

The Islamic University of Gaza- Civil Engineering Department

Infrastructure planning and management

(ENGC 6342)

Lecture 5. Generic Matrix Approach

نهج المصفوفة العامة

By

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Generic Matrix Approach for Comparing Alternatives with Multiple Attributes Components

1

- A definition for each of two or more objectives.

2

- A Method for obtaining numerical values that express the degree of attainment **تحقيق** of each of the objectives.

3

- A method for considering society's preferences, which assists the analyst to make trade-offs among the objectives

4

- A method for comparing alternatives plans after completing these trade-offs.

Generic Matrix Methodology

1

- The characteristics of interest to the analyst and decision-makers are grouped in several “major categories of characteristics”

2

- Weights are established for each major categories of characteristics, in percentages so that the weights total **100%**, representing their relative importance to the society

3

- The “component” or individual characteristics of interest to analysts and decision-makers, are listed for each of the” major categories of characteristics .”

4

- Weights are established for each of components characteristics on (**Scale 1 – 3**) with integer values increasing for higher level of importance.

5

- Alternative plans are evaluated and compared, using the just-described systems of characteristics and weights and applying ratings for each of the component characteristics (**Scale 1-5**)

Example: The municipal offices of Gaza Town are located in a number of buildings in different part of the community:

- part of which are rented spaces in privately owned buildings.
- The population of the municipality is increasing rapidly with a greater need for municipal services.
- The municipality wishes to consider alternatives to the current situation, not only to provide larger capacity but also to improve efficiencies and perhaps costs through consolidations **دمج**, thus facilitating movement among offices by municipal employees and by citizens who often need to deal with more than one agency for construction permits and other matters.
- The following alternatives have been identified through a preliminary study by the Town Planning Department.
- The community is fairly flat with very little relief.
- Soils are sandy clay throughout, and ground water is twenty meter deep except in the central portion, where heavy withdrawals have raised the levels by 5 meter.
- All of the existing buildings are either one – or two – story.

Alternative 1: Existing arrangements would in general be retained. Modest improvements would be made at various locations.

ستبقى الترتيبات القائمة بشكل عام. سيتم إجراء تحسينات متواضعة في مواقع مختلفة

This would be a stopgap measure that would provide adequate capacity for about ten years but would not overcome the other problems mentioned.

سيكون هذا تدبيراً مؤقتاً من شأنه أن يوفر سعة كافية لحوالي عشر سنوات ولكنه لن يتغلب على المشاكل الأخرى المذكورة

A bus serve would be provided, which would probably have to be subsidized even if fares were charged, to connect the offices and reach parking areas in various parts of the community.

سيتم توفير خدمة الحافلات ، والتي من المحتمل أن يتم دعمها حتى لو تم تحصيل رسوم ، لربط المكاتب والوصول إلى أماكن وقوف السيارات في أجزاء مختلفة من المجتمع.

Alternative 2: A portion of the offices would be consolidated and enlarged at or near existing agencies, where they are located at sites in the outlying areas of the community, with available area for expansion.

سيتم دمج جزء من المكاتب وتوسيعه في أو بالقرب من الوكالات القائمة ، حيث توجد في المناطق النائية من المجتمع ، مع مساحة متاحة للتوسع.

Most of the other installations would be sold.

سيتم بيع معظم المنشآت الأخرى.

Consolidation would be single-story and, depending on architectural style and location, may intrude **ازعج** or be out of character with respect to their suburban neighbors.

سيكون الدمج في طابق واحد ، واعتمادًا على النمط المعماري والموقع ، قد يكون هذا النمط خارج السمات والنمط للضواحي المجاورة.

Existing buildings would be razed and new ones built with ample outdoor parking, and/or existing installations would be expanded more modestly to achieve a lower level of consolidation.

سيتم تدمير المباني الحالية وبناء المباني الجديدة مع مواقف فسيحة في الهواء الطلق ، و / أو سيتم توسيع المنشآت القائمة بشكل أكثر تواضعا لتحقيق مستوى أقل من الدمج

Bus services may still be considered to connect the fewer number of offices.

لا يزال من الممكن اعتبار خدمات الحافلات لربط العدد القليل من المكاتب المتباعدة

Alternative 3: The largest of the existing office buildings, a one-story building located in the center of the community and the most conveniently reached location (although parking nearby is sometimes difficult), would be enlarged by putting columns along the circumference of the building and increasing the height to two stories by extending over the existing building and partially out over the surrounding streets.

سيتم توسيع أكبر مباني المكاتب الموجودة ، وهي عبارة عن مبنى من طابق واحد يقع في وسط المجتمع والموقع الأكثر ملاءمة (على الرغم من صعوبة وقوف السيارات في بعض الأحيان) عن طريق وضع أعمدة على طول محيط المبنى وزيادة ارتفاع إلى طابقين من خلال توسيع المبنى الحالي وجزئيًا على الشوارع المحيطة

A two-story building would not exceed the height of the other buildings in the central area.

لن يتجاوز المبنى المكون من طابقين ارتفاع المباني الأخرى في المنطقة المركزية

Such construction would be too expensive to justify on-site indoor parking, but open-air parking would be provided at a distance of three-quarters of a mile, with shuttle bus service.

سيكون مثل هذا البناء مكلفًا للغاية لوجود موقف السيارات الداخلي في الموقع ، ولكن سيتم توفير مواقف السيارات في الهواء الطلق على مسافة ثلاثة أرباع ميل ، مع خدمة الحافلات المكوكية.

Alternative 4: The centrally located existing office building would be razed, requiring temporary housing of the current tenants, and a high-rise replacement housing almost all of the municipal agencies would be constructed with ample indoor parking.

سيتم تدمير مبنى المكاتب الحالي الموجود مركزياً ، مما يتطلب إسكاناً مؤقتاً للعاملين، وسيتم بناء مبنى بديل مرتفع يكفي لجميع الوكالات البلدية تقريباً مع مواقف سيارات داخلية وافرة.

Such a building would tower over its neighbors, especially if a portion of the site is landscaped, and traffic would increase in the central area.

مثل هذا المبنى سيطل على جيرانه ، خاصة إذا كان جزء من الموقع ذو مناظر طبيعية ، وستزداد حركة المرور في المنطقة المركزية

In the next page, it is required to

- Establish a matrix system for comparing the four plans for municipal offices for Gaza Town.
- Define the major objectives (or major categories of site characteristics).
- Assign a weight as a percentage to each objective, depending on its relative importance, so that they total 100 percent.
- Make a list of **component characteristics** that may be useful in analyzing each objective, and assign a weight of **1, 2, or 3** to each characteristic indication its importance, with **3** being the most important Using your judgment, assign **a rating** to each plan for each component characteristic of **1 to 5**, with the higher value corresponding to better site conditions with respect to that characteristic.
- Obtain comparative overall ratings for the plans, assuming that a score of 100 represents a perfect site. Recommend one or more official, citizen, and public interest organization groups that could be sources of individuals to serve as advisory groups for the studies of Problem.

Solution

		Alt. 1		Alt. 2		Alt. 3		Alt. 4	
Characteristic	Weight	Rating	PTS	Rating	PTS	Rating	PTS	Rating	PTS
Cost	%30	(1-3)	(1-5)	(1-5)		(1-5)		(1-5)	
razing cost <small>تكلفة الهدم</small>	2	4.7	9.4	1.5	3	4.6	9.2	1.5	3
construction cost	3	4.1	12.3	1.1	3.3	1	3	1.7	5.1
renting cost	2	4.5	9	4.3	8.6	3.9	7.8	2	4
installation cost	1	3.5	3.5	4.5	4.5	1.3	1.3	2.1	2.1
SUBTOTAL	8		34.2		19.4		21.3		14.2
MAXIMUM POINTS ESTIMATED	40								
PERCENTAGE			25.65		14.55		15.975		10.65

		Alt. 1		Alt. 2		Alt. 3		Alt. 4	
Characteristic	Weight	Rating	PTS	Rating	PTS	Rating	PTS	Rating	PTS
Engineering Feasibility	%40	(1-3)	(1-5)	(1-5)		(1-5)		(1-5)	
capacity	3	1.2	3.6	4.3	12.9	4.6	13.8	5	15
service	3	1.8	5.4	3.9	11.7	4.1	12.3	4.9	14.7
accessibility	3	2	6	2.4	7.2	4.2	12.6	4.8	14.4
parking	3	2.1	6.3	4	12	4.3	12.9	5	15
Congestion ازدحام	2	4.6	9.2	2.5	4.7	1.6	3.2	2	4
SUBTOTAL	14		30.5		48.5		54.8		63.1
MAXIMUM POINTS ESTIMATED	70								
PERCENTAGE			17.43		27.71		31.31		36.06

		Alt. 1		Alt. 2		Alt. 3		Alt. 4	
Characteristic	Weight	Rating	PTS	Rating	PTS	Rating	PTS	Rating	PTS
Public Support %10	(1-3)	(1-5)		(1-5)		(1-5)		(1-5)	
beneficiaries المستفيدين	3	3	9	3.5	10.5	3.7	11.1	4.7	14.1
neighbors	2	4	8	1.2	2.4	3.9	7.8	4	8
SUBTOTAL	5		17		12.9		18.9		22.1
MAXIMUM POINTS ESTIMATED	25								
PERCENTAGE			6.8		5.16		7.56		8.84

		Alt. 1		Alt. 2		Alt. 3		Alt. 4	
Characteristic	Weight	Rating	PTS	Rating	PTS	Rating	PTS	Rating	PTS
Socio-economic impact	%10	(1-3)	(1-5)	(1-5)		(1-5)		(1-5)	
income	3	3.2	9.6	4.2	12.6	4.4	13.2	4.6	13.8
recreational oppourtunities	1	1.5	1.5	1.8	1.8	2	2	4.5	4.5
public transportation	2	4	8	4	8	4	8	3	6
health and safety	2	3.8	7.6	4	8	4	8	4	8
SUBTOTAL	8		26.7		30.4		31.2		32.3
MAXIMUM POINTS ESTIMATED	40								
PERCENTAGE			6.675		7.6		7.8		8.075

		Alt. 1		Alt. 2		Alt. 3		Alt. 4	
Characteristic	Weight	Rating	PTS	Rating	PTS	Rating	PTS	Rating	PTS
Environmental impact	%10	(1-3)	(1-5)	(1-5)	(1-5)	(1-5)	(1-5)	(1-5)	(1-5)
water quality	3	3.9	11.7	3.4	10.2	2.8	8.4	2	6
air quality	3	4	12	4.2	12.6	2	6	2.5	7.5
construction nuisance	2	4	8	3	6	2	4	2.2	4.4
traffic nuisance	2	4.1	8.2	4	8	1.5	3	1.8	3.6
SUBTOTAL	10		39.9		36.8		21.4		21.5
MAXIMUM POINTS ESTIMATED	50								
PERCENTAGE			7.98		7.36		4.28		4.3
Overall Site Quality	100 %		64.53		62.38		66.93		67.92

The best alternative is alternative 4, since the overall quality for it is the largest among other alternatives (67.92%)