Faculty Sufficiency And AACSB Accreditation Compliance Within A Global University: A Mathematical Modeling Approach

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ABSTRACT

This manuscript proposes a mathematical model to address faculty sufficiency requirements towards assuring overall high quality management education at a global university. Constraining elements include full-time faculty coverage by discipline, location, and program, across multiple campus locations subject to stated service quality standards of the Association to Advance Collegiate Schools of Business (AACSB). The model offers perspectives as to efficient faculty management policies, including unique approaches to integrating fixed and flexible labor classifications when operating within a multi-campus global delivery system. Empirical results have been implemented by the New York Institute of Technology's (NYIT) School of Management in developing its global faculty deployment strategies in support of NYIT's AACSB accreditation initiative.

Keywords: AACSB Accreditation Compliance; Faculty Sufficiency Requirements; New York Institute of Technology

INTRODUCTION

This manuscript presents a mathematical model that addresses service quality as it relates directly to accreditation guidelines within an academic organization. More specifically, the model addresses faculty resource allocation, in terms of qualified full-time faculty, that will comply with faculty sufficiency accreditation standards of the Association to Advance Collegiate Schools of Business (AACSB).

The model presented here contributes to the literature through its specific faculty-planning application to comply with AACSB accreditation standards, with the unique inclusion of both fixed (tenured and tenure-track) and flexible (contracted) full-time faculty appointments within the context of a global university delivery system. The overarching objective is to meet expected enrollment efficiently without compromising quality, as defined by the AACSB standards of accreditation. The resulting empirical recommendations support a faculty allocation policy that has been implemented, with significant cost savings, at the New York Institute of Technology, while simultaneously guiding the faculty recruitment pathway of its School of Management (SOM) in support of its AACSB initial accreditation.

THE MATHEMATICAL MODEL

The formulation of the full-time faculty (FTF) resource allocation integer linear programming model is presented, below. A more detailed explanation of the variables, objective, and constraint set follow the formulation.

Let:

x_{ijk} = credit hours assigned to the FTF in discipline i at campus location j, within program k, ;
y_{ij} = total number of FTF in discipline i allocated to campus location j; and
v_{ijkp} = number of section equivalencies assigned to the FTF in discipline i at campus location j, within program k, under credit hour format p.

where

f_{ij} = number of fixed (tenured or tenure track) FTF allocated to campus location j;
d_{ijk} = credit hours to be scheduled for discipline i in program k, at campus location j;
l_j = base load for a FTF at campus location j; and
m_{ijkp} = credit hours per section of a course offered for discipline i in program k, at campus location j, under credit hour format p.

$$Objective: Minimize\ Z = \sum_i \sum_j y_{ij} \quad (1)$$

Subject to:

$$\sum_k x_{ijk} \leq y_{ij} l_j \ \forall i, j \quad (2)$$

$$x_{ijk} \leq d_{ijk} \ \forall i, j, k \quad (3)$$

$$y_{ij} \geq f_{ij} \ \forall ij \quad (4)$$

$$x_{ijk} = \sum_p v_{ijkp}\, m_{ijkp} \ \forall i, j, k \quad (5)$$

$$\sum_j \sum_k x_{ijk} \geq .6\left\{\sum_j \sum_k d_{ijk}\right\} \forall i \quad (6)$$

$$\sum_i \sum_k x_{ijk} \geq .6\left\{\sum_i \sum_k d_{ijk}\right\} \forall j \quad (7)$$

$$\sum_i \sum_j x_{ijk} \geq .6\left\{\sum_i \sum_j d_{ijk}\right\} \forall k \quad (8)$$

$$\sum_i \sum_j \sum_k x_{ijk} \geq .75\left\{\sum_i \sum_j \sum_k d_{ijk}\right\} \quad (9)$$

$x_{ijk} \geq 0, v_{ijkp} \geq 0, and\ y_{ij} \geq 0\ \forall i, j, k, p$ and (10)

$y_{ij}\ and\ v_{ijkp}\ are\ integer\ variables.$ (11)

The variables x_{ijk} are not constrained to integer value, as the School of Management offers 1.5 credit hour courses. The appropriate specification of this variable's feasible choices is by way of constraint set (5), discussed below.

Subscript values are chosen to represent:

- The SOM disciplines *i* = accounting, economics, finance, human resource management, law, management, management information systems, marketing, and quantitative methods;
- Campus locations *j* = Abu Dhabi, Nanjing, New York – Old Westbury, New York – Manhattan, and Vancouver; and
- Programs *k* = Bachelor of Science in Business Administration, Executive Master of Business Administration, Master of Business Administration, and Master of Science in Human Resource Management.

The decision variables y_{ij} and x_{ijk} specify the total number of FTF required by location, and the credit-hour teaching assignments made to these FTF members by discipline and program (at their campus location) respectively. The objective (1) is to determine the minimum number of FTF required. The interpretation of v_{ijkp} is detailed under the discussion for constraint set (5), below.

The model specification must include the anticipated schedule of courses (by credit hour) that will be delivered by discipline and campus location and by program (d_{ijk}). The SOM plan for faculty recruitment during a fall season (e.g., Fall 2012) must be in place by the end of the prior spring semester (e.g., Spring 2012). Hence the enrollment/demand profile and resulting schedule utilizes the actual enrollment data and schedule for the most recently completed full academic year (e.g., 2011/2012), with a percentile adjustment made to reflect any anticipated or planned change. This adjustment typically derives from discussion between the SOM, the Office of Academic Affairs, and the Office of Enrollment Management. The discussion of forecasting the demand for courses is beyond the scope of this manuscript and is left as an implication for future research.

Model solutions must take into account the number of tenured and tenure-track FTF at each campus location that the school classifies as fixed labor, f_{ij}. This core set of faculty (i.e., fixed labor) ensure stability and are blended with additional FTF that are issued rolling contracts (i.e., flexible labor). This aspect of the model provides a unique opportunity for the school to adjust quickly to dynamic changes in market demand or program enrollment with financial efficiency, ensure continued compliance with faculty sufficiency accreditation standards, and respond to the issue of noted shortages of qualified faculty in the market. Each FTF member' base teaching load is set at l_j credit hours; with the subscript designated in the case that base load is differentiated by campus locations based on international regulatory requirements. The base load does include requisite adjustments to account for the cumulative release time that the school wishes to provide for scholarship and/or required alternative assignments. The discussion for the parameter set m_{ijkp} is deferred, as with the variable set v_{ijkp} , to the discussion for constraint set (5), below.

Constraint set (2) ensures that the number of credit hours assigned to the FTF across all programs *k*, within each discipline *i* at campus location *j* ($\sum_k x_{ijk}$) does not exceed the capacity of the FTF within the specified discipline for each campus location ($y_{ij}l_j$). Similarly, constraint set (3) guarantees that the number of credit hours assigned to FTF by discipline, campus location, and program (x_{ijk}) does not exceed the number of credit hours scheduled (d_{ijk}). Constraint set (4) is with respect to the fixed FTF, that is, the optimal number of FTF allocated (y_{ij}) must include the fixed labor (f_{ij}), across each discipline and campus location.

Constraint set (5) ensures the feasibility of the values considered for the credit hour assignments (x_{ijk}). That is, credit hour assignments must be a logical combination of the section credit hour values. As an example, the Manhattan (*j* = MA) Master of Science program in Human Resource Management (*k* = MS) offers courses in the Human Resource Management discipline (*i* = HR) in two formats: 3 credit-hour and 4 credit-hour (e.g., $m_{HR,MA,MS,1} = 3\ and\ m_{HR,MA,MS,2} = 4$). Hence the number of credit hours assigned to the FTF ($x_{HR,MA,MS}$) must be a logical combination of the credit hour possibilities. That is:

$$x_{HR,MA,MS} = 3v_{R,MA,MS,1} + 4v_{HR,MA,MS,2} \quad (12)$$

Constraint sets (6) – (9) ensure compliance with stated AACSB accreditation standards. Specifically, (6) ensures that at least sixty (60) percent of the credit hours offered within a given discipline *i* are instructed by the FTF. Note that this constraint introduces global campus perspective by summing across all campus locations and programs ($\sum_j \sum_k x_{ijk}$) for each discipline. This is an extension of the one campus model and illustrates how schools may interpret the AACSB accreditation standard's specification to cut across all locations and programs simultaneously. This is especially appealing for schools that can evidence their culture of development as "one school," as opposed to more traditional "branch campus" structures. This approach, when combined with constraint sets (7) and (8), which ensure that at least sixty (60) percent of the credit hour instruction is by FTF at each campus (across all disciplines and programs) and by each program (across all disciplines and campus locations), respectively, maintains overall high quality but simultaneously facilitates the ability to offer and support a low-enrolled program at a global site.

Constraint set (9) ensures that the total credit hour assignments for the FTF ($\sum_i \sum_j \sum_k x_{ijk}$) must represent at least seventy-five (75) percent of the credit hours scheduled within the School of Management during the year ($\sum_i \sum_j \sum_k x_{ijk}$).

Constraint sets (10) and (11) are by way of non-negativity and integer requirements.

EMPIRICAL MODELING RESULTS

NYIT has utilized the model discussed above annually to determine the appropriate blend of fixed (tenure-track) and flexible (contracted) labor that is required. The results are generated from Excel spreadsheets conjunct with What'sBest software, result in the model's optimal solution.

Utilizing the enrollment data for AY2011-2012 with small adjustments to reflect NYIT/SOM perspectives, a proposed timetabling for academic course schedules was finalized for academic year 2013-2014. Utilizing this schedule, the math model provides information for faculty requirements and guides the ensuing faculty recruitment efforts to be conducted.

Utilizing *What'sBest* solution software, the model results in optimal outcomes for FTF allocation (y_{ij}), shown in Table 1:

Table 1: Required Full-Time Faculty Resources to Meet Scheduling Requirements

		DISCIPLINE									TOTAL
		ACCT	ECON	FINC	LAW	HRMT	MGMT	MIST	MRKT	QANT	
CAMPUS	Abu Dhabi	1	1	1	1	0	1	1	1	1	8
	Nanjing	0	1	1	0	0	1	0	1	0	4
	New York - MA	3	1	2	1	2	4	1	2	2	18
	New York - OW	2	2	2	1	2	2	1	2	1	15
	Vancouver	1	1	1	0	0	1	1	1	0	6
TOTAL		7	6	7	3	4	9	4	7	4	51

The results in Table 1 provide the optimal solution. That is, fifty-one (51) FTF members are optimal.

IMPLICATIONS FOR MANAGEMENT POLICY

The model discussed earlier not only generates optimal solutions, but also provides opportunities for the management team at both the SOM and NYIT to consider implications of model inputs and outputs.

One interesting implication is that NYIT has recently changed its policy towards faculty hiring. This year the School of Management is introducing and expanding flexible FTF to the New York campus locations for the first time. This will provide necessary means to reallocate faculty lines between the New York campus locations to encourage efficiency of solutions. Moreover, although fixed FTF in New York still designate one campus location as their primary teaching location, the School of Management is now introducing the concept of deploying faculty to either or both of the two locations. These two changes are quite significant departures from existing policy and represent process improvements that derive from the implications of the model.

CONCLUDING COMMENTS

The model developed here extends the existing literature on capacity planning in higher education by addressing the faculty staffing needs of a multi-campus operation with a combination of fixed and flexible assignments. The model advances the extant literature by providing guidance for faculty hiring decisions by location and type of faculty (e.g., fixed, flexible), subject to quality constraints, and including plans for alternative assignments for faculty, so as to optimize faculty allocation decisions. It is hoped that these types of considerations may inform university or college administration towards effective management policy and sound financial planning.

In summary, the current model has provided NYIT administrators with an efficient faculty allocation plan since 2008. This plan has resulted in the deployment of faculty in ways that have progressively moved the school towards compliance with AACSB accreditation standards. Moreover, the approach taken here, which includes flexible and fixed labor within the context of a multi-campus operating environment, enables the school to respond effectively to shifting enrollment patterns and redeploy existing faculty lines when necessary. It is anticipated that other institutions facing similar challenges may benefit by way of the consideration of this model or derivatives of its core formulation.

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