

FORMULATION OF ARCHITECTURAL DESIGN GUIDELINES FOR TECHNOLOGICAL UNIVERSITIES IN *MYANMAR*

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ABSTRACT: This research paper presents the guidelines of architectural design for technological university academic buildings, which is appropriate for *Myanmar* context. The objective of this research is upgrading technological university academic building design according to national technology, science and to suit education system. The scope of the research is confined to the study of the academic buildings space descriptions, the requirements and preliminary factors of designing new buildings or renovation existing buildings. The employed methodology of this applied research is consisted of greatly three main parts. The first portion is reviewed and study on educational background, theoretical description and space standards from literature. The second is field survey and practically analysis on existing technological universities and colleges of foreign and local as textual, visual and situation analysis. The result of this research is contributed by formulating guidelines in order to assist in the process of designing technological university academic buildings and preparation of accommodation schedule. In the formulation of general design guidelines, three optimum sizes of technological universities for *Myanmar* are assumed in order to determine as basic concepts for determining accommodation schedule. To suit these optimum sizes, the functional requirements, the space allocation, area requirements and accommodation schedule are formulated. Moreover, the architectural designs guidelines are proposed for functional relationship and desirable space composition of academic area in the design process.

Keywords: Design Guidelines, Educational Facilities, Educational Functional Requirements, Technological Universities

1. INTRODUCTION

In *Myanmar* context, building the technological university in each development zone is an important strategy according to the education development plan. The technological universities are institutions, which confer both bachelors and advanced degrees in the technological fields, usually stressing graduate work, research and professional training. The research periods and tasks for this study contained the following categories:

- ❖ Background study
- ❖ Theoretical study on literature
- ❖ Analytical approach to existing academic buildings of international and local technological colleges and universities
- ❖ Questionnaire Survey on the opinions of user groups from current operational technological colleges

The three main functions of technological education are teaching and training professionals, research and community development. The mainly concerned issues are building types and user groups. In the technological

university campus, the common types of buildings can be classified as academic buildings, administrative buildings, residential buildings and amenity buildings. The main user groups of the students, the teaching staff and the administrative staff are the great important factors for academic building design.

2. METHODOLOGY

The type of this research is applied research that is conducted for the purpose of applying, with testing theory and standard and then evaluating its usefulness in solving problems. The three research procedures are collection and processing of data firstly, analysis and evaluation in analytical stage and then all implication data are synthesized with the qualitative and quantities methods. Based on those synthesizing result, the guidelines for general design and architectural design are formulated. The formulation program is intended to guide the production of the academic building program and the preliminary design requirements.

2.1. The Background Study on Technological Education of Myanmar

The research work is firstly reviewed on educational background to get an understanding of the current educational system. The features of education structure, teaching method and curriculum are relevant to the work of the designing academic buildings. An educational institution's size is traditionally measured by student enrolment, and student enrolment is the principal basis for determining the educational space needs identified. The curriculum is general activities of the education and that are important factors, which contribute to the education. The quite different curriculum results in a different time allocation and different space requirements. From the statistical analysis on curriculum, the teaching period for each subject can be calculated. The common and individual activities can also be classified. Moreover, an understanding of teaching method will enable to arrange the space. The activities of issue in the pattern of education may results in building design and layouts. This implication data will provide the basic concepts need for determining accommodation schedules, educational specification and design brief.

2.2. The Theoretical Study on Influence Factors of Academic Building

The theoretical study on influence factors of academic building design has very broad implication in terms of building design with the general requirements needed for determining space allocation and space utilization in space programmed. In space allocation program, the space allocation can be calculated with two methods: traditional method and utilization method. The traditional method is the

maximum usages of spaces and the utilization method is saving space need for wastes of costs. The results from two methods are compared in synthesis and formulation sections. According to this theoretical method, the utilizable factors for each kind of space are needed to calculate to meet *Myanmar* context. As of a theoretical aspect, the utilization factors for each kind of space are also considerable point and can be summarized as ready references.

In the accommodation scheduling method, the utilizable index per user for each kind of space should be determined to be reasonably meet of academic performance. The calculation of area requirements are also evaluated with the user capacity and determination of specialized spaces. The standards of anthropometric factors usages in buildings are determined the space description and utilization index for each space. The implication of features of climate responsive design in tropical region is the orientation and layout of building within the campus. This implication factors from the climate are greatly effect on the building layout and orientation within the campus.

2.3. The Analytical Approach to Existing Technological Universities

The analyses of currently operational academic buildings are also needed to get much information of designing buildings. To know technology for improving learning, teaching and research spaces, the international technological universities are analyzed. Field survey on existing technological colleges and universities of *Myanmar* can be identified problems and needs. The functional requirements, provided facilities, space allocation and utilization are also calculated in practically. Feasible analysis on technological universities is provided the functional requirements of academic building and provided facilities. The socio-economic survey is conducted by questionnaire to the communities and user groups and interviewing with the experts. The opinions of user groups are greatly affected on building designs. The reply from questionnaire survey of currently operated local colleges can be obtained the problems and requirements of buildings. The implication factors from visual analysis and textual analysis on the case of foreign technological universities are also provided the academic building design with the general requirements needed for determining space allocation and space utilization in space programmed.

2.4. The Synthesis and Evaluation of Design Implication Factors

The research process will be approach to analytical point of view and compare theoretical and practically analysis. The implication factors from all study programs

are synthesized and evaluated in this stage to be appropriate for *Myanmar* context. Facilities need to support teaching, research, community service, and deployment of effective technology. The methods of evaluation are the marking system, calculation the mark and then determine the most need. In space allocation program, the first calculation is the appropriated utilizable factors for each kind of space. The space allocation is calculated by two of traditional method and utilization method. In this calculation, the general teaching space and specialized space are also classified and separately calculated.

According to the research result, the suitable utilization index for each type of space is obtained. Based on this utilization index, the required area and space utilization can be calculated. The accommodation schedule for academic buildings can be called as education specification and design brief. The pre-design factors and detail space requirements can be manipulated by visual analysis summarization. The implication factors of detail visual analysis on pre-design factors of each type of space and provided facilities are the pre-preliminary design factors for academic building design. The desirable spatial compositions in building program are proposed for the circulation, the sequences of space and spatial relationship.

3. RESULT AND DISCUSSION

The results of this research are the guidelines of general and architectural design for academic building design. The final step of research is formulation based on the design process and guiding as discussion. In the formulation process, the architectural design guidelines are proposed in order to be met appreciable requirements, to satisfy the problems and needs and to show the ways of solution in the design process. The formulation of architectural design guidelines procedure is based on the process of designing the technological university academic buildings. The building program contains the detail space description with the available area utilization. This detail program can be used as the basic for architectural design and to conduct space composition. The designer who focuses the academic design can be used these summarization data and referenced for designing the academic buildings of technological university.

3.1. Formulation of General Design Guidelines

The first section is the general guidelines for the optimum size of technological universities in *Myanmar* as a sample. In this section, the educational program, courses and the organization structure for each optimum size are formulated.

3.1.1. Formulation of the Optimum Size

The optimum size of technological university appropriate for *Myanmar* context is based on current offered courses and programs, student enrolment rate, capacity range and setup education policy. Assumption optimum size of student capacity is two times of current student capacity due to future changes. Formulation of optimum size of student capacity is accounted the aspect of policy. As shown in tables, assumption optimum size of student capacity can be calculated as three sizes.

Table 1.0 The Optimum Size For Technological Universities In Myanmar

Optimum Size	Student Capacity	Allowable Size
Minimum Size, A	1000, one thousand	1200
Medium Size, B	3000, three thousands	3600
Maximum Size, C	6000, six thousands	7000

3.1.2. Formulation of the Educational Program and Courses

Formulation of the educational program and courses is based on current educational program. Due to the limitation of university sizes and requirements, not all of courses are available in each university. Minimum numbers of four courses can offered and maximum is eighteen. The Architect should consider the changes of student enrolment and more offered courses and advanced degree. The number of enrolment for the different courses varies greatly. Moreover, the extension and addition are also considered for future changes.

Table 2. The Educational Program for Technological Universities in Myanmar

Description	Size A	Size B	Size C	Possible changes
Enrolment for each Year	200 students	600 students	1000 students	Increased enrolment
Allowable Enrolment for each Year	240 students	720 students	1500 students	20 % Allowed
Academic Department	4 nos.	8 nos.	14 nos.	Introduce more departments
Offered Courses and Degree	Bachelor	Bachelor	Bachelor	Offer more courses and award more
Enrolment for each Department per year	50 students	75 students	100 students	Increase enrolment
Allowable Enrolment or each Department	60 students	90 students	120 students	20 % Allowed

3.2. Formulation of Architectural Design Guidelines

The second formulation is for architectural designs pre requirements and composition pattern of spaces in building program. The types of facilities and functional requirements, space allocation and spatial requirements, space utilization and area requirements, composition of spaces pattern in building program are also proposed.

3.2.1. Formulation of the Types of Facilities and Functional Requirements

Facilities need to support teaching, research, community service, and deployment of effective technology. Increase support for teaching, research, and creative work. The education brief, user requirements study and accommodation schedule are needed to adjust with all aspect of both educationist and Architect. In technological university, the essential necessary for providing educational environment is basic teaching and learning spaces. The instruction function consists of those activities whose output directly contributes toward the mission of teaching and learning. Instruction includes teaching and training activities and departmental research.

Activities included in this category are computer laboratories, language laboratories, music practice rooms, mathematics tutoring and testing facilities and other similar facilities. Other teaching facilities are not used on a regularly scheduled basis, but they do serve users either in groups or individually. Other institutional activities include public service, auxiliary activities, athletics, community relations, etc. The basic function can be classified based on their usages. It looks at academic space by three major types, such as teaching space, research space and resource spaces. There are basic producers and inter-relations of functions common to all forms of teaching areas. The extended of facilities required for each of these functions depends on the scale and category of the teaching space.

The Figure 1 presents the grouping of function according to their nature and provided facilities. The elements and facilities for common and individual areas are grouped based on their usages of private and public. The common general accommodations are traditional classroom and lecture hall style and used for the same facilities and activities of each academic department. The user from all of courses, academic year and academic departments are used these spaces in the same way. Therefore, the provided facilities and functional are same in way of evaluation. Some of the general teaching spaces are used for common and individual of each department such as classrooms, tutorial rooms and departmental office.

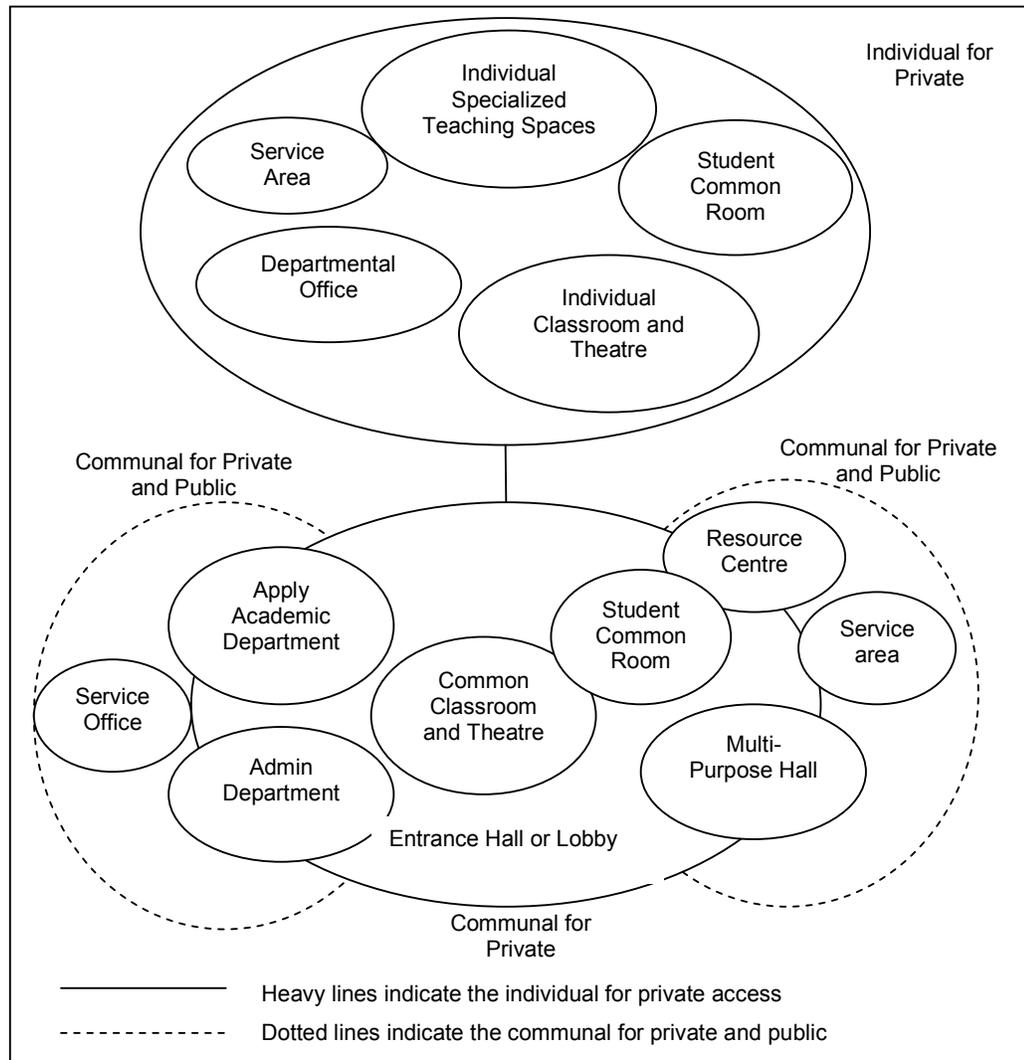


Figure 1. Diagram of Grouping of Function According To Their Nature

The specialized accommodation needs special supply, equipment and design environment. According to the nature of each course, the common group can be sub-divided into three groups: lab and workshop, computer aided facilities, drawing and design studio. In all these categories, supporting spaces often called service space are integrated in the each category. In common usages, language laboratories, workshops and drawing studio are also concluded. The needs for each academic department are different from one to another. The teaching facilities for specialized accommodation are many complex and more specific. Especially, the need of laboratories, language laboratories, workshops, design studios and drawing studio are differ from one courses to another at each level.

3.2.2. Formulation of Space Allocation and Spatial Requirements

In space allocation programmed, two of the many important qualities of spaces programmed for education are capacity and time. The concept of capacity is concerned numbers of student enrolment in each department. The numbers of group or section are depending on the capacity of each academic year for each course. The concept of time is concerned the number of space usages per week. One space used for forty separate periods in a week can be called a space period. The space periods and requirements of space numbers can be calculated by computing of teaching periods. Based on space period, the space needed can be calculated. The space periods needed for each courses in education program can be calculated based on calculations of time allotted, teaching periods and method for each courses in education program. The basic concepts of space allocation and determining space period for general teaching spaces in academic areas are shown in Figure 2 for more clear understanding.

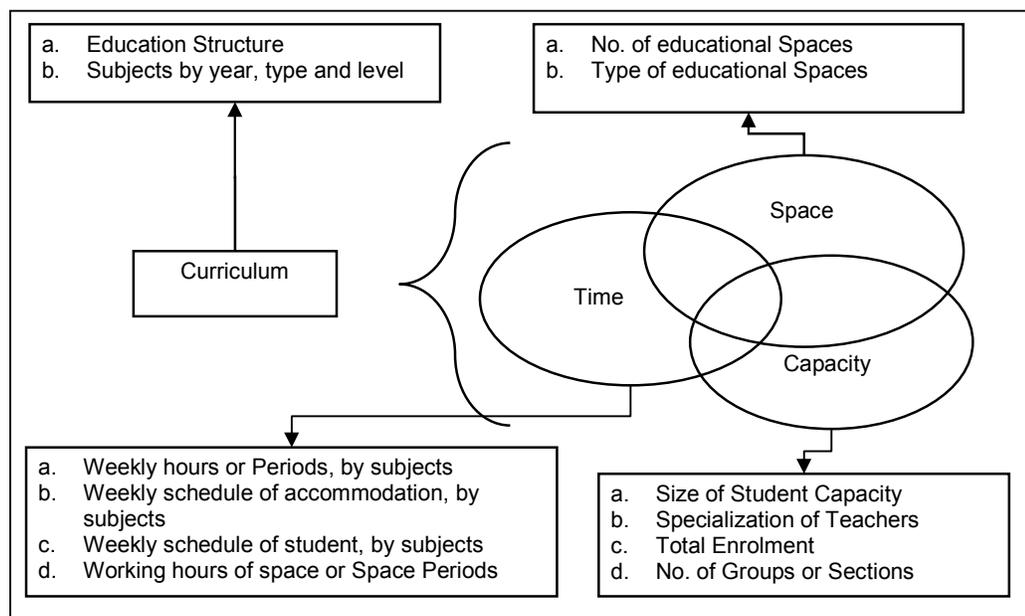


Figure 2. The Basic Concept of Space Allocation in Academic Areas

In space programmed, if the teaching period is forty periods in a week, the forty separate periods for each teaching space is needed. One space can be used for forty separate periods in a week. This is traditionally allocation method and the maximum utilization. The use of all spaces for all the time is not possible. The optimum utilization of space periods is needed to be calculated. The optimum utilization of space period is available for each space of own function. The concept of capacity is concerned the numbers of student enrolment of each department per each academic year. The numbers of group or section are depending on the

capacity of each academic year for each course. The desirable student capacity for *Myanmar* context is 50 to 150 numbers. If the capacity is more than that, the education environment will not be convenience with nature facilities. The teaching period of each courses is forty time per week from the statistical analysis. For each space, the total number of teaching space are summarized and translated by summing all of teaching period. The space periods and requirements of space numbers are calculated by computing of teaching periods.

The allocation of general teaching spaces to every separate teaching group, traditional method, give a consistently lower utilization percent than is the case when the needs for general teaching spaces are exactly calculated using theoretically calculation. This is result in fewer timetabling problems and in higher utilization. The similar calculations are presented for each course of each academic year. The total number of calculation is ninety, multiply of eighteen courses and five academic years. The method for calculation of space need employs teaching period (time of subject taught), space period (space used per week), student capacity size and number of section or groups (number of student occupancy). The total number of space need for each course per academic year is obtained by multiplying the number of sections by the number of space periods in one week. This is maximum space needed calculation. The utilizable space needed can also be calculated divided by the utilization factor.

3.2.3. Formulation of Space Utilization and Area Requirements

The type of accommodation schedule is needed to suit the educational requirements according to the detailed content of the curriculum and specialized spaces for certain course. There are two types of spaces in accommodation schedule: programmed spaces and non-programmed spaces. The programmed spaces are main concept and basic requirements for academic and non-programmed spaces are the servicing and supply space for academic building operation. The factors for programmed space are calculated with per user and combination of these can be obtained the area for all space according to user capacity. Non-programmed spaces are calculated based on programmed space ratio and the area can be obtained the combination and evaluation after programmed space calculation.

The accommodation comprises spaces for which used in program and others for which no special program are arranged. Programming can be arranged for maximum utilization for spaces and thus waste of capital expenditure. In scheduling accommodation program, the main concept are the capacity, the space

allotted, space utilization, required area and area index. The accommodation schedule contains functional requirements, capacity and number of each space, utilization index and the area requirements. This is the sampling for determining the accommodation schedule and not rigid formula. The schedule is different from one size to another according to offer courses and programs. According to their curriculum and subject taught, the specialized teaching spaces are different and so the accommodations are. Therefore, the designer should focus the offered courses and programs.

3.2.4. Formulation of Composition Pattern of Spaces in Building Program

The desirable spatial compositions in building program are proposed for the circulation, the sequences of spatial relationship and composition. There are basic producers and inter-relations of functions common to all forms of teaching areas. The extended of facilities required for each of these functions depends on the scale and category of the teaching space. The main activities are:

- ❖ Student activities to attend classrooms and theatre of common and individual facilities
- ❖ Teaching staff to circulate for each department and to attend meeting and conference at common space
- ❖ Admin staff activities to control and serve for academic spaces

The functional relationship should be the following accessibility. There are basic producers and inter-relations of functions common to all forms of teaching areas.

- ❖ To attend classrooms and theatre of common, the student movement should be flexible and easy access to one space to another
- ❖ The separate spaces should be connect with desirable link
- ❖ To circulate for each department and to attend meeting and conference at common space, the movement of teaching staff should also be flexible

The following Figure 3 shows the relationship between functions and production of facilities. Due to the differences between the functional requirements, the activities and movement are also quite different. Based on this functional diagram, the own functional diagram for each individual academic department can also be drawn. The differences between various departments are the specialized functional requirements and the movements. These will indicate space requirements, spatial relationship and location of spaces in the general scheme of the building plan.

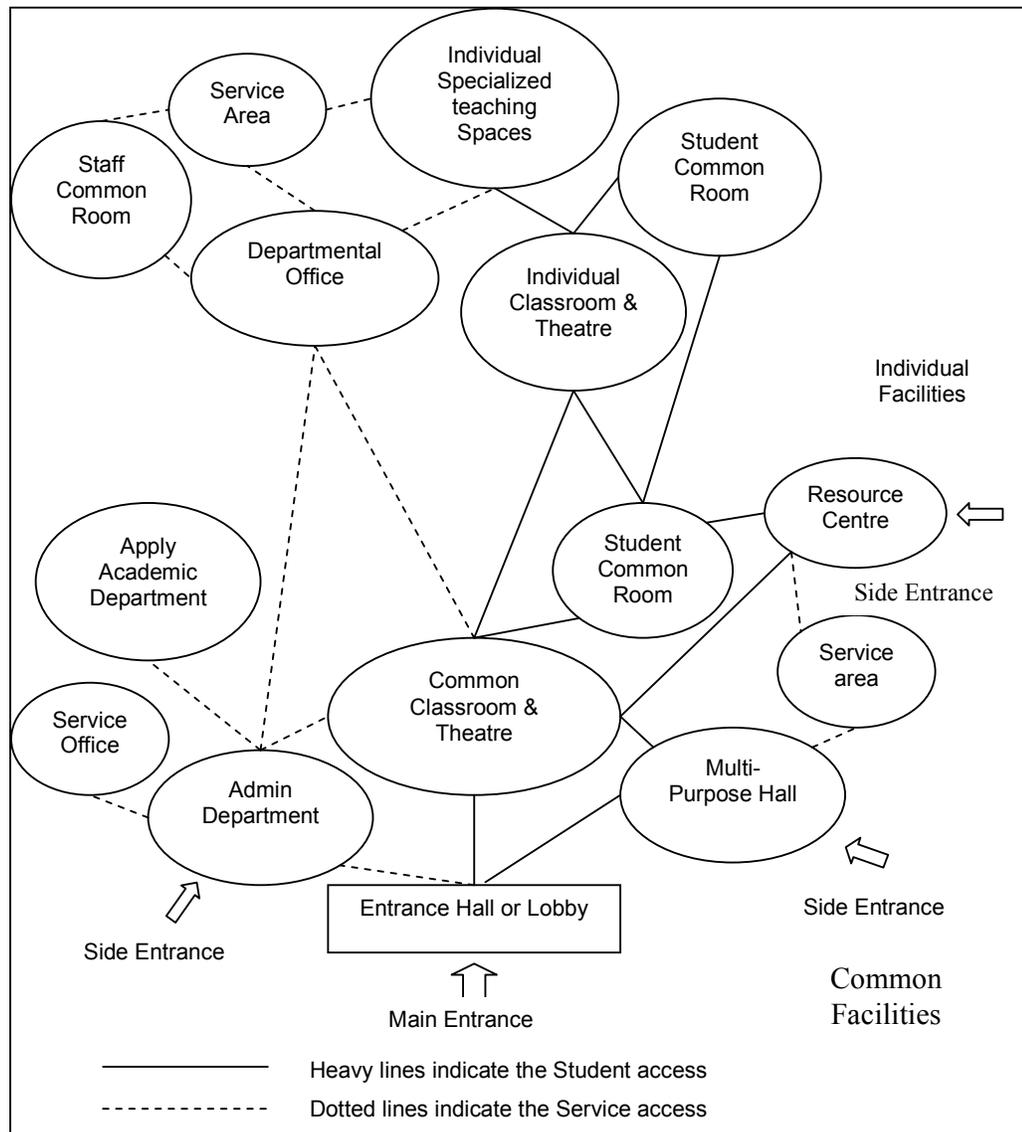


Figure 3. Relationship between Function and Production of Facilities

In working out the space relationship of instructional areas, learning areas and admin areas, the following facts are needed to consider.

- ❖ Learning activities should be located next to or close proximity to other learning activities
- ❖ Each space should have each own exits
- ❖ Space relationship should be facilitated the movement of student and teachers
- ❖ Space arrangement should be optimized the usage of space

The three types of space distribution pattern can be distinguished for multi-individual academic departments. The spatial composition is also concerned the organization of production spaces. Due to the increased numbers of department,

the relationships between functions are complex. According to the analysis program, the possible distribution patterns are evaluated. Based on this space distribution patterns, the basic concept for spatial composition can be proposed. The specific shape and pattern for each type of space is depend on each usage. Based on the sequences of spatial relationship, the possible distribution spatial arrangement and basic plan shape of buildings are evaluated. According to the summarization of all evaluation, the spatial composition for each type can be classified as following. The common form of are:

- ❖ Molecular Composition Pattern
- ❖ Linear Composition Pattern
- ❖ Radial Composition Pattern

The basic producers and inter-relations of functions to all forms of teaching areas for each capacity size are concerned with the area utilization. The more space utilization and academic department, the functional relationship and spatial pattern are more complex.

4. CONCLUSION

As a conclusion, the proposed architectural design guidelines are formulated to achieve feasible results adaptable to the needs of *Myanmar* society. The formulation of architectural design guidelines procedure is based on the process of designing the technological university academic buildings. The results are aimed to be used by the Architects, designers, student-Architects and related design professional and provided them a ready-reference for enable and encourage design excellence. The following criteria should be used to guide the accommodation process:

- ❖ Additional requests will be reviewed according to priorities for academic programs, research, and support services.
- ❖ Space should be allocated equitably and space allocations are made to units, not individuals.
- ❖ Departmental and unit allocations should be as contiguous as possible, unless interdisciplinary research, teaching or work group needs dictate otherwise.
- ❖ Existing space allocations must be utilized as fully as possible before additional allocations are made.
- ❖ Extensions should be considered as needed if the space remains available.

The formulation of general design guidelines will provide for the sampling and optimum size for designing. Based on this capacity sizes, the architectural

design guidelines are manipulated and so these will provide the designer in the field of basic functional requirements of academic areas and their desirable relationship, space description, allocation, utilization and the spatial composition pattern of each size. Classrooms and other generalized teaching facilities should be depleted with the result of space allocations. The exception of very specialized teaching labs, all teaching spaces should be generally assigned. Space allocated for time-limited uses reverts to unassigned status after completion of the specified time period, and must be vacated by the user.

Adjunct admin and per course lecturers should be housed in shared offices with at least one other person. Emeritus staff who still carry teaching loads and advise graduate students may keep a single office and other emeritus admin should share an office or hostelling space, when possible. Individual staff offices may be private, shared, or open landscape, as appropriate. Specific allocations will depend on duties of the individual.

Department spaces typically include head office, administrative staff common space, store area, other support and service space; copy, file, mail, work rooms, break rooms, commons and conference rooms. The need and size of these shall be assessed on a case-by-case basis. The guideline is intended to guide the Architect or the designer in the planning and programming of space allocation and space utilization of academic buildings.

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