 1997). The Office of Management and Budget Directive states that for a wide range of federal projects a 7% interest rate should be used, with the exception of water resource projects, which can use a lower interest rate. A 7% interest rate reflects the amount a taxpayer would earn if he or she personally invested the money (OMB, 1997). With the exception of projects that fall under the 1997 directive, it is ultimately up to the governmental agency to decide which interest rate they will use while conducting the analysis (Sullivan, Wicks et al. 2006).

2.2.2. Benefit-Cost Ratio Method. Sullivan et al. (2006) presents two main versions of the B/C ratio. Both versions can be calculated using any equivalent worth method, but only present worth (PW) formulas will be shown. The first formula is the conventional B/C ratio. This formula takes the present worth of all benefits (B) and divides it by the sum of the initial investment (I) and the present worth of all operation and maintenance expenses (O&M) (Sullivan et al. 2006).

$$B/C = \frac{PW(benefits\ of\ the\ proposed\ project)}{PW(total\ \cos t\ of\ the\ proposed\ project)} = \frac{PW(B)}{I + PW(O\&M)} \qquad (1)$$

The second method is the modified B/C ratio. This formula sums the present worth of the project's benefits with the present worth of the operation and maintenance expenses, then divides the total benefits by the initial investment (Sullivan et al., 2006).

$$B/C = \frac{PW(B) + PW(O\&M)}{I} \tag{2}$$

In B/C ratio analysis, a project is acceptable if the B/C ratio is greater than one. Both the conventional and modified B/C ratio methods will yield equivalent results in determining the acceptability of a project.

Sullivan et al. (2006) reiterate that many public projects include disbenefits (DB). Their B/C ratio can be modified to take into account these factors. The ratio can also be modified to include the market value (MV) of the project, along with other non-accounted for reduced cost (RC) or added benefits (AB). Reduced costs, or added benefits, are capital that is saved by implementing a project. This occurs, for example, when an older operating system with high maintenance fees is replaced by a new system with low maintenance fees. The capital saved from the lower maintenance fees can be included into the ratio as either a reduction in cost or an addition to the benefits, both of which yield equivalent results. In the following conventional and modified B/C ratio equations, the saved capital is accounted for as a reduced cost.

$$B/C = \frac{PW(B) - PW(DB)}{I - PW(MV) + PW(O\&M) - PW(RC)} \tag{3}$$

$$B/C = \frac{PW(B) - PW(DB) + PW(O\&M)}{I - PW(MV) - PW(RC)}\infty \quad (4)$$

Although the B/C method is the preferred method by which government agencies evaluate public projects, it has been widely criticized. According to Sullivan et al. (2006), there are three main criticisms of the method. The first criticism is that the B/C method is often used as a tool for after-the-fact justification of a project rather than for project evaluation. This criticism deals with biased information being introduced into the equation to manipulate the outcome. In order to avoid such inaccuracies, the B/C analysis should be conducted by an unbiased party.

Another criticism addressed by Sullivan et al. (2006) is that it does not take into account instances in which one specific group will incur all the benefits while another group will pay all the costs. Sullivan et al. (2006) propose the following example of this problem in the public sector. Town A wants to build a large chemical plant that would boost their economy by providing 100 jobs, but would also release toxins into Town B's water supply, causing long term adverse health effects among its citizens. The benefits of the project would include the new jobs and boosted economy, while the cost would include increased medical bills of Town B citizens. The B/C ratio does not take into account the fact that the people getting the benefits are not paying the cost. Analysis of this project would show only the net monetary effect of the project without regard to the distributional inequities (Sullivan, Wicks et al. 2006).

The third criticism of the B/C studies, according to Sullivan et al. (2006), is that qualitative information is often ignored. During analysis of public projects there is often qualitative information that cannot be transferred into quantitative information and is

therefore not considered in the B/C ratio. This exclusion of relevant qualitative information leads to biased B/C analysis. Sullivan et al. (2006) state that although the qualitative information may be presented with the ratio during the project evaluations, it can easily be forgotten. Thus, decisions are often made based strictly upon the quantitative data. An example of this occurrence is if a farmer is given a small plot of land and had the option of either putting five chickens on the land or one sheep. The farmer was given the information that he could earn five dollars a month by sheering the sheep and selling the wool, or by choosing the chickens, he could earn three dollars a month by selling the eggs and the chickens would reduce the insect population in the area. Sullivan et al (2006) believe the that qualitative information, reduction of insects, although presented, is quickly forgotten and that the farmer's decision will be made based on the quantitative data, earning five dollars per month for a sheep or earning three dollars a month for the chickens. Based on the quantitative information the farmer will probably choose to take the sheep.

2.2.3. Framework for Benefit Analysis. By analyzing the benefits of public projects, monetary value can be assigned and the B/C ratio can be calculated (Sullvan et al. 2006). However, difficulties can be found when trying to quantify the qualitative data. The following Chapters, 2.2.3- 2.2.5, detail the guidelines used by the U.S. Environmental Protection Agency (EPA) for preparing economic analyses.

In the EPA guidelines, the EPA (2000) states that, while economic analysts should seek precision, they must also make professional judgments and assumptions when analyzing benefits. Some main problems in analyzing public projects is that they involve large uncertainty in both measured data and model creation. Because of these

large uncertainties, it is important that the analyst assess the quality of the data and clearly state the reasons for their analytical choices (2000).

The EPA (2000) often uses the Willingness to Pay and Willingness to Accept Compensation theory to evaluate benefits. This theory assumes that individuals can maintain the same levels of utility while trading goods, services, and money. By monitoring the tradeoffs, analysts can determine the value consumers place on the goods and services. The EPA (2000) defines Willingness to Pay (WTP) as the maximum amount of money an individual would be willing to forgo in order to obtain an improvement or maintain a current state while Willingness to Accept Compensation (WTA) is the minimum amount of money a person would accept to forgo the improvement or endure the decrement. In general, the WTP is used to value benefits because it is easier to measure and estimate.

The EPA (2000) defines a project's benefits as "the sum total of each affected individual's WTP for the policy" (p.61). Calculating the benefit in this fashion ensures that no individual or group receives preferential treatment when assessing the projects. According to the EPA (2000), altruistic values of two types can be included in the benefit calculation: paternalistic altruism and altruism towards future generations. Paternalistic altruism is when an individual cares about the benefits his or her neighbor will gain from the project and does not care about the cost that will be imposed on the individual. Altruism toward future generations is when the cost is incurred entirely by the current generation, but the future generation will reap the benefits (EPA, 2006).

For any given project, there are a number of benefits. These benefits usually cannot be bundled into one large group, but must instead be analyzed using the "Effect-by-Effect" approach (EPA, 2000). In this EPA-approved approach, the individual benefits of the project are identified, quantified, and valued separately, and then summed to determine the overall benefit of the project. There are three steps to the EPA's (2000) "Effect-by-Effect" approach: identify potentially affected benefit categories, quantify significant physical effects, and estimate the values of the effects. In the first step an initial understanding of the project should be developed and research should be performed on the effects of the proposed project. The second step is quantifying significant physical effects. In this step, the EPA (2000) states that analysts need to perform risk assessments to determine the possibility of the effects and should also describe the qualitative effects that cannot be represented quantitatively. The final step in the EPA's (2000) "Effect-by-Effect" approach involves estimating the value of the effects. In this step analysts should consider using more than one method to estimate the value of the effect, but should also be wary of double counting benefits, which can lead to an incorrect analysis. According to the EPA (2000), analysts should also provide sources of data and confidence levels in those sources.

According to the EPA (2000), analysts should be aware of five main principles when analyzing benefits. The first principle stated by the EPA (2000) is to focus on key issues that will likely influence whether the project will be selected. The second principle is to coordinate frequently with others involved in the development of the project to ensure consistency between the groups and open the lines of communication in case an emergency arises. The third step stated by the EPA (2000) involves considering

changes in behavior, not just physical changes. Although detailed analysis of specific behavior change cannot be conducted, possible significant behavioral effects should be addressed. The forth principle stated by the EPA (2000) is to guard against double counting benefits which can cause the project's stated benefits to be overestimated and can skew the results of the B/C ratio. The fifth principle is to explicitly address uncertainty and non-monetized effects. The analyst must address uncertainties in their data in order for decision-makers to be able to make free and informed choices and they should also stress the qualitative data so that it is not overlooked by the decision-makers.

2.2.4. Benefits Valuation. The EPA (2000) has developed four main methods of valuing benefits: the market method, the revealed preference method, the stated preference method, and the benefit transfer method. The market method is used to evaluate environmental policies only and, as such, will not be discussed in this thesis. The reveled preference method determines individual WTP values for certain goods by examining related goods that are traded in markets. The revealed preference method encompasses five sub-methods, but of these five methods only the Recreation Demand Model is relevant to and will be discussed in this thesis. The recreation demand model focuses on trips and visits to sites for recreation and compares the trade off between the satisfaction received from the trip, to the time and money spent. It can be used to determine the willingness to pay for certain recreational activities.

The EPA's (2000) two types of stated preference methods attempt to measure WTP directly from surveys and respondents. The first type, Contingent Valuation (CV), is the most well developed stated preference method. The CV method surveys individuals, asking whether they would be willing to pay a certain amount for an

improvement or commodity or asks about their maximum WTP (EPA, 2000). This technique has many critics. One criticism of the EPA's (2000) CV method states that bias can be easily introduced into the method through careless wording of questions or anchoring of answers. Critics also claim that, because respondents are not required to make payments, the hypothetical nature of the questions causes respondents to overestimate their WTP. According to the EPA (2000), to perform a valid CV survey both economic and psychological theory tests should be performed before survey distribution.

Conjoint analysis and contingent ranking is the second model in the EPA's (2000) stated preference method. In this model, analysts ask respondents to make choices between two or more choices or to rank several similar commodities with different attributes and prices. This method often gives respondents binary choices, either A or B, or multiple choice questions that ask the respondent to make tradeoffs between prices and other features of presented commodities. The critics of conjoint analysis question the viability of disaggregating the project into attributes that can be separately traded-off.

The benefit transfer method is the final method suggested by the EPA (2000). In the benefit transfer method, information from previous similar projects are transferred to the new project. This method is useful to the EPA because original data collection is time consuming and costly. There are five steps to completing the benefit transfer method: describe the new case, identify existing relevant studies, review available studies for quality and applicability, transfer the benefit estimates, and address uncertainties. When performing a benefit transfer, careful consideration should be given

to differences in characteristics of the population and in characteristics of the risks being valued (EPA, 2000).

2.2.5. Presentation of Analytical Results. The EPA (2000) has developed general guidelines for presenting economic analysis data to policy makers. The first guideline emphasized by the EPA (2000) states that analyst should strive to achieve maximum clarity in their assessment. The second guideline states that all references used in the economic analysis, excluding confidential business documents, should be divulged and the analyst's confidence level in the sources should be avowed. The EPA (2000) also states in the third guideline that all modeling and analytic frameworks should be explained so the policy makers understand the basic framework. Although many of these frameworks are very detailed, the policy makers should understand the key concepts and evaluation method of the frameworks (EPA, 2000). The fourth guideline states that uncertainties in the analysis should be clearly stated and the policy makers should understand the effect the uncertainties have on the project. When presenting a project, the EPA (2000) suggests that all possible effects of the project should be monetized to enhance "the value of the conclusions to policy makers" (p. 176). In projects where not all effects can be monetized, the EPA (2000) states that all non-monetized effects should be emphasized to the policy makers. The reasons why the effects could not be monetized should also be stated.

2.3. PROJECT PORTFOLIO

2.3.1. Project Portfolio Management System. According to Gray and Larson (2006), there are seven reasons why project management is important: the compression of product life style, global competition, knowledge explosion, corporate downsizing, increased costumer focus, rapid development of third world and closed economies, and multi-project environments. Historically, project managers have been in charge of planning and executing projects. In the new-school of project management, project managers will also help develop the organization's strategy (Gray & Larson, 2006). Gray and Larson (2006) state that "for these reasons project managers will find it valuable to have a keen understanding of strategic management and project selection processes" (p. 22).

The strategic management process is made up of four sequential activities (1) review and define the organizational mission, (2) set long-range goals and objectives, (3) analyze and formulate strategies to reach objectives, and (4) implement strategies through projects (Gray & Larson, 2006). In the first activity defined by Gray and Larson (2006), a mission statement should be developed. An organization's mission statement defines the scope of business and provides guidance for future decisions. Mission statements should rarely change and should be well known and followed by the organization's management and employees (Gray & Larson, 2006).

The second activity defined by Gray and Larson (2006) is developing long term goals and objectives. An organization must translate the mission statement into specific, measurable, assignable, realistic and time related (S.M.A.R.T.) objectives. The third step in the process described by Gray and Larson (2006) consists of formulating strategies to meet the chosen objectives. This step involves determining who the customers are and

what the customers want, along with performing a strengths, weaknesses, opportunities and threats (SWOT) analysis. In a SWOT analysis, internal and external environments are analyzed and strategic decisions are made, based on the conclusion.

The final stage defined by Gray and Larson (2006) is to implement strategies through projects. They describe a strong project priority system as necessary for project implementation. Gray and Larson (2006) state that, with a priority system in place, an organization can lessen the effects of the implementation gap, organizational politics, resource conflicts, and multitasking.

According to Gray and Larson (2006), a project portfolio system evaluates, prioritizes and selects the projects that best meet an organization's objectives. They identify seven benefits of a successful project portfolio system:

- Builds discipline into project selection process.
- Links project selection to strategic metrics.
- Prioritizes project proposals across a common set of criteria, rather than on politics or emotion.
- Allocates resources to projects that align with strategic direction.
- Balances risk across all projects.
- Justifies killing projects that do not support organization strategy.
- Improves communication and supports agreement on project goals.

In many organizations there are three types of projects: compliance, operational, and strategic (Gray & Larson, 2006). Compliance projects are emergency projects that must be completed. These projects, if not completed, will halt all current business operations. An example of a compliance project is renovating smoke stacks to meet EPA admission standards. Operational projects are needed to support current operations. An example of an operation project would be to update all network computers to the newest operating system. Strategic projects are directly related to helping the

organization reach its long-term objectives. An example of a strategic project would be to open a new facility in Idaho.

Gray and Larson (2006) state that projects that fall in the compliance area should receive the highest prioritization. Once the compliance projects are prioritized, projects from the other two categories can be ranked. They mention two methods for selecting projects: financial and nonfinancial. Financial methods include determining the payback period and net present value, while nonfinancial methods use multi weighted scoring models to rank the projects. Once ranked, the selection process begins (Gray & Larson, 2006). In this process, management decides how to distribute the organization's resources and select projects to be implemented (Gray & Larson, 2006). This process involves balancing the portfolio between organizational resources and project risks. At this stage, Gray and Larson (2006) suggest that a SWOT analysis be performed to determine if any selection criteria have changed. Discussing the final project portfolio, Gray and Larson(2006) state that "models should not make the final decisions—the people using the models should" (p.35). They go on to say that project selection "is a much more subjective process than calculations suggest" (Gray & Larson, 2006, p. 36).

2.3.2. Portfolio Framework. Archer and Ghasemzadeh (1998) published a paper in the International Journal of Technology Management that outlined a framework for project portfolio selection for private enterprises. Figure 2.2 shows the structure they developed.

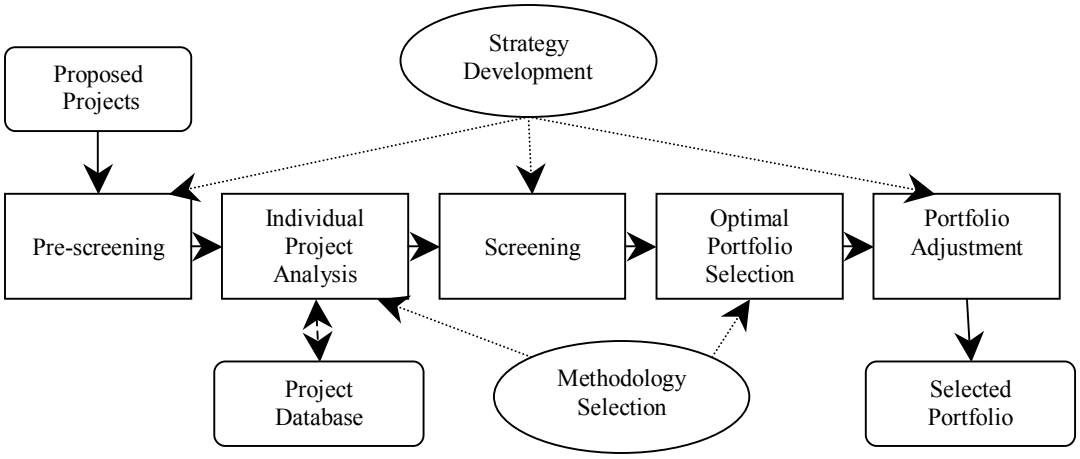


Figure 2.2. Project Portfolio Selection Framework

Archer and Ghasemzadeh (1998) initially proposed steps that are undertaken to determine the strategic focus of the organization and then decide on a selection methodology. Once the strategic focus of the organization is set, they say, it should not undergo any radical changes during the project selection process. The organization's selection methodology should match the culture of the organization and should remain unaltered during the process, unless preferred methods are discovered (Archer and Ghasemzadeh 1998).

The first operational stage presented by Archer and Ghasemzadeh (1998) is the pre-screening stage. In the pre-screening stage, guidelines are manually applied to the proposed projects to ensure that they meet the organization's strategic plan. This stage should consider the feasibility of the project and determine the availability of a project champion.

The screening stage is the next step in the process developed by Archer and Ghasemzadeh (1998), in which the projects are compared to pre-selected criteria. Any

project that does not meet the criteria will be eliminated to minimize the number of projects that will undergo further scrutiny in the optimal portfolio selection stage.

The optimal portfolio selection stage considers interactions between proposed projects using comparative approaches, such as Analytical Hierarchy Process (AHP), pair-wise comparison, Q-sort, and scoring models (Archer & Ghasemzadeh, 1998). Archer and Ghasemzadeh (1998) mention that, although these approaches are commonly used, none of the techniques take into consideration multiple resource constraints or project interdependencies. Also, they say all mentioned approaches, except for the scoring models, become unwieldy when a large number of projects are being considered.

Archer and Ghasemzadeh (1998) proposed that a two step process be implemented to eliminate the shortcoming of the previous methods. In the first step of this process, the project's worth is determined by using a comparative approach for smaller project sets or a scoring model for larger project sets. The second step involves developing a linear program to optimize the overall portfolio based on project worth, resource constrains, and interdependencies. The final stage in Archer and Ghasemzadeh's (1998) portfolio framework is portfolio adjustment. This stage allows the decision makers to manually alter the portfolio if it is unbalanced.

Another type of portfolio framework was designed by Veth (2006). In his approach there are four stages to project selection. The first stage is to collect all initiatives or project ideas. The second stage it to develop prioritizing criteria and apply the criteria to the proposed projects. This step is equivalent to Archer and Gasemzadeh's (1998) pre-screening step and determines the strategic fit of the project. Veth (2006) proposes using either a strategic mapping method or scorecard approached to provide

good starting points to determine a project's strategic fit. Veth's (2006) third step is to rank the projects according to their business value. In this step he proposes that financial benefits be calculated to determine each project's effect on business forecasts. The final step in Veth's (2006) model is to asses the risk and resource constraints of the ranked projects.

2.3.3. Detailed Project Selection Framework. A year after their earlier paper, Archer and Ghasemzadeh (1999) published another paper in the International Journal of Project Management. This paper further detailed the project evaluation stages, including pre-screening and screening, and elaborating on portfolio selection, which was the first step in the optimal portfolio selection phase.

Archer and Ghasemzadeh (1999) proposed that screening should be used based on carefully selected pre-set requirements to eliminate unnecessary projects before the portfolio selection phase. They identified four main ways to screen projects: economic evaluation, benefit/cost techniques, risk, and market research. Through economic evaluation, the proposed project undergoes analysis and the net present value, internal rate of return, payback period, and expected values are used to determine the project's feasibility (Archer & Ghasemzadeh, 1999). Their Benefit/Cost techniques involve using the previously discussed B/C ratio to determine if the project is worth pursuing. Risk evaluation involves determining the work breakdown structure (WBS) of the project and the associated possibility of not meeting the objectives in the WBS. Risk is the combination of the possibility of an unfavorable outcome and its consequences (Archer & Ghasemzadeh, 1999). The overall project risk can be determined by evaluating individual risks in the WBS. Models used to determine risk include Monte Carlo

simulation, decision theory, and Bayesian statistical theory (Archer & Ghasemzadeh, 1999). Market research is the final screening method and involves collecting data and forecasting the success of a given product or project. Data can be collected though many methods, some of which include focus groups, consumer surveys, and preference mapping (Archer & Ghasemzadeh, 1999).

Archer and Ghasemzadeh (1999) define portfolio selection as "simultaneous comparison of a number of projects on particular dimensions, in order to arrive at a desirability ranking of the projects" (p. 210). Once ranked, those projects at the top of the list will be placed into the portfolio, subject to resource constraints. The five main project selection techniques proposed by Archer and Ghasemzdadeh (1999) include ad hoc approaches, comparative approaches, scoring model, portfolio matrices, and optimization models.

According to Archer and Ghasemzdadeh (1999), ad hoc approaches include profiles and interactive selection. Their profiles are crude forms of scoring models in which limits are set for particular desired attributes; projects not meeting the set limit are discarded. Interactive selection is an iterative process conducted by the project champions and decision makers until a desirable portfolio is achieved. Ad hoc approaches are often preferred, regardless of whether or not they produce an optimum portfolio, because of their simplicity and the minimum amount of effort needed to complete the process (Archer and Ghasemzadeh 1999).

Comparative approaches such as Q-sort, pair-wise comparison, and AHP are also used in project portfolio selection (Archer & Ghasemzadeh, 1999). These methods first determine the weights of different objectives, then the project's contribution to each of

the objectives in order to place projects on a comparative scale. Again, according to Archer and Ghasemzadeh (1999), the decision maker selects projects from the top of the list until all resources are exhausted. One general disadvantage of comparative approaches is that the comparison can be burdensome and lengthy for a large number of projects (Archer and Ghasemzadeh 1999). According to Abe et al. (2006) a similar comparative approach is used at Boeing. In this approach, a dependency matrix is formed to help aid in the project portfolio selection phase (Abe et al., 2006).

Scoring models, which are also used in Archer and Ghasemzadeh's (1999) portfolio selection, involve a small set of criteria, such as cost, resources, and risk. Archer and Ghasemzadeh (1999) rank projects on a set scale according to how well they meet the criteria, then add the scores to determine the overall score. Scoring models that are weighted to increase one particular criteria's importance are called weighted scoring models. In this process, projects with higher scores are chosen until resources are exhausted. One advantage of this approach is that the model does not have to be recalculated if one project is removed (Archer and Ghasemzadeh 1999).

The fifth portfolio selection technique as described by Archer and Ghasemzadeh (1999) is the use of optimization models. Their optimization models are usually based on mathematical programming and take into consideration resource constraints, project interdependencies, and market interactions and can be used in conjunction with comparative models such as Q-sort and AHP (Archer and Ghasemzadeh 1999). A similar method utilizing both comparative approaches and optimization models was developed by Abe et al. (2006). Their model was used to optimize the selection of transformational projects. Yoshimura, Fujimi, and Nishiwaki (2006) developed a decision making support

system for resource allocation in product development projects. Their process used optimization procedures to support project selection and determine resource allocation. The procedure used by Yoshimura et al. allowed for simultaneous evaluation of all possible project sets and determined the optimum portfolio and resource allocation. However, because of the large amount of data and time needed to program such elaborate models, optimization models are not easily utilized (Archer and Ghasemzadeh 1999).

3. PROPOSED SOLUTION METHODOLOGY

The following ten-step process was synthesized from the studies described in the literature review. Steps 1 and 2 along with steps 7 through 10 of the ten-step process were devised from Lang's (1975) strategic planning model while steps 3 through 6 were duplicated from Archer and Ghasemzadeh's (1998) portfolio framework. The ten steps shown in Figure 3.1 have been designed to be completed by either a second party brought into the city for the process or a community member. If the steps are performed by a community member, it is important that the member act only as a facilitator of the process and refrain from showing favoritism to any particular project. The steps require no complicated calculations or computer programming, so they can be performed in communities with few economic development resources.

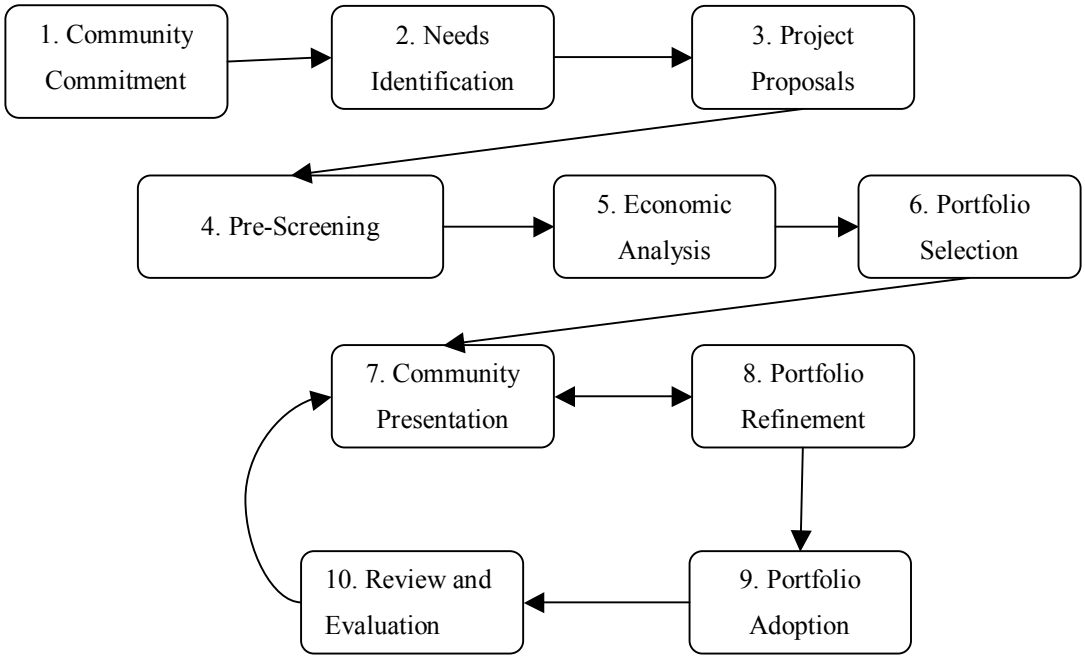


Figure 3.1. Ten-Step Process for Economic Development

3.1. STEP 1: COMMUNITY COMMITMENT

The first step in promoting economic development in rural communities is to ensure that the entire community is engaged. Confirming this community commitment is the cornerstone of the ten-step process. If the community does not want to manage economics, continuation of the economic development process is futile. In order to determine whether the community is committed, the ten-step process utilizes two further sub-steps. The first sub-step involves confirming the official commitment of the local government. This commitment should be achieved by presenting the economic development process to the city's government at a regularly scheduled meeting. The governmental agency should indicate whether or not they would like to proceed with the process by an official vote that is recorded.

The second sub-step should be performed after the governmental agency approves continuation of the process. A community council should be developed. This council should consist of volunteer members from both the governmental and private sectors of the community. It is important that the community council represent a wide variety of community interest, such as business, retail, religion, health and welfare, and education. The council should also appropriately represent minorities in the community. The process facilitator should attend all council meetings, but his or her job is only to facilitate the meetings so that the steps in the process are completed.

When forming a community council, all members should be volunteers and they should be personally committed to the goal of the council. The importance of having an all volunteer council is that those who have volunteered will accept ownership of the process and will work diligently until it is complete. Members who are forced to

participate are less productive because the do not feel the same ownership in the project as the volunteers.

3.2. STEP 2: NEEDS IDENTIFICATION

The second step in the process is determining the city's needs. Needs identification should be performed by the entire community council. The council members should focus on interests, not positions, by developing broad community needs rather than specific community projects. A good example of a community need would be to increase the tax base. This need is broad and covers everything from encouraging new businesses to enter the area to encouraging community members to shop locally. A poor example of a community need would be to bring in a company that would "create fifteen jobs." A better descriptor would be to state that the community needs to bring in a company that would "create employment."

The selected needs should be broad, but specific enough to accomplish the overall goal of economic development. If the needs are not focused on economic development, unrelated projects will be considered and valuable time and resources will be spent analyzing projects that do not promote the overall goal. Once the council develops a set of needs, it should vote to accept them as the official community needs. Once accepted, the official community needs should remain unchanged throughout the rest of the process.

3.3. STEP 3: PROJECT PROPOSALS

The third step in the economic development process is to accept project proposals. Accepting project proposals may take up to one month to complete, depending on how many members are on the community council. The process facilitator should meet with each individual on the community council and discuss project ideas. Performing this step individually promotes an environment in which the council members are not afraid to share their ideas. At this time no particular project should be scrutinized and a list of all proposed projects should be compiled and submitted to the community council. Although it may take some time to perform this step, it is recommended that it be completed within one month to prevent council members from losing interest in the process.

3.4. STEP 4: PRE-SCREENING

Pre-screening is the fourth step in the ten-step process. There are two suB/Categories to the pre-screening process: project versus needs comparison and scoring method.

3.4.1. Project versus Needs Comparison. Once the projects have been proposed, they should be compared to the community's needs. This step will eliminate projects that do not directly meet a community need or the overall goal of economic development. A description of the comparison method can be found in Chapter 4.4.1.

3.4.2. Scoring Method. After comparing the proposed projects with the community needs, the community council must look at the remaining projects to determine whether the community has enough resources to provide in-depth analysis of

each. If resources are limited, a further elimination step should be performed. Since detailed analyses of the projects have not been completed at this point, information such as total cost and benefit to the community is uncertain. In this situation, the best elimination technique is to utilize a scoring method. An example of the suggested scoring method can be seen in Chapter 4.4.2. Once scored, the projects should be ranked according to the number of points they received. The community council should then assign resources to analyze the projects, starting with the project that received the most points and continuing downward until all resources are exhausted.

The scoring method described in Chapter 4.4.2 is a simple way to eliminate further projects from the portfolio selection process, but it has some flaws. The lack of a complete project analysis requires the committee members to rank the projects based on limited knowledge, which can lead to the elimination of projects that could have had the most favorable results. Individual biases about projects can also impact this method. The scoring method should be completed individually to prevent groupthink or peer pressure. An in-depth discussion of each project should be performed and both the pros and cons of the projects should be presented to the members of the committee, thus allowing them to make a free and informed choice on what projects they feel would best benefit the community. Projects to be further analyzed should be chosen by the committee as a whole, enabling the committee to claim ownership of the projects and assume responsibility for their success.

Once the projects are selected, project champions must be assigned. This person is a community member that will head the team assigned to analyze a particular project.

A project champion should be a community volunteer who is interested in the project's success and willing to push for its completion should it be chosen for the final portfolio.

3.5. STEP 5: ECONOMIC ANALYSIS

Economic analysis, the fifth step in the ten-step process, is the most challenging part because of the complexities of analyzing public projects. Differences in communities and proposed projects cause this step to vary between applications. The process facilitator must choose the appropriate economic analysis tool for each of the projects. The diversification of the proposed projects may require that more than one analysis tool be utilized. Guidelines to help the facilitator select economic tools follow.

The first step in analyzing any project is to determine the project's owner. Most community projects will be owned by the taxpayer. However, in some instances the proposed project's owner may be an individual. In these cases, a PW analysis should be performed on the quantitative data to determine economic feasibility. If ownership is determined to belong to the taxpayer, quantitative and qualitative information about the project should be collected. The quantitative information includes the cost of the project, along with the operation and maintenance fees, reduced cost, and market value. Qualitative information includes both the project's benefits and disbenefits (per EPA). Quantitative information can be collected via straightforward project analysis, while qualitative information should be obtained using the EPA methods presented in Chapter 2.2.4.

The most valuable method for determining WTP is the Stated Preference Method. As described in Chapter 2.2.4, in the Stated Preference Method it is important to

psychologically and economically test all surveys before distribution to insure they are unbiased and statistically valid. In order to obtain useful survey, the confidence level should be at least 95% (Chambers, 2005; Parker, 2002). When determining the WTP, the group facilitator should also consider both types of acceptable altruistic benefits and guard against double counting. An example WTP survey can be found in Appendix A.

Once both qualitative and quantitative information has been assimilated, the B/C ratio method should be used to determine whether the project is economically desirable. To set the interest rate for the B/C ratio, it is suggested that either an interest rate of 7% be used to correspond to the 1997 Office of Management and Budget directive or, if money is borrowed specifically for the project, the interest rate on the borrowed capital can be used. If the result of the B/C ratio is greater than one, the project is acceptable.

3.6. STEP 6: PROJECT SELECTION

The sixth step in the ten-step process is portfolio selection. In portfolio selection the Analytical Hierarchy Process (AHP) is used to compare the remaining projects and rank them according to selected weighted attributes. The attributes used in the AHP will differ by community. However, the most common attributes will be associated with the community needs. Once the projects are ranked, the portfolio will be comprised of the highest ranking projects within resource limitations. Further explanation of the AHP model can be found in Appendix B.

One disadvantage of the AHP is that lengthy calculations are required due to the numerous comparisons. Also, all rankings must be recalculated if one project is eliminated. Critics of the technique also find flaws in its use of a seemingly arbitrary

scale of one to nine. According to Forman and Gass (n.d.), “when constructing a hierarchy of objectives, one should attempt to arrange elements in clusters so that they do not differ by more than an order of magnitude in any cluster” (p. 8). The AHP model has a verbal scale range from one to nine, but Forman and Gass (n.d.) say it is acceptable to range this scale to two orders of magnitude, although any further expansion of the scale results in decreased accuracy and increased inconsistencies.

In the AHP method, attributes are weighted based on what people perceive to be most important. Another flaw arises because "the perceived meaning of the verbal expressions varies from one subject to the next and also depends on the set of elements involved in the comparison" (Pöyhönen, Hämäläinen, & Salo, 1997, p. 8). Other critics of the method point to the phenomenon of rank reversal, which can occur when certain projects are eliminated from the rankings (Dyer, 1990). Proponents of the AHP method state that rank reversal should occur in some situations and that illogical reversals can be corrected manually (French, 1988). Research conducted by Leskinen and Kangas (2005) found that rank reversal can be eliminated in cases with constant pairwise comparison.

3.7. STEP 7: COMMUNITY PRESENTATION

The seventh step in the ten-step process is to present the project portfolio at a special community meeting. The meeting should consist of an open house where the project champions and their team members are available to answer questions regarding their particular projects. All projects that were analyzed should be represented at the

meeting, but those receiving portfolio spots should be highlighted. All data used in the selection process should also be available, including economic analysis and AHP results.

Following the open house, a community meeting should be held where feedback from the community should be received and taken into consideration. It is important for the project champions to sell their project to the community at this time. This part of the process is essential to having the community members feel as though they own the portfolio.

3.8. STEP 8: PORTFOLIO REFINEMENT

Following the community meeting, the next step is to refine the portfolio to reflect the views and decisions of the community. As shown in Figure 3.1, this process is iterative. Once the feedback from the community meeting is compiled, the portfolio projects may require rearrangement. The revised portfolio must be presented again to the community for further feedback. This process should be repeated until the community members are satisfied with the portfolio.

3.9. STEP 9: PORTFOLIO ADOPTION

Once the community is satisfied with the portfolio, the community council should present the portfolio to the city council for a vote to accept or decline the portfolio. If the portfolio is accepted, the city council and the individual project champions must ensure that the project is completed.

3.10. STEP 10: REVIEW AND EVALUATION

The final step in the ten-step process is review and evaluation. In this step, systematic evaluation of the progress of the portfolio should be scheduled. The evaluation should be conducted by the community council, then the results presented to the community. If the portfolio requires refinement, the community council should adjust it and then return to the seventh step to proceed through the finalizing steps. The final four steps in the ten-step process are a continuous loop that should be utilized until the completion or abandonment of the portfolio.

4. CASE STUDY OF VIENNA, MISSOURI

Vienna, Missouri, is a small town located at the intersection of Highway 63 and Highway 42 in rural, Missouri. Vienna is the county seat of Maries County and is located next to the Gasconade River. According to the 2000 census, the population of Vienna was 628 with 30.7% of the population age 65 or older (U.S. Census Bureau, 2000). Vienna was chosen for this process because of its need for economic development and ease of accessibility. The ten-step process was facilitated by a community member with the help of Missouri University of Science and Technology's graduate students. The students involved in the process were enrolled in Dr. Karl Burgher's Project Management class during the winter semester of 2008 and their role in the process was to analyze the public projects chosen by the community.

4.1. IMPLEMENTATION OF STEP 1

In November of 2007 the ten-step economic development process was presented to the city council of Vienna, Missouri, at a regularly scheduled monthly council meeting. At the meeting, the ten-step process was discussed, along with the expectations of the community members and the graduate students' role in the process. Once the facilitator answered all questions, the council members discussed whether or not they would like to proceed with the process. A motion was made to proceed with the economic development process, the motion was seconded and it carried unanimously.

After the city council voted to continue the economic development process, a community council was formed. In order to form the community council, the facilitator

notified business owners, religious groups, and school officials and informed them of the ongoing process and of the public meeting that was scheduled. The meeting was also publicized in the Maries County Gazette, which serves the city of Vienna and local surrounding areas. At the meeting, the ten-step process was again presented and attending community members were asked to volunteer for the community council. Ten community members volunteered for the council and then developed a name: Vienna Economic Team (V.E.T). The V.E.T. then voted to continue the ten-step process by indentifying community needs.

4.2. IMPLEMENTATION OF STEP 2

Community needs were developed by the V.E.T. through open discussion and brainstorming. Seven community needs were originally developed, but the V.E.T. narrowed the community's needs down to four by eliminating needs not relevant to economic development,. The V.E.T. then voted to accept the four needs as the official needs of the community. Below are the four needs identified by the V.E.T.

- Increase the tax base of the community
- Create safe transportation methods for the community
- Provide recreational facilities for the community
- Make the community more environmentally friendly

4.3. IMPLEMENTATION OF STEP 3

Once community needs were determined, the council adjourned and the facilitator of the process scheduled private meetings with each individual V.E.T. member. During the individual meetings, the facilitator recapped the community needs and recorded the

council member's project ideas. Three weeks were devoted to interviewing Vienna's ten council members and compiling the proposed projects. Below are the original projects proposed by the V.E.T. members.

- Construct sidewalks along Ball Park Road and Vienna-Rolla Road
- Construct walking path through park
- Construct soccer fields
- Construct arcade and bowling alley
- Construct country club with golf course and pool
- Organize a weekend farmers market
- Construct multi purpose building
- Construct recycling center
- Revamp current Chamber Dollars
- Develop plan to utilize windmills for electricity
- Develop plan for implementing rural water treatment systems
- Construct helicopter pad
- Design a way to reduce the echo inside Youth Building
- Create Tee-ball fields
- Construct a new pavilion at City park
- Construct new announcer stand at rodeo arena
- Develop plan to acquire public access to Gasconade River

4.4. IMPLEMENTATION OF STEP 4

4.4.1. Implementation of Step 4 – Comparisons. After the facilitator meet with all V.E.T. members and compiled the suggested projects, a meeting was scheduled. At the scheduled meeting, the members of the V.E.T. compared the list of suggested projects to the city's needs. The comparison was performed by examining each project individually and determining which needs that project fulfilled. If a project did not fulfill any needs, it was eliminated. In the case of Vienna, Missouri, only one of the suggested projects failed to meet any needs and was consequently eliminated. The eliminated project was 'develop plan for implementing rural water treatment systems.'

4.4.2. Implementation of Step 4 – Scoring Method. After the community compared the needs to projects, the facilitator determined that the community did not have enough resources to provide an in-depth analysis for all sixteen projects. The facilitator based this decision on the fact that the community was relying on the Missouri S&T graduate students for the in-depth analysis. The twenty four students in the class would be working in teams of two, which only allowed enough resources to analyze twelve projects. In order to determine which projects would be analyzed, the V.E.T. utilized a scoring method. V.E.T. members were given a sheet a paper with all sixteen projects listed. They were then to individually rank each project from one to sixteen, with sixteen being the project he or she felt was most likely to increase economic development in Vienna. Once all V.E.T. members were finished, the facilitator collected the project rankings. The facilitator then calculated the score of each project. A project's score was determined by summing all of the V.E.T. member's rankings for that project. The project's overall rankings were then determined. The projects were ranked by the score they received, with the projects receiving the highest scores being the more desirable.

Once the twelve projects to be analyzed were determined, the facilitator contacted the V.E.T. members and asked for volunteers to be project champions. The facilitator also contacted community members with vested interests in the projects to acquire project champions. A list of project champions and assigned students can be found in Appendix C. After the projects were chosen and champions were assigned, students from the Engineering Management 361 class began the in-depth analysis of the projects. The order in which the projects were ranked is listed below.

1) Construct sidewalks along Ball Park Road and Vienna-Rolla Road
2) Construct walking path through park
3) Construct helicopter pad
4) Construct a new pavilion at City park
5) Construct recycling center
6) Construct multi purpose building
7) Create Tee-ball fields
8) Develop plan to utilize windmills for electricity
9) Design a way to reduce the echo inside Youth Building
10) Organize weekend farmers market
11) Construct new announcer stand at rodeo arena
12) Revamp current Chamber Dollars
13) Construct soccer fields
14) Develop plan to acquire public access to Gasconade River
15) Construct arcade and bowling alley
16) Construct country club with golf course and pool

4.5. IMPLEMENTATION OF STEP 5

The first step in performing economic analysis is to determine project ownership. Four of the twelve projects were privately owned projects, while the other eight projects were taxpayer owned. This thesis focuses on developing a project portfolio that a city can implement. Since a city cannot implement private projects, the privately owned projects were not analyzed in this thesis. A list of the twelve projects and their owners can be found in Table 4.1.

The preferred benefit valuation method proposed by the EPA was the stated preference method. The stated preference method involves surveying the population to determine WTP. If the city of Vienna was to pass out one survey per household, approximately 300 surveys, 169 of the surveys would need to be returned in order to obtain a confidence level of 95% with a confidence interval of ±5% (Creative Research Systems, 2003). Because of the high number of needed responses, over 56%, the facilitator, advised by economists Dr. Richard Bryant and Dr. Michael Davis, deemed

that the stated preference method would not be feasible given the surveying methods available to the City of Vienna. Because WTP could not be determined for the city of Vienna, the B/C ratios for the project could not be calculated. Without the B/C ratios, the V.E.T. could not further eliminate projects before the portfolio selection step.

Table 4.1. Project Ownership

Taxpayer Owned	Privately Owned
• Construct sidewalks along Ball Park Road and Vienna-Rolla Road • Construct walking path through park • Construct helicopter pad • Construct a new pavilion at City park • Construct multi purpose building • Create Tee-ball fields • Develop plan to utilize windmills for electricity • Design a way to reduce the echo inside Youth Building	• Construct new announcer stand at rodeo arena • Organize a weekend farmers market • Construct recycling center • Revamp current Chamber Dollars

4.6. IMPLEMENTATION OF STEP 6

Since no projects were eliminated during the B/C ratio step, all public projects were evaluated in the portfolio selection step. In this step the AHP method was utilized to determine the final ranking of the projects. The first step in the AHP model involved the prioritizing community needs. The V.E.T. prioritized the city's needs by evaluating information collected by community questionnaires and by personal preference. These questionnaires were distributed with the monthly water bill to all households and business with running water in the City of Vienna. Of the 300 questionnaires mailed, 72 were returned and the compiled information was presented to the V.E.T. Because of the small

number of respondents, the facilitator informed the V.E.T. that the questionnaire results did not produce a valid sample of the City of Vienna, and should only be used as information, not to validate a decision. A copy of the questionnaire and the results can be found in Appendix D.

Once the community needs were prioritized, and their overall weight determined through the A.H.P. method, the projects were compared based on their ability to meet each community need. The project comparison results and prioritized community needs were then compiled and the final ranking of the projects were determined. Table 4.2 shows the final ranking of the proposed projects. The complete AHP model can be found in Appendix B.

Table 4.2. Final Project Rankings

Projects	Score	Ranking
• Develop plan to utilize windmills for electricity (Windmills)	33.77	1
• Construct sidewalks along Ball Park Road and Vienna-Rolla Road (Sidewalks)	14.80	2
• Construct multi purpose building (Multi)	14.15	3
• Create Tee-ball fields (Tee-ball)	8.91	4
• Construct helicopter pad (Heli pad)	8.58	5
• Construct walking path through park (Path)	8.07	6
• Design a way to reduce the echo inside Youth Building (Echo)	7.73	7
• Construct a new pavilion at City park (Pavilion)	3.98	8

Once the projects were ranked, resource constraints were determined. Table 4.3 shows the resources available to the city of Vienna while Table 4.4 states the estimated project cost. Based on the resources available and the individual project cost, the portfolio consisted of the projects listed in Table 4.5.

Table 4.3. Available Community Resources

Park Fund	$95,000.00
Capital Improvements Fund	$161,000.00
Street Fund	$156,000.00

Table 4.4. Estimated Project Cost

Projects	**Estimated Cost**
• Develop plan to utilize windmills for electricity	3.25 Million
• Construct sidewalks along Ball Park Road and Vienna-Rolla Road	$403,675
• Construct multi purpose building	1.8 Million
• Create Tee-ball field	$20,000
• Construct helicopter pad	$15,000
• Construct walking path through park	$67,305
• Design a way to reduce the echo inside Youth Building	$2,000
• Construct a new pavilion at City park	$80,000

Table 4.5. Vienna Economic Development Portfolio

Projects:	**Funded through:**
Develop plan to utilize windmills for electricity	Carnahan Grant
Sidewalk Improvements	2008 Safe Routes to School grant, $50,000 from street fund, and $100,000 from Capital Improvements
Build Tee-ball fields	St. Louis Cardinals and Kansas City Tee-ball grants along with $10,000 from park fund
Construct helicopter pad	$15,000 from Capital Improvements Fund
Construct walking path through park	$35,000 from Conservation Grants and $30,000 from Park Funds
Design a way to reduce the echo inside Youth Building	$2,000 from Park Funds

4.7. IMPLEMENTATION OF STEP 7

The next step in the process was to present the portfolio to the citizens of Vienna. A community meeting was held in the cafeteria at the public school. The data from the

in-depth analysis of all twelve projects was presented, along with the final portfolio selection. The Engineering Management 361 students attended the meeting and gave presentations on their assigned projects. After the presentation the project champions, V.E.T. members, and the facilitator were available to answer any questions the citizens of the community had. Feedback forms were distributed to the community members in attendance. These forms were collected by the facilitator after the question and answer session. The feedback forms used for the case study can be found in Appendix E.

4.8. IMPLEMENTATION OF STEP 8

The V.E.T. members scheduled a meeting following the community presentation. At this meeting the V.E.T. members read the feedback forms completed by the community members, then decided on whether or not to adjust the portfolio. Once the V.E.T. members decided on a revised portfolio, a final community presentation was scheduled to present the portfolio and justify the decisions made by the V.E.T. Feedback forms were also present at this meeting, allowing citizens to comment on the portfolio. Table 4.6 shows the portfolio finalized according to the community feedback sessions.

Table 4.6. Finalized Vienna Economic Development Portfolio

Projects:	Funded through:
Develop plan to utilize windmills for electricity	Carnahan Grant
Sidewalk Improvements	2008 Safe Routes to School grant, $50,000 from street fund, and $100,000 from Capital Improvements
Build Tee-ball Fields	St. Louis Cardinals and Kansas City Tee-ball grants along with $10,000 from park fund
Construct helicopter pad	$15,000 from Capital Improvements Fund
Construct walking path through park	$35,000 from Conservation Grants and $30,000 from Park Funds
Design a way to reduce the echo inside Youth Building	$2,000 from Park Funds

4.9. IMPLEMENTATION OF STEP 9

Once community members were satisfied with the portfolio, the finalized portfolio was presented to the city council at a regularly scheduled council meeting. The city council then voted to approve or deny the portfolio. On May 5, 2008, the city council of Vienna, Missouri, to accept the portfolio with a unanimous vote.

4.10. IMPLEMENTATION OF STEP 10

Step ten of the process should be completed bi-annually until the portfolio is obsolete. The evaluation should be conducted by the community council and the results presented to the community. If the portfolio requires refinement, the community council should adjust the portfolio and then return to the seventh step to proceed through the finalizing steps. The final four steps in the ten-step process are a continuous loop that should be utilized until the completion or abandonment of the portfolio.

5. CONCLUSIONS AND FURTHER AREAS OF RESEARCH

The following conclusions were reached as a result of this research:

During this process it became apparent that there is a need for an easy-to-use and easy-to-understand project prioritizing system for smaller municipalities. The task of determining which projects to implement is difficult to accomplish and probably beyond the capability of smaller municipalities without a skilled facilitator.

The success of any process in smaller communities is rooted in the commitment of the city's government, community council, and citizenry. The commitment of the city's government is essential because they control the city's resources. If a strategic plan is developed without the city government's commitment, that process probably cannot be implemented. The commitment of the community council is important because they can develop new ideas for the city and can provide external resources that may be valuable to the success of the process. In the case of project portfolio selection, project champions and citizenry are vital. Without them, many projects would be left incomplete. Further research should be conducted on ways to enhance early community involvement in the community development process.

Community development for smaller municipalities involves many areas of analysis. Some of these areas had a wide range of available resources that provided insight into how communities and volunteer organizations work. Other areas, such as community economics and community portfolio selection, provided few such resources. In the field of economics, further research should be conducted to develop a technique to analyze public projects when the community population and surveying techniques are not adequate to conduct statistically valid surveys. Further research should also be conducted

on developing a simple mechanism to help with determining project benefits, especially those projects dealing with quality of life.

Overall, this thesis provides a usable tool for smaller municipalities looking for economic growth. It is an inexpensive way for communities to implement projects that will support their strategic plan and better the quality of life for their citizens. By implementing projects to promote economic growth, the tax base will subsequently increase, as will the quality of life. By implementing projects to improve quality of life, the smaller community can attract more people and businesses, thus increasing the tax base and promoting economic growth. This research is to be used freely by any community in the hope that small town America will continue to survive.

APPENDIX A.

WTP SURVEY EXAMPLE

My name is Amanda Alpaugh, I am currently a Graduate Student at the Missouri University of Science and Technology, formerly UMR. I have been working with the city council and interested community members to develop projects that will boost the economic development of Vienna. The next step in our process is to determine the benefits the suggested projects will have on the community. It is very difficult to determine the benefits of community projects because benefits cannot always be easily measured. Because of this, the benefits must be placed in some measurable terms. The best method of making the benefits measurable is to determine the community member's Willingness to Pay (WTP). WTP represents the benefit to the community member in terms of dollars.

WTP is determined by surveys, such this one, that ask community members to state the maximum amount of money they would be willing to voluntarily exchange in order to receive an improvement. Attached to this sheet is a survey to determine individual WTP for the economic development projects. ***Please*** take the time to fill out the survey, my grade depends on it!

There are a few rules to keep in mind while taking this survey:

1. **All community members 18 or older may take the survey.** If you did not receive adequate amount of surveys, you may obtain more surveys from the city hall.

2. **When determining your WTP you must only take into account you as an individual.** For example, Do not consider the benefit your cousin will receive from the improvement.

3. **Exceptions to rule number two.** When determining your WTP, you can include the benefits received from the two types of altruism described below.

    - **Paternalistic Altruism**: Parents have paternalistic altruism for their children when they care about their children's health or consumption in and of itself, not because of what the child likes. A classic example of paternalistic altruism is the parent saying, "Eat your spinach. I don't care if you don't like it. It's good for you."

    - **Altruism Towards Future Generations**: This is where the project's costs are borne completely by the current generation, while future generations reap the benefits.

1. The Vienna Economic Team (V.E.T.) has proposed that a walking path be built at the city park. The walking path will be located on the outskirts of both the City Park and Fairground lands. Along with a walking path, resting areas will be established as well as seasonal restrooms. The walking path was proposed to help alleviate the hazards caused by the large number of people walking on the streets of Vienna. It will also provide an area for the senior citizens to exercise and a more convenient walkway during the county fair. For more information regarding this project please contact Gean Gillispie: 744-5882

- As a citizen of Vienna, I would be willing to pay $_____ annually for the next seven years to obtain a hard surface (asphalt or concrete) walking path around the City Park and Fairgrounds.

- As a citizen of Vienna, I would be willing to accept a $_____ annual tax increase to obtain a soft surface (shredded tires, rock, or woodchips) walking path around the City Park and Fairgrounds.

2. The V.E.T. has proposed that a permanent helicopter pad be built on city land located directly behind the Maries Manor Nursing Home. The helicopter pad would be a permanent structure that meets all FAA requirements. The lighting for the helicopter pad will be controlled by a switch located at the Ambulance Building. The helicopter pad was proposed to meet the need of a safe landing zone for a helicopter in case of a medical emergency. Because of the large amount of money spent on the dirt work performed on the City's baseball diamond, the City no longer allows helicopters to land in the field. This forces the helicopters to land in front of the Ambulance Building. There are many hazards located in that area such as power lines, a retaining wall, and trees. For more information regarding this project please contact John Rujawitz: 422-6123

- As a citizen of Vienna, I would be willing to accept a $_____ annual tax increase to obtain a permanent helicopter pad that meets FAA regulations and is located on City land directly behind the Maries Manor Nursing Home.

3. The V.E.T. has proposed that the pavilion located next to the playground at the City Park be rebuilt. The new pavilion would be taller than the current structure and would include amenities such as BBQ grills and increased seating area. The new pavilion was proposed because the current pavilion lacks adequate ventilation, has uneven, rough flooring, and needs a new roof. For more information on this project contact Therese Roberson: 422-3549

- As a citizen of Vienna, I would be willing to accept a $_____ annual tax increase to obtain a new pavilion located at the City Park that has more ventilation, smoother floors, more seating areas, and BBQ pits.

4, The V.E.T. proposed that the tennis courts located at the City Park be overhauled. The overhaul process will include resurfacing of the current courts and repairing the perimeter fence. This project was proposed because the existing courts have extensive cracks in the concrete with grass growing in them and the fence surrounding the area is in poor condition. For more information regarding this project contact Therese Roberson: 422-3549

- As a citizen of Vienna, I would be willing to accept a $_____ annual tax increase to obtain newly overhauled tennis courts and perimeter fence at the City Park.

5. A V.E.T. member has proposed an alternative to project number four. The V.E.T. member proposed that a tee-ball diamond be built at the City Park. This project will involve destruction of the current tennis courts and construction of a tee-ball diamond as a replacement for the tennis courts. This project was proposed because a V.E.T. member felt that a tee-ball diamond would benefit the community more than overhauling the tennis courts. For more information regarding this project contact Therese Roberson: 422-3549

- As a citizen of Vienna, I would be willing to accept a $_____ annual tax increase to obtain a tee-ball diamond that will be built at the current location of the tennis courts.

6. The V.E.T. proposed the construction of a Multi-Purpose building at the City Park. The building will be located in the open area west of the baseball diamond. The building will be a one story building and will include city administrative offices and a gymnasium with a stage. The building was proposed because of the lack of an indoor recreational facility for the community as well as an inclement weather location for fair activities. The building will have city administrative offices for the mayor and city employees along with conference rooms to host public meetings. For more information regarding this project contact Mayor Jr. Darr: 422-3023

- As a citizen of Vienna, I would be willing to accept a $_____ annual tax increase to obtain a Multi-Purpose building located at the City Park that will provide indoor recreational facilities and city administrative offices.

7. The V.E.T. has proposed that the interior of the Youth Building located at the City Park be altered to reduce the echo inside the building. Acoustic absorbing materials will be placed inside the building to reduce the amount of echo. This project was proposed because of the inconvenience caused during social gatherings by the echo inside the building. For more information regarding this project contact Carol Miller: 422-3719

- As a citizen of Vienna, I would be willing to accept a $_____ annual tax increase to reduce the echo in the youth center by placing acoustic absorbing materials inside.

8. The V.E.T. proposed the construction of a wind farm to help subsidize the cost of electricity for the citizens of Vienna. Wind tests will be performed to determine the best location for the windmills. The wind farm was proposed because of the need for more environmentally friendly ways of producing electricity. For more information regarding this project contact John Roberson: 422-3520

- As a citizen of Vienna, I would be willing to accept a $_____ annual tax increase to obtain a wind farm that is environmentally friendly and will reduce electricity bills by approximately 0% to 10%.

- As a citizen of Vienna, I would be willing to accept a $_____ annual tax increase to obtain a wind farm that is environmentally friendly and will reduce electricity bills by approximately 11% to 25%.

- As a citizen of Vienna, I would be willing to accept a $_____ annual tax increase to obtain a wind farm that is environmentally friendly and will reduce electricity bills by approximately 26% to 40%.

- As a citizen of Vienna, I would be willing to accept a $_____ annual tax increase to obtain a wind farm that is environmentally friendly and will reduce electricity bills by approximately 41% to 55%.

- As a citizen of Vienna, I would be willing to accept a $_____ annual tax increase to obtain a wind farm that is environmentally friendly and will reduce electricity bills by approximately 56% to 70%.

- As a citizen of Vienna, I would be willing to accept a $_____ annual tax increase to obtain a wind farm that is environmentally friendly and will reduce electricity bills by approximately 71% to 85%.

- As a citizen of Vienna, I would be willing to accept a $_____ annual tax increase to obtain a wind farm that is environmentally friendly and will reduce electricity bills by approximately 86% to 100%

APPENDIX B

AHP MODEL

The AHP model used for project prioritization in the city of Vienna, Missouri is described below. This model was implemented by the process facilitator and the rankings determined by V.E.T. members.

The first step of the AHP process is to rank the relative importance of the objectives. In the case of Vienna, Missouri, the objectives being considered were the four community needs: (1) increase the tax base of the community (ITB), (2) create safe transportation methods for the community (TRA), (3) provide recreational facilities for the community (REC), and (4) make the community more environmental friendly (EVI). A scale of one to nine was chosen because of the small number of objectives being compared. To compare objectives i and j, where i is assumed to be at least as important as j, the scale shown in Table B.1 was used. The comparisons developed by the V.E.T. can be seen in Table B.2.

Table B.1. Comparative Descriptions

Value a_{ij}	***Comparative Descriptions***
1	Objective i and j are of equal importance
3	Objective i is weakly more important than j
5	Objective i is strongly more important than j
7	Objective i is very strongly more important than j
9	Objective i is absolutely more important than j

Table B.2. Community Need Comparisons

	ITB	**TRA**	**REC**	**EVI**
ITB	1	6	6	1
TRA	1/6	1	7	1
REC	1/6	1/7	1	1/6
EVI	1	1	6	1

The next step in the AHP model is to determine the overall weights of each objective. This will be completed in two sub-steps. The first sub-step is to take each entry in Table B.2 and divide it by the sum of the column in which it appears. Below is an example for the (ITB, TRA) entry.

$$(ITB, TRA) = \frac{6}{6+1+1/7+1} = \frac{3}{4} \tag{5}$$

Once all entries are completed, the average across the rows is computed. By taking the computed average and multiplying it by one hundred, the objectives weight would be represented as a percentage of the whole. This two-step process works because each column is normalized by setting the appropriate value to one. For example, the first column is normalized by entering 1 for (ITB, ITB). For a consistent decision maker, each column should be identical except for the normalization. By dividing each entry by the sum of the column, we would expect to obtain identical column entries. However, because there are often inconsistencies in decision making, the columns are usually not identical. In the AHP, the columns are averaged to determine the overall weight of the objective and reduce the effect of inconsistencies in the decision making process. Table B.3 shows the computed matrix and associated weight of each objective for the City of Vienna.

Table B.3. Community Need Weights

	ITB	TRA	REC	EVI	AVG.	Weight
ITB	0.43	0.74	0.30	0.32	0.45	45%
TRA	0.07	0.12	0.35	0.32	0.22	25%
REC	0.07	0.02	0.05	0.05	0.05	4%
EVI	0.43	0.12	0.30	0.32	0.29	26%

The next step in the AHP model is to compare the projects based on their ability to meet the objective. Abbreviations were used to identify the projects during this process, the project abbreviations can be found in Table B.4. For example, Table B.5a compares between projects based on the ability of the projects to fulfill the community need to increase the tax base. The projects are compared on the same scale used to rank the objectives. Once the comparison is complete, the weight of each project based on that objective is determined. The project weight, based on the objective, is determined in the same way as was the objective weight calculated above. This process was completed for all four objectives. Tables B.5-B.12 show the project comparisons and associated weights based on the objectives.

Table B.4. Project Abbreviations

PROJECTS
• Construct sidewalks along Ball Park Road and Vienna-Rolla Road (Sidewalks)
• Construct walking path through park (Path)
• Construct helicopter pad (Heli pad)
• Construct a new pavilion at City park (Pavilion)
• Construct multi purpose building (Multi)
• Create Tee-ball field (Tee-ball)
• Develop plan to utilize windmills for electricity (Windmills)
• Design a way to reduce the echo inside Youth Building (Echo)

Table B.5. Project Comparisons Based on ITB

	Sidewalks	Path	Heli Pad	Pavilion	Multi	Tee-ball	Windmills	Echo
Sidewalks	1	1	1	1	1/6	1/3	1/9	1/5
Path	1	1	1	1	1/5	¼	1/9	¼
Heli Pad	1	1	1	1	1/9	1/5	1/9	¼
Pavilion	1	1	1	1	1/4	1/5	1/9	¼
Multi	6	5	9	4	1	6	1/6	6
Tee-ball	3	4	3	5	1/6	1	1/5	5
Windmills	9	9	9	9	6	5	1	8
Echo	5	4	3	4	1/6	1/5	1/8	1

Table B.6. Project Weights Based on ITB

	Sidewalks	Path	Heli Pad	Pavilion	Multi	Tee-ball	Windmills	Echo	Avg	Multiply by ITB Weight
Sidewalks	0.04	0.04	0.04	0.04	0.02	0.03	0.06	0.01	3%	1%
Path	0.04	0.04	0.04	0.04	0.02	0.02	0.06	0.01	3%	1%
Heli Pad	0.04	0.04	0.04	0.04	0.01	0.02	0.06	0.01	3%	1%
Pavilion	0.04	0.04	0.04	0.04	0.03	0.02	0.06	0.01	3%	1%
Multi	0.22	0.19	0.32	0.15	0.12	0.46	0.09	0.29	23%	10%
Tee-ball	0.11	0.15	0.11	0.19	0.02	0.08	0.10	0.24	13%	6%
Windmills	0.33	0.35	0.32	0.35	0.74	0.38	0.52	0.38	43%	19%
Echo	0.19	0.15	0.11	0.15	0.02	0.02	0.06	0.05	8%	4%

Table B.7. Project Comparisons Based on TRA

	Sidewalks	Path	Heli Pad	Pavilion	Multi	Tee-ball	Windmills	Echo
Sidewalks	1	8	1/4	7	7	4	6	6
Path	1/8	1	1/5	5	4	5	7	8
Heli Pad	4	5	1	7	5	1	1	1
Pavilion	1/7	1/5	1/7	1	1	1	1	1
Multi	1/7	¼	1/5	1	1	1	1	1
Tee-ball	¼	1/5	1/6	1	1	1	1	1
Windmills	1/6	1/7	1/8	1	1	1	1	1
Echo	1/6	1/8	1/9	1	1	1	1	1

Table B.8. Project Weights Based on TRA

	Sidewalks	Path	Heli Pad	Pavilion	Multi	Tee-ball	Windmills	Echo	Avg	Multiply by TRA Weight
Sidewalks	0.17	0.54	0.11	0.29	0.33	0.27	0.32	0.30	0.29	6%
Path	0.02	0.07	0.09	0.21	0.19	0.33	0.37	0.40	0.21	5%
Heli Pad	0.67	0.34	0.46	0.29	0.24	0.07	0.05	0.05	0.27	6%
Pavilion	0.02	0.01	0.07	0.04	0.05	0.07	0.05	0.05	0.05	1%
Multi	0.02	0.02	0.09	0.04	0.05	0.07	0.05	0.05	0.05	1%
Tee-ball	0.04	0.01	0.08	0.04	0.05	0.07	0.05	0.05	0.05	1%
Windmills	0.03	0.01	0.06	0.04	0.05	0.07	0.05	0.05	0.04	1%
Echo	0.03	0.01	0.05	0.04	0.05	0.07	0.05	0.05	0.04	1%

Table B.9. Project Comparisons Based on REC

	Sidewalks	Path	Heli Pad	Pavilion	Multi	Tee-ball	Windmills	Echo
Sidewalks	1	1/3	5	1	1/5	1/7	5	3
Path	3	1	8	5	1/3	½	6	7
Heli Pad	1/5	1/8	1	¼	1/6	¼	4	3
Pavilion	1	1/5	4	1	1/6	¼	4	3
Multi	5	3	6	6	1	4	7	7
Tee-ball	7	2	6	4	1/4	1	5	4
Windmills	1/5	1/6	1	¼	1/7	1/5	1	1/3
Echo	1/3	1/7	3	1/3	1/7	¼	3	1

Table B.10. Project Weights Based on REC

	Sidewalks	Path	Heli Pad	Pavilion	Multi	Tee-ball	Windmills	Echo	Avg	Multiply by REC Weight
Sidewalks	0.06	0.05	0.15	0.06	0.08	0.02	0.14	0.11	0.08	0%
Path	0.17	0.14	0.24	0.28	0.14	0.08	0.17	0.25	0.18	1%
Heli Pad	0.01	0.02	0.03	0.01	0.07	0.04	0.11	0.11	0.05	0%
Pavilion	0.06	0.03	0.12	0.06	0.07	0.04	0.11	0.11	0.07	0%
Multi	0.28	0.43	0.18	0.34	0.42	0.61	0.20	0.25	0.34	2%
Tee-ball	0.39	0.29	0.18	0.22	0.10	0.15	0.14	0.14	0.20	1%
Windmills	0.01	0.02	0.03	0.01	0.06	0.03	0.03	0.01	0.03	0%
Echo	0.02	0.02	0.09	0.02	0.06	0.04	0.09	0.04	0.05	0%

Table B.11. Project Comparisons Based on EVI

	Sidewalks	Path	Heli Pad	Pavilion	Multi	Tee-ball	Windmills	Echo
Sidewalks	1	6	6	6	5	6	1/8	6
Path	1/6	1	1	1	1	1	1/8	½
Heli Pad	1/6	1	1	1	1	1	1/8	1/3
Pavilion	1/6	1	1	1	1	1	1/8	1/3
Multi	1/5	1	1	1	1	1	1/9	1/3
Tee-ball	1/6	1	1	1	1	1	1/7	¼
Windmills	8	8	9	8	9	7	1	8
Echo	1/6	2	3	3	3	4	1/8	1

Table B.12. Project Weights Based on EVI

	Sidewalks	Path	Heli Pad	Pavilion	Multi	Tee-ball	Windmills	Echo	Avg	Multiply by EVI Weight
Sidewalks	0.10	0.29	0.26	0.27	0.23	0.27	0.07	0.36	0.23	7%
Path	0.02	0.05	0.04	0.05	0.05	0.05	0.07	0.03	0.04	1%
Heli Pad	0.02	0.05	0.04	0.05	0.05	0.05	0.07	0.02	0.04	1%
Pavilion	0.02	0.05	0.04	0.05	0.05	0.05	0.07	0.02	0.04	1%
Multi	0.02	0.05	0.04	0.05	0.05	0.05	0.06	0.02	0.04	1%
Tee-ball	0.02	0.05	0.04	0.05	0.05	0.05	0.08	0.01	0.04	1%
Windmills	0.80	0.38	0.39	0.36	0.41	0.32	0.53	0.48	0.46	13%
Echo	0.02	0.10	0.13	0.14	0.14	0.18	0.07	0.06	0.10	3%

The overall score of each project can then be determined by using the equation below.

$$project\ A\ Score = \sum_{n=1}^{4} (project\ A\ avg.\ weight\ based\ on\ objective\ n * avg\ weight\ of\ obective\ n) \qquad (6)$$

The project scores and final rankings can be found in Table B.13.

Table B.13. Project Scores

Projects	Score	Ranking
• Develop plan to utilize windmills for electricity (Windmills)	33.77	1
• Construct sidewalks along Ball Park Road and Vienna-Rolla Road (Sidewalks)	14.80	2
• Construct multi purpose building (Multi)	14.15	3
• Build Tee-ball fields (Tee-ball)	8.91	4
• Construct helicopter pad (Heli pad)	8.58	5
• Construct walking path through park (Path)	8.07	6
• Design a way to reduce the echo inside Youth Building (Echo)	7.73	7
• Construct a new pavilion at City park (Pavilion)	3.98	8

APPENDIX C

PROJECT CHAMPIONS AND GRADUATE STUDENTS

PROJECT CHAMPIONS AND GRADUATE STUDENTS

- **Construct sidewalks along Ball Park Road and Vienna-Rolla Road**
  - **STUDENTS**
    - TobyThielemier
    - Kiran Rangarajan
  - **CHAMPION**
    - Carl Henderson
- **Design a walking path through City park**
  - **STUDENTS**
    - Sam Emery
    - Kwame Boateng
  - **CHAMPION**
    - Gean Gillispie
- **Construct helicopter pad**
  - **STUDENTS**
    - Everett Probasco
    - Navina Tungapindi
  - **CHAMPION**
    - John Rujawitz
- **Construct a new pavilion at City park**
  - **STUDENTS**
    - Sriram Venkateswaran
    - Ray Beezley
  - **CHAMPION**
    - Therese Roberson
- **Construct tee-ball field**
  - **STUDENTS**
    - Sriram Venkateswaran
    - Ray Beezley
  - **CHAMPION**
    - Therese Roberson
- **Construct multi purpose building**
  - **STUDENTS**
    - Joe Winters
    - Shishir Jai
  - **CHAMPION**
    - Mayor Darr
- **Construct recycling center**
  - **STUDENTS**
    - Janet Carrol
    - Jie Feng
    - Carlos Pales
    - John Koch
    - Srivardhan Paluvatla
    - Timothy Andrews
  - **CHAMPION**
    - Bruce Struemph

- **Develop plan to utilize windmills for electricity**
    - **STUDENTS**
        - Mathew Thomas
        - Arvind Nanduri
    - **CHAMPION**:
        - John Roberson
- **Design way to reduce echo inside youth building**
    - **STUDENTS**
        - Chaitanya Delankar
        - Chad Peterson
    - **CHAMPION**
        - Carol Miller
- **Organize weekend farmers market**
    - **STUDENTS**
        - Teju Tammina
        - Parthiv Shah
    - **CHAMPIONS**
        - Jesse Carroll
        - Virginia Carroll
- **Design announcer stand at rodeo arena**
    - **STUDENTS**
        - Duo Yang
        - Kalon Ladd
    - **CHAMPION**
        - Gary Weiss
- **Revitalize chamber dollars**
    - **STUDENTS**
        - Amogh Shenoy
    - **CHAMPIONS**
        - Therese Roberson
        - Stephanie Feeler
        - Vivian Honse

APPENDIX D

V.E.T. QUESTIONNAIRE AND RESULTS

YOU CAN WIN A $50 GIFT CERTIFICATE!

Name (please print):_____

Phone Number (to be used to contact the winner):_____

As part of the Vienna Economic Development process, the Vienna Economic Team (V.E.T.) chose to focus on four areas of community development that they felt were the most important. The V.E.T. now asks for community feedback on the chosen areas. The feedback received from the community will help the V.E.T. in determining which community projects to implement. Below are the four areas for community development. Please rank the areas from 1 to 4 with 1 being the area in which you feel is the most important and 4 being the area you feel is least important.

- Increase tax base----------_____
- Create safe transportation venues (heliport, walking trails, sidewalks, paths to schools, bike paths, etc.) for the community -----_____
- Provide recreational facilities for the community----------_____
- Create a more environmentally friendly community----------_____

Once you have completed this questionnaire please return it to Vienna City Hall (P.O. Box 196). All completed questionnaires will be entered into a drawing for 50 dollars worth of Chamber Dollars which can be used at participating Chamber of Commerce businesses in Vienna. For a list of participating businesses please visit the Chamber of Commerce website at www.viennamo.com. The questionnaires are due on 29 February and the winner will be drawn at the city council meeting on 3 March.

If you receive this questionnaire as both a business owner and Vienna resident, please complete only one questionnaire.

Table D.1. Individual Questionnaire Results

Community Needs	Reply 1	Reply 2	Reply 3	Reply 4	Reply 5	Reply 6	Reply 7	Reply 8	Reply 9
Increase Tax Base	4	2	4	1	4	3	3	4	2
Create Safe transportation venues	1	1	2	3	1	4	4	3	3
Provide recreational facilities	2	3	3	2	3	1	1	1	1
More environmentally friendly	3	4	1	4	2	2	2	2	4
Community Needs	**Reply 10**	**Reply 11**	**Reply 12**	**Reply 13**	**Reply 14**	**Reply 15**	**Reply 16**	**Reply 17**	**Reply 18**
Increase Tax Base	4	1	3	2	3	4	1	4	1
Create Safe transportation venues	2	3	1	3	4	2	2	2	3
Provide recreational facilities	3	2	4	4	2	3	4	1	2
More environmentally friendly	1	4	2	1	1	1	3	3	4
Community Needs	**Reply 19**	**Reply 20**	**Reply 21**	**Reply 22**	**Reply 23**	**Reply 24**	**Reply 25**	**Reply 26**	**Reply 27**
Increase Tax Base	4	4	4	3	1	3	4	4	4
Create Safe transportation venues	1	1	1	4	4	1	1	2	1
Provide recreational facilities	2	2	2	2	2	2	3	1	2
More environmentally friendly	3	3	3	1	3	4	2	3	3
Community Needs	**Reply 28**	**Reply 29**	**Reply 30**	**Reply 31**	**Reply 32**	**Reply 33**	**Reply 34**	**Reply 35**	**Reply 36**
Increase Tax Base	1	1	4	4	3	3	4	1	3
Create Safe transportation venues	4	3	3	1	2	2	1	4	1
Provide recreational facilities	3	2	1	2	4	4	2	2	2
More environmentally friendly	2	4	2	3	1	1	3	3	4
Community Needs	**Reply 37**	**Reply 38**	**Reply 39**	**Reply 40**	**Reply 41**	**Reply 42**	**Reply 43**	**Reply 44**	**Reply 45**
Increase Tax Base	4	4	1	4	2	3	1	4	4
Create Safe transportation venues	1	1	2	3	1	2	2	2	1
Provide recreational facilities	2	2	4	1	3	1	3	3	2
More environmentally friendly	3	3	3	2	4	4	4	1	3
Community Needs	**Reply 46**	**Reply 47**	**Reply 48**	**Reply 49**	**Reply 50**	**Reply 51**	**Reply 52**	**Reply 53**	**Reply 54**
Increase Tax Base	4	4	4	4	4	1	4	4	1
Create Safe transportation venues	2	2	1	2	1	4	1	2	3
Provide recreational facilities	3	1	3	1	2	3	2	3	2
More environmentally friendly	1	3	2	3	3	2	3	1	4
Community Needs	**Reply 55**	**Reply 56**	**Reply 57**	**Reply 58**	**Reply 59**	**Reply 60**	**Reply 61**	**Reply 62**	**Reply 63**
Increase Tax Base	1	4	4	4	2	1	4	4	3
Create Safe transportation venues	4	3	1	3	1	2	1	2	1
Provide recreational facilities	3	1	2	1	4	3	2	3	2
More environmentally friendly	2	2	3	2	3	4	3	1	4
Community Needs	**Reply 64**	**Reply 65**	**Reply 66**	**Reply 67**	**Reply 68**	**Reply 69**	**Reply 70**	**Reply 71**	**Reply 72**
Increase Tax Base	1	3	4	3	2	1	4	2	4
Create Safe transportation venues	2	2	2	2	4	2	3	3	3
Provide recreational facilities	3	1	3	1	1	3	2	2	2
More environmentally friendly	4	4	1	4	3	4	1	1	1

Table D.2. Averaged Questionnaire Results

Community Needs	Averaged Results
Increase Tax Base	3.4
Create Safe transportation venues	2.5
Provide recreational facilities	2.6
More environmentally friendly	3

APPENDIX E

FEEDBACK FORM

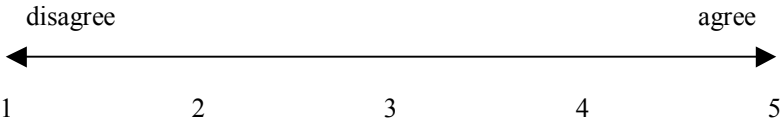
Vienna Economic Development Portfolio

Community Feed Back Form

Please take the time to fill out this feedback form; the information gathered will help the Vienna Economic Team (V.E.T.) determine the finalized portfolio.

Please circle the number that best represents you opinion to the questions below:

1. **The projects chosen for the portfolio will best promote economic development in Vienna.**



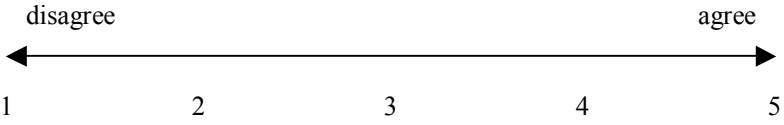
Comments:_____

_____

_____

_____

2. **The portfolio is feasible for the city of Vienna**



Comments:_____

_____

_____

_____

Please provide your comments and suggestions on the Vienna Economic Development portfolio.

_____

_____

_____

_____

_____

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VITA

Amanda Danielle (Stratman) Alpaugh was born on April 8, 1985 in Jefferson City, Missouri. She is the daughter of Richard and Louise Stratman of Argyle, Missouri, and the wife of Stephen Andrew Alpaugh, Jr. She completed her primary and secondary education at Maries R-1 schools in Vienna, Missouri. After high school, she continued her education at Missouri University of Science and Technology, formerly known as the University of Missouri-Rolla, where she earned a Bachelor of Science degree in Aerospace Engineering in December 2007 and a Master of Science degree in Engineering Management in May 2008.

Amanda was commissioned as an officer in the United States Air Force in December 2007 and entered active duty in 2008.