



Assessment Tools for Educational Buildings as means of Architectural Design Development

Case Studies: Faculties of Engineering in Egypt

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Abstract

An educational building represents a physical unit, or asset, within faculties of engineering. An architectural department building, being part of an educational organization, should support students' and users' activities, as most of their daily activities happen inside faculty buildings and the surrounding urban contexts. The assessment purpose is to measure the performance of the faculty buildings while fulfilling the original function for which they have been designed, in relation to the fulfillment of users' requirements. This is achieved through an assessment survey; where the result will ensure better design development for governmental faculties of engineering in Egypt, especially the architectural department buildings. The approach depends on measurement parameters to analyze records of performance for current buildings; then suggest an architectural design development scheme that enhances both the educational process and the future performance of the buildings.

1. Research objective

To create a better architectural environment in governmental faculties of engineering by enhancing performance of buildings and achieving users' satisfaction, through the utilization of assessment tools and parameters, in order to fulfill design development according to the assessment results.

2. Research hypothesis

Building assessment tools can be used in the development of an architectural design that can reform architectural department buildings in governmental faculties of engineering; to act as an example of raising the efficiency of education and the performance of educational buildings.

3. Research method

A quantitative study is used for the assessment of architectural department buildings in faculties of engineering; in order to reach the needed architectural design for development. An applicable approach will be implemented upon reaching assessment results which will depend on these parameters:

- Urban context
- Building form
- Approach and Entrance
- Users Satisfaction
- Building Materials

The study will be applied through identifying the hierarchy of architectural department buildings, then using an assessment mechanism which will be followed by field inspection; in order to reach an actual condition analysis and suggest solutions.

4. Case studies selection criteria - Expected research results

The expected result of the assessment will be a set of guidelines for an architectural design development scheme that can be applied on existing architectural department buildings in governmental faculties of engineering; in order to raise their efficiency through the following steps:

- Listing the real threats as well as strength and weakness points concluded from the assessment model
- Conducting a users' survey and a comparative analysis
- Designing a development plan by making use of possible opportunities
- Dividing the development plan into short, medium, and long term plans according to priorities
- Providing a complete hypothesis for the development scheme

Since Egypt has many faculties of engineering and architectural department buildings, the research will

study those faculties under the condition of being in Cairo, in relation to international universities, and operating under their strict regulations; in order to be a good benchmark. The faculties should be permitted to make the survey, specifically with respect to the targeted architectural department buildings. If an architectural department was imbedded inside a generic faculty of engineering building, the whole faculty building is then included in the survey. Engineering faculties are categorized into two groups; the first featuring governmental ones, while the second features those of the private sector. By creating a comparative analysis between the two groups, we can reach assessment results and suggest an architectural design development scheme for governmental faculties.

Measures are represented in analyzing the urban contexts, building forms, approaches and entrances; from the researchers' points of view. In addition to a questionnaires form used to create a users' satisfaction survey on the building materials used, and the overall satisfaction with the educational buildings and surrounding urban context (Please see appendix 1).

5. Tools of Assessment Parameters

The assessment has many parameters to be measured, those parameters can be defined when the following questions got answered, and the parametric questions are:

• Urban Context

Does the building suit the pattern of the surrounding area?

Does the scale of the building match the scale of the surrounding buildings, and does it fit in the site where it's located?

Does the building seem to fit harmoniously with adjacent land usages?

Does the building, and its intended educational usage, blend well with the type and appearance of adjacent buildings?

• Building Forms

Do the subdivided parts of the building appear to have functions that are easy to identify?

Are the various parts of the building carefully-planned in relation to one another, and in relation to the characteristics of the site?

Does the relation between the building parts make it appear as one unified structure?

Is there a variation in the massing that provides interest and variety?

• Approaches and Entrances

Are there sufficient routes, pathways, streets, and passageways provided for - and surrounding - the building?

Do the routes link the building to the surrounding building structures?

Are the routes arranged with consideration of busy periods, quiet periods, regular movement patterns, and traffic jams?

Are there nodes (meeting points) for traffic around the building, and what happens there?

Are all the circulation routes understandable and convenient?

• Users' Satisfaction

Are all circulation routes within the building easily comprehended by newcomers, visitors, and service staff?

Are the interior circulation routes clearly marked and easily understood?

Does the building suit the students' ability to personalize their workspaces? (Please see fig.1)

Does the classroom function in relation to other space requirements; such as small group meetings, projects, etc...?

Are teachers' offices in accessible locations?

• Building Materials

Does the appearance of the building reflect its construction system and building materials?

Do the building materials integrate well with each other; forming a pleasant appearance?

What's the effect of the interior cladding materials on the building users?

Is the texture of interior materials acceptable by the students and staff?



1. See-through elevator
2. Presentation area
3. Lighting design exhibit
4. Materials & textures exhibit
5. HVAC exhibit
6. Walkie-talkie handrail
7. Light table area
8. Large model area
9. Tracing area
10. Structure exhibit
11. Light & shadow area
12. Nature observation area
13. Mobile interactive cart
14. Pattern design area
15. Shadow theater
16. Laptops everywhere
17. Design studio area
18. Exhibition wall

Fig. 1 Design of the learning environment supports multiple learning styles

This survey was done through six faculties that were chosen with the criteria of being in Greater Cairo. Cairo University, Ain Shams and Helwan University were chosen to represent governmental universities, while British, Russian and German universities were chosen to represent the private sector. The purpose was to examine the faculties of engineering, especially the architectural departments, to assess the work atmosphere of the governmental universities by holding this comparative analysis. This is based on how the private faculties could be considered as models from an appearance point of view; being supported with huge funds. Accordingly,

such an analysis should reveal the strengths and weaknesses of governmental universities. Many tools were integrated together to form the whole assessment approach which studies student comfort and productivity.

6. Cases of study

Since faculties serve students who need a comfortable and welcoming environment, so a questionnaire was used to collect data from them. The questions were divided into five main categories, which were urban context, building form, approach and entrance, users satisfaction, and building materials. The previous parameters were measured to assess how the physical environment was considered a vital part of the teaching process, while impacting student productivity as well. The parameters were chosen from a checklist that was applied to educational buildings. The mentioned checklist was prepared by experts of The American Institute Architects (AIA), in addition to The School of Architecture, College of Design, in North Carolina State University, with support from the National Clearinghouse for Educational Facilities of The United States.

A learning environment has a holistic set of goals that integrate both educational and architectural ones. The educational goals focus on the body (physical learning), mind (cognitive learning), and spirit (emotional learning), while the architectural goals consist of firmness (structure), commodity (function), and delight (beauty). Universities used to take, in the past, the architectural model of an old industrial factory. Nowadays, universities started to transform to be more community-oriented; through shared facilities and multiple uses. A great learning environment can be divided into three factors; the first is to have small learning communities that promote social interaction and nonacademic activity, the second is relying on daylight and renewable energy sources, while the third and last factor is the connection to the outside; which is mostly missing in governmental universities. In addition to these factors; the successful model of a good learning environment is the one which supports multiple learning styles.

6.1. Department of Architecture – Faculty of Engineering – Cairo University

The building consists of 8 floors. The architectural department occupies most of those floors at the mentioned building. The department includes an architectural library, a print center, drawing halls, as well as lecture and staff rooms. The following is an analysis of the building in terms of:

Urban Context

- The building belongs to the modern architectural movement as it appears in a huge scale that doesn't suit the pattern of the surrounding from the varied old buildings that mostly follows the classical era, building

shape is the minimum shape which let the function fulfilled, in addition to that the structural elements shaped it (Please see fig.2, 3).



Fig. 2, 3, the architecture department building huge scale in relation to its context

- The building does not fit harmoniously with adjacent land usages as it seems different than surroundings, in addition to that it is completely hiding the buildings behind it due to the building height and position and partially hiding the main administrative building. It does not imply its intended educational usage, as it looks like a traditional administrative building as this type repeated many times when the thinking of form follow function and the structural which shape the form were fashionable.

Building Form

- The form of the building appears to have functions that are easy to identify and which are carefully-planned in relation to one another, especially at the drafting halls.
- It consists of only one mass in the shape of a cuboid as one unified structure without a diversity of masses, which causes monotony.
- The repetitive form of the building facades may also be causing boredom as the facades just contains set of repeated rectangular.

Approach and Entrances

- The main entrance is clear, as it is located at the middle of the main facade while being emphasized by a module of columns and a huge steel elements above.
- There are sufficient routes, pathways, streets, and passageways surrounding the building; which are clearly linked to the surrounding building structures.
- There are multi-nodes (meeting points) surrounding the building, in front of the main facades, that are prepared for the gathering of students and visitors as well.

Users' Satisfaction

- All circulation routes within the building are easily comprehended by newcomers as it is clear to distinguish, that to visitors, and service staff. On the other hand, the staff offices are in accessible locations which are a good aspect that allows communicating with the students.
- The drawing halls suit the students' ability to personalize their workspaces with a low level of acceptable noise.

Building Materials

- The reinforced concrete structural system of the building is clear and visible to the limit that it shapes the building shape, while complying with concrete louvers that were veneered by a granulate finish; and - unfortunately - painted later.
- The materials used in the building envelope are highly integrated with each other; although this integration may cause boredom as it consists of repeated shapes.
- The internal finishing and cladding materials include marble, granite, ceramic, and parquet; which may have good impact on the users that can relate to this variety. (Please see fig.4, 5, 6)

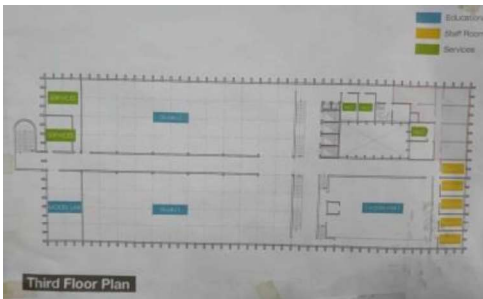


Fig. 4, 5, 6 Building external and internal finishing materials, and plan

6.2. Department of Architecture – Faculty of Engineering – Ain-Shams University

The building consists of 5 floors. The department includes a print center, drawing halls, and lecture and staff rooms. The following is an analysis of the building in terms of:

Urban Context

- The building belongs to the modern architectural movement, as the designer was influenced by the pioneering architect Le Corbusier and his ideas about brutalism. On the other hand, the building is relatively suitable with respect to its built area and its height in comparison to adjacent buildings.
- The building fits harmoniously with its urban context as it is surrounded by buildings for complementary activities such as a library, spaces for social activities, playgrounds, and a mosque.
- The exterior appearance of the building implies its educational use. The façade treatments, openings, and hierarchy of masses imply being an educational activity building.

Building Form

- The plan of the building appears to have functions that are easy to identify and which are carefully-planned in relation to one another, as different spaces could be clearly identified.
- It consists of only one mass of a cuboid shape as one unified structure with diversity applied through solids, voids, and façade recessions; creating light and shadow.
- Difference is shown in the façades, creating harmonious diversity without distinguishing a particular façade. Meanwhile, the exterior façades are in harmony with the façades of the adjacent surrounding buildings.

Approach and Entrances

- The main entrance is clear, and is emphasized by a higher level and huge entrance stairs.
- There are sufficient routes, pathways, and passageway surrounding the building, which are clearly linked to the surrounding buildings and activities. On the other hand, a kind of hierarchy could be noticed throughout the widths of pathways and routes, widening at the entrances and main façades, and narrowing around the rest of the building.
- There are multi meeting points surrounding the building, which are prepared for students' gatherings to practice various activities (social, learning, and entertainment).

Users' Satisfaction

- All circulation routes/corridors within the building are easily comprehended by newcomers, visitors, and service staff. On the other hand, staff offices are close to the vertical transportation elements and are easy to access.
- Drawing halls suit the students' ability to personalize their workspaces as well as allowing teamwork with a low level of noise.

Building Materials

- A reinforced concrete frame structural system is clear and visible through the façades.

- Construction and finishing elements of concrete frames, masonry bricks, glass, and wooden windows; are all well integrated with each other.
- The interior finishing materials include marble, granite flooring, stone, and wood cladding along with a suspended ceiling of gypsum board. This variety of materials has created a good impact on the users. (Please see fig.7:10)

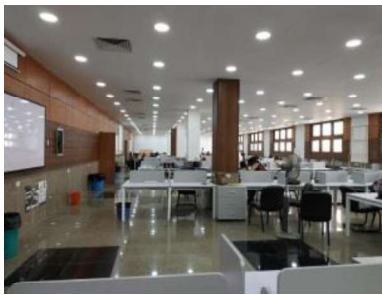


Fig. 7, 8, 9, 10 and 8 Building architecture appearance, plan, layout and finishes

6.3. Department of Architecture – Faculty of Engineering – British University in Egypt (BUE)

There is no separate building for the architectural department; as it is part of the faculty of engineering building; which consists of 3 floors and a basement. The architectural department includes a library, sustainability center, drawing halls, lecture halls, and staff rooms. The following is an analysis in terms of:

Urban Context

- The building belongs to a historical/elective trend that was associated with the post-modern architectural movement. The building matches with adjacent buildings in terms of form, façades style, and height.
- The building fits harmoniously within its urban context, as it is surrounded by the rest of the university buildings (administrative building, other faculties, etc...) that own the same architectural style.
- The exterior appearance of the building implies its educational use. Mass hierarchy, style, façade

treatments, colors, and openings imply that it is an educational activity building.

Building Form

- Although it is a complex building that contains all departments of the faculty of engineering, the building form appears to have functions that are easy to identify and which are carefully-planned in relation to one another. Different spaces, halls, and staff rooms could be clearly identified.
- The building form consists of several masses connected together, by horizontal and vertical links, to create a unified structure with a hierarchy in masses and heights. The aim is to achieve diversity of masses through a variety of heights, solids, voids, and shaded entrances.
- The style of the façades matches with the colors creating unity, where the façades are also in harmony with the adjacent surrounding buildings.

Approach and Entrances

- The main entrance is clear, and is emphasized by two full height towers and a shaded recess.
- There are sufficient routes, pathways, and passageways surrounding the building.
- The layout of the university is based on a main path (a spine) passing through all buildings, and the mentioned building is located on that spine in order to be clearly linked to surrounding buildings and activities.
- There are multi meeting points surrounding the building, which are prepared for students' gatherings; to practice various activities.

Users' Satisfaction

- All circulation lobbies and corridors within the building are easily comprehended by newcomers, students, and service staff.
- Drawing halls suit the students' ability to personalize their workspaces as well as allowing teamwork with a low level of noise, but there is a shortage in the number of these halls.

Building Materials

- The appearance doesn't reflect neither the construction system nor the building materials.
- The exterior finishing materials and colors are highly integrated within the building style; featuring paint on cement plaster, glass, and gypsum ornamental elements.
- The interior finishing materials include marble, wood, and carpet for flooring, paint and wooden cladding for the walls, matching with a suspended ceiling of gypsum board. (Please see fig. 11:14)



Fig. 11, 12, 13, 14 the building external appearance, plan, layout and finishes

6.4. Department of Architecture – Faculty of Engineering – German University in Cairo (GUC)

There is no separate building for the department of architecture, as it is part of the building of the faculty of engineering that consists of 5 floors. The architectural department occupies the first floor and parts of the second and third floors. The following is an analysis in terms of:

Urban Context

- The building belongs to the late modern architectural movement. It fits harmoniously in terms of form, scale, and height with adjacent buildings and its urban

context; as it is surrounded by the rest of the university buildings (administrative buildings, faculties, etc...).

- The building appearance seems to be an administrative building rather than an educational building through its mass, style, façade treatments, colors, and openings. On the other hand, the facades are in harmony with the adjacent surrounding buildings.

Building Form

- The form consists of double U-shaped masses linked together by a square-shaped core that encloses the main building entrance. The plan appears to have functions that are partly easy to identify. Drawing halls, classes, and staff rooms are almost specified.
- The building masses are connected through horizontal corridors and vertical transportation systems, in order to accomplish unity. Meanwhile, diversity is achieved through a variety of orientation in the cuboidal masses as well as solids and voids.
- Curtain wall facades match with relevant colors and materials; adding unity to the building form.

Approach and Entrances

- The building has four entrances; one of them is the main one and is clear and emphasized by its additive form, main fountain, and color. Furthermore, the entrance can be easily identified through the main entrance of the university. On the other hand, the entrance to the architectural department, in the middle of the U-shaped mass, is not clear enough as it is just a big opening in the inner façade.
- There are sufficient routes, pathways, and passageway surrounding the building.
- There are multi meeting points surrounding the building, which are prepared for students' gatherings to practice various activities.

Users' Satisfaction

- All circulation lobbies and corridors within the building are partly comprehended by newcomers, students, and service staff.
- Drawing halls and classrooms suit the students' ability to personalize their workspaces as well as allowing teamwork and performance of duties among a low level of noise.

Building Materials

- The appearance of the building reflects its construction system and building materials.
- The exterior finishing materials and colors, such as the color of cement-based paints, curtain walls, and aluminum cladding; are highly integrated within the building style.
- The interior finishing materials include marble, wood, ceramic and parquet for flooring, paints and wood for wall-cladding along with a suspended ceiling of gypsum tiles. (Please see fig. 15, 16, 17)

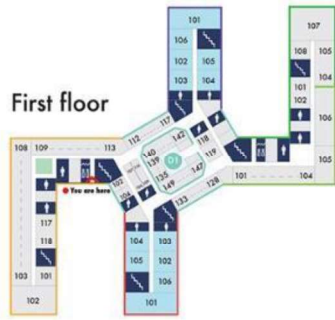


Fig. 15, 16, 17 departments of architecture appearance, plan, layout and finishes

6.5. Department of Architecture – Faculty of Engineering – Egyptian Russian University

There is no separate building for the department of architecture, as it is a part of the main building of the faculty of engineering that consists of 4 floors, including a basement. The architectural department occupies the first floor and parts of the second floor. The following is an analysis in terms of:

Urban Context

- The building belongs to the elective trend that was associated with the post-modern architectural movement. It matches with adjacent buildings in terms of form, facade style, and height.
- The building fits harmoniously within its urban context as it is surrounded by the rest of the buildings of the faculty of engineering (laboratories, workshops, and cafeteria), which belong to the same architectural trend.
- The exterior appearance of the building implies its educational use. The mass hierarchy, style, façade treatments, colors, and openings imply an educational activity building.

Building Form

- The form consists of variable masses that are connected together, by horizontal and vertical links including two patios. The aim was to create a unified composition with a hierarchy of overlapping shapes (rectangular and elliptical), as well as a hierarchy in heights, and recession of masses.
- Although it is a complex building that contains all departments of the faculty of engineering, form appears to have functions that are easy to identify and which are carefully-planned in relation to one another. Different

spaces, halls, and staff rooms could be clearly identified.

- The style of the colored facades matches with the recessing of masses; creating unity in the building form. Meanwhile, the facades are in harmony with the adjacent surrounding buildings.

Approach and Entrances

- The building has two entrances. The main entrance is clear and is emphasized by a double height recessed mass, its different paint color, and its elevated stairs.
- A hierarchy in routes, sufficient pathways, and passageways surrounding the building can be noticed.
- There are multiple meeting points surrounding the building, which are prepared for students' gatherings to practice various activities.

Users' Satisfaction

- All circulation lobbies and corridors within the building are easily comprehended by newcomers, students, and service staff.
- Drawing halls and classrooms partly suit the students' ability to personalize their workspaces because of the moderate noise levels. There is also not enough workspace for groups and common projects.

Building Materials

- The appearance of the building reflects its construction system and building materials.
- The exterior finishing materials and colors, such as cement-based paints and curtain walls, are integrated within the building style.
- Interior finishing materials for halls and classrooms include marble and ceramic for flooring, interior paints and marble wall-cladding, with no suspended ceiling. (Please see fig. 18, 19, 20)

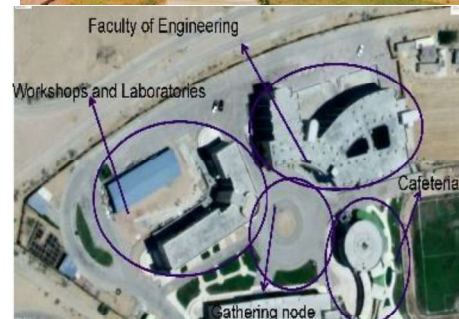




Fig 18, 19, 20 building appearance, plan, layout and finishes

6.6. Department of Architecture – Faculty of Engineering – Helwan University

The building consists of 6 floors. The architectural department occupies only two floors of the building. The department includes an architectural library, drawing halls, lecture rooms, and staff rooms. The following is an analysis of the building in terms of:

Urban Context

- The building strongly belongs to the late modern architectural movement. It looks like a landmark on campus, perfectly suiting the pattern of the surrounding buildings in terms of color, style, and façade treatments.
- The exterior appearance of the building implies its educational use. The mass hierarchy, style, façade treatments, colors, and openings imply being an educational activity building.
- The building fits harmoniously within its urban context as it is surrounded by other campus buildings; such as an administrative building, a mosque, lecture halls, and activity areas.

Building Form

- The plan of the building appears to have functions that are easy to identify and which are carefully-planned in relation to one another, as different spaces could be easily identified.
- The form consists of two main masses of almost rectangular plans, which are connected together; and include two patios, creating a unified composition. On the other hand, diversity is shown through huge stand-alone structural elements at the main façade, solids and voids as well as recessed facades; for shading purposes.
- The style of the shaded main façade matches with the recessed relevant masses; creating unity through the building form. The exterior facades of the building, in general, are in harmony with those of adjacent surrounding buildings.

Approach and Entrances

- The main entrance is clearly specified and emphasized by wide openings, recessed masses, huge structural pillars at the entrance, and pathways leading to it.
- A hierarchy in routes, pathways, and passageways surrounding the building can be noticed; widening at the entrances and main facades and narrowing around the rest of the building.
- There are multiple meeting points surrounding the building, which are prepared for students' gatherings to practice various activities.

Users' Satisfaction

- All circulation lobbies and corridors within the building are easily comprehended by newcomers, students, and service staff. Staff offices are close to the vertical transportation elements and easy to access.
- Drawing halls and classrooms partly suit the students' ability to personalize their workspaces because of moderate noise levels. There is also not enough space for work groups and common projects.

Building Materials

- The appearance of the building reflects its construction system and building materials.
- The exterior finishing materials, such as paints and marble-cladding for the structural columns at the main facade are integrated with the building style.
- The interior finishing materials for corridors, halls, and classrooms include marble, wood and terrazzo for flooring, paint and marble for the walls, with no suspended ceiling. (Please see fig. 21: 24)





Fig 21, 22, 24 and 24 Faculty building, plan, layout and finishes

7. Analysis Methodology

A questionnaire was held among the students and analyzed through a number of steps, to assess how the architectural departments at faculties of engineering of governmental universities can perform better as the private sector faculties do; assuming that the private sector universities perform better, having financial resources and better overall appearance. The analysis consisted of the following:

- Descriptive statistics and test of hypothesis: in order to test whether the mean of each of the 20 indicators vary

significantly between governmental and private universities.

- Binary logistic regression: this statistical model is used mainly for measuring the effect of the change in the independent variables on the odds ratio of the binary dependent variable.

Here, the outcome variable (dependent variable) is the type of university. It will take the value of 0 if it is a governmental university and 1 if it is private. The set of independent variables are measured on Likert scale and the research will deal with them as metric variables.

8. Results

Only some of the variables can enhance the governmental faculties and let them perform at the level of the private ones from the architectural point of view, such as:

- The scale of the building and its matching with that of the surrounding buildings
- The relation between the building parts and its appearance as one unified structure
- The building materials and their level of integration with each other; forming a pleasant appearance
- The texture of interior materials

9. Discussion of the Results

Through descriptive and hypothesis testing (comparing means using independent samples T test), a test is done to complete 20 variables which formulate the questions in the questionnaire. The following table shows that three of the variables don't have significant differences, which means that both categories of the universities are equal at this point, so those variables are excluded from the regression analysis, (Please see table 1).

Table 1: Descriptive analysis of the variables showing the significance

	Governmental or Private	N	Mean	Std. Deviation	T statistic	Sig (2-tailed)
Does the building suit the pattern of the surrounding area?	Governmental	147	2.9796	.82320	-3.250	0.001
	Private	113	3.2920	.69026		
Does the scale of the building match the scale of the surrounding buildings?	Governmental	147	2.9796	.70681	-4.573	.000
	Private	115	3.3739	.68134		
Does the building seem to fit harmoniously with adjacent land usages?	Governmental	144	2.7917	.89188	-3.415	.001
	Private	113	3.1504	.75854		
Do the building and its intended educational usage blend well with the type and appearance of adjacent buildings?	Governmental	146	2.8151	.87890	-3.658	.000
	Private	115	3.2174	.88637		
Do the subdivided parts of the building appear to have functions that are easy to identify?	Governmental	147	2.6463	.89751	.002	.998
	Private	113	2.6460	.91535		
Are the various parts of the building carefully planned in relation to one another and in relation to the characteristics of the site?	Governmental	144	2.5625	.78195	-4.444	.000
	Private	113	3.0177	.85547		
Does the relation between the building parts make it appear as one unified structure?	Governmental	147	2.8844	.91799	-3.632	.000
	Private	114	3.2807	.81478		

Is there a variation in the massing that provides interest and variety?	Governmental	146	2.2603	.91013	-3.736	.000
	Private	113	2.6991	.97179		
Are there sufficient routs, pathways, streets, and passageways provided for, and surrounding, the building?	Governmental	145	2.6759	.92708	-1.765	.079
	Private	114	2.9035	1.10485		
Do the routes link the building to the surrounding building structures?	Governmental	145	2.8621	.95467	-3.590	.000
	Private	115	3.2783	.89392		
Are the routes arranged with consideration of busy periods, quiet periods, regular movement patterns and traffic jams?	Governmental	144	2.5694	.94353	-3.194	.002
	Private	115	2.9391	.91082		
Are there nodes (meeting points) for traffic around the building?	Governmental	146	2.8356	.98979	-4.684	.000
	Private	115	3.3826	.86433		
Are all circulation routes within the building easily comprehended by newcomers, visitors, and service staff?	Governmental	146	2.5274	.99096	-2.954	.003
	Private	113	2.8850	.93305		
Are staff offices in accessible locations?	Governmental	145	2.7310	.93731	-2.087	.038
	Private	113	2.9646	.85491		
Does the building suit the students' ability to personalize their workspaces in addition to acceptability of noise levels?	Governmental	146	2.4863	1.02544	-3.217	.001
	Private	114	2.8684	.88761		
Does the classroom function in relation to other space requirements such as small group meetings and projects?	Governmental	146	2.6644	1.05880	-2.603	.010
	Private	114	2.9737	.85663		
Does the appearance of the building reflect its construction system and building materials?	Governmental	146	3.0616	.89614	-.486	.628
	Private	113	3.1150	.85306		
Do the building materials integrate well with each other; forming a pleasant appearance?	Governmental	145	2.6759	.86508	-5.903	.000
	Private	114	3.2895	.78395		
What's the effect of the interior cladding materials on the building users?	Governmental	147	2.5510	.84548	-4.425	.000
	Private	114	3.0000	.78706		
Is the texture of interior materials acceptable by students and staff?	Governmental	147	2.4354	.93683	-5.431	.000
	Private	113	3.0177	.79037		

An advanced analysis done through a Binary Logistic Regression, The above results of the hypothesis tests revealed:

- The subdivided parts of the building appear to have functions that are easy to identify.
- Sufficient routs, pathways, streets, and passageways are provided for, and surrounding, the building.
- The appearance of the building reflects its construction system and building materials.

The mentioned variables don't vary significantly between governmental and private universities. So, they will be excluded from the regression analysis. Since the number of independent variables is large, they are analyzed using a stepwise procedure. First, the measures of a model quality will be presented (Please see table 2). Those models are used when many variables are analyzed, and those tests revealed that regression is in a good quality state. Second, the regression model based on those qualities models is defined only by four variables (Please see table 3). This can increase the opportunities of raising the level of the governmental

faculties of engineering to reach the level of appreciation of those in the private sector universities.

When any of those variables is enhanced, one unit of expectation of the whole faculty increases according to the exp. (B) values of the table. For example, if the scale of the building in relation to the surrounding is enhanced one unit, the opportunity of the faculty enhancement increases 2.227. If the building materials are well-integrated with each other to form a pleasant appearance, this will increase the opportunities 1.845. Then the texture of interior materials and the relation between the building parts which makes it appear as one unified structure come after.

Table 2: Quality models of regression

Omnibus test of model coefficients	Chi-square = 65.404 Sig = 0.000
Pseudo R ²	Cox and Snell R ² = 0.241 Neglekerke R ² = 0.323
Hosmer and Lemeshow test	Chi-square = 12.578 Sig = 0.127

Table 3: The variable which can enhance the architectural design in governmental faculties (Arranged in order of importance)

	B	Sig.	Exp. (B)
Does the scale of the building match the scale of the surrounding buildings?	.801	.000	2.227
Does the relation between the building parts make it appear as one unified structure?	.446	.019	1.562
Do the building materials integrate well with each other; forming a pleasant appearance?	.612	.001	1.845
Is the texture of interior materials acceptable by students and staff?	.552	.004	1.736
Constant	-7.614	.000	.000

10. Conclusion

Our great governmental universities can compete with the private sector universities which have more financial resources, but they need guidance in highlighting what is needed to be done. This is what raised the research question: What controls the enhancement operation to let the universities compete with the private sector ones? The research challenge was to define the responsible variables, in order to recommend the start point which will increase the opportunities of perceiving university performance in a better way by the audience or the users; to be equivalent to the private sector ones. The research focused on the faculties of engineering, and specifically the architectural department. The main outcome of the research was defining the action needed and having it arranged in order of priority. It is also recommended to consider the material integration and most importantly; the suitability of the building scale in relation to the surroundings.

11. References

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Appendix 1

Questionnaire form

Facilities of Engineering Building Assessment Checklist

Faculty of Engineering - Building		Evaluation Levels			
		strong	moderate	weak	non exist
Urban Context	Does the building suit the pattern of the surrounding area? مدى مناسبة المبنى لمحتواه العمراني				
	Does the scale of the building match the scale of the surrounding buildings ? مناسبة مقياس المبنى لمقاييس مباني البيئة المحيطة				
	Does the building seem to fit harmoniously with adjacent land usages? درجة انسجام المبنى مع استخدامات الاراضي				
	Does the building, and its intended educational usage, blend well with the type and appearance of adjacent buildings? هل يوحي المبنى انه مبنى تعليمي من مظهره الخارجي				
Buildings Form	Do the subdivided parts of the building appear to have functions that are easy to identify? هل اجزاء المبنى تساعد في فهم وظيفة كل جزء بسهولة				
	Are the various parts of the building planned carefully in relation to one another, and in relation to the characteristics of the site? هل اجزاء المبنى مصممة بربط كل جزء معا ومع شخصية الموقع				
	Does the relation between the building parts make it appear as one unified structure? هل اجزاء المبنى او المبانى تظهر في هيكل واحد كوحدة مترابطة				
	Is there a variation in the massing that provides interest and variety? هل يوجد تنوع في الكتل يحقق اهتمام و تنوع جيد				
Approach and Entrances	Are there sufficient routes, pathways, streets, and passageways provided for - and surrounding - the building? هل يوجد تدرج في الطرق و الممرات و الشوارع حول المبنى				
	Do the routes link the building to the surrounding building structures? هل الطرق تربط المبنى بباقي المباني				
	Are the routes arranged with consideration of busy periods, quiet periods, regular movement patterns, and traffic jams? هل الطرق تعتبر في تصميمها الاوقات المزدحمة و المسارات العادية				
	Are there nodes (meeting points) for traffic around the building? هل يوجد ساحات تجمع				

Users' Satisfaction	Are all circulation routes within the building easily comprehended by newcomers, visitors, and service staff? هل مسارات الحركة واضحة للزوار الجدد و الطاقم				
	Are Staff offices in accessible locations? هل مكاتب طاقم العمل في اماكن سهلة الدخول				
	Does the building suit the students' ability to personalize their workspaces, in addition to noise levels? هل المبنى يمكن الطلاب من خلق فراغات عمل خاصة كمكان و بدون ضوضاء				
	Does the classroom function in relation to other space requirements; such as small group meetings, projects, etc...? هل قاعات الدراسة و الرسم مجهزة باماكن لاجتماعات مجموعات العمل و المشروعات المشتركة و غيرها				
Building Materials	Does the appearance of the building reflect its construction system and building materials? هل يعكس مظهر المبنى نظامه الانشائي و مواد بناؤه				
	Do the building materials integrate well with each other; forming a pleasant appearance? هل تتكامل مواد البناء و التشطيب مع البعض لتظهر شكل جيد للمبنى				
	What's the effect of the internal cladding materials on the building users? مدى تأثير مواد التشطيب الداخلي على المستعمل				
	Is the texture of interior materials acceptable for students and staff? هل ملمس التشطيب الداخلي متوافق مع كل من الطلاب و طاقم العمل				
Thermal Comfort	is the air temperature suitable? هل درجة الحرارة مناسبة داخل المبنى				
	is the humidity in ordinary rates? هل درجة الرطوبة مناسبة داخل المبنى				
	is the airvelocity stable? هل سرعة الرياح مستقرة				
	is the daylight and sun control suitably done? تواجد ضوء النهار بالمبنى و هل يتحكم به جيدا				