Environmental resources as latent primary factors of production in tourism: the case of forest-based commercial recreation

DAVID W. MARCOUILLET

Department of Urban and Regional Planning, University of Wisconsin – Madison
106 Old Music Hall, Madison, WI 53706, USA. Tel: +1 608 262 2998.
Fax: +1 608 262 9307. E-mail: dave@mac.wisc.edu

The supply of tourism, in many respects, remains an unresolved area of theoretical and empirical development. The reasons for this are many, but the author argues in this paper that one of the limiting core areas of conceptual development in tourism economics is the general need for an analytical framework that captures generic production processes used to produce output from the tourism sector. One important unresolved issue of production includes use of critical resources such as environmental goods that serve as latent primary factor inputs to the production process of tourism. Often, these resources are hidden from analysis due to their non-priced common-pool attributes. This is particularly true in rural amenity-rich regions where nature-based tourism firms are becoming increasingly important to regional economies. Using forest resources as an example, the incorporation of non-priced tourism production inputs more completely specifies the tourism production function, provides a critical linkage to land and recreation resource management, and allows for more integrative tourism planning approaches.

How is tourism produced? This question provides a basis for analysis of tourism sector output and is a central component of neoclassical approaches to tourism economics. Yet, we have few tourism-specific theoretical constructs upon which to proceed. Necessarily, the economic analysis of tourism is built from assessments of market supply and demand. That is to say, market demand rests on an ability to define and model individual motivations for leisure travel while

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market supply is rooted firmly within the cost structure of tourism-dependent firms. Although we have made progress in developing workable definitions of tourism demand, tourism supply remains nebulous and ill-defined. This helps to explain the slow rate of progress in formulating generalizations about the tourism phenomenon. A more comprehensive assessment is critical to infer important balances that impact public policy and planning for future tourism development.

Our difficulties in generalizing supply issues of tourism are, in large part, due to the complex inter-relationships between the tourism phenomenon and external (or exogenous) economic, social, and environmental issues. Attempts to characterize tourism market supply have been limited due to a general lack of product definition and explicit incorporation of external characteristics critical to producing tourism output. Furthermore, there are important natural-resource-based public goods that tourism uses in its production that defy empirical analysis due to their non-priced and common-pool characteristics. A basic premise of this paper is that the characteristics and extent of natural resources do indeed matter in the production of regional leisure-based tourism output. This is particularly true in natural amenity-rich communities, examples of which can be found in regions with significant water, forest, and geologic resources.

The tourism literature is replete with studies which identify environmental resources as key components that support leisure-based tourism. Many have looked at the importance of off-site landscape and ecosystems as keys to the competitiveness of individual firms. The type and extent of environmental resources surrounding a site have been shown to be dramatically linked to tourism sector profitability due to the image-boosting values of 'placelessness'. Many point to the natural environment as a basis for a marketable tourism attraction or product. The reasons for this are embedded within individual preferences for leisure activities. There is a growing interest in solidifying the linkages between tourism and the environment to develop a more systemic approach. Lacking, however, is a conceptual basis that outlines the fundamental economic linkages between environmental resources and the tourism production process which is necessary for such analysis. In this paper, these linkages are made more explicit using forests as an example of an environmental resource used in producing nature-based tourism experiences within a rural amenity-rich region. Moving beyond the traditional approaches to tourism production requires a general understanding that alternative environmental resource management regimes generate different output levels of public goods. These resource-based public goods serve as latent primary factor inputs into the production process of tourism.

This paper is organized into four basic sections. First, alternative approaches to characterizing the tourism production process are presented. The next two sections identify the importance of environmental attributes to tourism using forest resources as an example and provide a basis for integrating these attributes into the tourism production process. A commonly used functional form for production is suggested as a starting point for characterizing tourism production. The paper concludes with a set of further research needs and briefly describes some of the relevant policy implications of a broader approach to tourism supply analysis.
Approaches to tourism production

Smith described the limitations of secondary data representing the tourism sector as an important difficulty in defining tourism supply. He argued that tourism supply rests on a definition of the tourism sector that specifies the extent of tourism reliance. Although criticized as an oversimplification of the complex and partially industrialized structure of tourism supply, Smith's perspective emphasizes the measurement of scale, performance, and economic impacts for locality-specific firms catering to travellers and visitors. While important for characterizing the tourism sector, this work falls short of addressing the specific components that comprise the neoclassical microeconomic approach to sector market supply. In early work on defining the tourism sector, Neil Leiper touched on an important question that gets to the core of a more integrative approach to tourism production: 'how does one classify inherent, natural features which are attractions?' Furthermore, given that these 'natural features' are inherent in the production of tourism, how does one incorporate their importance into economic analysis? To do this, one must deal with the fundamental input structure of the tourism sector. In order to characterize production, analysis requires an assessment of sector-level cost structure and its use of primary factor inputs, traditionally defined as land, labour, and capital.

Realizing these limitations, Smith in more recent work attempted to characterize both the tourism product and the tourism production process. He defined the tourism production process as a set of inter-related notions beginning with the physical plant and progressing through service, hospitality, freedom of choice, and involvement. These, Smith argued, comprise the tourism experience, or product. Smith further proceeded to outline the production process to include primary factors of production (land, labour, capital), intermediate inputs, intermediate outputs, and final outputs (defined in terms of individual experiences). This characterization is found in Table 1. In addition to the traditional factors of land, labour, and capital, he made cursory reference to natural resources such as water. Furthermore, he referred to this production process as apparently flowing in a linear form with little detail provided as to how production takes place.

<table>
<thead>
<tr>
<th>Primary inputs (resources)</th>
<th>Intermediate inputs (facilities)</th>
<th>Intermediate outputs (services)</th>
<th>Final outputs (experiences)</th>
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<tr>
<td>Land</td>
<td>Parks</td>
<td>Park interpretation</td>
<td>Recreation</td>
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<td>Labour</td>
<td>Resorts</td>
<td>Guide services</td>
<td>Social contacts</td>
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<td>Water</td>
<td>Transportation modes</td>
<td>Cultural performances</td>
<td>Education</td>
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<td>Agricultural produce</td>
<td>Museums</td>
<td>Souvenirs</td>
<td>Relaxation</td>
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<td>Fuel</td>
<td>Craft shops</td>
<td>Conventions</td>
<td>Memories</td>
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<td>Building materials</td>
<td>Convention centres</td>
<td>Performances</td>
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<td>Capital</td>
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<td>Restaurants</td>
<td>Meals and drinks</td>
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<td>Rental car fleets</td>
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Although Smith’s article was insightful as a means of conceptualizing the tourism product, we are still left with the need to address key economic components of the production process: namely, that production be framed in terms of primary factor inputs. Simply stated, the manner in which a region’s endowment of natural resources interacts with the more traditionally defined inputs of land, labour, and capital determines the character of tourism output. These primary factors can be combined to produce equal levels of tourism output along production isoquants.

The conceptual basis of sector supply that identifies total sector output as a function of intermediate purchased inputs, components of value added, and imported inputs requires more thorough examination. It is important to realize that tourism supply is based upon a wide array of non-priced public goods that would logically be accounted for as a component of value added, or returns to factor inputs. Intermediate purchased inputs and a cursory glance at labour and capital usage provide an incomplete picture of tourism supply.

Environmental resources and tourism

Tourism researchers have long focused study on the linkages between tourism and the environment. Many have argued that natural resources provide the basis for tourism presence in a region. There has been a growing literature that makes a connection among environmental resources (e.g., forests, water resources, etc.), their management, and the presence of tourism activity. We face, however, a dearth of usable economic generalizations that allow us to make linkages between environmental costs and benefits resulting from alternative environmental resource management regimes and the production of tourism. For ease of discussion, let us consider the situation that exists in amenity-rich regions between the timber resource, forest-based recreation, and the set of nature-based tourism-sensitive firms that are increasingly dominant within these economic structures.

In an effort to conceptualize this linkage more specifically, one would need to focus on these alternative management regimes and develop a set of trade-offs that provide the basis for tourism experience. With reference to forestry, this set of public and private good trade-offs is outlined in Figure 1.

Forest resources located in remote rural areas are often managed for multiple uses: traditional market-based extraction (e.g., timber production) and/or non-market uses (e.g., recreation). Within a policy context, particularly in environmental policy, these multiple uses have traditionally been presented as mutually exclusive: one cannot enjoy a recreational experience in a forest if it has been harvested. Under traditional forest management regimes this black-and-white depiction may have held true. But today, if we view the application of forest management as lying along a spectrum that varies from intensive (short-rotation silviculture for fibre production) to extensive (longer-rotation silviculture), we realize that there are differential combinations of market and non-market outputs. If we assume that the ‘output’ from the forest resource is multidimensional, we can model a trade-off between output levels across alternative forest management regimes.

The two-dimensional output stream can be characterized in terms of private (i.e., market) and public (i.e., non-market) goods. Under intensive forest manage-
ment regimes the forest resource is used in the more extractive sense of managing stands of trees to maximize fibre production. Output of the forest here is relatively easy to measure: the price of the commodity (wood) times the volume of the commodity harvested. Our traditional approach to modelling the economic impact of alternative forest management regimes has been to identify biological productive potentials for use as exogenous shocks to a static system. This approach, however, ignores the fact that there are public good (non-market) benefits flowing from the forest resource (as depicted in Figure 1 by the area below the diagonal line). These nature-based public goods provide the linkage to the production of recreational experiences (the tourism product).

By explicitly recognizing the public good aspect of the forest resource, we see that a number of modelling problems become apparent. These difficulties can be summarized as including (1) the size of the box; (2) the base value of the public good under extreme intensive use (i.e. the value of the intercept on the Y-axis); (3) the shape of the top of the box; and (4) the amount of regionally exported public good (the level of the public good that is consumed locally versus that which is used by in-coming tourists).

Perhaps the biggest challenge is estimating the dollar value of the public good flowing from the forest resources. In other words, if the market determined dollar value of the harvested timber resource is known, what then is the non-market value of a stand of trees for recreational purposes? The generalized form of this question has been one of the primary research initiatives undertaken by resource economists during the past 25 years. Methods developed

Figure 1. Goods produced through natural resource management.
include (1) revealed preference models (hedonic pricing and travel cost) and (2) stated preference models (contingent valuation). While a complete review of these methods is beyond the aim of this paper, there is a large body of research to draw upon. Unfortunately, while these methods can be complex and rigorous, there is no guarantee that the final estimated value of the non-market good will be robust across alternative methods used.

The second empirical problem is that of estimating the value of the non-market good under the most intensive forest management regimes. In Figure 1, it is explicitly assumed that there will always be some non-zero public goods value of the forest. One could reasonably argue that, immediately following a clear-felling operation, there is zero recreational value to the forest resource. In other words, in this case there is no positive intercept on the Y-axis. Today, however, silvicultural techniques have been applied that not only represent intensive timber production but also retain high levels of growing stock. For example, the Menominee Nation of Native Americans in Northern Wisconsin has adopted "legacy forest" silvicultural practices in which only trees of a certain diameter are selectively removed. The dollar value of the harvests are high as the largest trees comprise the highest-value commodity and resultant price structure. Trees below some age/size threshold are left in place to continue growing. The Menominees represent an excellent example of how a forest can be intensively managed without sacrificing public goods values. In this type of intensive forest management, the intercept on the Y-axis would be significantly above zero.

The third issue is the shape of the top of the box. Given a square representation we assume that the sum of market and non-market values of the forest resource is fixed across all forest management regimes. Implicit in this assumption are fixed prices with respect to market and non-market goods. This may appear internally consistent, but recent evidence suggests that market and non-market prices fluctuate significantly. Casual observations of local price behaviour in areas where national forests have shifted from one management regime to another suggest that prices are very sensitive to harvesting policy. Simple supply and demand theory predicts that as more forested land is removed from harvest, the supply of timber drops and prices increase. As increased acreage has been placed aside in extensive management regimes, the reduced supply causes increases in timber prices that motivate accelerated rates of harvesting on private forest lands. More difficult to see is the change in 'willingness-to-pay' for a recreational experience in a forested area as management regimes change. Currently, these recreational experiences exist as common-pool benefits and are thus non-priced to the recreating public. Certainly, tourism sector businesses in the region are currently not charged for recreational experiences requiring extensive management regimes. Ultimately, it is these experiences that provide a basis for tourism business receipts yet extensive management regimes create significant opportunity costs for owners of forest land.

The fourth and final problem discussed here is the flow of non-market benefits that originate from the regional forest resource. Clearly, local residents benefit from the public goods derived from forest resources. Many residents elect to live in these forested rural regions because they enjoy living in close proximity to nature-based amenities. Benefits to residents are significant but intangible. Tourism-sensitive businesses, on the other hand, are increasingly prevalent and profitable in amenity-rich communities. Non-resident travellers
(tourists) visit these forested regions and spend considerable amounts of money in the local economy. Thus, relevant tourism production benefits would tend to be limited to the regional export-based portion of the public goods associated with environmental resource management.

Fundamental to this set of arguments is the simple notion that tourism-sensitive firms in natural-amenity-rich regions benefit from the quality and quantity of environmental resources present in the region. These amenities are created or heavily influenced through natural resource management and exist as positive externalities of the resource base. For example, in natural-amenity-rich regions the output of tourism goods and services relies on the forests, lakes, and publicly provided recreational opportunities present in the region. It is unlikely that people travel to forested regions because they have excellent restaurants or uniquely wonderful hotel beds (even though they may indeed exist!). Rather, it is the natural-amenity base available in the region that provides the basis for tourism sector output.

The complex manner in which public and private goods flow from forests and land management regimes to regional industries is presented in Figure 2. It is important to realize that the outcomes of resource stock manipulation are rooted in land management capability. At the core of this capability are management objectives of landowners. Particularly on public lands, these objectives are often characterized by a philosophy of multiple use. Given a broad set of objectives and the knowledge of land management techniques, landowners choose a management intensity and then manage forest resources accordingly. This is identified in Figure 2 as forest production and relies upon the flexible usage of productive factors. For instance, in forest production, landowners combine their land and its original growing stock with labour and capital inputs (primary factor inputs to timber production) to create outputs of private and public goods. In addition to generating household income directly (through returns to forest inputs), forestry production creates raw material outputs for forward-linked industries. In the case of forestry, these include both the wood products sector and the tourism sector.

Manipulation of environmental resource stocks determines the future status of a primary input into tourism; namely the condition of the forest resource, its aesthetic value, and its recreational potential. Combined with other regional amenities (social, cultural, and infrastructural), the status of the forest resource for recreational potential draws visitors to the region, who impact local businesses. These impacted local businesses comprise the forested region’s tourism sector which contributes a portion of its receipts to local households as wages/salaries and proprietary income. Furthermore, the supply and demand of primary factors influence future rates of return to these resource inputs. Using this inferred linkage between forestry and tourism, we can now characterize the conceptual basis for production in a rural amenity-rich region.

Environmental goods as latent factors of production

We are now left with a need to characterize generically the supply, or production function, of tourism. Economists have developed a wide array of functional forms that could be used to characterize production. For simplicity, let’s consider
Figure 2. Generalized impacts of natural resource production.
generalized Cobb–Douglas production function that includes public goods. Certainly, this should be viewed only as a first step toward characterizing the production function of tourism and its non-priced environmental resource inputs. It is important to realize that there are a substantial number of alternative functional forms that could characterize tourism production from the more restrictive (Leontieff) to the more flexible (constant elasticity of substitution). This presentation is simply intended as an initial attempt to characterize factor inputs used in the production of tourism.

Due to its impacts on the amenity value of aesthetics and recreation, timber production can be viewed as a stock resource used for tourism. The linkage between timber and tourism begins with the conceptual basis for timber production. The production of timber, itself, can be characterized as a continuously substitutable spectrum based upon unique combinations of primary factors of production. This is outlined in Figure 3. Explicitly, timber output is a function of land, labour and financial capital, and resource stocks (commonly referred to by forest economists as 'growing stocks'). The choice of land management alternative determines the unique combination of inputs. For example, a

![Image of Figure 3](image)

**Figure 3.** Production of alternative timber regimes. \( Y = f(\text{land, labour/capital, resource stock}) \)
landowner could produce a given amount of timber output (in dollar value terms) using relatively lower levels of land or growing stock inputs if these resources were combined with high labour and financial capital inputs. This would characterize the intensive industrial fibre production seen in forest plantations that optimize space, nutrients, and water use. On the other hand, the more selective management of larger growing stocks using relatively less labour and financial capital inputs or land inputs could produce the same amount of timber output as measured by dollar value. With reference to Figure 1, however, we realize that there are differences among land management regimes in the output of recreational (or public goods) value. This represents the resource stock input used in the production function of tourism.

In a similar fashion, tourism production can be conceptualized as a function of land, labour and financial capital, and resource stocks. The hypothetical tourism production function is graphically represented in Figure 4. The value of generic tourism output (dollars) can be produced in different ways that reflect alternative types of tourism production. The amusement park can produce tourism output using very little environmental stock or land inputs given a high input of labour and financial capital. On the other hand, most passive outdoor recreation pursuits reflect tourism output produced using high environmental resource inputs and relatively fewer labour and financial inputs. In this extreme, pristine amenity-based recreation and reliant nature-based tourism businesses depend on natural conditions that are almost iminical to labour and financial capital inputs. Finally, motorized outdoor recreation uses environmental resources as more or less a backdrop to leisure with heavy emphasis on open space (or land) inputs. Thus, the regional production of tourism output is characterized as a set of input alternatives.

To be more specific, the generalized production of tourism output is characterized as being determined by three specific primary factors of production as outlined in equation (1).

\[ X = f (S, LK, E) \]  

(1)

This states that tourism output \(X\) is a function of primary factors that include land input \(S\), a combined labour and financial capital input \(LK\) and environmental resource (or public goods) input \(E\) to the production process. Each of these is typically measured in monetary units using price-quantity relationships. Given the non-priced nature of environmental resource inputs \(E\), this reinforces the need to develop regional estimates of environmental values. Empirically, this can be accomplished using both stated and/or revealed preference techniques developed by resource economists over the past 25 years.

To complete the exercise of production function analysis, the researcher is required to specify or estimate some functional form. Most appropriately determined through additional empirical work, this specification could follow one of many previously identified functional forms. For example, the Cobb–Douglas functional form could be used as specified in equation (2).

\[ X = S^\alpha LK^\beta E^\gamma \text{ where } \alpha + \beta + \gamma = 1 \]  

(2)

In this presentation, tourism production is characterized as a flexible combination of the three previously identified primary factors of production. The shares of factor inputs are represented by \(\alpha\), \(\beta\), and \(\gamma\) respectively. The condition that
α + β + γ = 1 represents an assumption that tourism sector output is characterized by constant returns to scale in production. In short, it is assumed that firms can simply increase the use of primary factors and experience a continuously increasing output of tourism. Certainly, further work is needed to substantiate basic assumptions and more clearly ground production function assessment with empirical observation.

Thus, environmental resources are used by the tourism sector in varying levels depending on tourism type. Although much of what could be referred to as 'amusement-based tourism' may require little in the way of environmental resources, other types of tourism rely heavily on this base. For example, much of the increased attention to 'special-interest tourism' and 'ecotourism' relies on environmental resources as a key latent input. The conceptual basis presented in this paper offers the rather simple but all-too-often overlooked notion that analysis of tourism production needs to incorporate non-priced, non-market inputs. From a more general perspective, environmental resources are only one type of non-priced, non-market input used in the production of tourism. The incorporation of historic and cultural resources as primary factors of production in urban or cultural tourism could likewise follow a similar characterization.
With regard to contemporary tourism research, conceptually addressing tourism supply and its representative production structure is critical to developing more generalizable theories that explain the tourism phenomenon. This shift in modelling strategy is beginning to take shape within resource economics and regional analysis circles. Characterizing production of tourism is a key component in contemporary economic analysis of tourism and represents an important avenue of future research. The difficulty with this simple representation has to do with visualizing a production process that incorporates fundamentally non-priced public goods (environmental resources) as a key latent factor of production in creating a tourism product. Firms that choose to produce tourism output using environmental resources have a characteristic advantage in that use of this primary factor is currently carried out with no (or very little) direct cost to the affected firm.

Summary and policy implications

In this paper, I have argued that much of the existing tourism economics and planning literature has overlooked important components of tourism supply; namely analysis of factor input usage in the production process that generates tourism sector output. A key issue involved in addressing the output of an amenity-based tourism sector is its dependence on environmental resources present in a region. These resources are characterized as comprising a critical latent primary factor of production that requires further theoretical and empirical assessment. For this discussion, forests were used as an example of one such latent primary factor input. Linkages between natural resource management and tourism production were used to conceptualize output of alternative tourism types. Incorporating non-market goods and services into tourism supply analysis provides a more comprehensive understanding of the nature-based tourism phenomenon.

The production of nature-based tourism relies on primary factors of production that include land, labour and financial capital, and environmental resource stocks. The latter, environmental resource stocks, are manipulated through natural resource management in varying degrees depending upon the alternative management regime chosen by owners of the environmental resource. The type and extent of these resource stocks depend on the sensitivity of land management to producing public goods. Indeed, a general point made by this paper is that the type and extent of natural resource stocks present in a region help frame the production of tourism output. For purposes of initiating a dialogue, a generalized production function was proposed that represents alternative tourism types and incorporates a flexible environmental resource stock component with an inferred linkage between resource management and the production of tourism.

Further research is needed to substantiate the theoretical production relationships outlined in this paper. How does tourism type vary with natural resource attributes, land ownership patterns, and regional economic structures? To what extent do natural-resource attributes affect the presence of tourism firms? Do empirical evaluations substantiate our theoretical constructs — and why or why not? Furthermore, comparative assessments are needed to evaluate empirically the cost structure of alternative tourism types which would lead to more complete justification of functional forms that represent tourism production.
As we move toward more integrative approaches to rural development that view tourism as one of many economic activities appropriate to amenity-rich regions, progressive policies that are holistic and systemic need to be crafted. These policies could realistically incorporate the linkages required to equalize benefits and costs of producing the stock resources upon which tourism is based. Indeed, there are costs associated with natural-resource management for public goods that are rarely recovered by those who produce these goods. This is particularly acute for public goods produced on private lands and demanded by tourism interests. If the tourism sector requires a particular type, or quality of environmental resource, how should the public respond? Do we have an opportunity or ability to shift resource conservation costs to consumers thereby internalizing relevant production costs? Doing so could have the benefit of generating more equitable and efficient outcomes.

Contemporary public policies that address tourism development often focus solely on supporting tourism sector interests without attending to broader community development issues. In the USA, public tourism policies at all levels of government are dominated by marketing and promotional activities that result in increased tourist visits intended to provide expanded opportunities for tourism sector businesses. There is a need to extend policies beyond this myopic focus to account more effectively for broader linkages to the environmental, social, and economic sustainability of communities.

In rural amenity-rich regions, increased leisure-based visits place an increasing demand on environmental resources for recreational opportunities. The relevant question addressed in this paper deals with how we supply this increasingly demanded nature-based tourism product. In the case of forest-based recreation and reliant tourism businesses, a critical factor involved in this product includes the environmental resource base and its aesthetic and recreational value. The status of this environmental resource base is controlled by landowners, rarely themselves involved directly in the retail and service businesses that comprise the tourism sector. Integrating the needs and desires of nature-based tourism businesses with this environmental resource base, its management, and the owners of land comprises a critical set of stakeholder interactions that require creative public policies intent on maximizing benefits while ameliorating potential conflicts. The structure of tourism production and the importance of environmental resources to the tourism phenomena are key ingredients of public policy for land use, environmental conservation, community economic development, and tourism.

Endnotes


5. N. Leiper, 'The framework of tourism: toward a definition, tourist, and the tourist industry', *Annals of Tourism Research*, Vol 6, No 4, 1979, p 398. This reference is an example of one of many academic volleys (colligively referred to as the 'Smith-Leiper' debate) that attempt to solidify the status of tourism as an industry.


