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PLAN FOR CAPACITY BUILDING USING 3D MODELING & PLANNING DECISION SUPPORT SYSTEMS

for the
Prince George's County Planning Department
on behalf of
The Maryland-National Capital Park and Planning Commission



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1.0 Executive Summary

The Maryland-National Capital Park and Planning Commission (M-NCPPC), recognizing the value of 3D modeling and Planning Decision Support Tools as well as the challenges involved with implementing these tools, issued an RFP for a “**Plan for Capacity Building Using 3D & Modeling Applications**” for the Prince George’s County Planning Department. The RFP stipulated that the Plan included an in-depth needs assessment of the Department, an evaluation of available tools, and a survey documenting the use of 3D modeling and PDSS tools by other planning departments across the nation. The Environmental Simulation Center (ESC) – a not-for-profit that specializes in the application of digital tools to the planning process, assisted by Rhodeside Harwell – a multidisciplinary planning firm in the Washington DC region, were selected as the Consultant Team.

The Consultant Team provided a scope of work that responded to the requirements RFP and kicked off the project at the end of September 2009. Although this project started with a focus on matching 3D modeling and Planning Decision Support Systems (PDSS) to the Client’s needs and making training recommendations, early research and interviews with other agencies indicated that **the far bigger challenges in tool adoption were institutional in nature**. Indeed, as there are many tools that can be applied to many planning activities, and that set of tools is constantly changing, “building capacity” requires addressing the structure and culture of the organization in terms of how the technology is managed and decisions-made about the allocation of resources. Therefore, our most important recommendations are those that concern building an institutional framework to support capacity-building and decision-making – not only for the tools we recommend, and other technologies, but staffing and the development of applications which would best advance the goals and projects of the Planning Department.

1.1 The Challenges

Skills

Planners now have access to a bewildering number of tools that can enhance almost every aspect of the planning process – from public outreach to complex forecasting models. It is safe to say that there are far more tools available to any planner – in any specialty area – than they can possibly learn, so planners must choose carefully. Naturally, the tools that are easiest to learn and provide the “most bang for the buck” will be the first tools adopted. Spreadsheet and presentation tools, like Microsoft Excel, Word, and PowerPoint, are tools that are relatively easy to learn, and make planners’ jobs easier; therefore, they have been adopted to the point where they almost universally used by most planners.

And while working with numbers, writing reports, and making presentations are critical parts of a planner’s job, planning also has spatial and design components. Therefore CAD (Computer-Aided Drafting/Design), GIS (Geographic Information Systems), and 3D modeling tools should also be part of a planner’s toolbox. In addition, many of these core technologies (GIS, spreadsheets, 3D modeling, and presentation tools) have been combined to create a new class of tools: Planning Decision Support Systems (PDSS). Yet very few planners actually know how to use these tools themselves. This is most likely because these tools are more complex than word processors or spreadsheets, and – especially with GIS - - have their own concepts and vocabularies.



In our survey and interview of the Prince George's County Planning Department staff, we found that – although all the staff interviewed reported using GIS on a daily or weekly basis – their use was mostly confined simple queries and map display via PGAtlas. Less than half of the staff interviewed reported GIS skills at a level where they could effectively define the data and parameters of a Planning Decision Support System. Only 20% of the staff interviewed had the skills necessary to actually set up a PDSS – loading data and building formulas. It's not that PDSSs are excessively complex, but they do require an understanding of the GIS than goes beyond simple map queries and layer manipulation.

For 3D modeling, only one-third of the staff interviewed reported having used software to create 3D visual simulations. Of those, *all* reported using SketchUp and only a few reported using other software. Very few planners said they had the necessary skills, the time to learn those skills, or occasions to use those skills often enough so that they “stick”.

Education

We found that few planning schools have required GIS or 3D as part of their core curriculum or even offer it as an elective taught by the department although that is beginning to change. The ESC investigated the curricula of the top 25 planning schools in the United States and only three required a GIS course as part of the core curriculum. This finding was confirmed by a recently published survey of public planning agencies in Wisconsin (hereto after referred to as “the Wisconsin Study”) about “The barriers to GIS Use in Planning”.¹ (see Appendix B) That study found that only 10% of U.S. planning departments have GIS-related job requirements, and only two departments require courses that focus on advanced GIS capabilities for planning-related applications.

Specialization

Given the complexity of the tools, it is not surprising that most planners and planning departments delegate GIS and 3D modeling to “specialists”. Those specialists typically come from a geography or surveying background and the design professions, which makes sense because like CAD and 3D are “primary” technologies for architects, GIS is a “primary” technology for geographers. The problem is most CAD and/or GIS specialists have very little if any training in planning. Conversely, most planners have very little if any training in GIS or CAD.

Communication

There is a divide between GIS Professionals and Planners/Designers – both in terms of how these groups are organized within the agency structure and how they perceive particular tools and planning activities. Our own survey and interviews of other planning agencies – as well as the Wisconsin study – bear out that there are general, chronic communication problems between planners and GIS technicians everywhere. The aforementioned lack of training, coupled with specialization and a lack communication between domains results in planners not understanding the analytical potential for GIS and PDSS's.

Finding the right tools for the job

Many agencies struggle with rapidly changing technology and the challenge that presents to selecting the “right” tool for the job in the first place, as well as managing expectations about its use. Sometimes,

¹ Journal of the American Planning Association by Z. Asligul Gocmen and Stephen J. Ventura



agencies may acquire a tool that ultimately proves too complex to use without significant investments in training. Or they make significant investments in training but the tool quickly becomes obsolete. Agencies may also use tools in ways they were never intended to be used. Unfortunately, there is no one planning tool that does everything well. And while many 3D modeling and Planning Decision Support Tools have similar basic functionality, some tools support certain planning activities much better than others.

Lack of institutionalized skill

Developing a decision-making framework for adopting tools, developing applications, and hiring and/or training current and future staff is critical if an agency is to successfully adapt the existing institutional culture to using the IT tools. Significant capacity building is required at the front end of tool adoption, and agencies need an initial project to learn how to use the tool. It is just not possible to pick up a new tool and change business practices overnight.

When an agency acquires a new tool, particular staff members gravitate to it, but ultimately the use of the tool is never institutionalized due to lack of specialized skills, skill loss as the result of staff turnover, and most importantly – lack of a strategy to build capacity. Lack of institutionalized skills, either because tools were too complex and/or not enough resources were devoted to training, or by the failure of the agency to retain those skills as part of their “institutional knowledge”, is a major factor impeding the successful use of these tools by agencies.

1.2 Recommendations for Building Capacity

The major recommendations of this study seek to address some of the most significant questions that emerge from the aforementioned challenges: how does the Prince George’s County Planning Department build capacity and institutionalize the use of tools that are constantly changing? And how can the Department keep pace with technology in order to be able to choose the “right” tools and apply them successfully?

1.2.1 Institutionalizing Technology

Institutionalization of technology can be defined as the extent to which technology is integrated into the culture and practice of an agency, rather than being viewed as an add-on program, and the extent to which agency staff take ownership of the technology and its use. In order for 3D Visual Simulation and Planning Decision Support Tools to become institutionalized in the Planning Department, the Planning Department will need to devote the appropriate resources to use and manage the tools effectively in support of their planning activities.

Tools can get institutionalized by agencies in different ways to different extents:

- **Tool use can be assigned to a group of specialists:** An agency designates that specialists or a group of specialists use the tools. In a public agency, this means that official positions and/or entire departments are created specifically around the use of the tool. This is expensive and, with the increasingly rapid pace of technological adoption and change, becoming impractical because



job descriptions and entire departments can become superfluous or obsolete within a relatively short period of time.

- **Tool training can be voluntary/mandatory and application-specific:** Mandates or strong incentives are in place to ensure that all staff, not just technology enthusiasts, receive appropriate training in the use of tools. But, training alone is not enough. The staff need to understand how the tools can be applied to their work see the benefit of using the tools in their day-today work.
- **Tool training and use is mandatory and application-specific:** The agency has to have a process in place to make sure all staff are able to use the tool at a certain level of proficiency. (For example, an investment bank may only hire clerical staff who pass an assessment on basic Excel operational Skills, and then provide their own training on Excel applications specific for the financial industry, including the bank's own custom applications.)
- **Tool use is common, and training is primarily peer-to-peer:** A large number of people know how to use the tools and find them helpful. Staff turnover is no problem because the use of the tool is ubiquitous in their industry. Most people already know how to use the tool or a tool like it, and those that don't learn from their co-workers. (CAD for Architects, Spreadsheets for Accountants, Word Processing for just about everyone.)

Ideally, GIS for planners and 3D for urban designers will someday become as ubiquitous as CAD is for architects. This is an ambitious and worthy goal, so in the mean time, the recommendations and strategies to implement them outlined below borrow from all four of the paths to tool institutionalization described above: there is mandatory training for some and voluntary training for others -- but all training is application-specific. There are specialists, but their job is to train staff who, in turn, train their peers.

We strongly recommend that all staff who are interested should have the opportunity to learn the tools to whatever level of expertise they desire. Not everyone needs the same level of training on the tools; but all staff should be at least conversant on the tools, and managers need to understand the tools well enough so that they know when and where the tools might be useful, and what is involved in using the tools so they can manage staff and expectations effectively.

1.2.2 Recommendations to Institutionalize the Tool Selection, Implementation, Application, and Capacity-Building Process

In addition to building a strong institutional framework that supports the cultivation of internal staff capacity to use the tools effectively, these recommendations include steps to institutionalize the tool selection and evaluation process itself. This will provide the Planning Department with an on-going decision-making process to keep pace with technological change so that decision-makers are provided with the information they need to make wise choices about where and how to apply the tools and manage resources accordingly.

1. **Form an Executive Committee for Tools** – The Executive Committee should consist of a small group of management-level decision makers with one representative from each Division in the Planning Department as well as the Parks Planning and Development Division from the Department of Parks and Recreation. Their primary responsibility would be to make recommendations regarding tool selection, implementation, and applications development to the Planning Director or another senior planner appointed by the Planning Director.



The proposed Executive Committee would select which tools to implement based on their potential to improve workflow and planning outcomes, identify all the projects in the Department where applications of the selected tools would be beneficial, select the projects that would make appropriate pilots for tool development and implementation, and assign staff to one or more “Ad Hoc” Teams for tool application development under the leadership of the Technical Leads described below. In the future they may also create new types of ad hoc teams related to tools and capacity building like tool post-implementation review, needs assessment, etc.

The Executive Committee would meet at key points in the decision-making process. Once the Ad Hoc Teams are assembled and developing applications, the Executive Committee would probably meet on a regular basis to review their work and track the progress of pilot projects.

- 2. Designate or hire Technical Leads** – The Technical Leads are a critical component in the proposed strategy to implement IT tools in the day-to-day planning functions of the Department. They would provide 3D visual simulation and decision support tool expertise and advice to the Executive Committee and the entire Planning Department. They should be either new full-time positions (recommended), or a combination of a new position and existing staff. They would be responsible for researching, demonstrating, and recommending new tools as well as performing any tool-related needs assessments or feasibility studies deemed necessary by the Executive Committee (the role of the ESC in this project). The Technical Leads would also be responsible for implementing, developing curriculum, and providing in-house training on the tools ultimately selected by the Executive Committee and staff. They would also lead the small “ad hoc” teams of 3-5 staff in implementing tools, developing applications of the tools, and evaluating them.

The Technical Leads would be responsible to the Executive Committee and be able to work on multiple projects in different planning divisions. Two staff are recommended for redundancy, and each one should have strong working knowledge of the all tools selected by the Planning Department (most likely ArcGIS and recommended extensions, CommunityViz, and SketchUp), since many of those tools work together. However, we recommend one or the other or both of the Technical Leads have expertise in and take *primary* responsibility for *one* of each of the following:

- *3D/Urban Design Technical Lead* – This person is a planner who provides expertise in using SketchUp and AutoCAD/3D Max for planning and urban design applications as well as strong working knowledge of GIS and 3D GIS. Real-time modeling and/or Planning Decision Support Tools experience a plus.
 - *Planning Decision Support Tools 3D/GIS Technical Lead* – This person is a planner who provides expertise in using Planning Decision Support Tools (CommunityViz[®]) and GIS (ArcGIS) for planning and urban design applications, and has strong working knowledge of SketchUp as well. AutoCAD/3D Max and/or real-time modeling experience a plus.
- 3. Implement Tools** that support the Planning Department’s needs and are scale-able and adaptable to many different users with many different skill levels:



- Implement **SketchUp** as the primary 3D modeling tool for the Planning Department. It is relatively easy to learn compared with most other 3D modeling programs. It is very quick for simple massing models but can also create photo-real textured models that can be viewed in the application itself, in other real-time environments like Google Earth and ArcGIS Explorer, or in a 3D GIS like ArcGIS ArcScene or CommunityViz® Scenario 3D.
 - Implement **CommunityViz®** as the primary Decision Support Tool for the Planning Department. It has “wizards” that walk planners through some of the most common planning applications, such as the use of indicators and performance measures, but can be used for many other kinds of GIS data analysis, from simple tabular summaries to large models with complex formulas with multiple variables, spatial operators, conditional statements, etc.
4. **Train staff on the selected tools before deciding where and how to apply the tools.** – The Executive Committee and all staff that are expected to use the tools or manage other staff who are expected to use the tools should undergo basic training on the tools so as to better understand where and how the tools may be applied.

As much as possible, the Technical Leads should develop the curriculum and lead staff training **in-house**, so that as many staff that wish to learn the tools have the opportunity to do so. Another reason that Technical Leads should provide staff training is that through the training process, the Leads will begin to identify staff who have an aptitude and/or enthusiasm for the tools and who would be good candidates to start building a pool of staff from which future Ad Hoc Teams (see below) will be created for developing applications of the tools.

Prior to developing applications of the tools, the Technical Leads would provide in-depth tool training to staff working on the pilot project(s), as well as any other staff who are interested and might be using the tools.

5. **Find appropriate applications and pilot project(s)** – To identify potential applications of the tools within the Planning Department and evaluate them for their suitability as pilot projects for tool implementation and application development, the Executive Committee and Technical Leads would examine all of the Department’s current projects and methodologies, what projects and issues they anticipate over the next few years, and what applications and data will be used most frequently. In particular, they should identify the tasks that they do repeatedly, and which would benefit from doing them in a systemic way that builds institutional capacity (e.g. knowledge capture).
6. **Assemble Ad Hoc Teams that will develop applications of the tools** –Based on the selected pilot applications and tools, the Executive Committee and Technical Leads will determine the skills that are required to implement them, the division(s) that would be using the pilot applications, and the division(s) that will likely utilize the application in the future. The Executive Committee with the assistance of the Technical Leads will then assign staff to **Ad Hoc Teams** for tool application development on each pilot project.

The **Ad Hoc Teams** are small teams of 3 to 5 staff members that are drawn from a pool of qualified staff from existing Planning Divisions including IMD and Parks Planning and Development, and



lead by either the **3D/Urban Design Technical Lead** and/or the **Planning Decision Support Tools 3D/GIS Technical Lead**. There should be a least one team member from the Division where the pilot project is being executed, and at least one team member from Divisions that aren't hosting the pilot project but are interested in or plan on using the tool in the future.

The concept behind the **Ad Hoc Teams** is that, by mixing staff with different skill levels and areas of expertise – whether they are more technical in nature or more planning process oriented – opportunities for peer-to-peer learning and institutional knowledge capture are optimized:

- Less technically skilled staff would learn from the Technical Leads;
- The Technical Leads, working directly with the staff, would gain knowledge and insight that they would not otherwise have had about the how the planning applications are used;
- The staff on the team would gain the knowledge and proficiency that can only be obtained through “learning by doing”; and
- The staff from the Ad Hoc Teams would return to their divisions to demonstrate and train their colleagues with focused tutorials utilizing real applications of the tools that they built

Each Division should designate at least one of their most creative, forward-thinking, technically-capable staff planners in **3D/Urban Design** and one of their most creative, forward-thinking, technically capable planners in **GIS/Planning Decision Support Tools** to be available to serve on Ad Hoc Teams and serve as the Division's “point person” on the tools. However, any staff that have the desire to participate in the development and applications of the tools should be considered. These staff will comprise the “pool” that can be drawn from by the Executive Committee to create the Ad Hoc Teams lead by the Technical Leads to the Executive Committee to implement tools and develop applications of the tools. As these staff get training and experience though implementing and applying the tools, they will become, in effect, the “Technical Leads” to their own Divisions in the future.

The pool of staff available for the Ad Hoc Teams should be comprised of planning and urban design staff who have an affinity or desire to build technical capacity within the Department and their respective Divisions, have demonstrated that they can think creatively and analytically, and have completed in-house training on the tools, and have demonstrated an aptitude for using the tools.

7. **Develop applications of the tools in-house** – Under the supervision of the Team's Technical Lead, the Team staff develops a project plan, builds the application, tests the application and makes corrections if necessary, documents the process, and produces a user manual or knowledge-based memorandum to build “institutional knowledge.” They would present their findings to the Executive Committee and/or the entire planning department on a periodic basis.
8. **Monitor and evaluate the effectiveness of the tools** – After the tools are implemented, the Executive Committee and Technical Leads would also devise methods and procedures for monitoring and evaluating the effectiveness of each tool. This would largely be the responsibility of the 3D Visual Simulation Technical Lead and Planning Decision Support Tools 3D/GIS Technical Lead. If the tools are not performing as expected, the Executive Committee could reconvene the Ad Hoc Team or assign a new team to investigate why and make recommendations for changes needed



– either to the process or the tool itself in order to remedy any problems identified or implement improvements.

The aforementioned recommendations are purposely designed to be flexible, scalable, adaptable, and repeatable. Each recommendation builds incrementally on the previous recommendation. There might be only one or two pilot projects and Ad Hoc Teams rather than more. Eventually there might be four or five application development projects going on at once, not only for 3D modeling and Planning Decision Support, but for other new technologies like digital project collaboration, public outreach via social networking, mobile technologies, etc. In all cases the Consultant Team recommends that targets be established to evaluate how well these strategies and their implementation are working.

1.2.3 Additional Recommendations

1. **Provide tools and data “prepackaged” in ways that are useful to planners** – 3D Modeling and Decision Support/GIS capacity can be increased department-wide by the pre-packaging of tools and data in ways that will be both attractive and understandable for planners to use. PGAtlas provides good example of this: by making data and tools easily accessible to planners, this tool has proven to be indispensable for the Planning Staff.
2. **Encourage the Analytical Use of 3D and GIS** – The Wisconsin study found, as well as this study, that planners rarely take advantage of the analytical capabilities of GIS. That study concluded, and we concur, that the issue is less a problem of technical capacity than one of a lack of knowledge about how GIS can be applied to planning situations. We would add that planners rarely take advantage of the analytical use of 3D modeling and visual simulation in planning. The best way for planners to gain 3D modeling and GIS knowledge is to see first-hand how 3D modeling and visual simulation and GIS can be used analytically for planning applications and implementing 3D Modeling and Planning Decision Support Tools would reinforce this.
3. **Revise job descriptions to include more specific GIS and/or 3D modeling and urban design skills as a desired skill** – To assess the current “state of practice” concerning skills requirements for planners (and GIS personnel), and to look for possible models for job descriptions that incorporate skills in 3D modeling, GIS, and PDSSs, the Environmental Simulation Center researched other agencies that are similar to size to the Prince George's County Planning Department and are known to use 3D, GIS, and/or PDSS tools. We found only a few job descriptions for planners that had any reference to GIS, and most of those were only cursory. In fact, Prince George's County Planning Department is one of the few that explicitly mentions GIS, and for that the Department should be commended. None of the agencies we looked at mentioned or required that planners or GIS staff have skills with 3D modeling or PDSS tools.

In no cases did we find job descriptions for GIS positions that require planning skills or knowledge of planning concepts. In fact, the “divide” between planning professionals and GIS professionals seems to be reinforced by the way planning agencies approach building capacity in those skills: Rather than look for planners with skills in GIS, GIS is identified as an entirely separate activity requiring specialists and most often separate departments. 3D modeling, where it happens at all, tends to similarly get assigned to specialists.



It is clear that the Prince George's County Planning Department has an opportunity to be a thought leader in breaking down this particular barrier to integrating GIS (and 3D) in planning by requiring cross-domain skills for all staff. In fact, as planners become more skilled in GIS, there should be a reduced need for GIS “specialists”. And because GIS skills include making cartographic maps for different purposes, including publication, the need for Publications Specialists may also go down. As mentioned in the previous section, 3D/GIS/PDSSs for planners should be thought of in the same way CAD/BIM is thought of for architects: **as a tool not a specialty.**

4. **Work with local planning schools and advocate for the inclusion of 3D and GIS as part of core planning curricula** – The Prince George’s County Planning Department could be more proactive in shaping the future job applicant pool to better serve the needs of the Department by sharing its experiences with local planning schools and advocating for 3D and GIS as part of the core curricula required for planners.
5. **Encourage Collaboration through Mutual Education and Support** – Planners and the GIS specialists will need to engage in a mutual education process. A good model of this is the relationship that architects typically have with clients. It is part of the architect’s job to educate the client about what is possible and what is not, and the client needs to articulate as clearly and completely as possible how they want their building to perform and look. Planners and GIS specialists need to be versed enough in what they are looking at to assess the data for fitness of purpose. In other words, planners **and GIS specialists need to be better “clients” for each other.**

In public agencies, which are typically under-staffed and where there are very specific job descriptions and duties, it can be very difficult for planning professionals and GIS professionals to find the time that it takes to learn about each other’s work and collaborate on projects. This is time that needs to be planned for and included in the day-to-day operations of the Department. But given limited resources, it needs to be targeted to where it will do the most good and have the greatest positive impact on planning outcomes.

The Planning Department should explore ways to incentivize learning and communication. The Prince George’s County Planning Department already has many talented professionals on staff who are very good at what they do. Those staff, who are really good at a particular task and/or have expertise in a particular domain, could be recognized and – possibly as a “reward” for a job well-done or as part of their job responsibilities – be given time to write white papers or internal knowledgebase articles, or participate on an Ad Hoc Application Development Team. They could also be given time to mentor other staff who are interested in learning more about their area of expertise. The goal should be to educate the “apprentice” to eventually become a “master” themselves. **Resources normally allocated to “outside” training should be allocated for this “internal” training and capacity-building.**



1.3 Conclusion

The biggest challenges that Planning agencies face with building technical capacity are implementation-related: picking a tool that is too complicated or the wrong tool for the job, not enough resources devoted to capacity building at the front end of tool adoption, and the lack of institutionalized skill. The aforementioned recommendations and strategies to implement them, therefore, are strongly oriented towards creating a framework that supports building institutional knowledge just as much as building applications of tools. Although implementing these recommendations may require new investment and/or reallocation of existing resources, we believe that they could ultimately conserve the Department's resources through the more efficient and flexible allocation of staff time and expertise. Furthermore, by building and retaining technical capacity in house, the need to hire outside consultants would be reduced and most importantly these recommendations should enhance the quality of the plans created, the process of creating those plans, and the future livability of Prince George's County.