Multicriteria Assessment of Urban Development Projects – from Objectives to a Project Priority List

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1 ABSTRACT

Impact assessment is a crucial basis for decision-making. Characterization of projects, identifying objectives and indicators for the justification and comparison of alternatives represent essential elements of any impact assessment. Comparing alternatives against a set of objectives and criteria addresses different impact types, understanding merits of each option, and establishing a preference ranking calls for a framework to integrate information on effects and impacts, with values and preferences of decision-makers and stakeholders.

This paper refers to a study on "Integrated Urban Design Concepts" for the World Bank Consultancy for pilot cities under the "Uzbekistan Medium-Size Cities Integrated Urban Development Project" (MSCIUDP, World Bank, 2018). The focus of the paper is on multicriteria assessment that allows for a ranking of urban development projects for cities in Uzbekistan to enhance urban sustainability. The approach starts with the definition of a set of urban development objectives related to selected projects for several Uzbek cities. Based on the defined objectives, a set of indicators is extracted which allows describing the benefits on economic prosperity and well-being of society and on environment and climate improvement. Based on the assessment urban development projects shall be selected to be implemented in the pilot cities to foster their urban centrality.

The paper describes the suggested projects for one of the Uzbek cities, the selected indicators to examine wether the urban development objectives with their related criteria are met, and discusses details on quantifying, weighting and merging the indicators to achieve a final priority list.

Keywords: priority definition, assessment criteria, development objectives, urban development, Multicriteria asseesment

2 BACKGROUND AND OBJECTIVES

The "Integrated Urban Design Concepts" for the World Bank Consultancy was carried out by superwien urbanism ZT OG (project management), AIT-Austrian Institute of Technology GmbH and Umweltbundesamt Gmbh – with minor contributions. Superwien has designed a set of urban development projects together with AIT. AIT has carried out a spatial impact analysis to provide assessment indicators and conducted the assessment and prirotization of the designed projects.

A pilot city for which the assessment of the urban development projects has been carried out is Chartak (aka "Chortok"), a town with around 100,000 inhabitants, located in the Namangan Region in Eastern Uzbekistan. Projects in the framework of Uzbekistan Medium-Size Cities Development shall help to redirect in-migration from the capital city towards medium-sized cities like Chartak to allow a more balanced regional development of the country. The development of the medium sized cities as growth poles shall be fostered by strengthening the cities and especially the city centres through tailored urban planning and design activities. Only a populated centre can guarantee a lively urban city life with thriving local economies and the perspective for growth. The urban development challenges for Chartak are to make the city centre more attractive for the population, for entrepreneurs, as well as for tourists. (see: http://superwien.com/portfolio/chartak/)

The purpose of the assessment is to elaborate a priority list for the urban development projects, defined earlier, to foster urban centrality, economic prosperity and touristic attractiveness. The paper presents the activities of one work package of the project in the MSCIUDP framework: to describe, assess, and prioritize the suggested projects based on urban development objectives, related to a set of indicators. The evaluation and prioritization process will be conducted through a Multi-Criteria Analysis (MCA) that can be easily repeated and modified by the client himself. There are many different approaches (e.g. Haseli, et al. (2019). Ortiz G. et al. (2018)), as well as assessment tools (Weisroffer et al., 2005) available. But the requirement of the client was to provide a simple approach, that can be carried out with indicators which can be again easily derived with some basic spatial analysis skills, by using an easily accessible tool.

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3 PROJECTS, URBAN DEVELOPMENT OBJECTIVES AND RELATED INDICATORS

The general objective of the "Uzbekistan Medium-Size Cities Integrated Urban Development Project" is to improve state and dynamics of medium sized cities in Uzbekistan. Improving the city of Chartak shall be carried out by developing a set of projects which are fostering urban centrality, improving the built-up environment as well as the blue-green infrastructure of the city. The paper describes the approach based on these projects, as carried out during summer 2019 at an early project stage, indicators have been later recalculated (accessibility, spatial extent, costs) and the judgement has been changed later.

The addressed projects are the following:

A. Old Bazaar

B. Central Park

C. Walkable Corridor

D. New Bazaar

E. Western Waterfront

F. Urban Upgrade (Alisher Novoiy Mahalla)

G. Eco-trail

H. "Chartak City" Development

The map below gives the overview of location and extent of these projects within the city centre.

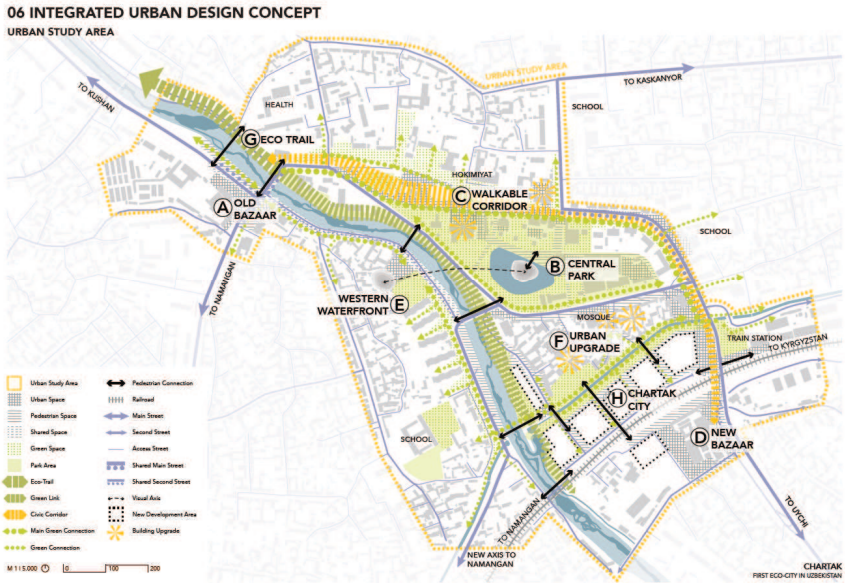

Fig. 1: Urban development projects for Chartak (Version June 2019)

Source: Superwien et al. (2019) Overall investment program for Chartak, Report Task 2. Version July 2019

The eight projects can be described roughly in the following way:

A - Upgrade of the Old Bazaar

This project proposes the redesign of public spaces adjacent to the Old Bazaar into a pedestrian friendly area with WIFI spots, trees and pergolas providing shade among other urban furniture. The road sections will be partly redesigned into shared-spaces. Speed bumps at the entrance points to the shared spaces will lower the speed for individual car traffic. The Eco-trail, which has its entry point there, will be integrated through a walkable access.

B –Central Park Revitalization

Through the redesign of the Central Park, the city centre will get a facelift of its most important and central green area. The pond will be revitalized, and a small bridge will allow access of the historic hill of Chartak. The park will have more trees that provide shade that will serve as a recreational park. The renovation of the Cultural Pavilion will be essential to activate the park and will create a link to the Walkable Civic Corridor.

C – Walkable Corridor

The main street of Chartak will be partly converted into a pedestrian zone or shared spaces with attractive pocket parks and green spaces. The first section will be car free and fully pedestrian. Important attractors will be the renovated Kindergarten with its new function as a gallery. Bike lanes and green pockets are implemented throughout the whole street. The railway bridge is the entry of the Civic Corridor and will be renovated.

D – New Bazaar

The public space adjacent to the new bazaar will be upgraded into a pedestrian friendly environment. A new bus station will be located closely that customers can reach the market conveniently. A new parking lot in the back also will serve the bazaar. New pedestrian connections to the surrounding areas across the railway facilitate better access to the new market.

E –Western Waterfront

The Western Waterfront will be converted into a linear park with a promenade and extensive green spaces. A public plaza will be equipped with benches and other street furniture. Trees and pergolas will provide shade. A community center will stimulate the plaza and its use for the surrounding communities. A new pedestrian bridge will serve as a link to the Eastern part of the waterfront and the Central Park.

F – Urban Upgrade of Alisher Novoiy Mahalla

The traditional residential use will be kept through the upgrade of this mahalla (neighbourhood). The streets will be renovated with an improved water and sewage system. The local mosque will be renovated, and its adjacent public space will be upgraded. Along the water channel, an esplanade with trees will be constructed. Also, a new park at the river will be built and a development site for new housing in the center is identified.

G – Eco-Trail

The Eco-Trail along the Chortoksoy river has its entry point at the Old Bazaar and leads to the water reservoir, a sanatorium and pilgrimage sites. The trail will have a length of 12 km, of which 5 km is located in the urban area of Chartak. It will be established as a 5 meter wide trail with a 5 – 10 m green buffer zone and seven attractor-zones (of approximately 100 m2), with 7 platforms to watch wild life and nature.

H – “Chartak City” - New Residential and Business Hub

This project will be a brownfield development of a former coal storage site that will include the integration of the railway station. The project will trigger private housing development on defined urban development areas, an education center including a public library in the area serves as an urban attractor. A 30 m wide linear park along the water channel will be estabished and new walkable connections to the mahalla and the new bazaar will be implemented.

For these projects a framewortk of major objctives has been defined: (1) Foster local identity, (2) Foster economic develoment and tourism, (3) Increase connectivity, (4) Foster residential functions in the centre, (5) Provide public greenopen spaces, (6) Improve non-motorized mobility.

These objecties are related to the eight projects serving as basis for indicators to assess and rank the projects with respect to the city’s benefits. The assessment and ranking / prioritization of the projects does not require to integrate all possible indicators. Here just a set of selected representative key performance indicators is defined, which allows to judge how the objectives are met by these projects. The addressed indicators refer to the number of affected inhabitants, number of affected workplaces, accessibility, extent of area by selected functions representing different aspects of urban development, as well as expected costs.

The number of population/workplaces within a distance range, do not only show the quality of accessibility but the amount of people living or working near these projects, which will experience their positive impact first. The land use classes by area indicate the increase of space for selected functions, making places more attractive. Green areas and shaded space indicate climate adaptation effects with respect to cooling.

The indicators are the following (the relation to the objectives shown above are listed in brackets):

- Population number within 15 minutes walking distance (1,3,4,6)
- Workplaces number within 15 minutes walking distance (2,3,6)

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- Pedestrian area, bike lanes (1,2,4,3)
- Urban area, commercial / mixed use (4,1)
- Cultural heritage area – site nearby (1,2,4,5)
- Social/ cultural – infrastructure (4,5,6)
- Recreation area, green space (additional shaded area) (4,5)
- Costs (divided into public and private costs to be covered by potential investors)

The following table shows the indicators for the 8 projects serving as proxies for accessibility, multi-functionality, and climate sensitivity:

Indicators / Projects	population within 15 min	workplaces within 15 min	pedestrian area/bike lane	Urban (commercial, mixed use)	culture, heritage	social, cultural infrastructure	recreation /green area
Old Bazaar improvement	8.000	5.000	19.300		510	-	
Central Park construction	9.850	4.340	-	16.500	2.600	-	41.600
Walkable civic corridor	10.300	4.480	25.900		3.900	2.200	
New Bazaar and Business Disrict	3.000	2.000	-	17.200	-	-	1.370
Public space along Western waterfront	10.800	4.300	6.900	4.100	-	1.250	7.500
Urban Upgrade Alisher.Nov.Mahalla	3.500	2.000	3.800	9.000	1.100	-	17.200
Ecotrail construction	15.000	5.500	3.200		700	-	99.999
Chartak City	5.000	2.000	10.100	9.300	300	3.300	22.500

Table 1: Indicators for project assessment. Source: AIT (2019) Overall investment program for Chartak, Report Task 3. Version July 2019

4 ASSESSMENT APPROACH AND APPLICATION - RANKING OF PROJECTS

There exist various sophisticated approaches to merge variables to common indicators – like factor analysis, cluster analsis etc. (c.f. Johnson, et al., 2007), all requiring statistical transformation and standardization. But the concept here is to provide a simple as possible transformation and aggregation technique which can be understood by every stakeholder, involved in the assessment process. As the indicators are quantified through different units, they must be transformed into ordinal-scaled indicators, which can then be aggregated in an additive way and can thus be further weighted to consider the different impact of the project tasks towards the initially defined development goals. Thus transformation towards ordinal scale with identical ranges and additive merging of the transformed indicators has been carried out. The transformation has been conducted achieving values between 0 and 10 where 0 indicates little impact and 10 indicates very high impact. The transformation equation has the following form:

$x^*_{p,i} = (x_{p,i} / (\max(x_i) - \min(x_i)) * 10 \quad (1)$,

where

$x_{p,i}$ = indicator x describing project (p),

$x^*_{p,i}$ = transformed indicator x judging project (p),

$\max(x_i) - \min(x_i)$ = the range of indicator x_i for all projects (p) as transformation base

Then a further weighting when summarising the transformed indicators towards weighted scores has been carried out to inegrate the importance of the indicators in representing to meet less or or more objectives by implenting the projects. The score S_p (the weighted sums) for each project have been calcuated by multiplying the transformed indicators with the particular weight w_i before summarizing, using equation 2:

i

$$S_p = \sum (x^*_{p,i} * w_i) \quad (2)$$

All calcluations have been conducted through an MS Excel spreadsheet with embedded equations, allowing all stakeholders for interactive changes of tranformation and weighting. The following table depicts the output: the transformed indicators, weights (below), weighted sums (scores) and initial ranking.

Indicators / Projects	population within 15 min	workplaces within 15 min	pedestrian area/bike lane	Urban (commercial, mixed use)	Public infrastructure, culture, heritage	social, cultural infra.	recreation /green area	weighted sum	rank
Old Bazaar improvement	5	9	7	-	1	-	-	**3,2**	**6**
Central Park construction	7	8	-	10	7	-	4	**5,0**	**3**
Walkable civic corridor	7	8	10	-	10	7	-	**6,1**	**1**
New Bazaar and Business Disrict	2	4	-	10	-	-	0	**1,8**	**8**
Public space along Western waterfront	7	8	5	2	-	4	1	**3,9**	**5**
Urban Upgrade Alisher.Nov.Mahalla	2	4	3	5	3	-	2	**2,4**	**7**
Ecotrail construction	10	10	6	-	2	-	10	**5,8**	**2**
Chartak City	3	4	8	5	1	10	2	**4,4**	**4**
weight	**1,0**	**1,0**	**0,5**	**0,5**	**1,0**	**1,0**	**1,0**	**6,0**	

Table 2: Project comparison –transformed indicators and weights, scoring, initial ranking. Source: AIT (2019) Overall investment program for Chartak, Report Task 3. Version July 2019

Then a final prioritization has been conducted considering cost efficiency and quick wins by modifying the ranks by adding bonus points (between 0 and 2). The lower the investment costs are and the faster a project can be implemented the more bonus points are distributed, as decided during stakeholder discussions.

Ranking / Projects	weighted sum	rank	area m2	Invest in Mill USD	Triggered invest > Mill USD	bonus for cost-efficiency,	bonus for quick wins	weighted sum 2	final rank
Walkable civic corridor	**6,1**	**1**	234.325 m²	3,1	-	**1**	**2**	**9,1**	**1**
Ecotrail construction	**5,8**	**2**	199.549 m²	5,0	-	**0**	**2**	**7,8**	**2**
Central Park construction	**5,0**	**3**	60.170 m²	4,6	-	**0**	**2**	**7,0**	**3**
Public space along Western waterfront	**3,9**	**5**	25.975 m²	1,7	-	**2**	**1**	**6,9**	**4**
Old Bazaar improvement	**3,2**	**6**	23.660 m²	1,7	-	**2**	**1**	**6,2**	**5**
Chartak City	**4,4**	**4**	54.208 m²	5,1	40,0	**0**	**0**	**4,4**	**6**
New Bazaar and Business Disrict	**1,8**	**8**	23.245 m²	1,5	-	**2**	**0**	**3,8**	**7**
Urban Upgrade Alisher.Nav.Mahalla	**2,4**	**7**	76.550 m²	2,8	-	**1**	**0**	**3,4**	**8**

Table 3: Final project prioritization – initial ranking, areal extent, costs, bonus points, final ranking. Source: AIT (2019) Overall investment program for Chartak, Report Task 3. Version July 2019

Table 3 depicts again the initially weighted scores, the initial ranks and as further information the project extent, leading to the final weighted scores and ranks for the projects.

The project prioritization with some important arguments and public costs are shown in the following list:

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(1) The Walkable Civic Corridor is expected to improve the accessibility and walkability of the city center – the costs are compared to the spatial extent moderate (3.1 M USD).

(2) The Eco-trail Project is matching with the objectives to become an ECOCITY and fostering tourism. Costs are compared with the impact on tourism, on local identity, boosting non-motorized traffic and the spatial exent of the project reasonable (5 M USD).

(3) The Central Park Project costs of 4.6 M USD are rather high, but the park would serve as attractive recreation area with an additional large scale cooling effect in the city centre.

(4) The Western Waterfront is expected boosting the attractiveness of centre and neighbourhood. The costs are, compared to the spatial extent of the project low (1.7 M USD).

(5) The Old Bazaar improvement will support fostering local identity, but will have no additional effect on economy. The costs are rather low (1.7 M USD), so quick wins can be expected.

(6) The "Chartak City" development will provide new housing and commercial use with high costs (5.1 M USD) to provide the basic infrastrucure there. Private investments of 40 M USD are required.

(7) The New Bazaar is expected to support local economic development south east of the center. Costs are expected to be low (1.5 M USD).

(8) The Urban Upgrade of the Alisher Mahalla will improve the local housing quality with high costs (2,8 M USD). It will only affect the population living there but not the whole city.

If the costs for all projects exceed the city budget, ranking gives priority to projects within the budget range.

5 DISCUSSION AND CONCLUSIONS

This multicriteria assessment is based on 4 steps: (1) definition of indicators reflecting criteria meeting the objectives, (2) transformation of the indicators to allow further merging, (3) initial weighting of the projects and (4) modifying the scores through additional points. While step 1 and 2 delivers objective results, step 3 adds a general weighting to the transformed indicators establishing an initial scoring, while step 4 interferes heavily through bonus points, changing the results in a distinct, subjective way. Although possible the stakeholder bonus points distribtuion does not affect the first places – ranks 1 and 2 remain at the same place, ranks 3 to 6 swap, while ranks 7 and 8 remain at the last places.

The client requests an approach, which provides initial expert judgement, but allows also to modify the outcome by adding own preferences. Enabling the distribution of individual bonus points allows controlling the assessment results by including own – subjective - policy opinions after recognizing the experts' objective judgement. Thus, this mixed objective-subjective assessment by adding step 4 to the process lead to satisfying results for the client as the initial assessment approach provide valid multcriteria assessment results reflecting the experts' opinions, which can be fully or partially accepted and finally modified by adding the client's policy preferences.

This mix of objective and subjective assessment is from a scientific viewpoint not correct, but allows the client to finally keep control. When working for clients the scientifically correct way is not always what the clients want. Working as policy advicers, requires to accept that decision making is the final responsibility of policy makers not of the experts which just support decision making.

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