The Science, Economics, and Politics of Malaria Vaccine Policy

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EXECUTIVE SUMMARY

Full Report at:
www.economics.ox.ac.uk/members/andrew.farlow

A submission to

UK Department for International Development[2]

and

The Malaria Vaccine Technology Roadmap[3]

and a response to the

Tremonti Report to G8 Finance Ministers[4]

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[1] © Andrew Farlow 2006. Further papers on vaccines, neglected diseases, and pharmaceutical R&D at: www.economics.ox.ac.uk/members/andrew.farlow. In particular, previous papers contain many more angles on 'Advance Purchase Commitments/Contracts', APCs, than are contained in the current report. Feedback and corrections greatly appreciated: andrew.farlow@economics.ox.ac.uk. A list of thanks is to be added when those involved agree to be listed or to remain as anonymous referees, given the sensitivity of some of the feedback the author has received.

[2] UK Department for International Development consultation process on Advance 'Market' Commitments.

[3] www.malariavaccineroadmap.net. The draft "Malaria Vaccine Technology Roadmap" (henceforth MVTR) is available on www.malariavaccineroadmap.net/pdfs/roadmap_071905.pdf. The "Roadmap Summary Results" (henceforth RMSR) is at www.malariavaccineroadmap.net/pdfs/roadmap_results.pdf. The "Malaria Vaccine Vision Meeting Summary Results" (henceforth VMSR) is here: www.malariavaccineroadmap.net/pdfs/summary.pdf.

[4] "Advance Market Commitments for vaccines: A new tool in the fight against disease and poverty." Report to the G8 Finance Ministers by Giulio Tremonti, Minister of the Economy and Finance, Italy, London, December 2, 2005, www.dfid.gov.uk/consultations/amc-report-tremonti.pdf. Background papers to the 'Tremonti Report' at: www.dfid.gov.uk/consultations/background-papers-tremonti.pdf.

Malaria vaccine policy has been an unusually busy field just recently, with a range of new proposals under consideration by policymakers and global leaders. This report seeks to explore the complexity of the underlying malaria science to try to work out some of the potential consequences for the economics and the finance of some of these proposals. In particular, the report is especially interested in evaluating the proposal of two malaria vaccine goals – one earlier lower efficacy vaccine and one later higher efficacy vaccine based on product-and region-specific characteristics, as suggested in the recently-initiated "Malaria Vaccine Technology Roadmap" – in combination with an elaborate subsidy/R&D funding scheme called an 'Advance Purchase Commitment/Contract' (APC), as currently promoted by G8 finance ministers, the UK Finance Minister, Gordon Brown, and US Senators Kerry and Lugar. The APC subsidy scheme is supposed to incentivize new privately financed investment into malaria vaccine R&D, and is not a procurement fund just to cover production costs of a vaccine that already exists.

Under the APC proposal, firms first sink their privately-funded R&D costs, to be repaid much later through a committee vested with the job of spreading a fixed pool of public subsidy over all developers at the end (with most getting nothing). Each potential malaria vaccine developer is tied in to the scheme via legally-binding contracts from the beginning. The overall size of the subsidy pool and the terms for its disbursal are set by policymakers at the start and managed by the committee at the end. We are told that this can be done so as to generate the required investment returns to investors such that they will invest in the development of a string of malaria vaccines of ever increasing 'quality'. These subsidy schemes have been very carefully crafted for public and political consumption in the language of the market, as Advance 'Market' Commitments (AMCs), even though they have precious few market-based credentials to them, and are really just large statist funding schemes. Rather than feed the myth-making, wherever possible this report avoids the nomenclature AMC and uses the nomenclature APC, for 'Advance Purchase Commitment/Contract', instead. Indeed, even the nomenclature APC is highly imperfect: The extent to which anything is 'committed' is increasingly unclear in the APC literature, and the ability of 'contracts' to create a credible commitment becomes increasingly difficult to believe the more one analyzes what such contracts would have to do. We proceed mindful of the dangers of creating, via the use of terminology, a false sense of security in the veracity of the underlying ideas.

The report finds that the *combination* of the two goals and the APC subsidy scheme would, in practice, put any new commercial pressure onto the lower efficacy first-goal malaria vaccine and current vaccine candidates. Indeed, in realistic applications, given strong self-fulfilling tendencies, such schemes would simply collapse down to provide the subsidy to cover the high production costs of the first low-efficacy vaccine generated, and struggle, and almost certainly fail, to generate multiple generations of malaria vaccines. By gambling on too few potential vaccine leads in an area of very risky science, this would increase the chances of not getting any vaccine. The argument that an overemphasis on goal-one vaccines – or even just one goal-one vaccine – is part of a long-term strategy to get 'better' vaccines later is explored, but is found to be not without extra costs and risks.

The report finds that recent analysis has tended to isolate parts of vaccine R&D from analysis of an overall package of measures to tackle malaria, including prevention and treatment, and from other parts of the vaccine R&D process. In consequence, malaria vaccine proposals generate tensions with, and burdens on, other parts of an overall package of malaria control measures. Unbalanced R&D subsidies would over-emphasize the creation and use of lower efficacy vaccines, thus harming incentives to create higher efficacy vaccines (and even vaccines at all) and to research and develop other parts of the greater global solution. The paper argues that malaria vaccine goals should not be set separately from an overall malaria control strategy, and that treating the two together will benefit the targeting of vaccines too.

The report finds that for all the recent talk that 'purchasers decide' *by their purchase decisions* the efficacy of any ultimate vaccines created via an APC, they do not. Their choices are highly subsidized, such that they face no relevant price signals *at the time of purchase* to guide choice over vaccine efficacy and the value of potential vaccines, even as they face worries about an ever-depleting subsidy pool, and rent-seeking and corruption pressures placed on them (terms like 'rent-seeking' are explained as they are encountered in the report, but are also gathered in a small glossary at the end). Whether purchasers get a 30%, 50%, 70% or any other efficacy, or a one-, three-, five-year or any other duration vaccine is principally driven, before they get to make their purchases, by the goal-setting process and the decisions of the committee running the APC scheme.

Similarly, because of the sunk nature of the subsidies, purchasers' decisions are distorted away from other control measures costing more to them 'at the margin' at the time of purchase, even if these other control measures would have been higher-value choices, and had it been better to have instead targeted resources at higher-efficacy, longer-duration, vaccines rather than lower-efficacy, shorter-duration, vaccines. It is crucial, therefore, that the ultimate users of vaccines have a say at every point in the decision-making process affecting the likely efficacy and duration of vaccines being targeted, and that the overall control strategy and range of options is fully articulated, and integrated into the budget constraint that they face. This suggests *real* markets and all 'malaria control products' treated equally, whether vector control, impregnated bednets, drugs, *or* vaccines. If this requires long-term commitment of global funding to bolster national malaria control programs so as to be able to purchase these products, then the attention of policymakers and global leaders should be on this and not on a malaria APC.

The report investigates the likely impact of the science and the twin-goals on the production costs of malaria vaccines in both the short-run and the long-run. It finds a complicated and elaborate set of interactions between the twin-goals, with each goal creating risks to the other. Combined with the complicated scientific problem – for example the need to tackle polymorphism and antigenic variation – this feeds extra production costs and risks onto firms. These issues have not been fully explored yet, and will tend to drive up average production costs. The report argues that these production cost issues will repeatedly feed back to harm R&D incentives, and also to make APC-based incentive schemes difficult to relate to firms' R&D efforts, making these schemes more risky to firms than currently suggested by their promoters. The report concludes

that APC subsidy schemes run the risk of having to be topped-up even as developers face a great deal of uncertainty about the level of overall funding available, with risk imposed on their investment decisions.

The report finds that the proposals made by APC advocates for assuring long-term access and low-price malaria vaccines, will instead increase risks to firms and create potential for long-term breakdowns and delays in access to vaccines (contrary to what is claimed). This is especially so for the proposal of never-before-used legally-binding low-price long-term supply contracts signed *before* R&D is even performed. The report argues that these sorts of 'legally binding' promises could never be relied upon to generate long-term access, and would harm many of the firms involved, or wishing to be involved, in R&D. It finds that many of the ways suggested to get around this problem – such as waivers of the contract conditions or flexible pricing rules – are simply ad hoc, creating a whole new range of risks to firms, as well as perverse incentives.

Instead, the report argues that much more attention needs to be placed on a range of ways to expand production capacity and competition, and to increase the number of players involved in vaccine discovery and production, with much more attention to delivery issues. This is just one of very many instances throughout the report where we find that a range of issues many years out have not been fully thought through such that they will feed back to harm R&D incentives. The report wonders whether targeting a higher efficacy vaccine from the start, with only an 'option' on a lower efficacy vaccine, would not actually save on these costs and ultimately speed up and stabilize access should a vaccine ever be created.

Given the dysfunctional nature of 'the market' and the risks this imposes on developers, the report tentatively argues for more (but not complete) separation between payments from purchasers and repayments of R&D investments, to try to mitigate some of these risks, with greater access to technology and competition at the later stages of the process. This is good for those doing R&D too, to the extent that they can benefit from the lower costs via greater returns to their R&D. This runs counter to recent proposals that seem intent on facing developers with 'market' risk if they wish to get repaid, even if the market is highly dysfunctional and would impose heavy downside risks on the value of firms' investments. Rather than a mechanism based on a sole supplier, a structure starts to emerge of more open and democratic collaboration and a system of financial risk-sharing contracts, possibly PPP (Public-Private Partnerships) based, until development of a vaccine (or vaccines), phasing into more competition in manufacture (with competition used to extract information, to drive prices lower, and to cover costs).

The report reviews the 'cost-effectiveness' evidence generated by supporters of a malaria vaccine APC and heavily used in this policy process, and finds that it has been designed to favor the APC and low-quality malaria vaccines, in a way that would not be justified by a fuller consideration of the overall financial constraint and the consequent tradeoffs between vaccines and non-vaccine options, and tradeoffs between different efficacies and 'qualities' of vaccines. The evidence is biased by: ignoring the true underlying costs of developing vaccines; ignoring components of development that are not paid for by the

APC subsidy scheme; ignoring delay; ignoring any risk created by the workings of the APC subsidy scheme itself; presuming a vaccine that will last for ever with minimal consideration of the need for follow-on generations of vaccines, even in the case of low-efficacy short-duration early vaccines; presuming low manufacturing costs in both the short- and the long-run (even as the two-goal structure, the APC subsidy scheme, and the nature of the underlying scientific problem make this difficult); ignoring the impact of a vaccine on other parts of a complete package of measures to control malaria; and by assuming masses of failure and imperfect policy application elsewhere but perfect application of the two-goal and APC subsidy scheme proposal itself. The biggest distortion of all is the way that the extremely high value of dealing with malaria, and therefore the high value of malaria vaccines themselves, has been routinely converted into the high value of any favored vaccine R&D funding proposal however unknown its workings and value, and however likely it is to actually work. The cost-effectiveness methodology allows even for proposals that are likely to fail to nevertheless be judged as highly cost-effective.

The report shows how this cost-effectiveness literature has been wrongly used to set the size of malaria, HIV, and TB vaccine APCs. The notion has been that by making the revenues from R&D investments on 'a' malaria, HIV, or TB vaccine similar to the revenues realized from investments in typical existing commercial pharmaceutical products, investors will be attracted. However this ignores the basic economic principle that it is revenues minus the costs of generating those revenues – i.e. overall investment returns – that matter to investors, and not revenues alone. These costs include out-of-pocket R&D cost and appropriate costs of finance. Realizing that we have no handle at all on these costs for malaria, HIV, and TB vaccines, APC advocates have simply chosen to ignore them. An APC is first and foremost a financial instrument that needs to appeal to investors based on investment returns. Yet, appealing to politicians seems to have been a more important priority than appealing to the harshest judge of all of such instruments – namely, financial markets.

The report explores a range of 'risk' issues already faced by firms working on malaria vaccine R&D, and the further risks that they would face under forthcoming proposals. It explains why it is good to face private developers with some risk and not to fully insure them, but observes that there is only an optimal amount of risk that developers should face, before it becomes self-defeating. The report argues that a big danger with a 'precommitted' subsidy-based R&D repayment scheme in an area of complicated science is that it faces firms with a range of extra risks all of which have to be priced in to required investor returns. These include in particular: heavy risks of 'time-inconsistency' resulting in too little incentive to do R&D in the first place; risks of having to 'rent-seek' the subsidy scheme and to engage in corrupt practices; and reputational risks reminiscent of AIDS drug price debacles of the past. The report argues that many of the risks created by APC subsidy schemes would not be hedgeable by privately-funded developers, since these risks are not idiosyncratic.

The report finds that biotechs would be especially open to risk under such schemes, because larger players would be able to delay their response and treat the APC as much

more of a financial 'option'; if it does not work, it is the biotechs who take most of the loss. The report worries that high rates of risk created in these attempts to solve the vaccine R&D problem will just feed back to harm the efforts. It argues that the current priority should be for more direct funding to biotechs, PPPs, and into research to resolve key fundamental scientific issues, but that this funding also needs to be more transparent and more fully and openly debated. It also finds that low-efficacy short-lived malaria vaccines (contrary, it would seem, to what some commentators say), do raise a range of liability issues that still have not been adequately resolved, and that feed back to harm R&D incentives and to face sponsors with risk too.

In a review of 'innovative financing mechanisms', the report finds the notion of 'stimulating the market' to be very narrowly and inadequately defined. Given that, relative to their health impact, a huge range of potentially very valuable markets are being 'underexploited' (Alzheimer's, diabetes, cancer, etc.) and given evidence of the very poor response of privately-financed developers to potential HIV vaccine markets, the report worries that there are dangers of simply misidentifying the problem as "too little purchasing power". The consequence is that too little attention is paid to tackling the scientific and institutional limitations, and too much attention is paid to apparently simpler fixes based on 'size' of purchasing power, that cause little or no private firm response, or heavily favor just a few and maybe even just one firm, and yet use up a lot of political and systems capacity in new-institution building, monitoring, and policing activities.

The word 'market' is heavily used in the wording of recent proposals, but this paper finds market thinking being repeatedly thwarted, replaced by complicated rules administered by a committee after large private costs have been sunk, and actions driven by contracts that would be extremely difficult to set up in advance and to make credible and efficient, with an over-reliance on sole suppliers, and with competition ignored at important stages of the development and production process. Tackling scientific, economic and finance problems has given way to, supposedly, simpler legalistic fixes, that then, on closer examination, turn out to be far from simple in practice.

The report explores the tradeoff between, on the one hand, price-based bidding of purchasers to try to control the corruption and rent-seeking generated by APC subsidy schemes, versus, on the other hand, the need to extract R&D costs that may be undermined by this bidding process. The rent-seeking and corruption pressures arise mainly because of the build-up of sunk costs and the difficulty of setting terms in advance in APC subsidy schemes (as compared to the very different sort of subsidy schemes being proposed for procurement of ACT drugs as discussed in the report). Most of the payment to a 'winning' firm (presuming that there are multiple parallel developers and that an APC is first and foremost an R&D instrument) is a 'windfall' and not simply to cover manufacturing costs, and will therefore be many times the winning firm's actual R&D outlays. This is the fuel for rent-seeking and corruption. The report argues that policymakers should not under-use the positive properties of competition and price-bidding at later stages of the development process to tackle these problems.

The report explores the nature of 'collaboration' to tackle such a complicated scientific problem, and finds it generally overlooked and inadequately treated by policymakers and politicians, more interested in masking the collaboration problem with bigger promised payments. Given the importance of information-sharing in the solving of such a highly complex scientific problem, the report finds that it might even be counterproductive to adopt a system that places no commercial value on a goal-2 malaria vaccine even as it creates some pressure on a goal-1 malaria vaccine, but in a way that puts most commercial players off even goal-1 vaccines.

The report worries about a range of under-explored issues, including the presence of various 'option value' and 'option cost' components to vaccine R&D projects, and 'crowding out'. Malaria vaccine R&D has an 'option value' component because it provides a good environment in which to test platform technologies, that is technologies (such as adjuvants and delivery technologies) usable across malaria and non-malaria applications and submarkets, and because there is also potentially a degree of market segmentation, including across income level and type of users (in the case of malaria, transient visitors to endemic areas, such as tourists or military personnel). There are also some potentially high 'option cost' components to early R&D on account of potential changes in technology. All these option elements make it difficult to know how to set APC terms, including the size of an APC, and to judge progress towards those terms. High option costs probably also underlie some of the resistance of firms and investors to get involved in research, the more so the earlier the stage of research and the more uncertain the science, but we simply have too little analysis to know how big the problem is.

Any scheme based on subsidy payments also has to concern itself with 'crowding out', that is, how it can exclusively target those who genuinely need subsidies to purchase the products, and how it can target those firms who need to be incentivized by the subsidies, so as to maintain the pull-power of the subsidies and to stop subsidies from being 'crowded out'. This involves decisions about which countries to treat as 'eligible' and 'non-eligible', with the latter left to face (tiered) monopoly prices instead. It also needs monitoring and mechanisms for denying many-multiples of subsidy payments to each firm in proportion to other financial help received.

In an extraordinarily complicated R&D process involving many different sources of funding, privately-funded developers would naturally worry, given the very long horizons, that this 'crowding out' would not be handled well, and that the economic-rent-seeking behavior of other players would bias the outcome. The paper argues that poorly-handled 'crowding out' would especially harm those nearer to scratch in their R&D efforts, and smaller and emerging firms, and would also reinforce the bad choices of projects by sponsors.

The paper argues against over-reliance on firm-level verbal evidence regarding new funding proposals, given the dangers, as repeatedly found in the public choice literature, of getting a highly misleading result. It argues for questions to be much more directly

linked to an obligation (and cost) on firms to do something. It suggests better use of data, including the use of event studies, to explore market responses to large new initiatives.

The paper takes a detailed look at the recent trial results of the candidate malaria vaccine RTS,S/AS02A. It finds an interesting set of results with respect to duration, source of efficacy, generalizability of result, and so forth. However, it finds that the science is still extremely high risk, and yet that the results have been very heavily hyped by politicians and in parts of the press. The main concern here is that funding decisions in response to this do not so distort the malaria vaccine and treatment playing field as to harm efforts (and, indeed, private financial incentives) elsewhere. Past vaccine failures – both for malaria and otherwise – suggest extreme caution in over-hyping one particular vaccine candidate over all others.

The report takes a detailed look at the recently announced Kerry-Lugar "Vaccines for the New Millennium Bill 2005". It finds that the legislation proposes to set up a mechanism to repay investors that is very risky and lacking in credibility to developers, even though it is crucial to get developers to respond. In particular, it is very unclear whether investors will get a fair and adequate return to their investments. To credibly sustain a precommitment – over very long stretches of time – requires either a costly action (for example, when a firm invests in excess capacity to deter rivals) or a costly punishment for reneging (for example, when interest rates rise rapidly if a country shows any sign of defaulting on its debt, including by allowing inflation). With neither of these available for vaccine precommitments, the wording of the legislation is everything, and, in this case, it is found to be seriously deficient.

On closer inspection, the Bill is also found to limit itself to malaria, HIV, TB, and pneumococcal (*streptococcus pneumoniae*) disease, missing out huge areas of infectious and other diseases. Since the Bill will have no impact on malaria, HIV or TB vaccine R&D, one concern is that, even if the Bill gets through, it would only in reality be used to try to achieve a result on pneumococcal disease – itself a useful outcome if it is achievable – even if this could have been achieved with less delay by other means, while misleadingly suggesting that a solution has been found for the other three vaccine problems. If the Bill fails, it would even harm the pneumococcal disease outcome.

The Kerry-Lugar Bill also sets up potential tensions between European (and other) malaria vaccine efforts and the US Treasury, because it would require all developers to be signed in to contracts, the purse strings of which would run through the US Treasury and the President of the United States of America. The Bill also places conditions on the countries deemed 'eligible' and 'non-eligible' for APC subsidies, and this would create later tensions between the US and Russia, China, India and middle-low income countries with regard to HIV vaccines, and possibly even malaria vaccines, since the scheme is set up to deny subsidies to them, leaving them to face monopoly prices instead. The fear is that this sets sponsors and firms up for vaccine price debacles, reminiscent of those over HIV drugs in the past, but this time dragging in G8 governments too. Indeed, at various points the report questions the logic of pitching funding instruments so heavily at G8 nations, given that most of them are running balance of payments deficits. It suggests that

there is some logic in incorporating into funding mechanisms those countries and regions running balance of payments surpluses, several of which would benefit greatly from the development of vaccines for killer diseases. Unfortunately, this route has been ignored because it conflicts with the desire of the advocates to set up APCs, even though such heavy interest in APCs is itself partly generated by the pitch to deficit countries.

The report reviews a number of perverse incentives generated by the wording of the Kerry-Lugar Bill. It also finds that the wording goes out of its way to avoid action to bolster malaria control programs now, and on funding, especially of vaccine PPPs and of basic science, which might actually have a genuine impact on malaria, HIV, and TB and other vaccines in five to ten years time.

The report describes in detail the policymaking process of the past two years or so. It describes how this process has recently become driven by short-term political needs, and a highly simplistic notion of malaria vaccine science and of the problems of malaria control in general. It outlines the ways in which the goal of current endeavors has been set ever-lower, and the way a huge list of practical issues have been deliberately ignored in thinking about malaria vaccines in order to get a 'policy success' even if not a 'successful policy'.

The report details how an early and perfectly legitimate interest in 'novel financial instruments' degenerated into being only about APCs. Subsequently, far from being an honest assessment of whether or not this particular instrument would work for vaccines such as malaria, interest in it was exploited to further other goals instead, some good (such as to promote action on late-stage vaccines even if APCs are not, strictly speaking, used) and some less so. We review how those, in particular the Center for Global Development in Washington, vested with the job of evaluating APCs, failed on all counts to satisfy the brief they were set. Just for illustration we pick a selection of issues from a much longer list: Who will want to run a malaria APC? How will APCs be treated as financial liabilities? Why were health infrastructure, vaccine distribution issues, and other interventions ignored?

The report assesses the involvement of key players, such as Britain's finance minister, in distorting this process, first by unbalancing the malaria playing field by personally making promises to influential players, and then by distorting the behavior of certain policy advocates keen to provide justification for this behavior. We see how this shows up in the wording of major policy pronouncements and in the overwhelming drive to push for an APC for malaria over all other policy options. The key need to generate a financially sound policy for all investors and sponsors to respond to, has been displaced by the need to generate language that will be appealing to politicians, even if it means a policy that will fail when financial markets and investors do not respond. The report extensively reviews the Tremonti Report prepared for G8 Finance Ministers and finds the financial thinking within it regarding malaria, HIV, and TB APCs to be especially poor.

The paper analyses the constraints of the G8 process, the role of spin used in the policy process, and the failures that emanate from institutional defects – often very subtle – of

the UK policymaking process in particular. In each case we see how this has tended in recent years to favor some outcomes over others, and has even undermined progress on good policy. The report likens the thinking processes in the UK Treasury and DFID, with respect to this issue, to that of NASA on the eve of the 1986 Challenger disaster. In his closing address of the commission enquiring into the disaster, Richard Feynman famously performed an extremely simple experiment with a piece of rubber and a glass of iced water that demonstrated that the shuttle was doomed to perish. NASA officials took a huge gamble – ignoring the engineers who tried desperately to get the launch cancelled – and it failed. Similar institutional failings have impacted the launch of APCs for malaria, HIV, and TB.

The report argues that even the language used has become highly obfuscatious to try to get around actually having to prove any evidence of effectiveness of policy proposals, in particular of malaria, HIV, and TB APCs. The report argues that the rush to prematurely lock in outcomes in highly command-and-control, statist, APC mechanisms is likely to intensify bad results, create later problems for both firms and sponsors, and risks damaging the reputations of policymakers and politicians. This rush isn't even necessary since there is good analysis on the horizon of issues that will help to better set policy, and the option value of waiting before locking in is very high. As bad subsidy schemes go, the particular subsidy scheme described here, in combination with the two operational goals, takes a lot of beating. So, what is the rush?

The report concludes that neither malaria vaccine nor drug scientists, nor biotechs, nor 'big pharma' (most, if not all, of whom regard APCs for malaria, HIV, and TB in particular as 'looming disasters'), nor PPPs would come out well from what is being proposed on the malaria APC front. This has been repeatedly reflected in feedback from correspondents across all of these diverse groups. The report concludes that even GSK stumbled into agreeing to something that they will only come to regret, given the 'dammed if they do, dammed if they don't' set of choices it will force upon them. The only people seemingly benefiting are policy-advocates and politicians. Only 'seemingly', since ultimately it will not even turn out to have benefited them either. Similarly, for all the high-sounding promises of funding, neglected diseases in general have lost out from the concentration on APCs. They continue to suffer from relative public (as opposed to foundation) funding neglect, and the push for APCs has conveniently concealed this, and, even, neutralized efforts to tackle it.

The paper finishes by outlining several potential Roadmap trajectories for the future. It proposes a different set of goals based on process and risk metrics to mitigate some of the inefficiencies and risks of the current goals. It summarizes 50 key recommendations in an attempt to rebalance the debate and to move the thought process forward. Frequently, the paper argues for more consideration of the ethical dimension underlying scientific decisions, and for a more open and democratic decision-making process.

In many ways this report has ended up as a defense of these more open democratic processes, such as those of the Malaria Vaccine Technology Roadmap, against largely politically-driven processes that force out certain economic and financial solutions to the

malaria vaccine problem, with the science then forced to fit in with these. During the writing of the report, much discontent surfaced both within the malaria vaccine community and across the malaria and global health community in general. There was a clear disjoint between the science and industry people and the Malaria Vaccine Technology Roadmap on the one hand, and the politicians and a relatively small group of policy advocates on the other hand, with current policy driven largely by the latter. This discontent suggests that there is a real opportunity for policy to move on, by allowing the voices of the former to be heard instead. The report concludes that it is now time for scientific reasoning to drive the creation of economic and financial instruments, with politicians made to fit, and for good financial thinking to take over from ultimately hollow big-gesture politics.