Economic Assessment of Inclusive Tourism in a Silk Road Heritage Destination: A Monte Carlo Simulation Study of Samarkand, Uzbekistan

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Abstract. This study assesses the economic potential of inclusive tourism in Samarkand as a Silk Road heritage destination. The analysis applies Monte Carlo simulation to evaluate two key aspects: the profitability of inclusive services at the hotel level and the expenditure structure of an inclusive tourist during a five-day trip. The hotel model shows that the most favorable service price is around 140,000 UZS, where expected profit reaches its highest level and the probability of obtaining a positive result remains relatively strong. The results also indicate that prices above 230,000 UZS significantly reduce the likelihood of profitability. From the consumer perspective, the expenditure model reveals that inclusive tourism generates considerable spending not only on accommodation but also on transport, recreation, shopping, and related support services. Among all expenditure components, caregiver service has the strongest effect on total expenditure, followed by recreation, shopping, and transport. These findings suggest that inclusive tourism in Samarkand should be viewed not only as a social necessity but also as a promising economic market segment. The study contributes to the literature by offering a simulation-based approach to destination-level economic planning for inclusive tourism.

Keywords: Inclusive Tourism · Accessible Tourism · Monte Carlo Simulation · Tourism Expenditure · Economic Assessment

1 Introduction

Inclusive tourism is now considered not only a social but also an important economic aspect of tourism. According to the World Health Organization, about 1.3 billion people in the world, or about 16% of the global population, live with a significant degree of disability [1, 2]. This reinforces the need to develop tourism services in a more accessible and safe way for all.

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According to the UN Tourism and ISO 21902 approach, accessible tourism for all involves ensuring equal and convenient access at all levels of the tourism value chain - information, transport, accommodation, services and use of tourist facilities [3, 4]. Therefore, inclusive tourism is not a separate social service, but a direction that enhances the destination's competitiveness, the scope of services, and the possibilities for sustainable development.

This issue is especially relevant for Silk Road heritage destinations. Historical cities such as Samarkand are distinguished by their cultural heritage, international tourist flows and the diversity of services [5–10]. However, the economic aspects of inclusive tourism in such destinations, in particular the composition of tourist spending, the acceptable price of services and the probabilistic assessment of market potential, have not yet been sufficiently studied. Most existing research focuses on barriers, infrastructure, and ease of use, while economic modeling is less common [11–14].

In this context, the purpose of this study is to assess the economic impact of inclusive tourism in the Silk Road heritage destination of Samarkand. The article analyzes the costs of inclusive tourism, the acceptable range of service prices, and economic efficiency for tourism entities using a Monte Carlo simulation. Such an approach enhances decision-making under uncertainty and helps to justify inclusive tourism as a factor of sustainable economic development. Monte Carlo simulation has been used in tourism economics as a useful tool for assessing uncertainty and economic impact [15, 16].

2 Literature Review

In the existing scientific literature, inclusive tourism has been studied mainly in relation to reducing physical, informational, and organizational barriers to the use of tourism services. At the same time, some studies view accessibility as a factor that enhances a destination's competitiveness; in particular, Porto et al. showed that a region's competitive advantage increases with tourism accessibility [17, 18]. European-wide assessments have revealed that the accessible tourism segment has significant economic potential: in 2012, demand from travelers with special access needs generated economic benefits of hundreds of billions of euros in the European Union, and this demand is projected to increase further [19, 20]. These conclusions indicate the need to view inclusive tourism not only as a mechanism for social support but also as a source of economic growth and the expansion of the service market [21].

In tourism economics research, tourist spending has emerged as a distinct field, and Brida and Scuderi have shown that analyzing the volume of spending and the factors that affect it at the microeconomic level is important for assessing the real economic impact of tourism [22]. Subsequent studies have found that tourist spending is significantly influenced by trip duration, travelers' income, group composition, mode of transport, and accommodation choice [23]. It has also been noted that the itemized expenditure approach, that is, the study of expenses by accommodation, food, transport and other components, provides a deeper economic conclusion than the total amount of expenditure [24]. However, most of the work in this area has focused on the flow of ordinary tourists, and the cost structure of inclusive tourists who use additional services, such as accompaniment, adapted transport, or special accommodation, has not been sufficiently

covered. This gap is especially noticeable in Silk Road destinations such as Samarkand, where heritage and services are combined [19].

The issue of assessing the tourism market under uncertainty is also gaining increasing attention in the literature. Recent work has shown that Monte Carlo simulation is a useful tool for assessing tourism demand, economic impact, and possible scenarios [15, 25]. In particular, this method is significant in that it shows a range of possible outcomes, not just the average value. However, the existing literature still has very limited application of Monte Carlo simulation to the assessment of inclusive tourism costs, the acceptable range of service prices, and economic efficiency [26]. Therefore, assessing the economic potential of inclusive tourism through a simulation approach in the case of Samarkand helps fill the existing scientific gap in this topic.

3 Materials and Methods

This study used the Monte Carlo simulation method to assess the economic potential of inclusive tourism in the Samarkand region. The analysis was conducted in two directions. In the first direction, the profitability of a hotel providing inclusive services was modeled. In the second direction, the composition of the 5-day travel expenses of an inclusive tourist and their possible changes were estimated. The model was used in conjunction with a scenario analysis approach suitable for decision-making under uncertainty.

The number of inclusive tourists visiting the hotel in the model was expressed based on the Binomial distribution:

$$P(N = k) = \binom{n}{k} p^k (1 - p)^{n-k} \tag{1}$$

Here, denotes the number of tourists, the number of trials, and the probability of attracting a tourist. In the model, the number of potential customers was set at 5,000, while the probability of acceptance was assumed to be 0.55. Market prices for inclusive services were modeled using a Normal distribution:

$$P_m \sim N\left(\mu, \sigma^2\right) \tag{2}$$

where = 150,000 UZS represents the average market price and = 60,000 UZS is the standard deviation. It was assumed that when the hotel's offered price was lower than the market price, the service would be purchased; otherwise, demand would decline and the risk of loss would increase. Total hotel costs were calculated as the sum of fixed cost and variable cost:

$$TC = FC + VC \tag{3}$$

where = 36,000,000 UZS, while was specified using a Normal distribution as (100,000,000, 30,000,000^2). Hotel profit was defined as follows:

$$\pi = R - TC \tag{4}$$

where denotes revenue and total cost. The probability of making a profit was calculated as the share of simulation runs in which profit was positive. In total, 1,329 simulation outcomes were generated for the hotel model.

The expenses for an inclusive tourist on a 5-day trip were divided into two categories: basic and contingent. Basic expenses included transportation, accommodation, food, shopping, and recreation. The minimum, expected, and maximum values for these expenses were determined based on the questionnaire results and data from the Booking.com platform. These parameters are presented in Table 1.

Table 1. Main Expenditure Items of an Inclusive Tourist for a 5-Day Trip, USD.

Expenditure item	Minimum value	Expected value	Maximum value
Transport	50	150	800
Accommodation	50	100	500
Food	50	125	600
Shopping	25	250	600
Recreation	100	250	800

The PERT distribution was used for the main costs because it produces a relatively realistic distribution based on minimum, most likely, and maximum values. The expected value in the PERT distribution is calculated as follows:

$$E(X) = \frac{a + 4m + b}{6} \tag{5}$$

where is the minimum value, is the most likely value, and is the maximum value. This approach assumes that costs tend to be shaped by the most likely value.

Probable costs included medical services and caregiver services. Their probability of occurrence was also estimated based on the questionnaire and is presented in Table 2. These costs were modeled using a combination of the Bernoulli and PERT distributions.

Table 2. Probabilistic Expenditure Items of an Inclusive Tourist, USD.

Expenditure item	Probability of occurrence	Minimum value	Expected value	Maximum value
Medical service	15%	50	200	1000
Caregiver service	25%	250	500	1000

The likely costs were estimated as follows:

$$B \sim \text{Bernoulli}(p) \tag{6}$$

where takes the value 0 or 1, i.e., it represents the cases where the cost did not occur or did occur. The total cost is then expressed as:

$$C_{total} = \sum_{i=1}^{5} \mu_i + \sum_{j=1}^{2} e_j \tag{7}$$

where is the main cost, is the potential cost. The calculations were performed in MS Excel, and 1500 random values were generated to assess the distribution of total costs, the cumulative distribution, and the relationship between cost types and total cost.

4 Results

The results of the Monte Carlo simulation showed that pricing is a crucial issue for a hotel providing inclusive tourism services in Samarkand. Figure 1 shows the changes in expected profit and the probability of profit as a function of the service price. As shown in the graph, the hotel's highest expected profit occurs when the price of the inclusive service is set at 140 thousand UZS. At the same time, the probability of making a profit at this point is also quite high, and according to the model, the hotel achieves a positive result in about 60% of cases. This situation shows the importance of setting prices in the inclusive services market, not maximum prices, but in a competitive range close to the market price. Based on the results, the 80–150 thousand UZS range for the optimistic scenario, the 150–230 thousand UZS range for the baseline scenario, and the price range above 230 thousand UZS for the pessimistic scenario were considered typical. Especially at prices above 230,000 UZS, the fact that the profit probability drops to almost zero indicates that the hotel's risk of loss increases sharply.

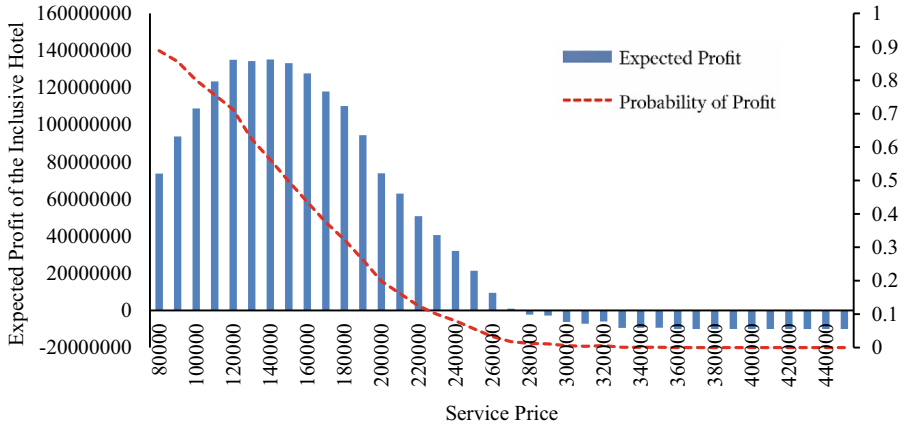

Fig. 1. Distribution of Expected Profit and Profit Probability.

The results of the simulation of the composition of expenses for an inclusive tourist on a 5-day trip are shown in Fig. 2. The graph shows the distribution of transportation, accommodation, food, shopping and recreation expenses for 1,500 simulations. Among these distributions, recreation expenditure is particularly distinguished by its relatively wide range of variations. In most cases, recreation expenses range from 200 to 400 US dollars, indicating that they account for a significant share of an inclusive tourist's total expenses. Although the remaining expense types also fluctuate within a certain range, their degree of change and their impact on total expenses differ. In this regard,

Fig. 2 shows not only the distribution of expenses by individual but also the services that constitute the structural composition of an inclusive tourist's expenses.

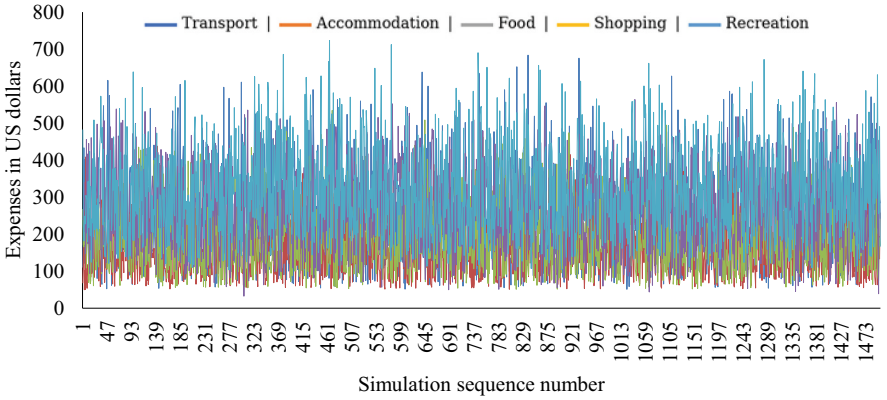

Fig. 2. Distribution of Main Expenditure Items across Simulations.

The cumulative distribution of the total 5-day expenses is presented in Fig. 3. This graph clearly shows that inclusive tourist expenses are not fixed at a single value but lie within a range. According to the model results, in 72% of cases, the total expenses are less than 1564 USD. In 50% of the experiments, the 5-day expenses are equal to or less than 1300 USD, and in 10% of the cases, they are 920 USD. These results show that consumer expenses can be quite high in the inclusive tourism segment. If these values are converted to daily terms, 1300 USD over 5 days averages 260 USD per day, and 920 USD averages approximately 184 USD per day. Based on this, the inclusive tourism market can be considered a segment with relatively high revenue potential for tourism entities.

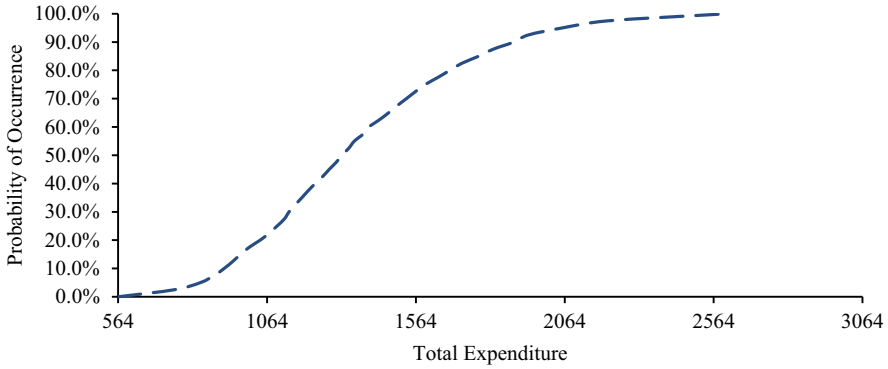

Fig. 3. Cumulative Distribution of Total Expenditure of an Inclusive Tourist.

The impact of expenditure types on total expenditure was assessed using correlation analysis, as shown in Fig. 4. The results indicate that caregiver services had the greatest impact, accounting for 67% of total expenditure. The following were recreation (35%), shopping (35%), transport (33%), medical service (28%), food (24%), and accommodation (23%). This result shows that additional and accompanying services are the most important economic factor in inclusive tourists' expenditure. In other words, as inclusive tourism develops, revenue is generated not only in the hotel and accommodation sector but also through related services such as caregiving, medical services, recreation, and trade. Therefore, Fig. 4 is one of the most important results showing that inclusive tourism has a multi-sectoral economic impact.

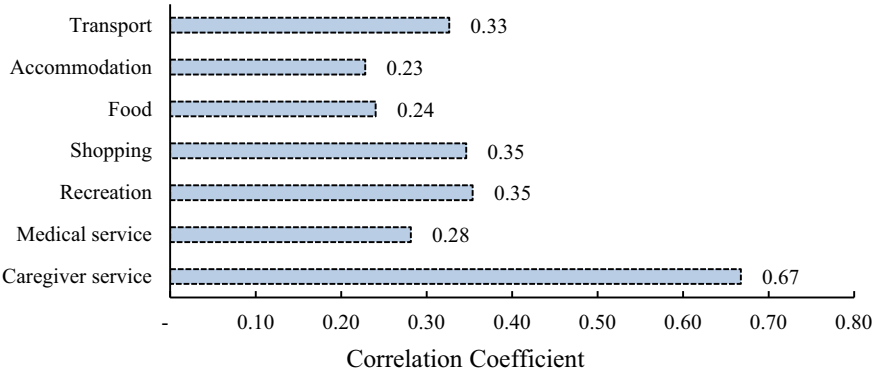

Fig. 4. Correlation between Expenditure Components and Total Expenditure.

In general, the results indicate that inclusive tourism is not only a socially important direction for the Samarkand region but also a promising market from an economic perspective [26]. At the hotel level, the right pricing strategy increases the likelihood of profitability, and at the consumer level, spending volume over 5 days confirms that this segment creates sufficient value for the services market. In particular, the strong influence of caregivers and related services indicates the need to expand these services to support the development of inclusive tourism in Samarkand.

5 Discussion

The results of this study show that inclusive tourism is a trend with not only social but also clear economic potential in the context of a Silk Road heritage destination like Samarkand. This conclusion is consistent with European studies showing that the economic contribution of the accessible tourism market is significant; in particular, people with access needs typically travel with an average of 1.9 companions, and the economic contribution increases further as accessibility improves [27].

The optimal service price, determined by the hotel model at around 140 thousand soums, and a sharp decrease in profit probability after 230 thousand soums, partially confirm and partially clarify some previous studies. For example, Liu found that travelers

with disabilities are more willing to pay for certain accessible travel products, especially accessible accommodation and equipped transport [28]. However, our results show that this willingness is constrained by the overall travel budget, as inclusive tourists also incur additional costs for accommodation, transport, recreation, medical support, and caregivers. Therefore, in the Samarkand context, it is more important to balance the pricing strategy with the service package than to simply increase prices. This is also consistent with hotel-level research showing that the economic impact of accessibility is more evident through social innovation and proper service organization [21].

Another important result is that the largest impact on total expenditure was from caregiver services. This finding is consistent with the companion effect in accessible tourism studies in Europe [27]. However, in the case of Samarkand, this effect was relatively stronger. This can be explained by the dispersed location of historical sites, the complexity of physical movement in some areas, and the higher need for additional organizational support along heritage routes. Thus, the inclusive tourism economy here is built on a tourist-plus-support system model rather than an individual-tourist model.

The significant role of recreation, shopping, and transportation expenses also underscores the need to assess expenses not as a single total, but by their components. This result is consistent with studies on itemized expenditure: Marrocu et al. showed that trip duration, income, group composition, and mode of transport significantly affect tourist expenditure, while Massidda et al. found that the determinants of the cost components differ [23, 24, 29]. Our results confirm this general pattern but show one important difference: while accommodation is often the central focus of ordinary tourists, in inclusive tourism, additional services, such as caregiver services and medical support, significantly alter the economic structure. In this regard, the development of inclusive tourism in Samarkand requires the formation of a single service package that includes caregiver support, medical support, adapted transport, and clear access information, not limited to physical accessibility [30]. Recent studies on the accessible tourism value chain have also identified information completeness and service interconnections as weak points [31, 32].

6 Conclusion

This study showed that inclusive tourism in Samarkand is not only socially significant but also a direction with clear economic potential. The results of the Monte Carlo simulation confirmed that the right pricing strategy is important in the inclusive services market, and at the hotel level, profitability is maintained within a certain price range. At the same time, an analysis of the 5-day expenses of inclusive tourists showed that this segment can also be a real source of income for accommodation, transport, recreation, and other related services.

One of the most important results of the study is that caregiver services and other additional services play a decisive role in the total costs. This means that, in the development of inclusive tourism, it is necessary to create a single package of services, not limited to physical accessibility, but also including caregiver support, medical support, adapted transport, and accurate access information. Overall, this study offers a useful approach for planning inclusive tourism on economic grounds and for making practical decisions in Silk Road heritage destinations such as Samarkand.

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