Institutional Capacity Building for Travel Demand Modeling at Metropolitan Planning Organizations (MPOs)

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ABSTRACT

In this paper, we discuss possible changes to the operation and functioning of MPOs that can potentially increase their institutional capacity and efficiency in the Travel Demand Model (TDM) development process as well as their overall competence level. Specifically, we identify the state-of-the art of techniques in the field of human resource management and project management, and examine their applicability in the context of MPOs and the TDM development process.

1. INTRODUCTION

A Metropolitan Planning Organization (MPO) is a federally mandated transportation decision-making body comprised of representatives from local government and transportation agencies. In this paper, the objective is to provide a brief overview of the responsibilities and organization set-up of MPOs as a prelude to the main objective of examining the funding, staffing, and schedule management challenges that MPOs face. The emphasis is on drawing on concepts from human resource (HR) management and project management.

1.1 Responsibilities of the MPOs

All MPOs have the same basic set of planning responsibilities. These responsibilities were established in the Federal Aid Highway Act of 1962 and have undergone continual changes through the years (Dempsey *et al.*, 2000, TRB, 2007). The most recent legislation, Moving Ahead for Progress in the 21st Century (MAP-21), was passed by the US Congress on July 6, 2012. The bill establishes a performance based planning approach by requiring that transportation plans use a "performance-driven, outcome based approach" that acts as a basis to develop policies and prioritize investments.[1] The exact implications of this legislation on the MPOs remain to be seen. But, in general, MPOs are required to produce the following documents (FHWA, 2007a):

- A long-range transportation plan – generally called the Metropolitan Transportation Plan (MTP);

- Short-range Transportation Improvement Programs (STIP);

- Annual statements of planning priorities and activities (generally called a Unified Planning Work Program or UPWP); and

- Public participation plans (PPP).

The MPO works in tandem with state and transit agencies, and performs a coordinating role in the transportation planning process. The nature and extent of the relationship between the MPO and other state and regional agencies, especially DOTs, varies from state to state. In undertaking their responsibilities, MPOs often utilize a Travel Demand Model (TDM) to assess the effectiveness of possible strategies and actions in response to public policy mandates, and to communicate the model results to policymakers and the public at large.

In addition to data assembly (for TDM development and other purposes), modeling, scenario development and analysis, and communication, some MPOs have additional responsibilities. Specifically, all MPOs in TMAs are required to produce a congestion management plan (CMP) that identifies strategies to reduce traffic congestion. Further, if an MPO fails to show transportation conformity regularly in its plans and updates, it is categorized as a non-attainment area (NAA) as per section 107(d) of the Clean Air Act (CAA) (USDOT, 2010). Such MPOs are (1) charged with the responsibility of coordinating air quality planning with the State DOT by ensuring that all their projects conform to the State's air quality plan known as the State Implementation Plan (SIP), and (2) are required to update the MTP every four years. Apart from these federal requirements, state laws can also impose additional requirements on MPOs.

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[1] Additional information regarding MAP-21 is available at: http://www.fhwa.dot.gov/map21/.

1.2 Current Study in Context

MPOs are in a unique position to act as facilitators for the analytic assessment of regional transportation policies and actions, and as information exchange centers and consensus builders between policy makers, the public, and other relevant agencies. From their inception in 1962 through the legislations of the post-Interstate Highway system era, MPOs have been tasked with many responsibilities – some even outside of the realm of conventional land-use and transportation planning. Additionally, the presence of numerous state and local initiatives has made every MPO unique in its own right. Today, there are about 385 MPOs in the United States. Some of them have flourished under the ideals set forth by the Transportation Equity Act series of legislations, while others have struggled to meet the most basic requirements. In this context, and as mentioned earlier, there is a preferential distribution of federal funds to the TMAs over the other MPOs. This places the small- and medium-sized MPOs, in particular, at some disadvantage, and makes it difficult for them to pursue their responsibilities to address the mobility and environmental needs of their region within the limited funds available. This is a problem common to all small- and medium-sized MPOs in the nation, which has led to the development of creative collaborative partnerships in some states (such as in Texas and Florida) between state departments of transportation (SDOTs) and small/medium-sized MPOs.

In the current paper, the objective is to research the transportation planning state of practice, coupled with a targeted synthesis of the state-of-the-art strategies in human resource and project management for capacity building, to identify strategies and techniques that can assist all MPOs, and small- and medium-sized MPOs in particular, to achieve their travel modeling and planning responsibility efficiently and effectively.

2. MPO ORGANIZATIONAL SET-UP AND FUNDING

Transportation planning is a cooperative process. The 3-C (continuous, comprehensive and cooperative) planning process was established with the intent that all relevant stakeholders stay informed of the critical mobility and accessibility-related issues in the region, thus providing them full opportunity to be involved in the decision making process. In this respect, the transportation laws (SAFETEA-LU and its predecessors) very effectively articulate the responsibilities of the planning agencies – including those of the MPOs. However, there are no explicit directives that the law prescribes on how an MPO should be structured, organized, and administered.

From an organizational perspective, MPOs generally have the following boards and committees (US Government Accountability Office (GAO), 2009):

- A governing policy board made up of local elected officials and state and public transportation officials.

- A technical advisory committee (including engineers, planners, and other local staff).

- A citizen's advisory committee.

- Miscellaneous committees specific to each MPO based on regional needs, such as a bicycle-pedestrian committee, a freight advisory committee, and a livable roadways committee.

The MPO staff is expected to prepare documents that aid the policy board to arrive at regional decisions. They may also be called upon to assess other initiatives involving local and community considerations.

The overall organizational set-up of an MPO is determined by agreement between the local government and the state. The nature and extent of the relationship between the local government and the MPOs varies significantly across the country. Broadly speaking, MPOs are hosted within Regional Planning Organizations (RPOs), Council of Governments (COGs) and other similar local government agencies, or operate as free-standing entities that function independently. Bond *et al.* (2010) report that 69% of MPOs in the US are hosted by another local government agency, of which RPO councils (26%) are most common as MPO hosts, followed by municipalities (20%), and counties (20%). Each of the two broad MPO organization set-ups – hosted versus independent – comes with its own unique set of advantages (see Table 1). In summary, a hosted MPO has the advantage of fiscal and skill-based economies of scale, while an independent MPO has the advantage of better work delineation and independence in policy formulation and administrative structure.

Of course, the MPO set-up is not exactly as simple as being either hosted or independent. Indeed, even within the hosted MPO set-up, there is a continuum between a completely integrated, hosted MPO and one that retains several features of an independent, free-standing MPO. In the next section, we discuss five finer types of organizational set-ups between the hosted MPO setting and an independent MPO setting.

2.1. Types of MPO Organizational Set-ups
Based on the literature on MPO organizational set-ups, five models of MPOs may be identified (Kramer and Hopes, 2007 and Bond *et al.*, 2010):

1. **All-in-one agency model** – In this setting, the MPO is treated as being one with the host and does not have any separate identity. Such agencies are usually housed within the Regional Planning Council. Both the governance (refers to the composition of the committees and policy board) and the staff functions (refers to the day-to-day responsibilities of the staff) are identical across the organization. Examples of such a model include the Southern California Association of Government and the Sacramento Area COG in California, and the Houston-Galveston Area Council and the North Central Texas COG within Texas.

2. **Dual purpose MPO model** – Under this setting, the host agency controls the MPO planning funds to support the transportation planning staff and ensures required expertise for the planning division. The governing body is dominated by the host officials, who are the ones also responsible for communication with external stakeholders. Examples include the Bay County Transportation Planning Organization (TPO) and the Florida-Alabama TPO in Florida.

3. **Component MPO model** – In this setting, the MPO is a separate unique entity with its own branding and sometimes even budget, but is still within the host agency. In particular, the MPO Director typically reports to the host agency and needs clearance from the host agency for administrative issues and/or organizational restructuring. But there are almost no overlapping duties for the MPO staff and those of the host agency, and the governance board is different for the two agencies. Examples include the Gainesville MPO in Florida, and the Sherman-Denison and Wichita Falls MPOs in Texas.

4. **Staff services agreement model** – The MPO governing board purchases a defined bundle of services from an outside source. The service provider may be a government agency or a consulting firm. The MPO is otherwise independent with its staff having only the MPO responsibilities, and a governance system that is completely independent of any local agency.

The Lake-Sumter MPO and the Sarasota/Manatee MPO in Florida are examples of this model.

5. **Freestanding independent MPO** – This is a fully independent MPO with complete autonomy over its administrative functions. The director and other staff are employed directly by the governing board. Examples include the Metroplan Orlando and the First Coast MPO in Florida.

An understanding of each MPO in the context of its regional organizational set-up would help to customize communications and information flow between state transportation/air quality agencies and MPOs, including gaining an understanding of who exactly to talk to at MPOs or their hosting agency for high-level decision making and to resolve operational hiccups.

2.2. MPO Funding

Independent of the MPO organizational set-up discussed in the previous section, MPOs receive funds from various federal and local sources to pursue such transportation planning activities as developing transportation plans, programs, and other mandated and guidance documents. The primary federal grants are provided by the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA). Generally MPOs receive 80% of their funds from federal grants and the remaining 20% funds from local and state governments through cash payments and other in-kind services (FHWA, 2007b).

The FHWA funding is channeled to MPOs for transportation planning activities through state DOTs. The funds from the FHWA (often referred to as PL-112 funds) are assigned to all the states on the basis of the ratio of the state's urbanized population to the nation's urbanized population. But, a minimum of half a percent of the total funds is allocated to each state (Handy and Brown, 2002). State DOTs are responsible for allocating a portion of the FHWA funds they receive to MPOs whose planning areas have a population of 50,000 or more. Each state has its formula to decide what portion of the PL dollars to allocate to MPOs, and how that MPO portion of money is allocated among MPOs in their state (AMPO, 2004, AASHTO, 2005). According to the Association of Metropolitan Planning Organizations (AMPO) (2004), MPOs receive an average of $924,693 PL dollars. But large MPOs receive substantially more PL funds than other MPOs. In fact, the median amount of PL dollars received by MPOs is only $302,000, which indicates that small-to-medium MPOs receive much less funds to execute a similar set of responsibilities as large MPOs.

The FTA follows a slightly different and independent procedure from the FHWA for distributing the funds to state DOTs. About 80% of FTA funds (known as FTA-5303) are distributed based on the ratio of the state's urbanized population to the nation's urbanized population (this is similar to the FHWA), while the remaining 20% are allocated according to the FTA's formula to accommodate the planning needs in large, complex urbanized areas that have a population over one million. However, there is no minimum guaranteed allocation of FTA-5303 funds for each state (FTA, 2012). State DOTs allocate these funds to the MPOs of urbanized areas in the state according to the FTA's approved state-defined formulas.

The source of the FHWA and FTA funds themselves is cumulatively known as Transportation Planning funds (TPF) that are 1.25% reserved funds from FHWA's Surface Transportation Program (STP), Bridge, Congestion Mitigation and Air Quality (CMAQ) program, National Highway System (NHS) and Interstate Maintenance (IM) Programs, and FTA's Mass Transit Account of the Highway Trust Fund and the General Fund (FHWA, 2007b). The FHWA apportionment for the years 2009 through 2011 averaged $316.59 million, while the

FTA's metropolitan transportation planning funding contribution was $38.7 million for these years.[2] These funds vary greatly every year depending on the extent to which Congress appropriates non-guaranteed funds authorized to be appropriated from the General Funds.

State governments provide support to MPOs within their state through a partial match of federal planning funds. Specifically, to receive FHWA's planning dollars, a state has to generate a 20 percent match to the FHWA funds. The match need not all come from the state, but the state is responsible for generating the match to receive federal funds. In practice, the match is also sometimes provided by local governments or third party agencies (Kramer and Hopes, 2007). Further, the match can be in the form of cash or in-kind services (such as insurance, purchasing, staff benefits and engineering services). Overall, about 80% of planning dollars in a state are available through federal funds and the remaining 20% are provided by state or local governments or any other agency.

2.3. Funding Challenges to Small- and Medium-Sized MPOs
One of the challenges small- and medium-sized MPOs face is the lack of sufficient transportation planning funds to undertake transportation projects critical to meeting the region's mobility and accessibility needs. In particular, small- and medium-sized MPOs receive less federal and state funds when compared to large MPOs, though they have similar responsibilities as large MPOs. Even if the funding levels are reasonable, small and medium MPOs have less authority and independence to use transportation planning funds to determine which projects to implement.

While the issue of the intensity of funding is somewhat more difficult to resolve, one pathway forward is to provide small- and medium-sized MPOs with more flexibility and freedom to use the limited resources available to them. On the other hand, more flexibility at the MPO level in the use of federal transportation funds may make the system less transparent in terms of accountability and performance assessment of projects (GAO, 2009). Essentially, a system of *accountable responsibility* is perhaps warranted. On the larger issue of the need for more funds, small- and medium-sized MPOs perhaps need to adopt a more entrepreneurial spirit and explore alternate sources of funding by leveraging their unique position as an organization that can forge constructive relationships between important stakeholders (local and state governments, social service providers, affected interest groups, businesses, and decision-makers).

3. MPO STAFFING – A TALENT MANAGEMENT PERSPECTIVE
Effective talent acquisition and talent management is a challenge for any organization today, and is particularly so for MPOs. According to the US Government Accountability Office (GAO) (2009), the average number of full-time staff across all MPOs is 11. However, this estimate is highly biased toward the larger MPOs. In fact, the average number of full-time staff at small MPOs is only three. These staff personnel are expected to deal with a variety of planning issues, one of which is to provide assistance with TDM development. Further, as policy needs change, so do the nature and structure of TDMs. Combined with typically rapid turnover rates of MPO staff personnel, the result tends to be a lack of continuity in knowledge and skills at the MPO. Small and medium MPOs have to deal with the issue of talent gap on the one hand, while dealing with the lack of funding for talent acquisition on the other.

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[2] The FHWA data has been sourced from http://www.fhwa.dot.gov/safetealu/fundtables.htm while the FTA apportionment data has been sourced from the U.S. Government Printing Office documents "FTA Fiscal Year 2009-2011 Apportionments, Allocations and Program Information" for the fiscal years 2009 through 2011.

To better understand talent management issues in organizations in general, and identify possible pathways forward for small and medium MPOs, we examined the talent management literature in the field of human resource management, which suggests the emergence of an increasingly integrated approach to talent management that encompasses multiple dimensions. A white paper on talent management by Balthazard (2006) identifies the key aspects of talent management. Figure 1 shows a modified talent management framework that we have developed and customized toward MPOs. Each component of this framework is discussed below in turn in the specific context of MPOs.

3.1. Competency and Workforce Planning

Competency describes the knowledge and skills resident within an individual or an organization. Competency planning refers to the analysis and planning involved in ensuring that the collective human resource competencies at an organization is in sync with the full set of competencies needed by the staff to pursue the organization's goals and objectives. An important component of competency planning is to develop an inventory of required competences and available competences, and then identify areas of competency inadequacy (or talent gaps) for workforce development. As a next step, a workforce plan is drafted. Workforce planning is the cornerstone of HR management. Very broadly, strategic workforce planning involves estimating the supply and demand of talent and then identifying the actions necessary to close the talent gaps that exist today and may exist in the future (Laurano, 2009). In the context of the MPOs, this exercise can prove to be useful in many ways. To be specific, it will help MPOs:

- identify the competency inadequacy (*i.e.*, talent gaps) in the workforce that needs to be addressed.

- identify people who are already there with skill sets that could be put to good use.

- seek appropriate personnel training.

- prioritize the recruitment positions in the event of a recruitment drive, as workforce planning identifies capacity risk as well as immediacy.

3.2. Recruitment

The next step corresponds to the phase where the organization actively seeks to acquire the needed competency. For small/medium-sized MPOs, this phase is riddled with challenges. In the highly competitive labor market of today, there is a huge disparity between what benefits an MPO can offer and those, for example, that a private consulting firm has to offer. This coupled with the limited supply of people with the unique skill sets that the MPO demands makes it difficult for MPOs to attract quality talent.

The MPOs (and state DOTs) need to approach this issue in a systematic way. While many different action plans may be pursued as part of a systematic approach, we identify three important facets of any such action plan. The first component is to augment the talent pipeline of potential MPO staff through internship or fellowship programs with local universities, supplemented with efforts to create an awareness of the opportunities and challenges that the transportation industry has to offer. Second, MPOs need to position themselves and brand themselves as the organization that they were envisioned to be – one that shapes urban development of a region and makes tangible impacts to the quality of life of its citizens. MPOs need to actively promote the vision for their existence – as a public body focused on

humanitarian causes. Third, a good screening system should be put in place to ensure efficient filtering of potential employees. The MPOs can seek opinions from the DOT or people in academia to evaluate the value and competencies that a potential employee brings to the table. Also, before categorically deciding to hire someone new, the MPO, using the competency inventory identified earlier, should identify people having the required competency and who can also serve in other roles that may help in job rotation to minimize costs (NCHRP, 2011).

3.3. Learning Management

Individuals have two types of innate talents within them – actualized talent and potential talent (Balthazard, 2006). Actualized talent refers to the skill set an individual has currently, while potential talent refers to the skill set an individual can easily acquire if offered the right learning environment. Given how important skilled workers are, and how quickly job descriptions can change in our fast evolving world, companies must do better at providing an environment to tap into the potential talent of their employees. This requires a consistent but focused investment in training and development. More formally, we define training and development as an organized activity aimed at imparting information and/or instructions to improve recipients' actualized talents, but also to provide the learning environment that taps into employees' potential talent to perform and adapt well to changing work needs.

Figure 2 presents a suite of possible training and development methods. In the context of MPOs, the "on the job training" and "job instruction training" are perhaps the most practical and efficient methods. For any method chosen, the implementation of the method may be undertaken either through outsourcing to an external agency or through in-house development of the learning materials (such as tapping into the knowledge and skills of its more experienced employees). Outsourcing has the advantages that (a) the employee undergoing training will develop a broad and deep understanding of the issues, (b) it offers strong diagnosis ability, and (c) it provides a fresh and "out-of-the-box" perspective. In-house development has the advantages that it (a) maintains integrity of information in the sense that details imparted will be highly tailored to the context of the specific MPO, and (b) is in line with the organization's core values and vision. The MPO should consider these aspects before arriving at a decision.

Learning management, however, does not end with the regular development of training and development methods and modules. There needs to be continual follow-up to training exercises already undertaken, and appropriate preparation in training exercises scheduled to be offered. In this context, De Smet *et al.* (2010) recommend the following:

a) *Help people want to learn:* This step is to avoid the "I am here because I have to be" behavior within employees. Companies must foster an environment that highlights the need of knowledge development and skill acquirement. They should have an interaction session that identifies the motivation and reasoning behind any training sessions offered.

b) *Uncover harmful mind-sets:* Even after acquiring a specific skill set, an individual may be reluctant to apply it owing to some pre-existing mind-set. The organization should dispel such myths and reinvigorate the individual so that she/he can benefit from the training.

c) *Get the leaders on board:* The organization should involve the leadership in the training, so that trainees perceive that what they are learning matters.

d) *Reinforce the new skills:* In the work place, supervisors should be assigned to ensure that the employee is correctly applying what she/he learned. Though, in the short term, an employee may feel such monitoring to be intrusive, it is beneficial in the long run.

e) *Measure the impact:* The organization should develop appropriate measures of performance for a before-and-after evaluation of employees learning, and make changes to the learning as appropriate.

3.4. Performance Management

Performance management includes activities that ensure that the goals of the organization are consistently being met in an effective and efficient manner. This exercise has to ensure that the individual, team, and organization activities and goals are all aligned, and that the employee is performing well to achieve the collective vision and mission of the organization (Balthazard, 2006). The goal of performance management is to create a consistent, fair, and impartial process for the establishment of performance standards in an organization. To this end, the MPOs need a metric that should quantify its success in mobilizing its resources and its workforce's productiveness. To identify where and how people are creating value, organizations use performance metrics that are designed to measure human productivity (Barber and Strack, 2005). Such performance measures are jargonized as key performance indicators. Many firms use quantitative organization-input related key performance indicators such as cost of personnel and training time per employee, while others use more qualitative employee-output related key performance indicators including value added per person and the return on investment of training/recruiting.

3.5. Compensation

Compensation refers to all forms of payments and benefits, including direct financial payments (such as salaries and bonuses), indirect payment (such as paid insurance) and non-monetary perks. The issue of fairness should always be fundamental in an organization's compensation policy. Rewards should be linked with performance and, as noted before, performance should be measured equitably (Balthazard, 2006). Though the MPOs might not have much flexibility in terms of pay, they can encourage some form of recognition within the office for their best employees to motivate deserving individuals.

3.6. Career Development and Succession Planning

Organizations cultivate leaders in several ways: by giving them feedback, coaching, mentoring, and training (Jones, 2000). It is often the case that such informal, but deliberate nurturing within companies, brings out leaders. More often than not, an employee will start finding the day-to-day tasks mundane. Jones (2000) recommends some basic principles that a company should adopt to keep employees motivated and develop leaders. We apply them in the context of the MPO and present them here. It is imperative that the senior staff at MPOs build a rapport with other staff and encourage their development. High-fliers should be identified and should be put in the spotlight. When identifying them, their qualification as well as competence should be considered. Developing leaders from within is beneficial as the individuals will be aware of the "lay of the land" and can ensure a smooth transition when the time comes for an incumbent leader to retire. On the other side, it is equally important for MPOs to sideline and remove mediocre performers from key positions, after a systematic, objective, and defensible assessment of performance.

4. TRAVEL DEMAND MODEL DEVELOPMENT – A PROJECT MANAGEMENT PERSPECTIVE

The travel demand model (TDM) is at the core of the functions that an MPO undertakes. The TDM provides travel-related quantitative numbers that inform many MPO policy decisions. However, the TDM development could become very laborious if not done systematically. In this section, we look at the TDM development from a project management perspective.

The Project Management Institute (2008) provides the following definition of a project: *A project is a temporary endeavor undertaken to create a unique product, service, or result.* Larson and Gray (2011) describe the major characteristics of a project as follows:

1. An established objective.

2. A defined life span with a beginning and an end.

3. Usually, the involvement of several departments and professionals.

4. Typically, doing something that has never been done before.

5. Specific time, cost, and performance requirements.

Most importantly, a project should not be confused with everyday work. In the context of MPOs, the Travel Demand Development Process is a project. To establish this, we look at the five major characteristics of a project and put things in perspective:

1. *An established objective* – to develop a state-of-the-art and practical TDM that will reflect the region's growth and transportation needs, and provide a means to evaluate alternative plans and policies within the scope of the planning period.

2. *A defined life span with a beginning and an end* – it is aligned with the development cycle of the LRTP.

3. *Usually, the involvement of several departments and professionals* – the MPOs and state planning are equally invested in this endeavor.

4. *Typically, doing something that has never been done before* – Every version of the TDM being developed builds on its predecessor and adds value.

5. *Specific time, cost, and performance requirements* – the MPOs and state planning agencies work on TDM development with limited staff and resources under pre-determined federally mandated timelines and limited funding.

The next section discusses how projects are typically organized and scheduled, providing suggestions for MPOs to make the TDM process potentially more efficient and effective.

4.1. Organizing Projects

A project management system provides a framework for implementing project activities within an organization. Once a project has been commissioned, one of three different project management structures is used by firms to implement projects: functional organization, project organization, and matrix organization. Table 2 shows the key project related characteristics of the major types of organizational structures. Each of the organizational structures is discussed.

Functional Organization: In this approach, projects are managed within the existing functional hierarchy of the organization, wherein the staff members are grouped based on their skill sets

into departments (see the first column of Table 2). The responsibilities are relegated to the respective departments and each department, independent of the other departments, will have to complete its project work. Communication is through usual management channels.

Project Organization: This approach is at the other end of the spectrum (see the last column of Table 2). Dedicated project teams, which operate separately from the parent organization, take over the project. They may or may not be financially constrained by the parent organization.

Matrix Organization: Matrix management is a hybrid organizational form that is between the extremes of the functional organization approach and the project organization approach. The matrix approach adopts a dual chain of command - one along functional lines and the other along project lines, with the project staff reporting simultaneously to both functional and project managers. Depending on the nature and extent of the project manager's influence, the matrix management structure can be further divided into weak, balanced, and strong matrix types.

The current setup for TDM development appears to fall under the functional organization approach, which offers considerable flexibility to the MPO with respect to its staffing resources without substantially impacting its day-to-day functioning. However, such an organizational approach can also lead to problems in quality control as well as lack of coordination and difficulty in meeting deadlines as MPO staff members have to juggle between TDM tasks and other obligations. Also, it is possible that since MPO staff work only on segments of the project, they do not identify with the entire project. The administrative communication channels might also slow down the process to some extent.

A possible alternative project management structure that may be considered by MPOs is the weak or balanced matrix approach. Such an approach recognizes the relative lack of independence of small- and medium-sized MPOs as well as the severe resource constraints under which these MPOs operate. This shift would require relatively minimal administrative changes. This, however, would involve assigning a point project manager whose role would be to oversee the TDM process for the MPO ensuring that things get done right and on time. We believe that this role will prove to be pivotal in fostering a sense of ownership with the project among the MPO staff and motivate a holistic approach to problem solving. Also, under this new system, the flexibility of the staffing resources that currently exists will remain unchanged.

4.2. Project Scheduling
The next step in the project management process is the proper scheduling of the project to ensure appropriate resource allocation and timely completion of the project. As a first step, a work flow network has to be created. A simple graphic displaying the sequential flow of work and tasks (or "activities") throughout the project is easily understood by everyone. Next, MPOs should come up with feasible activity time estimates for the different tasks. Equipped with these two, one can employ either of two decision support systems to schedule the TDM project (see Larson and Gray, 2011): (1) CPM – Critical Path Method, or (2) PERT – Project Evaluation and Review Technique. We will first discuss the Critical Path method here in some detail, since the method also constitutes an important part of the PERT method. However, the PERT method also accommodates some additional considerations that we will discuss briefly after the overview of the CPM method.

Critical Path Method (CPM): Basically, the CPM method entails the completion of a forward and backward scheduling pass that answers several questions, as listed below (in the listing below, an "activity" may be viewed as a specific task of the TDM project).

Forward Pass—Earliest Times

1. How soon can the activity start? (early start—ES)

2. How soon can the activity finish? (early finish—EF)

3. How soon can the project be finished? (expected time of completion)

Backward Pass—Latest Times

1. How late can the activity start? (late start—LS)

2. How late can the activity finish? (late finish—LF)

3. What activities represent the critical path? This is the longest path in the network which, if delayed, will delay the project.

4. How long can the activity be delayed? (slack or float—SL)

We start the forward pass with the first project activity (with ES set to zero) and follow each path through the network to the last activity. As we follow the path, we add the activity duration and get the ES and EF for each activity (ES + Duration = EF). The sequence of project activities which add up to the maximum overall duration is called the critical path and the schedule activities on a critical path are called "critical activities." The value of EF for the final activity corresponds to the expected time of completion for the entire project. The backward pass starts with the last activity on the network. We backtrack along each path deducting activity durations to determine the late start (LS) and finish times (LF) for each activity. The backward pass begins by setting the late finish (LF) for the final activity, which is usually set equal to the early finish (EF) of this final activity (as obtained from the forward pass, which is also equal to the expected time of completion) or any project deadline that may exist.

After the forward and backward passes have been completed, we measure the schedule flexibility as the difference between the early and late start/finish times. This difference between the LS and ES (LS - ES = SL) or between LF and EF (LF - EF = SL) is called the "total float". A critical path is typically characterized by zero total float. Total float tells us how flexible an activity is (*i.e.* by how much can it exceed its early finish date) without delaying the project completion date. It is also possible to determine "free float" - the amount of time that an activity can be delayed without impacting the early start of any activity that immediately follows.

Once the critical path is identified, the project managers can manage resources and staff dynamically to avoid delays. If any critical activity is delayed, the project manager should identify and shorten those tasks that will have the least incremental cost – this is called schedule crashing. Also, the project manager should identify the paths that are not critical, but with very little slack, and consider compressing activities along those paths – this is called fast-tracking.

Project Evaluation and Review Technique (PERT): One of the drawbacks of the Critical Path Method just discussed is that it is deterministic. This is overcome by using PERT. PERT focuses on scheduling projects under uncertainty. This involves specifying three estimates - optimistic,

pessimistic, and most likely completion times - to define an approximate range of activity duration (assumed to be beta distributed). Using random draws, the network is simulated many times over. While appealing, PERT can also be somewhat more confusing to absorb relative to the simpler CPM approach.

5. CONCLUSIONS

In this paper, we have discussed possible changes to the operation and functioning of MPOs that can potentially increase their efficiency in the Travel Demand Model (TDM) development process as well as their overall competence level. Broadly, we are making the following recommendations:

1) As part of the process management process for the travel demand model development project, each MPO should identify which one of the five types of organizational set-up models the MPO falls into (see Section 2). This can help customize communications and information flow between other transportation agencies and MPOs, including gaining an understanding of who exactly to talk to at MPOs or their hosting agency for high-level decision making and to resolve operational hiccups.

2) State agencies may wish to consider providing more flexibility at the MPO level in the use of federal transportation funds for the travel demand model development process, supplemented with the concept of *accountable responsibility* (see Section 2); State planning agencies may also, through training programs and mentor relationship, encourage small- and medium-sized MPOs to adopt a more entrepreneurial spirit and explore alternate sources of funding by leveraging their unique position as an organization that can forge constructive relationships between important stakeholders.

3) MPOs should consider the six-component talent management framework developed in the paper, and examine the recommendations made under each component of this framework (see Section 3).

4) MPOs may want consider a matrix-based approach to project organization and a Critical Path Method-based approach to project scheduling (see Section 4).

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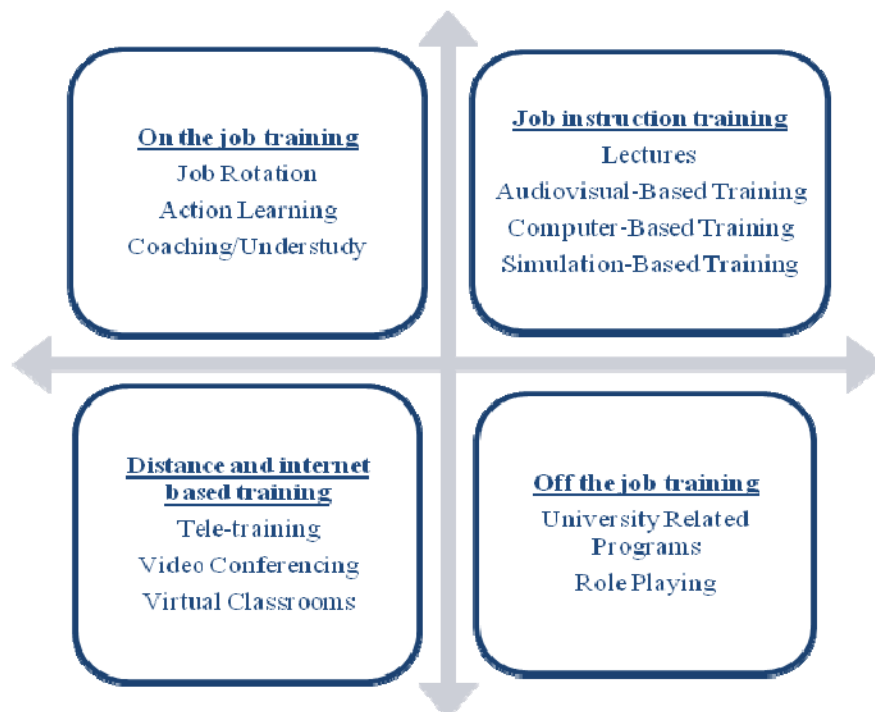[Source: Modified from Balthazard (2006)]

Figure 2 Training and development methods

Table 1 Advantages of each organization set-up

Advantages of Hosted MPOs	Advantages of Independent MPOs
• Reduces cost of operation in terms of renting floor space, staffing, and supplies. • Financial assistance from the host agency helps the MPO cover operational expenses and local match for federal funds. • Makes available employees with more specialized skill sets (such as GIS capabilities) for MPO purposes. • Facilitates integration of transportation planning with other regional planning objectives.	• Provides independence in political decision-making and administrative functionality (such as recruiting and purchasing). • Reduces conflicts and conflicts of interests between the host agency and the MPO. MPO is subject to host agency rules, budget, and oversight, greatly restricting their independence in hiring and purchases. • Provides a sense of identity as a specialized agency for the local population, which can inspire the work force to undertake tasks with passion, energy, and commitment.

[Source: Based on Bond *et al.* (2010)]

Table 2 Organizational influence on projects

Organization Structure / Characteristics	Functional	Matrix			Project
		Weak Matrix	Balanced Matrix	Strong Matrix	
Project Manager's Authority	Little or None	Limited	Low to Moderate	Moderate to High	High to Almost Total
Resource Availability	Little or None	Limited	Low to Moderate	Moderate to High	High to Almost Total
Who Controls the Project Budget	Functional Manager*	Functional Manager	Mixed	Project Manager	Project Manager
Project Manager's Role	Part-time	Part-time	Full-time	Full-time	Full-time
Project Administrative Staff	Part-time	Part-time	Part-time	Full-time	Full-time

[Source: Project Management Institute (2008)]

* The functional manager refers to the departmental head – in the context of the MPO it would be the MPO Director. The project manager, on the other hand, is the lead expertise with respect to that specific project. This position is comparable to the Chief Modeler position for the TDM process.