

## Article

# Adaptive Reuse for Sustainable Development and Land Use: A Multivariate Linear Regression Analysis Estimating Key Determinants of Public Perceptions

Ioannis Vardopoulos 

Department of Economics and Sustainable Development, School of Environment, Geography and Applied Economics, Harokopio University (HUA), 17676 Kallithea, Attica, Greece; ivardopoulos@post.com

**Abstract:** Adaptive reuse is a rapidly expanding frontier study area across the world. Adaptive reuse can have a significant influence in relation to contemporary trends in (peri-)urban sustainability, especially considering the past decades of the human-caused depletion of natural resources and environmental pollution. Adaptive reuse developments, which manage to incorporate a (scientifically) predefined set of conceptual theories, policy principles, and practical tools, as all the available data suggest, can achieve a good balance between invested capital, ecological conservation, the preservation of the cultural heritage, and sustainable urban regenerative renewal. This study focused on the recent FIX Brewery adaptive reuse project in Athens, Greece, as a means to establish the key public perception determinants of the adaptive reuse practice impacts on (peri-)urban sustainable development. Evidence for the relationships among five factors was provided through multiple linear regression analysis. The new empirical findings are likely to encourage concerned parties and stakeholders, and particularly regulatory entities, to pursue essential actions to set adaptive reuse at the core of urban and spatial masterplans, paving the way toward sustainable and circular cities.

**Keywords:** adaptive reuse; sustainability; circular economy; urban regeneration; industrial heritage; statistical analysis



**Citation:** Vardopoulos, I. Adaptive Reuse for Sustainable Development and Land Use: A Multivariate Linear Regression Analysis Estimating Key Determinants of Public Perceptions. *Heritage* **2023**, *6*, 809–828. <https://doi.org/10.3390/heritage6020045>

Academic Editor: Patricia Sanmartín

Received: 17 December 2022

Revised: 14 January 2023

Accepted: 16 January 2023

Published: 19 January 2023



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## 1. Introduction

Numerous underutilized and abandoned assets have resulted from deindustrialization in Europe [1]. Many factories have been shut down, and many industrial sites have been deserted [2]. This tendency has also formed the commonly known “black holes” in the urban morphology of cities, packed with underutilized and vacant installations waiting to be reborn [3]. These abandoned industries are actually untapped sources that can help make cities more desirable places to live in from the perspectives of the environment, the economy, the sociocultural context, architecture, and tourism [4–7]. Industrial institutions served as the main driving force behind social economic growth at the start of the nineteenth century, acting as representations of neoliberalism and power [8,9]. A number of these industrial units have now been reduced to bare monuments, disrupting the city’s continuity and symbolizing abandonment and degradation [10,11].

The pressing issue of unplanned and unsustainable urban expansion and growth [12–15] has sparked attempts to revitalize these no-longer-in-use developments [16]. Protecting, preserving, and reusing past industrial installations contributes to the development of an increasingly condensed and functionally organized community system [17], in addition to supporting (peri-)urban regenerative initiatives [18]. The concept of urban renewal encompasses a wide range of interconnected perspectives, such as social, cultural, ethical, legal, technical, and environmental [19–23].

Therefore, it is not surprising that professionals and government officials have shown a keen interest in recent years in creating strategies for the adaptive reuse of the available stock of abandoned architecture, especially culturally significant industrial complexes [21,24–26].

In order to preserve historic industrial setups, both national and international organizations stress the importance of establishing intervention targets and intermutual functional, conversion, and reuse opportunities; mechanisms; and assessment criteria [27,28].

In terms of functional changes, adaptive reuse includes a variety of options, from residential to non-residential. In particular, properties that have been successfully converted into non-residential public-use premises in the cultural context, namely museums, libraries, and similar institutions, are recognized as a means of sustainable urban renewal. Beyond the extension of the structure's lifecycle, the waste reduction, the reuse of energy, etc., significant direct and indirect economic and sociocultural benefits are brought to the community. This functional option helps preserve the character and legacy of certain eras; the city's identity [29,30], history, and culture [31,32]; and the community's ethos [33,34], so that they can be experienced and appreciated by both the present generation and the generations to come, whether as part of the community or just as visitors.

As long as it involves changing the functions of old and neglected developments to counterbalance sustainability concerns in terms beyond just the perceptions of the purpose and lifecycle of buildings (from design to demolition), the adaptive reuse of industrial properties of cultural significance—hereafter simply referred to as “adaptive reuse”—is a crucial enterprise. This work complies with Vardopoulos's definition of adaptive reuse [35], namely the process of adapting an existing property to a new use, preserving as many aspects as feasible of the initial construction development while modernizing its efficiency to reflect present-day norms. Currently, few research studies have examined how visitors' expectations and views of adaptive reuse projects are affected by new uses. Within this frame of reference, the scope of the current study was to identify the key determinants of public perceptions regarding the effects of adaptive reuse on (peri-)urban sustainability.

## 2. Review of the Adaptive Reuse Literature

One of the biggest resource consumers in the world is often considered to be the building industry [36,37]. Thus, efforts to improve its sustainability have arisen and are still growing through the adaptive reuse of existing properties [38]. As a consequence of the extensive and diverse solutions offered by the sustainability branch of the circular economy core concept [39,40], the notion of adaptive reuse has managed to garner a lot of attention [40]. The circular economy concept is described by a number of scientific publications (see [11,39,41–46]) deriving from the European Union's Horizon 2020-funded CLIC Project ([www.clicproject.eu](http://www.clicproject.eu)) as a way to circularize the flow of energy, raw resources, cultural capital, and social capital.

According to the results of recent investigations, the number of both funded research projects (see OpenHeritage [47,48], ReMIND [49], and ROCK [50–53]) and scientific papers devoted to adaptive reuse research has advanced significantly in recent years, and more advancements are anticipated in the future [54].

In an early adaptive reuse study, Bullen (2007) [55] argued that there has been increasing recognition of adaptive reuse projects' contribution to key aspects of sustainable development, with most owners of existing structures viewing adaptive reuse practices as a realistic and viable alternative to demolition. Four years later, Plevoets and Van Cleempoel (2011) [56] presented what was likely the very first comprehensive examination of adaptive reuse theoretical perspectives and practical techniques. They also discussed the complexities of adaptively reusing an architectural structure, namely the *genius loci* (see also [57]), and ultimately suggested that by placing emphasis and solely relying on the building's economic efficacy—particularly in the case of properties not listed as monuments under protection—other factors, such as the social, cultural, historical, and architectural value, which support broader urban sustainable development concerns, are left unaddressed. Bullen and Love (2009) [58] evaluated a strategic plan and the consequential laws enacted to promote adaptive reuse practices and found that providing incentives is essential for the successful implementation of these kinds of urban community transformational redevelopment projects. This is further supported by other studies showing that compliance

with policy and regulatory requirements, as well as state-of-the-art design principles and standards, are considered significant constraints associated with the successful development of adaptive reuse projects. As a result, efforts towards creating future regulations and government-led urban regeneration projects are required [59,60]. In a more recent analysis, Mohamed et al. (2017) [61] employed the so-called “three Es of Sustainable Development” to describe adaptive reuse practices. They also suggested that in adaptive reuse policy, intervening actions have become a necessity for addressing the “Equity” pillar. From a design point of view, Eyüce and Eyüce (2010) [62] observed that adaptive reuse project development fails to capture and provide an explicitly expressed design process as well as recognized and established methodologies that may serve as a fiducial mark; instead, they seem to be case-specific and require a special approach. This explains the profusion of case-study-based research methodologies [63–68]. Following this, Plevoets and Van Cleempoel (2014) [69] investigated adaptive reuse from the unique perspective of the interior architecture (see also [70]), considering how the interior design is anchored within the inner world of every building. On the other hand, in order to sway public perceptions towards forging a bond with the city and its past, Tsilika and Vardopoulos (2022) [8] emphasized the significance of the external faces of a building and the reasons for which an adaptive reuse strategy calls for their protection and preservation.

There is a considerable collection of research publications illuminating ways to create and/or apply adaptive reuse methodologies and structured conceptual systems, inter alia the adaptive reuse potential model [71], the design framework for adaptable buildings [72], adapSTAR [73], iconCUR [74], causal loop diagrams [75], the preliminary evaluation adaptability adaptation template [76], the triple-bottom-line model for optimizing retrofit practices [77], the learning buildings platform [78], and Maslow’s hierarchy of needs assessment framework [79]. Interestingly, there seems to be evidence of a strong positive connection between these strategies. [80,81]. Additionally, a rising number of scholarly journal articles on adaptive reuse adopting decision-making strategies based on various and complex sets of criteria (see [82,83]) are also available [84], such as the DELPHI model [85], the ANN-based method [86], the TOPSIS applications [87], the Macbeth methodology [88], the AHP technique [89], the DEMATEL approach [90], fuzzy sets [90,91], and combinations of the above [92].

Currently, published works have focused on modeling the deconstruction process and planning material reuse [93–97], constructing models of buildings’ lifecycle expectancy [98–100], rating the environmentally friendly characteristics of adaptive reuse developments [101,102], assessing infrastructure resilience [103,104], interface management [105], developing theories and applications for smart-city infrastructure and the internet of cultural things [19,106], measuring building stock vacancies [107], and establishing facility asset management kits [108]. The broader body of scientific literature also contains studies largely concerned with energy savings, thermal comfort, and modernization [109–112].

Other studies have focused on the key factors affecting the success of adaptive reuse developments [113], not to mention the suitability of the new use’s additional features and functions [114]. Previous research has also discussed the parties involved in adaptive reuse initiatives and how well they operate together [115].

Adaptive reuse conducted and supported by the community develops social networks while preserving a unique way of life, according to Yung Chan et al. (2014) [116]. Others emphasize the value of humanitarian adaptive reuse developments [43]. Glumac and Islam (2020) [117], for example, concurred that performance-based frameworks promoting adaptive reuse are enhanced by an end-user perspective. Others have illustrated the social supportive role that adaptive reuse may play in promoting individual well-being and quality of life [118,119], as described by Cortesi et al. [120] and others [121]. By examining the visitor perceptions and expectations, Md Ali et al. (2019) [122] considered the effects on the quality of the museum services after the adaptive reuse development of a culturally significant property into a museum. Other studies have examined how tourists (for research on memorable tourism experiences, see [123]) perceive adaptive reuse with reference to

satisfaction and, hence, destination competitiveness [124–126]. Still, the critical aspect of visitor perceptions related to the actual usability of the property, in connection with the choice of use and the achievement of local sustainable development, appears to be an overlooked topic in the lively international discussion on adaptive reuse. Thus, the purpose of this research was to fill this gap by exploring and establishing key determining factors for public perceptions regarding the impacts of adaptive reuse developments on the sustainable development of local (peri-)urban settings.

### 3. Materials and Methods

Building upon the heretofore-reported literature overview, this study conducted an empirical analysis, commonly regarded as appropriate for conceptualizing and understanding contemporary phenomena [127,128]. Therefore, a case-specific survey was developed and conducted to determine the elements influencing visitor views with regards to the impact of the adaptive reuse development of a culturally significant metropolitan industrial facility on the overall (re-)development of the (peri-)urban context.

#### 3.1. The Iconic FIX Brewery Building Case as a Point of Reference

In an attempt to offer a comprehensive and in-depth perspective on the variables involved in influencing visitor views of the impacts of adaptive reuse, the present research project laid emphasis on the recent adaptive reuse development of the long-unused FIX Brewery building in Athens, providing a space for the recently introduced Hellenic National Museum of Contemporary Art.

Johann Karl Fix established the brewing business bearing the well-known brand name “FIX” in Athens in 1865, and it quickly rose to prominence as one of the country’s leading breweries. Due to the rising demand, the brewing industry premises were moved close to the southeast Athenian neighborhood known as Koukaki, which at the time showed no signs of development. In the middle of the 1950s, the management of the FIX Brewery made the decision to completely renovate the industrial facility after taking into account the opportunities provided by Greece’s industrial restructuring.

Takis Zenetos and Margaritis Apostolidis, two well-known modernist architects [129], were assigned the task. During their prolific endeavor to provide shelter for a complex and evolving manufacturing line, ensuring adaptability and flexibility to meet future needs (even beyond the merely industrial), their ground-breaking overall architectural design represented the fundamental ideas of the modernist movement [130]. It did not take long after their work was completed in 1961 for the building to emerge as an illustrious monument of modern architecture, in addition to a symbol of the advanced growth and development of the modern era (Figure 1). However, soon afterwards, the brewery had to relocate out of the heart of the city, and the famous structure was regrettably left empty.



**Figure 1.** Complete overview of the Fix Brewery premises on Sygrou Avenue, Athens, circa 1960, architecturally designed by Zenetos and Apostolidis. Source: [131].

In 1994, a sizable portion of the northern section of the highly praised edifice was destroyed (Figure 2), amid harsh and intensifying criticism and denunciation [132].



**Figure 2.** The historic FIX Brewery’s northern section demolished in March 1995 despite resistance demonstrations.

After a protracted period of primarily ministerial meetings and deliberations, it was ultimately decided to utilize the “amputated” and neglected structure to provide a space for the recently established Hellenic National Museum of Contemporary Art. The partnership formed by Mouzakis Architects and 3SK Architects was assigned the reuse project. The Hellenic-Government-sponsored project was finished in 2014 (Figure 3).



**Figure 3.** World-famous FIX Brewery building as it currently stands, having been transformed to shelter the Hellenic National Museum of Contemporary Art; present exterior core perspective on Sygrou Avenue side.

### 3.2. Survey

A two-part questionnaire was created for the purpose of the survey. The survey form was subdivided into two core parts: one to determine the respondents' demographic characteristics, and the other to gather data on how the visitors perceived the impact of the adaptive reuse project on the nearby metropolitan environment, along with the contributing factors. Only closed-ended questions were posed to those who participated in the survey.

Unfortunately, the museum was closed during the investigation, since installation work for a permanent show was taking place. However, it was crucial for the study to consider the views of people whose visits (up until then) to the museum were verified as having taken place. The sample for this research project thus consisted of visitors who used 'Instagram' to publish a location-tagged picture (or picture set) from and of the Hellenic National Museum of Contemporary Art, counted as evidence of a visit (during the period of time when the premises were safe to accept visitors). This approach turned the aforementioned obstacle into an opportunity. Owing to the fact that the 'Instagram' social networking service has security precautions that prohibit large-scale mail-outs, it is important to note that mass-messaging Instagram subscribers was incredibly difficult and time-consuming in this context. Although this research design of effectively utilizing the 'Instagram' app to assemble a set of data might be applicable across various research disciplines [133,134], to the author's knowledge, no analysis has so far been published attempting to address the research gap identified herein.

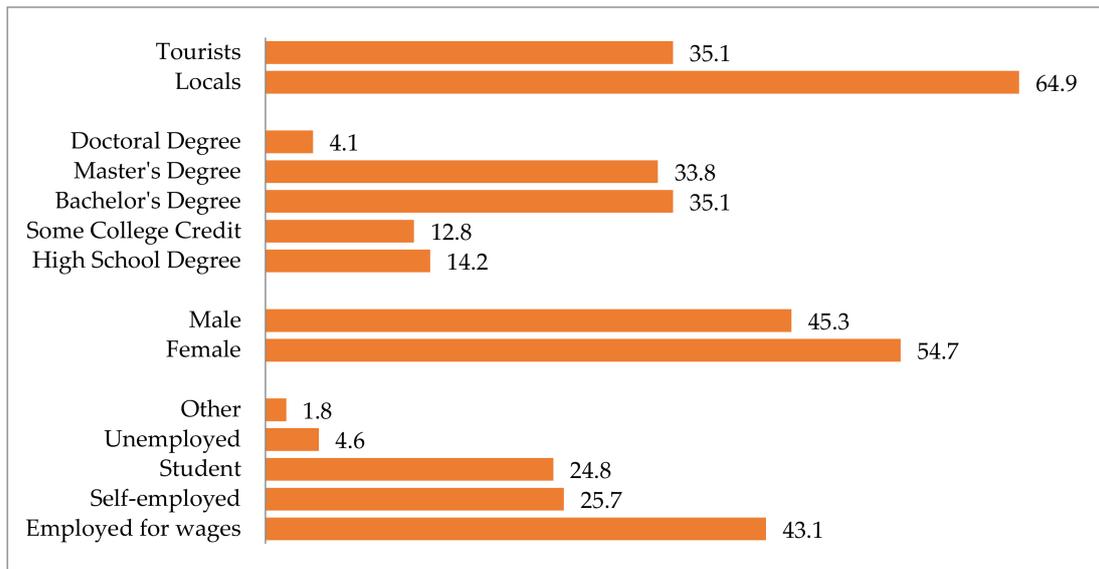
As a pilot test, the survey was initially sent to just a few 'Instagram' app visitors ( $n = 21$ ) prior to the full distribution (see [135,136]). The pilot resulted in a few modest alterations and revisions. The survey received a sum of  $N = 148$  accountable responses over the course of its 7 subsequent months of operation. It is widely supported [19,137,138] that because the sample was thought to be typical of the visitors to the Hellenic National Museum of Contemporary Art, it provided a solid foundation for examining the stated hypothesis. With a view to obtaining both descriptive and inferential statistics, data were analyzed statistically using SPSS (see also [139,140]).

## 4. Results

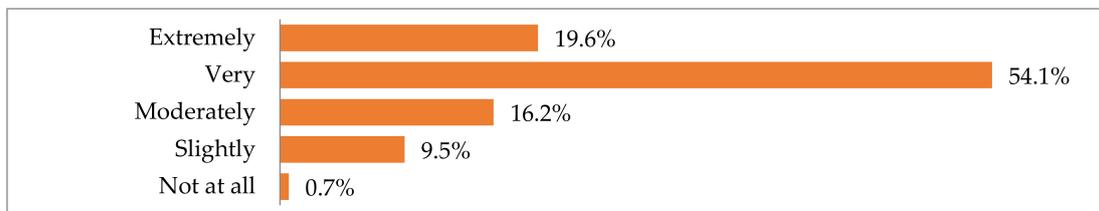
### 4.1. Descriptive Statistical Analysis

The sample predominantly contained young(er) graduates, which generally adheres to the representativeness of online surveys [141]. Of the 148 survey respondents, 54.7% were female. The sample included both tourists and locals (64.9%). The average age of the respondents was 31 years (minimum 18; median 30; maximum 62). The vast majority were university (post)graduate degree holders (73%). Regarding employment status, 66.9% had a paying job, 23.6% were students, and 5.4% were out of work (Figure 4). The respondents to the survey reported average monthly earnings of EUR 1191.8 (minimum 100; median 900; maximum 5000). The sample demographic profile analysis was supported by previous evidence from both official statistics as well as a vast body of published research [141,142].

In addition to being asked about their socioeconomic backgrounds, the Hellenic National Museum of Contemporary Art visitors were asked about: (1) the museum, concerning the reason(s) for and impressions of their visit, their activities before and after the visit, etc.; and (2) their opinions on adaptive reuse and their familiarity with the FIX Brewery building, among other things. First, almost everyone who responded believed that museums are tourist attractions (Figure 5).

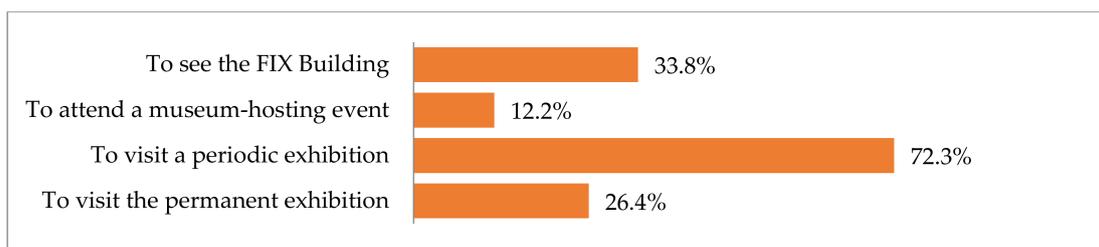


**Figure 4.** Sample demographics.



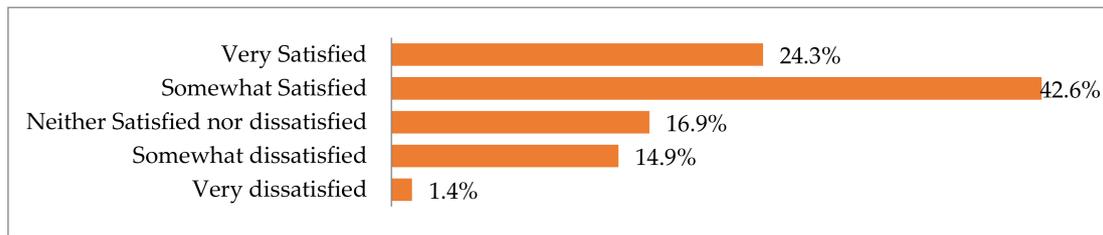
**Figure 5.** How much respondents thought of museums as tourist attractions.

A significant percentage of individuals polled indicated that their visit to the museum was for either an exhibition or a cultural event of some kind. Additionally, a sizeable percentage indicated that the purpose of their visit was to view the architecturally significant adaptive reuse of the building (Figure 6).



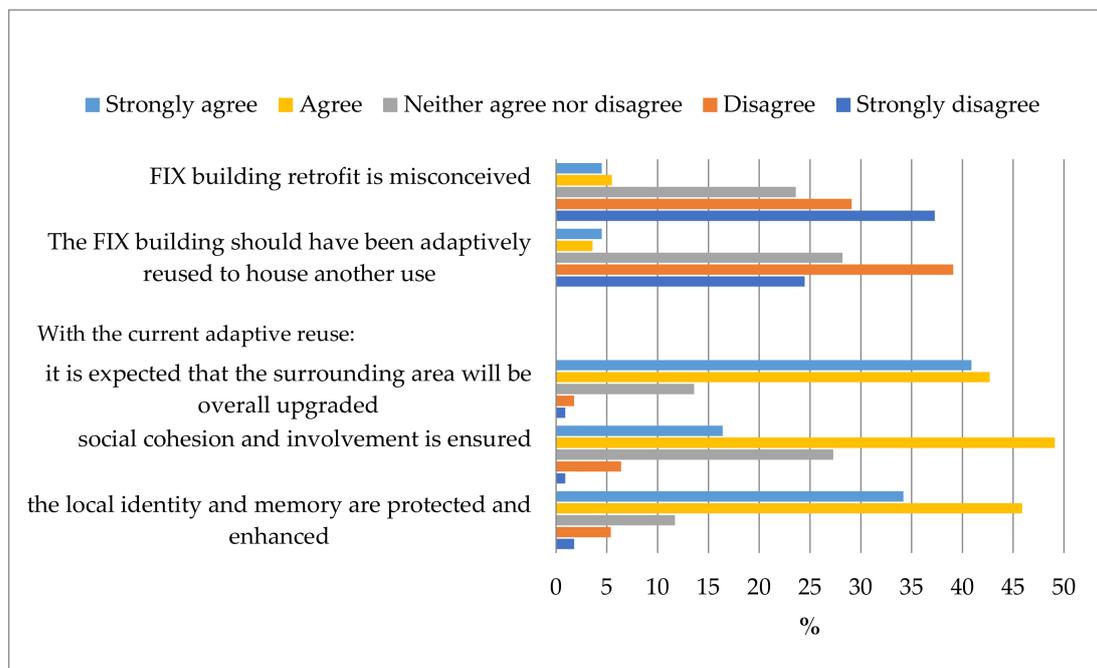
**Figure 6.** Reasons for visiting the Hellenic National Museum of Contemporary Art.

In view of the fact that the Hellenic National Museum of Contemporary Art had only recently opened its doors to the public, it can be considered pleasantly surprising that, overall, as indicated in Figure 7, those questioned were quite satisfied with their visit to the museum's facilities and exhibitions.



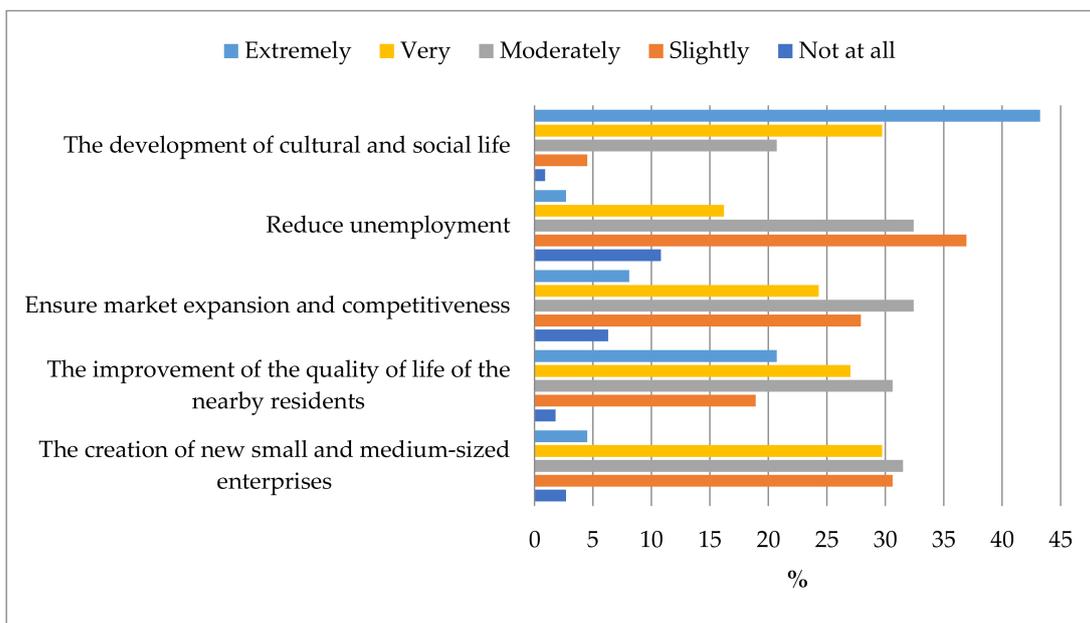
**Figure 7.** How satisfied or unsatisfied museum visitors were with their visit.

A sizable portion of Hellenic National Museum of Contemporary Art visitors (64.9%) said they combined their trip with a visit to a nearby cultural attraction or leisure facility. In general, respondents appeared to have some knowledge of the background of the FIX Brewery building, and several of those polled claimed that the FIX Brewery building adaptive reuse development was, to some extent, environmentally friendly and beneficial. Visitors believed that the transformation of the FIX Brewery building to make space for the Hellenic National Museum of Contemporary Art was a good fit in terms of new use. Additionally, they favored preserving the urban character of the area and promoting social interaction (Figure 8).



**Figure 8.** Hellenic National Museum of Contemporary Art visitor views on the FIX Brewery transformation development.

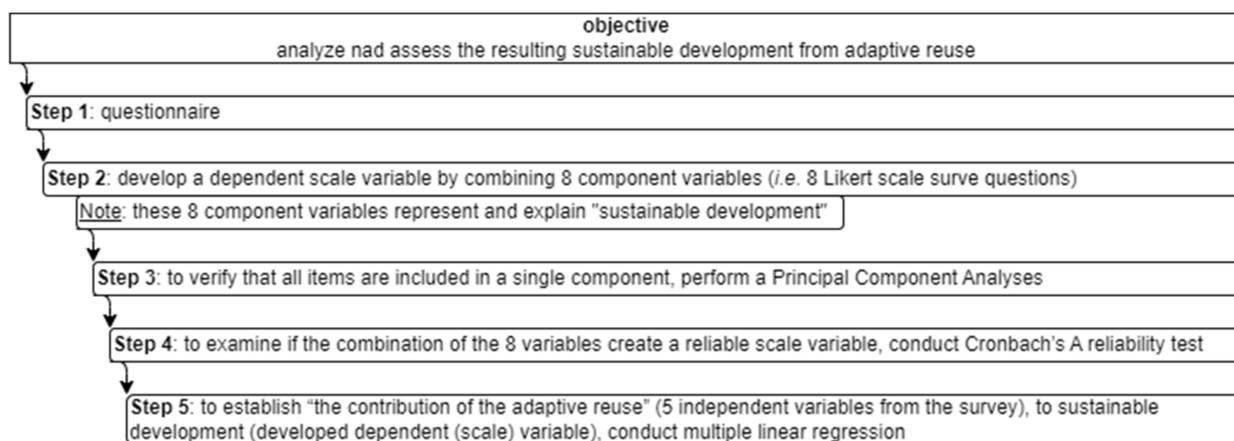
According to the respondents, the FIX Brewery building adaptive transformation development to provide shelter for the Hellenic National Museum of Contemporary Art promoted the development of cultural and social life and improved the quality of life for locals (Figure 9).



**Figure 9.** Visitors’ opinions on the effects of the FIX Brewery building’s adaptive reuse as a facility for the Hellenic National Museum of Contemporary Art on other variables.

4.2. *Dependent Variable Creation*

Given the lack of relevant research tools, as well as the need to analyze and assess the sustainable urban development resulting from the reuse of historic industrial buildings, the variable SDScale\_MEAN, expressing respondents’ perceptions of “the contribution of the adaptive reuse of the FIX Brewery building to house the Hellenic National Museum of Contemporary Art to sustainable development”, was developed (Figure 10) through a combination (using the mean value of each) of the eight variables presented in Table 1.



**Figure 10.** Dependent scale variable creation methodological flow chart.

Following the remarks of Cabrera-Nguyen [143] and of Worthington and Whittaker [144], the formulation of the questions, governed by the sustainability theory, relied mostly on relevant existing scales, indicators, and study findings, including: the place sustainability scale for measuring residents’ perceptions of the sustainability of a city by Taecharungroj et al. [145], the sustainability outlooks and the methodology of urban sustainability assessment [146], the international list of urban sustainability indicators [147], the composite indicator for sustainable local development by Salvati and Carlucci [148], the sustainable city model by Egger [149], the dimensions of the ecological city [150], the

sustainability in the built environment holistic assessment kit [151], the factors affecting sustainable development [152], and the critical factors affecting local sustainable development through adapted reuse projects [90].

**Table 1.** Component variables of the dependent variable.

Coded Variable	Variable
ENVIRON	To what extent do you consider the adaptive reuse of the FIX Brewery building to be environmentally friendly?
SMEs	The adaptive reuse of the FIX Brewery building to house the Hellenic National Museum of Contemporary Art contributes to the creation of new small and medium-sized enterprises.
LIFEQUALITY	The adaptive reuse of the FIX Brewery building to house the Hellenic National Museum of Contemporary Art contributes to the improvement of the quality of life of the nearby residents.
INCOMERAISE	The adaptive reuse of the FIX Brewery building to house the Hellenic National Museum of Contemporary Art contributes to raising the incomes of the nearby residents and professionals.
TOURISMCENTER	The adaptive reuse of the FIX Brewery building to house the Hellenic National Museum of Contemporary Art contributes to the strengthening and establishment of the city as a visitor/tourist attraction.
MARKET	The adaptive reuse of the FIX Brewery building to house the Hellenic National Museum of Contemporary Art contributes to ensuring market expansion and competitiveness.
UNEMPLOYMENT	The adaptive reuse of the FIX Brewery building to house the Hellenic National Museum of Contemporary Art contributes to reducing unemployment.
CULTURALADVANCEMENT	The adaptive reuse of the FIX Brewery building to house the Hellenic National Museum of Contemporary Art contributes to the development of cultural and social life.

The answers to the questions were recorded on a five-point Likert scale (a well-established tool with international impact created by the American psychologist Rensis Likert), which was composed of specific speech expressions graded in a single direction, as follows: 1 = not at all; 2 = a little; 3 = enough; 4 = much; 5 = very much (see [120,153]).

It should be mentioned that there is intense debate about the nature of data generated by self-reported scales, a rather controversial area between ordinal and continuous variables [154–157]. Likert-type scales are usually used to measure attitude through a specific range of answers for a given question or statement [158]. Scales, in theory, belong to the ordinal type of measures, since the records are grouped into categories/orders that follow a natural or logically acceptable ascending (or descending) sequence. They lack, however, the feature of predetermined equal intervals between values. Nonetheless, contemporary scholars frequently presume that the aforementioned characteristic of equal intervals applies. Thus, although attitude and emotions cannot be measured with accuracy in either the social sciences or other scientific fields [159,160], it is generally accepted that data from self-reported scales can be considered as interval; continuous, especially when the scale takes at least five possible values [161], and can be used without reservations in parametric statistics [162–164].

In order to examine if the combination of the eight variables would create a reliable scale variable (i.e., the variable SDScale\_MEAN), a Cronbach's alpha reliability test was conducted. Prior to the reliability tests, a principal component analysis (PCA) [141,165] was performed in order to check that all items were included in a single component, as this is a parameter that the Cronbach's alpha reliability test does not take into account. The PCA procedure revealed that the eight Likert items all represented the same dimension. The Cronbach's alpha reliability coefficient was 0.879, although it would be lower if any of the eight elements were removed, allowing the variable SDScale\_MEAN to be created.

#### 4.3. Multiple Linear Regression

The contribution of the adaptive reuse of the FIX Brewery building to house the Hellenic National Museum of Contemporary Art (i.e., independent variables TOURATRACTION, NEXTVISIT, SATISFA, HISTORYPERCEPTION, and NATIONALITY, see Table 2) to sustainable development (i.e., dependent variable SDScale\_MEAN) was predicted using multiple linear regression. Partial regression plots and a plot of the studentized residuals against the predicted values both showed linearity. There was independence between the residuals, as assessed by the Durbin–Watson statistic of 2.126. Homoscedasticity was observed from the visual inspection of the studentized residuals versus the unstandardized predicted values, as well as from the results of a Breusch–Pagan test for heteroscedasticity. There was no evidence of multicollinearity, as assessed by tolerance values greater than 0.8. The assumption of normality was met, as assessed by a Q-Q Plot. The multiple linear regression statistically significantly predicted SDScale\_MEAN,  $F(5.142) = 10.166$ ,  $p < 0.0001$ ,  $\text{adj. } R^2 = 23.8\%$ . The  $\text{adj. } R^2$  value, from an exploratory (and not explicative statistical) standpoint, was notably high (roughly 25%), showing that these results could be refined by a broader analysis, possibly searching for more variables “affecting” or “explaining” sustainable development. All five independent variables contributed statistically significantly to the prediction; regression coefficients and standard errors can be found in Table 2.

**Table 2.** Multiple linear regression model.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	1.553	0.349		4.454	0.000	0.864	2.243
TOURATRACTION	0.186	0.063	0.220	2.935	0.004	0.061	0.310
NEXTVISIT	0.229	0.117	0.148	1.961	0.052	−0.002	0.460
SATISFA	0.242	0.056	0.338	4.295	0.000	0.131	0.353
HISTORYPERCEPTION	0.082	0.038	0.155	2.147	0.034	0.007	0.158
NATIONALITY	−0.439	0.150	−0.212	−2.934	0.004	−0.735	−0.143

TOURATRACTION: Do you consider that museums in Greece are tourist attractions?

NEXTVISIT: Was your visit to the Hellenic National Museum of Contemporary Art combined with a visit to another cultural recreational space?

SATISFA: Overall, how satisfied or dissatisfied were you with your visit to the Hellenic National Museum of Contemporary Art?

HISTORYPERCEPTION: Do you know the history of the FIX Brewery building that houses the Hellenic National Museum of Contemporary Art?

NATIONALITY: What is your nationality?

According to Table 2, it was found that respondents who (a) considered museums in Greece to be tourist attractions, (b) combined their visit to the Hellenic National Museum of Contemporary Art with a visit to another cultural recreational space, (c) were satisfied with their visit to the Hellenic National Museum of Contemporary Art, (d) knew the history of the FIX Brewery building that houses the Hellenic National Museum of Contemporary Art, and (e) had a non-Greek nationality had a more positive perception of the contribution of the adaptive reuse of the FIX Brewery building to house the Hellenic National Museum of Contemporary Art to local sustainable development (i.e., a higher value of the dependent variable SDScale\_MEAN).

#### 5. Discussion and Conclusions

Adaptive reuse is an expanding area of frontier research around the globe. It can have a significant impact in relation to the present trends in urban sustainable development, following decades of human disdain and negligence in the form of resource depletion and environmental deterioration. Initiatives for adaptive reuse can achieve a superior balance between financial investment, environmental conservation, cultural heritage protection, and urban regeneration by incorporating specific methodologies and strategies.

This study focused on the case of the famous FIX Brewery, which was recently renovated and now houses the Hellenic National Museum of Contemporary Art, in an effort to pinpoint the variables influencing public views of the impact of adaptive reuse on sustainable urban development. Evidence for connections between five components was provided through multiple linear regression analysis.

The majority of respondents agreed that cultural institutions such as museums throughout Greece should be viewed as tourist attractions. According to the regression model presented in Table 2, TOURATTRACTION was a significant positive predictor of SDScale\_MEAN in the model, at a 1% level of statistical significance. For every one-unit increase in TOURATTRACTION, there was a predicted increase of 0.186 in SDScale\_MEAN, with all other variables remaining constant. Or, in other words, for every increase of one point in TOURATTRACTION, SDScale\_MEAN was predicted to increase by 0.186 points. Therefore, the more this viewpoint is shared, the more likely it is that people will embrace the opinion that adaptive reuse creates urban opportunities. This result backs up Smith and Bugni's [166] assertion that there are links between visitors' perceptions, thoughts, feelings, and actions regarding architecture [124]. Additionally, this conclusion supports earlier research findings that suggested tensions between tradition and modernization within the complex relationships between tourism and cultural heritage [167].

NEXTVISIT was a significant positive predictor of SDScale\_MEAN in the model, at a 10% level of statistical significance. This meant that for every one-unit increase in NEXTVISIT, there was a predicted increase of 0.229 in SDScale\_MEAN, with all other variables kept constant. Since NEXTVISIT was binomially coded (0 = no, 1 = yes), the interpretation can be put more simply: for the respondents who combined their visit to the Hellenic National Museum of Contemporary Art with a stop at a different cultural facility, the predicted SDScale\_MEAN was 0.229 points higher than for those who did not combine their visit to the Hellenic National Museum of Contemporary Art with a stop at a different cultural facility. The reason for this could be that culture serves as a flywheel for sustainability in urban areas rich in cultural resources. Furthermore, the importance of culture as a sustainable development factor has long been established, and this finding emphasizes the prospects of adaptive reuse processes for revitalizing European urban historical centers, as well as the significant implications of clustering in systems [168].

The empirical findings implied that expectations for local sustainable development resulting from the adaptive reuse process were significantly positively impacted by museum visitor pleasure. As a matter of fact, SATISFA was a positive predictor of SDScale\_MEAN in the model, at a 1% level of statistical significance. Consequently, for every one-unit increase in SATISFA, there was a predicted increase of 0.242 in SDScale\_MEAN, with all other variables held constant. Or, in other words, for every increase of one point on SATISFA, SDScale\_MEAN was predicted to increase by 0.242 points. Several factors must be taken into account when using old urban industrial structures as museums in urban redevelopment plans. Visitor satisfaction is one of these factors. The antecedents of museum visitor experiences have not been studied by many researchers. While earlier research by Brida et al. [169] revealed no connections between the neighborhood and tourists' satisfaction, Gao et al. [170] identified that authenticity has no major influence on visitor satisfaction. The potential links between urban destination and museum visitor satisfaction, however, have not been addressed in prior research. This study offers fresh perspectives, partially addresses the knowledge vacuum, and has significant field-wide ramifications.

Furthermore, the results of the current investigation showed that the more information a visitor had about the FIX Brewery building, the more likely it was that they believed that repurposing the FIX Brewery building to house the Hellenic National Museum of Contemporary Art improved the neighborhood in general. Old buildings, particularly unique and historic industrial buildings, i.e., lieux de mémoire (see [171]) with the characteristics of a valuable asset to be exploited, provide the opportunity for the sustainable development of a city, the preservation of local collective memory, and the transmission of local and national cultural identity to future generations through maintenance and reuse

actions [64,172]. The findings of this study embrace the idea of “cultural capital” as a product of participation experiences and knowledge gained via cultural heritage traditions, customs, values, identity, and history, reflecting a community’s cultural and traditional resources, and consequently suggest that the adaptive reuse of such buildings automatically implies altering this “capital”.

Moreover, NATIONALITY was a significant negative predictor of SDScale\_MEAN in the model presented in this study. For every one-unit increase in NATIONALITY, there was a predicted decrease of 0.439 in SDScale\_MEAN, with all other variables held constant. Since NATIONALITY was binary coded (0 = non-Greek, 1 = Greek), the interpretation could be put more simply: for the Greek respondents, the predicted SDScale\_MEAN was 0.439 points lower than for the non-Greek respondents. Adaptive reuse projects are critical factors in sustainable urban development, not only in terms of extending the lifespan of buildings, but also in terms of contributing to the transfer of cultural identity from one period to another and from one generation to the next. This transfer ultimately leads to cultural renaissance through urban regeneration [173].

Thus, if the evolution of a building from its previous use to a stage of adaptation is understood, then the reciprocal relationship is revealed, that is, buildings representing spatial landmarks of modern society’s emotional and collective memory [174] are actually part of a community’s culture and reflect the degree of culture that has been achieved at a particular point in time [175]. The longer the period between industrialization and deindustrialization, the more a building becomes a symbol and is identified with the cultural image of its community and place [176]. It is feasible for a community’s industrial building legacy to be preserved through adaptive reuse methods; however, without the transfer and/or preservation of its content in the new use, it will fail to contribute to urban cultural rebirth (see [177]).

According to earlier studies, decision-makers consider a number of variables when determining the new use of a structure. The scientific literature, it would seem, lacks a reference point for how users evaluate the final choice made once the adaptive reuse project is complete and the possibility for sustainability that has become apparent. The current study filled this gap by considering the decision-making behind the FIX Brewery building development. However, it could also help future designers and planners of adaptive reuse projects by encouraging them to add a set of decision evaluation criteria to the post-occupancy analyses and evaluations [178] and possibly even involve a creative backup plan that could be used if the evaluation were to be unsuccessful.

This study closes by suggesting that adaptive reuse developments can contribute markedly to local (peri-)urban sustainable development and directly or indirectly positively influence the local societal structure by enhancing the residents’ quality of life, empowering the cultural component, and turning the neighborhood into a well-liked tourist destination.

The promising empirical data obtained from the current research should allow the agencies responsible to take all the required actions to place adaptive reuse at the center of the city’s sustainable development plans. The findings of this study may, in general, be beneficial for important players pursuing the sustainability perspective in urban development. In addition, while the findings of the current work were based on a research methodology applied to a particular case study, a similar methodology may be used in a wider context, leading to more generally applicable findings and interpretations.

**Funding:** This research received no external funding.

**Institutional Review Board Statement:** Ethical review and approval were waived for this study. The survey was anonymous, gathering no sensitive data, and the participants provided consent to use their answers for research.

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** The data presented in this study are contained within this manuscript for reproducibility purposes.

**Acknowledgments:** I would like to thank all the people who directly or indirectly helped me in carrying out this study. I would specifically like to acknowledge Xanthos Pattichis for his support in advanced statistics.

**Conflicts of Interest:** The author declares no conflict of interest.

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