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Will Jennings

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Why costs overrun: risk, optimism and uncertainty in budgeting for the London 2012 Olympic Games

WILL JENNINGS*

School of Social Sciences, University of Manchester, Oxford Road, Manchester, M13 9PL, UK

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The systematic under-estimation of costs in budgeting for large-scale projects raises the vexing question of why there are such incongruities between the projections made at initial stages and the eventual outturn cost. As a first step to understanding the sources of such budgeting overruns in the context of the Olympics, this research note outlines how the costs of the London 2012 Olympic Games were under-estimated in a series of budget forecasts, identifying sources of error and categorizing these according to the effects on budgeting of: (1) inattention to risk inside government; (2) biases in decision-making in the evaluation and use of information; and (3) uncertainty in project management and administration. These factors are accentuated through the planning and budgeting context, as estimates at different stages of the process serve alternative purposes and entail varying levels of knowledge and scrutiny.

Keywords: Cost overruns, mega-events, Olympics, optimism bias, risk.

Context

Large scale 'mega' projects and events are problematic venues for the management of risk, and for budgeting in particular. In one of the initial studies into the feasibility of a bid for the 2012 Olympics, the total cost to London of hosting the Games was estimated at a modest £1.8 billion (for details of that budget forecast, derived on the basis of a range of assumptions about a 'specimen bid', see Arup, 2002a, 2002b). This figure later increased to £4.2 billion in the bid dossier that was submitted to the International Olympic Committee (IOC) and again revised upwards to £9.325 billion in a formal government review of the budget in 2007. Since that review, cost increases have been absorbed into the sizeable construction and programme contingencies for the project. Far from the London 2012 experience being exceptional for the problem of spiralling costs, the under-estimation of project costs is the norm in organization of the Olympic Games (see Jennings, 2012a), with the average cost overrun from the estimates presented in the bid dossiers of applicant cities being equal to more than 200% in all Games since 1976. This is consistent with extensive evidence on the systematic bias of mega-projects towards cost inflation (Merrow, 1988; Flyvbjerg *et al.*, 2002, 2003; Jennings, 2012b). This research note uses the case of London 2012 to test a number of explanations of cost overruns in major projects in general and in organization of the Olympics in particular.

Method

The concept of optimism bias is prominent in studies of large-scale projects (e.g. Flyvbjerg *et al.*, 2003), and has also become influential in official planning guidance for public works (e.g. HM Treasury, 2011). There are, however, disparate theories about the underlying causes of optimism bias, for example being grouped according to technical (e.g. scope creep, imperfect information), psychological (e.g. decision-making biases), economic (e.g. rent-seeking by firms and consultants), and political-institutional (e.g. bureaucratic and organized interests) categories (see Flyvbjerg and COWI, 2004). Each of these theoretical perspectives tends to be attached to the selection of particular forms of measurement and, because of this,

*E-mail: will.jennings@manchester.ac.uk

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are often limited in their discrimination between the concurrent causal effects of variables, posing a threat to internal validity.

Studies of cost overruns in large-scale construction and infrastructure projects have a range of methodologies available to them. Influential works in this field have used quantitative methods to determine the general distribution of cost overruns in major projects and the factors associated with them (e.g. Merrow, 1988; Flyvbjerg *et al.*, 2002, 2003). An alternative approach is to undertake multi-*N* qualitative analysis of planning and budgeting processes and outcomes, comparing the characteristics of cost overruns across a series of similar cases (e.g. Hall, 1980; Jennings, 2012a).

This research note uses a single case to analyse the evolution of cost estimates over time through a form of 'process-tracing' (George and McKeown, 1985). To do this, it analyses mutations in the estimated costs over a series of budget forecasts/assessments for the London 2012 Olympics produced and published at significant intervals during the planning, bidding and delivery phases (these are described in further detail below). These figures were identified through a comprehensive search of the public record and provide a *longitudinal* sampling frame that enables demonstration of how both headline costs and estimates of specific items have risen over time and between critical points in the decision-making process. The data were compiled from the original documents (with the exception of the final budget which is detailed in a National Audit Office report) and selected items are included where budget definitions of categories are consistent, and enable direct comparison. Because there have been no revisions of the official budget *as a whole* since 2007, this remains the benchmark for assessing costs (although there have been changes in the expected cost of some items since 2007, which are discussed here). This approach is designed to generate insights into generalities of the budgeting process and the impact of the decision-making context of budget preparations on cost estimates. For example, this distinguishes between initial scoping and the tendering phase (prior to the IOC's selection of London as host of the Olympic Games in this case) and the later efforts of government to establish the terms of the public sector's financial commitment to the event. Such an approach does not, as a rule, consider incremental revisions of the budget made on an ad hoc basis. Further, it focuses upon the headline figures and a selection of major items because the budgets often leave ambiguities over which items are covered under general categories (in some instances limiting the scope for direct comparisons). The purpose of the qualitative analysis is therefore to use the case to test alternative explanations of cost overruns in major projects such as the Olympics. This method is intended to inform the design of future multi-*N* studies, enabling systematic testing of causal effects of different variables on the likelihood, timing and magnitude of cost overruns. It identifies changes in cost estimates and then assesses how these are linked to (1) the political context of budgeting and adherence to guidance and technical analysis; (2) the state of decision-making mindsets in the formulation of estimates and the application of budgeting procedures and the sorts of information used to construct and evaluate budgets; and (3) changes to budgeting assumptions based upon changes in technical or accounting scope and unanticipated shocks (i.e. incomplete information).

Data

Over time, the cost estimates for the London 2012 Olympics evolved through a number of forms and stages of budget preparation. Those selected for analysis here are (1) the budget developed by external consultants for a 'specimen bid' (Arup, 2002a); (2) a subsequent probabilistic assessment of the risks and uncertainties associated with the bid (PricewaterhouseCoopers, 2003); (3) the estimates of the required expenditure that were presented to the IOC as part of London's candidate file (London 2012 Ltd, 2004); and (4) the revised budget produced by the UK government in 2007. These represent the main public communications of the projected costs of London 2012. There are often difficulties associated with resolving the question of what the final cost of the Olympic Games *is*. As the Auditor-General of New South Wales concluded in a report following the Sydney 2000 Olympics, '[t]here is no one, simple answer to this apparently simple question' (New South Wales Audit Office, 2002, p. 3). This uncertainty is, in part, due to the changes in the political and managerial purpose of budgets at different times in the project-event lifecycle as well as to variation in resourcing of budgeting exercises. Such contexts give rise to variation in the amount of information and resources available for preparation of estimates as well as differences in the substantive purpose and meaning of the numbers. The cost estimates of budgets presented at the bid stage are often speculative and used as a basis for justification, for example, whereas budgeting at later stages tends to reflect the concern of decision-makers with measuring and controlling costs. As this analysis will outline, this has significant consequences for drift between projections made at the initial stages of budget preparation, where information on technical

specifications and funding lines tends to be sparse, and budgets produced once the objectives, designs and financing have been agreed upon.

Through comparison of data on the rising cost estimates for London, presented in Table 1 in nominal prices,[1] it is possible to explain how the cost has blown out from an initial forecast of less than £2 billion. While differences in the classification of certain budget items can make direct comparisons difficult in some instances, it is clear that the estimated costs of the operations and construction of infrastructure and facilities for the Olympics have been subject to considerable growth over time (even if inflation is controlled for), reaching almost 1000% for the latter. Another main area in which there was escalation of costs was the estimated security costs, which were not reported in the budgets of either the Arup (2002a) report or the candidate file (London 2012 Ltd, 2004), despite estimates of security costs having been undertaken at that point. This omission amounted to some £600 million that was missing from the original estimates of the total cost. (Since the 2007 government budget there has been a further increase of £271 million in the cost of onsite security.) To similar effect, the tax liabilities of capital expenditure had not been included prior to the 2007 budget, leading to the addition of £836 million to the corrected budget of 2007. The last of the main sources of the rising costs of London 2012 was the addition of sizeable contingencies for construction of venues and infrastructure (£500 million) and for the interconnectedness of project risks at the programme level (£2247 million, including tax liabilities) (National Audit Office, 2007, p. 16). While there have been subsequent increases in the cost of some venues since 2007—for example, with the cost of the main stadium rising from £535 million in July 2008 to £547 million in February 2009 (see Department for Culture, Media and Sport, 2009, p. 47)—most of this inflation has been absorbed through the contingencies. In certain respects, then, the incumbent government took the initial political 'hit', in terms of criticism and unpopularity, through announcing the updated budget in 2007, giving it substantial latitude for discretion in its subsequent management of the budget.

Analysis

While it is well established that major projects tend to have poor track records in terms of their completion times and cost overruns (e.g. Merrow, 1988; Flyvbjerg *et al.*, 2002, 2003; Altshuler and Luberoff, 2003) there is less consensus as to the determinants of overoptimism in planning and budgeting. Further, 'uplifts' of cost projections are a potential solution to reduce the likelihood of overruns (Flyvbjerg and COWI, 2004, pp. 28–35) but do not address the problem at source. Other explanations such as 'strategic misrepresentation' (Flyvbjerg *et al.*, 2002) are at odds with those that highlight the lack of detail in scope definition (Merrow *et al.*, 1981). This debate is fuelled

Table 1 Estimated cost of specified items of the budget for the London 2012 Olympics

	Arup (2002)	PricewaterhouseCoopers (2003) nominal case	Candidate file estimates (2004)	Government revised budget (2007)
	£ million 2002 prices	£ million 2003 prices	£ million 2004 prices	£ million 2007 prices
Operations	779	897	1539	n/a
Infrastructure and facilities	403	731	2670	4486[c]
Land acquisition	325	425	–	–
Site security	–	–	190[b]	268
Total security	160.2	170	–	600
Tax	–	–	–	836
Contingency	109[a]	–	–	2747
Total cost	1800	3140	4209	9325
Nominal £ in 2007 prices (GDP deflator)	1.13	1.11	1.08	1.00
Source	Arup (2002a, 2002b)	PricewaterhouseCoopers (2003)	London 2012 Ltd (2004)	National Audit Office (2007)

Notes: [a]Denoted as 'provision for risk' (Arup, 2002a, p. 5).
[b]Estimate at time of bid, not included in budget (National Audit Office, 2007, p. 33).
[c]Excludes cost of site security listed as part of Olympic Delivery Authority core costs (National Audit Office, 2007, p. 16).

because large-scale projects of this sort span the worlds of politics, capital financing and investment, planning, engineering and project management, and so attract diagnoses and remedies aimed at often disparate aspects. While no single field of enquiry has all the answers, it is possible here to draw upon three strands of thinking to organize analysis of some of the contributing factors of the under-estimation of costs for the London 2012 Olympics. The first of these concerns the role of partisan politics and executive government in the acceptance of over-confident assumptions and projections, such as found in accounts of planning disasters in major public projects and policies (e.g. Hood, 1994; Dunleavy, 1995; Moran, 2001). According to this viewpoint, the risks and uncertainties attached to cost estimates are often discounted in political and bureaucratic contexts. The second strand of thinking relates to the problems of decision-making under conditions of uncertainty, which give rise to systematic biases (Kahneman and Tversky, 1979). This field provides a menu of biases to account for misjudgements of either individual or collective decision-making, such as 'group think' (Janis, 1972) and 'illusions of control' (Clarke, 1999). The third of these strands concerns the technical complexities and uncertainties inherent to mega-projects of this sort, as changes in scope definition or technological requirements lead to drift from initial projections (Merrow, 1988; Capka, 2004). Such a perspective highlights how modifications to project specifications and exogenous environmental shocks lead to the updating of critical assumptions. Together, these strands of thinking are far from being exhaustive, but highlight the wide range of variables that can be attributed as a source of cost overruns in major projects such as the Olympics.

In light of the budget data, then, it is possible to test the validity of each of these alternative perspectives regarding underlying causes of the under-estimation of costs for the London 2012 Olympics. The remainder of this paper therefore seeks to evaluate the extent to which the cost overruns can be attributed to explanations drawn from the following categories of: (1) inattention to risk inside government; (2) decision-making biases in the evaluation and use of information; and (3) uncertainty affecting project management and administration.

Inattention to risk inside government

It is possible to argue that under-estimation of the cost of London 2012 was due, in part, to inattention to risk inside government: in the failure of British government to recognize the uncertainties surrounding key assumptions and forecasts. For example, over-estimation of the level of private sector investment in development of the Olympic Village required a subsequent increase in the size of the public sector funding package. This was because in preparation of the London bid budget '£738 million of funding from the private sector was included, despite not being supported by robust analysis' (Public Accounts Committee, 2008, p. 5). More widely, the bid budget did not follow the government's own guidance on budgeting procedures for major projects, and the risk of optimism bias, 'despite HM Treasury having been consulted and the bid agreed across Government' (Public Accounts Committee, 2008, p. 9). Indeed, there was sizeable error (in the statistical meaning of the term) attached to the estimates of costs put forward in the assessments undertaken by external consultants, such as Arup (2002a, 2002b) and PricewaterhouseCoopers (2003), as '[a]ll made clear in their advice ... that significant uncertainties existed and that further work was required to develop robust budget figures, and this work was based on plans that have subsequently changed significantly' (National Audit Office, 2007, p. 7). It is unsurprising, then, that these initial projections had little resemblance to the amended budget later signed off by government in 2007: 'before the bid, the size, scale and complexity of what was to be delivered, as well as the need for this scale of programme contingency, had not been fully appreciated' (Public Accounts Committee, 2008, p. 9). There is reason to argue, then, that inattention of decision-makers inside government to the risks and uncertainties inherent to certain budget items, and the implicit confidence intervals attached to forecasts, was a source of the under-estimation of the cost of London 2012.

Biases in decision-making

There is some evidence that biases in decision-making were an important factor in growth in the costs of London 2012 above initial predictions. In hindsight the over-optimism of the initial forecasts is self-evident, inasmuch as the estimated headline cost alone increased almost 300% from the candidature file submitted to the IOC in 2004 to the government's revised budget in 2007. More significantly, inspection of the feasibility studies into the development of a London bid reveals that these were geared around a review of the documents of successful bids of the past and acknowledged the need for 'escaping from the world of realism' (Luckes, 1998, p. 2). It is also arguable that other decision-making biases were at work in formulation of the initial versions of the budget. Specifically, there is some evidence of the anchoring of cost estimates with reference to information from

past Olympic Games or previous budget estimates, without reflection upon the underlying uncertainties attached to them or the degree to which estimates of Games costs were comparable across different contexts. The exploration of costs for a 'specimen bid' (Arup, 2002a) was, for example, considered to be 'a good baseline' (Select Committee on Culture, Media and Sport, 2003, p. 16) for the projection of future costs, even though these estimates had been compiled in the absence of information about 'agreed project objectives and outputs' (Arup, 2002a, p. 4). Further, both the specimen bid (Arup, 2002a, 2002b) and the benchmarking exercise undertaken for government (PricewaterhouseCoopers, 2003) included figures that were taken from the budgets of other major sporting events (i.e. the Olympic Games held in Atlanta in 1996 and in Sydney in 2000 and the Commonwealth Games in Manchester in 2002), without critical examination of the degree to which the cases were comparable. These were problematic cases for comparison because of their operational and construction characteristics. For example, the Atlanta Olympics involved a lower ratio of investment in the facilities and infrastructure than was planned for London, while Manchester's Commonwealth Games had far fewer security threats to contend with than a London Olympics in the period after 9/11.

As a result, some of the information used to construct and evaluate the budget estimates for London 2012 was used as a point of reference for upward or downward adjustments of nominal values, rather than performing scrutiny of the fundamentals of the planning assumptions, such as the technical specification of venues or the specific roster of items to be included in the final budget. Because of this, the initial budgeting exercises did not explore the potential for inclusion of items associated with additional costs outside the pre-defined set of budget categories. The Arup (2002a, p. 5) specimen bid, for example, included a £109 million provision for 'risk', but in practice this was just a straightforward percentage uplift of the cost estimates. Another potential bias in the use of information from other Olympics or major events concerns 'representativeness' (Tversky and Kahneman, 1974), in the treatment of information on costs drawn from distinct economic, social, political and geographical contexts as being drawn from a single population of (mega-event) budgets. While the functional characteristics of an Olympic Games staged in London have similarities with those held in Atlanta and Sydney, the costs associated with procurement and security, for example, are subject to place- and time-specific parameters. Security provisions in Atlanta in 1996 and Sydney in 2000 are not comparable to London in 2012, because of the changed planning context after 9/11, while the global financial crisis that hit in 2008 constrained opportunities for procurement from construction firms and the securing of private finance for projects such as the Olympic Village. The representativeness of figures across events also varies according to the extent to which public spending on regeneration and infrastructure is incorporated within the Olympic budget subject to the particular planning 'vision' of the Games organizers and their political principals. For example, the London bid was geared more around the theme of regeneration and investment to a greater extent than Atlanta, whereas Barcelona or Athens were drawn from a more comparable class of case.

Uncertainties in economic and technical dimensions of project management

While inattention of government to risk and the presence of biases in decision-making are significant factors in the under-estimation of costs for the London 2012 Olympics, there is compelling evidence concerning the effects of scope creep in technical designs and structural requirements of the venues and infrastructure, as well as in the classification of costs through accounting. Specifically, growth in costs of construction of venues and infrastructure between the specimen bid, the probabilistic cost assessment, the candidature file submitted to the IOC and the government-amended budget (shown in Table 1) are not just attributable to cost inflation for existing designs, but also reflect the increased size and complexity of the plans for the main Olympic site and associated infrastructure. The total costs of infrastructure and event facilities were put at just £403 million in the Arup (2002a, p. 5) report and £751 million for a mid-range scenario in the PricewaterhouseCoopers (2003, p. 10) probabilistic cost assessment. At the time of the bid the cost of venues and infrastructure was estimated to be £2670 (London 2012 Ltd, 2004, p. 105), although this figure also included around £810 million of investment on 'non-Olympic' infrastructure from government and the £650 million Olympic Village to be financed through a public-private partnership (National Audit Office, 2007, p. 33).

After the revised budget introduced large contingencies to absorb any future cost increases (National Audit Office, 2007, p. 16), there was further pressure on the projected cost of the venues, with the rising cost of the main stadium attributed to insufficient competitive tension in procurement and cost pressure due to 'additional scope requirements' in changes to the design of the stadium roof (see Department for Culture, Media and Sport, 2009, p. 47). Both the aquatics centre and velodrome were subject to

increased costs due to changes in design specification, with cost pressure of £25 million for the velodrome being attributed to 'complex foundations and ground conditions' (ibid., p. 47). While the escalating costs of the London Olympics can be linked to changes in the scope and structural requirements of construction, the main factor behind the increased headline figures was scope creep in budgeting classification itself during the government's consolidation of the budget in March 2007. In this, much of the increased cost—from £4.2 billion at the time of the bid to £9.325 billion in the revised budget—was a result of reclassification of certain items as core Olympic costs and due to inclusion of items that had been omitted from the bid due to uncertainty. Specifically, £1044 million of expenditure on infrastructure for the Olympic Park was re-integrated into the official budget while the costs of tax liabilities on capital spending (£840 million) and security provision (£600 million), which had been omitted from previous estimates, were also consolidated into the budget. These budgeting omissions—of infrastructure, tax, security and a programme contingency to manage the interconnectedness of risk at the programme level—amounted to more than £4 billion, far greater than the increases in costs due to changes in technical scope (for example, the cost of the aquatics centre increased from an estimate of £75 million at the time of the bid to £313 million, while the cost of the main stadium increased from £280 million to £547 million over the same time period). These changes in accounting classification are also consistent with drift in the purpose of the Olympic budget over time, evolving from a speculative planning and bidding document (based on high levels of uncertainty and limited knowledge) to a tool for public accounting and programme management.

Alongside these increases of costs due to scope creep both in technical designs and accounting definitions, some of the pressures on costs can be linked to exogenous factors, in particular in the security and economic domains. At the height of the global financial crisis, commercial developers were unable to raise the anticipated private finance for the Olympic Village and Media Centre projects, requiring bailouts of around £700 million from the public sector (National Audit Office, 2011, p. 17). The economic downturn also was a factor in the loss of competitive tension in tendering for two of the largest sporting venues—the main stadium and the aquatics centre (National Audit Office, 2008, pp. 37–8). Some changes in scope creep are therefore linked to external hazards or threats, rather than changes in the preferences of planners or their political principals.

Conclusion

These alternative diagnoses of determinants of the cost overruns of the London 2012 Olympics have sought to extend understanding of the over-optimism present in Olympic budget estimates and mega-projects in general. The relevance of ideas drawn from a range of disciplines and fields suggests theoretical and methodological pluralism is desirable when dealing with a vast and complex project such as the Olympics. The use of a single case enables the contextual analysis of budget preparations. From this, it is evident that cost estimates tend to come into focus over time, as uncertainties of scope diminish and as information and resources are increasingly committed to formulation of definitive plans and accurate figures. The process of budgeting therefore entails a series of stages at which different visions of the Games are communicated. This gives rise to 'drift' in the practice and the perceptions of budgeting, from the initial scoping and risk assessments, to promotion of bid documents to the IOC, to the finalizing of the financing arrangements for the Games. Such a contextual view cautions against claims of strategic misrepresentation on the part of planners (Flyvbjerg *et al.*, 2002), since budgets can have quite different meanings and applications at different points in time and are often not presented as objective truths. This points to the possibility of viewing budget plans for mega-projects in the same way as Clarke's (1999) characterization of disaster plans as 'fantasy documents' designed to express uncertainty in terms of risk and to provide reassurance about manageability to an external audience.

In itself, the concept of optimism bias offers a false panacea for gaining insight into causal processes underlying cost overruns in major projects, since the inferences drawn from these systematic patterns of behaviour are insufficient for determining why certain projects go over budget whereas others do not. Further, solutions targeted at changing over-optimistic cultures at the project adoption phase (e.g. Public Accounts Committee, 2012, p. 9), and cost 'uplifts' (e.g. Flyvbjerg and COWI, 2004), do not entirely resolve the underlying problem (in some instances uplifts may even set a high baseline from which further overruns can occur, for example legitimizing changes in technical scope later on). The method and analysis presented in this paper highlight a number of potential lines for future enquiry. First, the disparate theoretical focus on technical, psychological, economic and political-institutional categories needs to be integrated within a more comprehensive framework that enables

systematic testing of the causal effects of different variables on the likelihood, timing and magnitude of cost overruns. Secondly, future research might consider how process-tracing methods of the sort used here might be combined with multi-*N* qualitative analysis to determine the causes of cost overruns across a larger sample of (a) Olympic Games, and (b) mega-projects in general. As such, there is potential for case studies to be integrated with quantitative methods, for example through 'fuzzy set' comparative analysis (Ragin, 2000), to assess the *relative* size of effect of (qualitative) variables associated with cost overruns. This would, for example, qualitatively assign weights to each of the variables that contributed to the project cost overrun (e.g. political interference, shortfalls in private investment, changes in accounting or technical scope of the project, unexpected increases in labour costs). Such an approach would be able to offer more generalizable insights into sources of cost overruns in major projects. It might, in turn, enable the development of a theory better equipped for dealing with the intersection of politics, psychology, economics, engineering and project management.

Through this brief analysis of the under-estimation of costs in budgeting for the London 2012 Olympics it is evident that there are a number of alternative explanations for the question of why costs overrun in Olympic budgets and mega-projects of this sort more widely. First, under-attention of decision-makers inside government to risk can lead to the detachment of cost projections from assumptions or uncertainties inherent to the methods used to generate them. Secondly, over-optimism is a common feature of the process of drawing up bid documentation designed to secure votes of IOC members, rather than rewarding realism, while the anchoring of cost estimates with data from other events introduces potential error into budgeting. Thirdly, and finally, the rising costs of the Olympics are often associated with scope creep, due to change either in the technical specification of projects or in budgeting classification, and with exogenous shocks in the wider economic and security environment. The under-estimation of costs in an event the scale of the Olympics (Jennings, 2012a) is consistent with the systematic bias of mega-projects towards cost inflation (e.g. Merrow, 1988; Flyvbjerg *et al.*, 2003) and unsurprising in view of the large number of points at which it is possible for things to not go according to plan. This research note has sought to show, however, that to understand the determinants of cost overruns it is important to locate budgeting in context and recognize the problems inherent to decision-making under conditions of uncertainty.

Note

1. Figures are reported in nominal prices to enable referencing against the original sources, with the value of nominal values in 2007 prices adjusted using the GDP deflator also listed in Table 1. Price inflation therefore accounts for a small percentage of the cost inflation (no more than 15%).

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