

Tourism destination development: the tourism area life cycle model

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ABSTRACT

The tourist area life cycle has been in existence for over four decades since its publication in *The Canadian Geographer* and was described as 'one of the most cited and contentious areas of tourism knowledge... (and) has gone on to become one of the best known theories of destination growth and change within the field of tourism studies' It was noted as one 'Of the most influential conceptual models for explaining tourist, development'. The model was developed primarily from the Product Life Cycle model used in business and management studies and modified to explain the process of development and change that took place in tourist destinations throughout the world. The model has received considerable attention over its life span, but has often been cited from second hand sources or misquoted on many occasions. Its appearance in a non-tourist journal has resulted in it often not appearing in various early literature surveys based on tourism-focused sources and for its first decade access to the original article was limited and difficult, as demonstrated by many requests to the author for copies of the article. Electronic access to journals and libraries have resolved this problem, but its considerable visibility (in excess of 56,000 reads on Research Gate) and use (close to 5000 citations) means that it has possibly entered the realm of tourism myths and become part of accepted dogma in the field of tourism development. This could present problems to those challenging the original concept and introducing alternative or contradictory ideas and propositions, and it is perhaps, appropriate to briefly review the history of the concept.

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Introduction and definition

The tourist area life cycle (Butler, 1980) has been in existence for over four decades since its publication in *The Canadian Geographer* and was described by Hall and Butler (2006, p. xv) as 'one of the most cited and contentious areas of tourism knowledge... (and) has gone on to become one of the best known theories of destination growth

and change within the field of tourism studies' It was included in what Che (2017, p. 164) noted as 'some of the most influential conceptual models for explaining tourist, development, including resort morphology, the tourist-historic city and the tourist area life cycle'. The model was developed primarily from the Product Life Cycle model used in business and management studies and modified to explain the process of development and change that took place in tourist destinations throughout the world. It proposed that the life cycle of a tourist area could be divided into a number of stages (exploration, involvement, development, consolidation, stagnation, followed by a range of options from rejuvenation to decline), and the rather brief discussion noted the different characteristics of destinations at each of those stages. It also commented on the emergence of tourist destination regions and placed considerable importance on the concept of carrying capacity and tourist numbers in determining the shape of the curve of development for each destination. The model did not state that all destinations would enter decline, rather arguing the opposite, by proposing that appropriate management of its resources should enable a destination to continue in operation and attract tourists. The model has received considerable attention over its life span, but as Wang et al. (2016) illustrated, has often been cited from second hand sources or misquoted on many occasions. Its appearance in a non-tourist journal has resulted in it often not appearing in various early literature surveys based on tourism-focused sources and for its first decade access to the original article was limited and difficult, as demonstrated by many requests to the author for copies of the article. Electronic access to journals and libraries have resolved this problem, but its considerable visibility (in excess of 56,000 reads on Research Gate) and use (close to 5000 citations) means that it has possibly entered the realm of tourism myths (McKercher & Prideaux, 2014) and become part of accepted dogma in the field of tourism development. This could present problems to those challenging the original concept and introducing alternative or contradictory ideas and propositions, however, It remains a frequently cited model, and it is perhaps, appropriate to briefly review the history of the concept.

Historical review

The three decades following the second World War saw enormous changes in tourism at both the domestic and international scales. Domestic tourism saw the car and to a lesser extent the coach replace rail as the predominant mode of travel to tourist destinations, while at the international level, air travel became widespread, enabling the establishment of new tourist destinations for a rapidly growing market as the world's economies grew in the peace time boom. It was against that backdrop that writing and research on tourist destinations began to appear in academic publications. Of particular relevance are the works of Christaller (1963), Plog (1973) and Wolfe (1952) who all focused on the ways in which tourist destinations grew and changed over time Christaller (1963) promoting an evolutionary approach involving the gradual conversion of communities to a tourism dominated locale, echoing earlier writing on the English holiday resorts (Barrett, 1958). Plog's (1973) conclusions on the pattern of destination development was prompted by work on the psychology of visitors and their changing tastes, while Wolfe (1952) neatly summarised the results of such developments as 'the divorce from the geographic environment' in recognition of the

way tourism development was physically changing communities, as well as altering their economic and social functions. Research on the form or morphology of such places was presented by Jarrett (1954) and more widely by Stansfield (1972) and Stansfield and Rickert (1970), and the dispersal of tourism development at a regional scale discussed by Miossec (1977) and others (Pearce 1989)

The original article was very short by modern research paper standards and limited in references and devoid of empirical data. It was a classic example of much writing in that period, when concepts and ideas were proposed based on observation, induction, and experience, often not being subjected to data gathering, analysis and interpretation. Since publication the model has been used extensively in a variety of settings, from the South Pacific to family scale enterprises in Mexico. A number of alternative approaches have been applied, most notably by Agarwal (2002) who introduced the idea of a modification or pause in the development process reflecting the introduction of a post-Fordist approach and refocusing of development. Other writers, e.g. Gale (2005) discussed the model in the context of modernism and post-modernism, and questioned specific aspects of the model including the value of the carrying capacity argument and the difficulties of measuring whatever was meant by 'development' and by the phrase 'tourism area'. A wide range of uses and alternative viewpoints and approaches to the model were included in two volumes dealing with its applications and modifications (Butler, 2006a, 2006b).

One aspect of the model that has become more relevant over time is the relationship implied between level of use and quality of experience. The original article argued for the management of resources of destinations to preserve their integrity and thus maintain the appeal and attractiveness of a location to visitors. It can be regarded as an early call for sustainable management in that maintaining quality by operating with the limits of its resources as the model proposed would ensure long-term viability as illustrated by consistent or increasing visitor numbers. Clearly, in the early stages of the model's application, growth was the principal, if not the only aim of most tourist destinations, a view being increasingly challenged in the current era (Dwyer, 2022), but much less so during the first three decades of the TALC's existence. The relationship between destination development and external forces has been discussed less than that with internal influences, although Keller (1987) had noted the existence of instability as destinations changed stage of development, reflecting local adaptation to difference levels of external control and influence. As noted below, the COVID19 pandemic was the clearest indication of the dependence of destinations and tourism as a whole on stability and security in travel, and how little individual destinations could do to counteract such massive external constraints and impacts on tourism in general.

Current trends

There are three significant trends and theories which have impacted or have begun to impact on the TALC concept and model; further developments in sustainable tourism management, application of path dependency concepts, and linkage of development concepts with evolutionary economic geography (EEG). All three concepts were summarised and discussed together in Brouder's seminal paper (2017).

Sustainable tourism is a term which has gained massive support in theory and principle, although one can argue strongly that it has had little overall effect on tourism and its environmental impacts at the global level. While many individual enterprises have moved significantly towards reducing energy consumption, carbon emissions, food miles, imported labour and the use of non-renewable sources of supply in many areas, the continued growth of long-haul tourist travel, mostly by air, the growth of cruise traffic, and apparently insatiable demand for tourism of most kinds have left the tourism footprint larger than ever. As noted below, this situation may change in response to the belated efforts to diminish climate change, but the rapid recovery from COVID19 suggests both the tourist market and the tourism industry, along with many governments at all levels, do not yet appreciate the need to curtail and redirect tourism development. It has fallen to individual destinations to take steps to avoid what has become known as overtourism (Dodds & Butler, 2019, Milano et al., 2019). Whether overtourism really exists or whether it is, as some proponents of continued tourism growth (UNWTO 2020) would argue, simply a matter of poor management and not excessive numbers, it has become too significant in media of all forms to be ignored. Failure to deal with the problem (Butler & Dodds, 2022) has mirrored the failure to successfully implement sustainable tourism policies despite their widespread approval in principle and the lack of the level of integration that is necessary for effective action is widespread and clear. Saarinen (2004) argued two decades ago of the competing viewpoints in destination development and their failure to work together to define and reach common goals. Little has changed in the intervening period, with continued growth remaining the dominant approach in most locations, sometimes despite local opposition, but often with local support in an absence of perceived viable alternatives. As Hall (2011) has argued, there is little evidence of widespread support for massive change in policy with regard to development, and while others (e.g. Fletcher 2011) regard sustainable development as sustaining capitalism when they wish for an alternative ideological approach, there has inevitably been no major progress along the sustainable pathway.

Path dependency in tourism has been paid limited attention in the context of the TALC until relatively recently, but the volume by Brouder et al. (2017) on *Tourism Destination Evolution* makes a valuable and significant contribution in this area. Further examination of how pathways develop, under whose control they are formulated and directed and how they can be modified and refocused is important. Ma and Hassink (2014) showed how path dependency has affected tourism destination development in China, and Halkier et al. (2019) explored the relationships between governance, development and EEG. The ability to alter what may have been regarded previously as an inevitable and unalterable path of development was illustrated in Gill and Williams's (2011) work on Whistler, however, significant movement from the continuous growth paradigm to a more sustainable pathway can be halted or modified by both internal and external forces, emphasising the vulnerability of the limited development approach to established ways of thinking, especially in remoter areas with limited alternative possibilities (Carson & Carson, 2017). In the context of the TALC too little attention has generally been paid to the idea of stability and sustainability as a desirable pathway, with most attention being paid on ways to avoid the decline scenario of that model because of the fear that any cessation in growth would

represent the first step towards decline. Such was not the intention of the model but the long expectation of continual growth meant such an outcome was perceived as inevitable

The emergence of what has become known as evolutionary economic geography was highlighted in the special issue of this journal (2014) and hailed by the editors (Ionnides et al 2014, p. 536) as 'a promising avenue of research and theory building', with the ability to 'better understand how tourism evolves through time'. The potential links to the TALC are obvious, with the latter's focus on how tourism spaces evolve over time. Boschma and Martin's (2010) handbook described in some detail the new approach in economic geography and its relevance to other fields although with limited reference to tourism, and the contributors to the special issue added invaluable links and examples of how that approach could be utilised in the tourism context, in particular Sanz-Ibáñez and Anton Clavé (2014). The relevance of EEG to destination development is clear, and the fact that the TALC argues for destinations to be treated as products strengthens the validity of that approach, as shown by the work on agglomeration and clustering of tourist attractions and developments (Weidenfeld et al., 2010, 2013). As Brouder (2017, p. 444) concludes, it should be possible to use 'the concept of sustainable development as a critical lens on EEG in tourism studies and vice versa', and perhaps in the context of the TALC in particular.

Future research directions

One obvious line for future research is to continue the work done related to the general field of evolutionary studies, such as EEG noted above. The advent of COVID19 and the subsequent pandemic focused a great deal of academic attention on its impacts on tourism and travel and revealed to many audiences, not least political ones, just how important tourism was and is to many economies and to peoples' well-being because of its economic and social importance. Enabling tourism focused communities to survive and continue is important, not just because there is often no obvious alternative economic pathway, but because many potential tourists wish them to continue to provide leisure opportunities. Leisure (recreation/tourism) has continually evolved, and what were tourist destinations have become recreation resources and in turn leisure locations, reflecting changes in transportation, market tastes and other forces. Thus, further examination of how agglomeration works in a tourism context (e.g. Weidenfeld et al., 2013) could be a useful path to follow, as would work on incorporating the roles of entrepreneurs, public sector agencies and local stakeholders in determining the ongoing well being of destination communities.

A second potentially valuable topic of research would be much deeper examination of the political ecology of tourist destinations, the ways in such communities are actually managed and controlled, and the decision-making processes at work within them, building on the research of Gale (2005) and others such as Saarinen and Kask (2008). The whole issue of sustainable development in the tourism context is certainly due for more critical and detailed examination. In the three decades or more since sustainable development) it has been a topic more suited to geographical study than any other field. The general global failing to move tourism convincingly towards the

admittedly impossible goal of sustainability, despite considerable advances at an individual enterprise level might lead one might to argue that little has really changed in that field since a review almost a quarter of a century ago (Butler, 1999).

In the context of the TALC, most of the initial studies followed a descriptive application of the model, focusing on one or a small group of destinations. Sanz-Ibáñez and Anton Clavé's paper (2014) noted above, has gone some way in this direction in linking evolutionary studies with economic and destination development, as did Brouder (2017) in drawing attention to the difficulties in challenging the pro-growth model, citing the vulnerability of local destination stakeholder attempts to move towards a more sustainable future and the legacy of institutional inertia maintaining the status quo in favour of growth, and why such a situation exists deserves closer examination. The development of the concept of regenerative tourism (Bellato et al., 2023) may present an alternative way of moving towards a more positive and less problematic form of development of tourist destinations.

One problem in pursuing a non-growth or de-growth (Andriotis, 2018) agenda is that many local stakeholders and tourists at large do not support such an agenda, and neither does 'the industry' or many public sector agencies. While residents may oppose further growth in some locations, as shown in Barcelona, Venice, and other cities (Dodds & Butler, 2019; Milano et al., 2019), they are often not willing to accept reduced employment or income generation, particularly when participating in tourism operations, and the tourist population in general appears in favour of more, not less, development of opportunities. The idea that COVID19 might provide a change of heart at a global and industry scale has proved predictably incorrect, however worthwhile proponents' goals may have been.

Part of the problem lies in the fact that there is no 'tourism industry' as such where that might imply a single agency which could be controlled and managed at the global or even regional scale. Tourism is made up of a vast number of enterprises at all scales, most in competition with each other and with little willingness to give up any competitive advantage or market opportunity they may have. There is no single body to appeal to for moderation or a more sustainable approach and examination of how to move successfully and globally towards a seriously sustainable approach at the destination level when other areas such as air transport are showing little inclination to do so, is essential. It is necessary to move significantly beyond relying on green washing and promoting sustainability to attract tourists in large numbers, especially when sustainable options often cost more than conventional ones. Most tourists' decisions are driven by cost and value and in times of uncertainty, conflict, inflation, and economic recession will remain so until attitudes can be changed. Actions to mitigate climate change, including realistic taxation of aviation fuel and similar measures may be effective in reducing some of the unsustainable elements of tourism and may result in some destinations entering a decline phase of their life cycles because of reduced markets, particularly in the case of long-haul destinations where alternative opportunities exist closer to home. The effect of such potential measures should be a focus of immediate attention to ensure that such effects, both reduced and increased visitation to destinations, can be anticipated and appropriate management decisions be identified in order to avoid otherwise inevitable problems (Gerritsma, 2019).

Conclusion

A number of conclusions may be identified. One is the fact that the TALC model is still being used, albeit with modifications and adjustments as might be expected. Beginning with the recognition by Agarwal (2002) and others that 'one curve does not fit all', various versions of the original model have appeared and continue to be promoted. The call for a sustainable approach (although not using that terminology in 1980) was recognised somewhat belatedly compared to the initial applications and testing of the model, both as a descriptive and a predictive model but has become more significant as dissatisfaction with growth as the only measure of success has developed. Numbers of visitors were taken as the measure of development in the original model because they were felt to be the only common statistic available in most destinations as a measure of growth and development, but alternatives, although more difficult to access, should be available, such as resident attitudes, visitor satisfaction and other expressions of well-being and quality of experience, of both visitors and visited alike.

Concern over excessive tourist numbers in destinations, harking back to the initial argument about the importance of carrying capacities in the TALC model, have appeared in a considerable number of locations, and such opposition to current levels of visitation need to be recognised and addressed. No-growth or de-growth options are now becoming reality, as too is the influence of COVID19. Any model of destination development from now on has to illustrate the almost total disappearance of tourists during the period 2020–2022, and the original TALC curve has been modified accordingly (Butler, 2024). The likelihood in the future for many destinations can and should be stability, preferably sustainability rather than growth, and in more cases than anticipated in 2018, decline and even exit from tourism may be a realistic if unwanted result of the pandemic. The full effects of COVID19 will not be known for many years, if ever, and its impacts on destinations and their life cycles are uncertain with a range of possible regrowth or decline futures inevitable (Butler, 2021)

Exploring the past and future of tourist destinations remains an important element in the geographic panoply of research topics, in part because of the importance of these places and the need to understand their development pathways and options, as well as linkages with other forms of economic activity, and in part because it is essentially geographic in focus and purpose. Managing such communities for sustainable long-term success in environmental, social and economic terms is simply commonsense and essential for the future well-being of those destinations for both residents and visitors.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Notes on contributor

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References

- Agarwal, S. (2002). Restructuring seaside tourism. The resort life-cycle. *Annals of Tourism Research*, 29(1), 25–55. [https://doi.org/10.1016/S0160-7383\(01\)00002-0](https://doi.org/10.1016/S0160-7383(01)00002-0)
- Andriotis, K. (2018). *Degrowth in tourism: Conceptual, theoretical and philosophical issues*. CABI.
- Barrett, J. A. (1958) *The Seaside Resort Towns of England and Wales*. Unpublished PhD thesis, University of London
- Bellato, L., Frantzeskaki, N., & Nygaard, C. A. (2023). Regenerative tourism: A conceptual framework leveraging theory and practice. *Tourism Geographies*, 25(4), 1026–1046. <https://doi.org/10.1080/14616688.2022.2044376>
- Boschma, R., & Martin, R. (2010). *The handbook of evolutionary economic geography* Edward Elgar.
- Brouder, P. (2017). Evolutionary economic geography: Reflections from a sustainable tourism perspective. *Tourism Geographies*, 19(3), 438–447. <https://doi.org/10.1080/14616688.2016.1274774>
- Brouder, P., Clave, A., Gill, A. M., & Ioannides, D. (2017). *Tourism destination development*. Routledge.
- Butler, R. W. (1980). The concept of a tourist area cycle of evolution and implications for management of resources. *The Canadian Geographer*, XXIV(1), 5–12.
- Butler, R. W. (1999). Sustainable tourism: The state of the art. *Tourism Geographies*, 1(1), 7–25. <https://doi.org/10.1080/14616689908721291>
- Butler, R. W. 2024. *The tourism area life cycle Review. Relevance and revision*. Bristol: Channelview Publications.
- Butler, R. W. (2006a). *The tourism area life cycle: Applications and modifications*. Clevedon.
- Butler, R. W. (2006b). *The tourism area life cycle conceptual and theoretical issues*. Clevedon.
- Butler, R. W. (2021). COVID 19 and its potential impact on stages of tourist destination development. *Current Issues in Tourism*, 25(3), 1–14.
- Butler, R. W., & Dodds, R. (2022). Overcoming overtourism: A review of failure. *Tourism Review*, 77(1), 35–53. <https://doi.org/10.1108/TR-04-2021-0215>
- Carson, D. A., & Carson, D. B. (2017). Path dependence in remote area tourism development Why Institutional legacies matter. In P. Brouder, A. Clave, A. M. Gill, & D. Ioannides (Eds.), *Tourism destination development* (pp.103–122).Routledge.
- Christaller, W. (1963). Some considerations of tourism location in Europe: The peripheral regions—underdeveloped countries—recreation areas. In *Regional Science Association Papers XII* (pp. 95–105). Lund Congress. <https://doi.org/10.1111/j.1435-5597.1964.tb01256.x>
- Dodds, R., & Butler, R. W. (2019). *Overtourism issues, realities and solutions*. De Gruyter.
- Dwyer, L. (2022). Tourism development and sustainable well-being: A beyond GDP perspective. *Journal of Sustainable Tourism*, 20, 1–18.
- Fletcher, R. (2011). Sustaining tourism, sustaining capitalism? The tourism industry's role in global capitalist expansion. *Tourism Geographies*, 13(3), 443–461.
- Gale, T. (2005). Modernism, post-modernism, and the decline of British seaside resorts as long holiday destinations. *Tourism Geographies*, 7(1), 86–112. <https://doi.org/10.1080/1461668042000324076>
- Gerritsma, R. (2019). Overcrowded Amsterdam; striving for a balance between trade, tolerance and tourism. In C. Milano, J. M. Cheer, & M. Novelli (Eds.), *Overtourism excesses, discontents and measures in travel and tourism* (pp. 1215–1148). CABI.
- Gill, A. M., & Williams, P. (2014). Mindful deviation in creating a governance path towards sustainability in resort destinations. *Tourism Geographies*, 16(4), 546–562. <https://doi.org/10.1080/14616688.2014.925964>

- Halkier, H., Müller, D. K., Goncharova, N. A., Kiriyanova, L., Kolupanova, I. A., Yumatov, K. V., & Yakimova, N. S. (2019). Destination development in Western Siberia: Tourism governance and evolutionary economic geography. *Tourism Geographies*, 21(2), 261–283. <https://doi.org/10.1080/14616688.2018.1490808>
- Hall, C. M., & Butler, R. W. (2006). Foreword. In *The tourism area life cycle: Applications and modifications* (pp. xv–xviii). Channelview Publications.
- Hall, C. M. (2011). Policy learning and policy failure in sustainable tourism governance: From first- and second-order to third-order change? *Journal of Sustainable Tourism*, 19(4–5), 649–671.
- Ioannides, D., Halkier, H., & Lew, A. A. (2014). Special issue introduction: evolutionary economic geography and the economies of tourism destinations. *Tourism Geographies*, 16(4), 535–539.
- Keller, C. P. (1987). Stages of peripheral tourism development—Canada's northwest territories. *Tourism Management*, 8(1), 20–32. [https://doi.org/10.1016/0261-5177\(87\)90036-7](https://doi.org/10.1016/0261-5177(87)90036-7)
- Milano, C., Cheer, J. M., & Novelli, M. (2019). *Overtourism excesses, discontents, and measures in travel and tourism*. CABl.
- Ma, M., & Hassink, R. (2014). Path dependence and tourism area development: The case of Guilin, China. *Tourism Geographies*, 16(4), 580–597. <https://doi.org/10.1080/14616688.2014.925966>
- McKercher, B., & Prideaux, B. (2014). Academic myths of tourism. *Annals of Tourism Research*, 46, 16–28. <https://doi.org/10.1016/j.annals.2014.02.003>
- Miossec, J. M. (1977). Un model de l'espace touristique L'Espace. *L'Espace géographique*, 6(1), 41–48. <https://doi.org/10.3406/spgeo.1977.1690>
- Pearce, D. (1989). *Tourist Development Harlow*: Longman
- Plog, S. C. (1973). Why destinations areas rise and fall in popularity *Cornell Hotel and Restaurant Association Quarterly*, 13, 6–13.
- Saarinen, J. (2004). 'Destinations in change': The transformation process of tourist destinations. *Tourist Studies*, 4(2), 161–179.
- Saarinen, J., & Kask, T. (2008). "Transforming tourism spaces in changing socio-political contexts" the case of Parnu, Estonia as a tourist destination. *Tourism Geographies*, 10(4), 452–473. <https://doi.org/10.1080/1461668802434072>
- Sanz-Ibáñez, C., & Anton Clavé, S. (2014). The evolution of destinations: Towards an evolutionary and relational economic geography approach. *Tourism Geographies*, 16(4), 563–579. <https://doi.org/10.1080/14616688.2014.925965>
- Stansfield, C. A. (1972). The development of modern seaside resorts. *Parks and Recreation*, 5(10), 14–46.
- Stansfield, C. A., & Rickert, J. E. (1970). The recreational business district. *Journal of Leisure Research*, 2(4), 213–225. <https://doi.org/10.1080/00222216.1970.11970002>
- Wang, X., Weaver, D. B., Xiang, L., & Zhang, Y. (2016). In Butler (1980) we trust? Typology of ceter motivations. *Annals of Tourism Research*, 61, 216–218. <https://doi.org/10.1016/j.annals.2016.07.004>
- Weidenfeld, A., Butler, R. W., & Williams, A. (2010). The role of clustering, cooperation and complementarities in the visitor attraction sector. *Current Issues in Tourism*, 14(7), 595–629. <https://doi.org/10.1080/13683500.2010.517312>
- Weidenfeld, A., Williams, A. M., & Butler, R. W. (2013). Spatial Competition and Agglomeration in the Visitor Attraction Sector. *The Service Industries Journal*, 34(3), 175–195. <https://doi.org/10.1080/02642069.2013.778251>
- Wolfe, R. I. (1952). Wasaga Beach – the divorce from the geographic environment. *Canadian Geographies / Géographies canadiennes*, 1(2), 57–66. <https://doi.org/10.1111/j.1541-0064.1952.tb01711.x>