

SOME UPSTREAM RESEARCH PROGRAMS FOR MUSLIM  
MATHEMATICIANS: OPERATIONALIZING ISLAMIC VALUES  
IN THE SCIENCES THROUGH MATHEMATICAL CREATIVITY

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Mathematics, like all other sciences, exact or inexact, pure or impure, is value-laden. Values were there before the axioms, and the latter embody the former. Hence mathematics is *formalization of values* by which they are clarified and made operative. This understanding is explored here by suggesting some upstream research programs for Muslim mathematicians as a guide toward operationalizing Islamic values in the sciences through the power of mathematical rigor and objectivity.

**Keywords:** Upstream/downstream research programs; Islamic mathematics; values; value systems; science and values; Islamic worldview.

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This article is inspired to a large extent by my reading and understanding of the works of Roshdi Rashed<sup>1</sup> and Imre Lakatos.<sup>2</sup> In my opinion their works, among those of others,<sup>3</sup> are very important for creative<sup>4</sup> Muslim mathematicians who want to reflect deeply on the meaning, scope, and goals of mathematics as well as on the nature of the truth and certainty<sup>5</sup> sought by mathematicians when they do, or rather, *create* mathematics. The foundational conceptual, meta-mathematical starting point here is to see mathematical creativity as “a human activity, a meta-process, which acts upon and generates new mathematics.”<sup>6</sup>

Although my discussion shall focus for the most part on Islamic mathematics,<sup>7</sup> Malay-Islamic mathematics,<sup>8</sup> and the Islamization of mathematics,<sup>9</sup> I believe that the underlying, more general thrust of this article will

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be of some relevance to all non-western mathematicians<sup>10</sup> who wish to develop philosophies, methodologies, and practices of mathematics that are more in line with their respective religious beliefs, cultural traditions, and value systems.<sup>11</sup> If mathematics, like science in general, is value- and culture-laden,<sup>12</sup> then, *ipso facto*, any theories, methods, and models developed in mathematics will accordingly also be value- and culture-laden.<sup>13</sup> As argued by Brian Martin, the Platonic conception of mathematics as value-free is itself a value-laden conception which only serves to hide from most people the intimate links between mathematics as such and the belief systems of its practitioners.<sup>14</sup> Or, in the words of Rev. Richard S. Kirby, who argues for a “theology of mathematics”:

The future math, like the past, cannot be value free. It has always been a radically human activity. It serves human purposes. It may be rigorous, but its objectivity is subject to human values, including the [evolving] ideology of ‘objectivity’. It is also one of the most vibrant areas for human creativity, as new fields emerge in areas such as vector analysis, topology, calculus, set theory, and many other fields.<sup>15</sup>

Similarly, in his important inaugural professorial address the eminent Malaysian mathematician Shaharir bin Mohamed Zain shows in some detail through a selection of mathematical topics that:

...the development of each topic was indeed first started by appealing to a value system and belief on the basic nature of the issue. Then, the mathematical results obtained were used to confirm and strengthen the value system or belief. More often than not, this [i.e., the results obtained] became a new value system and belief on which further development of mathematical science was based...[hence] mathematical science is not as objective as it is commonly believed... not purely quantitative and logical...mathematical truth is shown here as many-valued and relative to a particular agreed paradigm. Its acceptance is not purely based on rationalism, logic and consistency, but also based on pragmatism, aestheticism, rigour, sophistication, belief and personality of scholars.<sup>16</sup>

From the above conclusion that mathematics is value-laden, Shaharir then draws the attention of Malay-Muslim mathematicians to the idea (quite novel at the time) of the rationality and the imperative of the Islamization of mathematics as a “symbiosis” between mathematics and the Islamic value-system, namely, a mathematics whose objective, quantitative results embody the cognitive and ethical values of Muslim mathematicians who care deeply about understanding and living the Islamic vision of truth

and reality<sup>17</sup> in both their personal and professional lives.<sup>18</sup>

### **Upstream and Downstream Research**

What is meant here by “upstream” research<sup>19</sup> is research that is motivated by a high sense of critical self-awareness on the part of the researcher of his personal identity and purpose in life, in line with his understanding of, and commitment to, the worldview and value-system he is embracing or declares himself to be embracing, and includes the understanding of the real problems he has identified to be tackled as a result of that critical self-awareness.<sup>20</sup> This attitude obviously implies a consummate desire for intellectual creativity and entails the uncommon moral courage to formulate and pursue a concomitant research program that will be seen in the eyes of many of his peers to be against current thinking, or useless, or even altogether senseless, and hence one that will most likely not be funded under the prevalent system of public and private research funding, and will not contribute significantly to personal career advancement.<sup>21</sup>

Studies have shown that, in the history of Islamic and western mathematics, it is such upstream research that generated new mathematical theories—even new mathematical fields!—not previously imagined or anticipated and which, in turn, not only generated new sciences and technologies but also opened up new vistas on aspects or orders of reality underlying the natural order that had been previously inaccessible to, hidden from, or overlooked by the intellectual scrutiny and the spiritual insight of thinkers and scholars.<sup>22</sup>

What is in contrast, though not necessarily in opposition,<sup>23</sup> to upstream research is what can be called “downstream” research, which unfortunately (for the most part<sup>24</sup>) has been the concern and focus of the great majority of mathematicians, especially Malay-Muslim mathematicians.<sup>25</sup> Downstream research is “retail research” that is restricted to the narrow, largely uninteresting objectives of merely developing technical refinements to existing mathematical theories, theorems, and sub-fields that have already “matured,” or, worse still, to develop new but trivial applications therefrom or to test the effectiveness of, and reception to, the various readily available techniques, methods, softwares, and models. Such retail work is very effective as a means (in fact, *is* the best means) to generate piles of publishable (largely repetitive?) academic articles in scholarly journals each year, and to, in turn, put one on the fast track to promotion to full, tenured professorship, in line with the mantra “publish or perish.”<sup>26</sup> Needless to say, this kind of work is more, even when at its best, in the nature of a “mopping-up operation” rather than of identifying

new, authentic, non-trivial problems and formulating lasting solutions to them.

The intellectual nadir of such downstream research is reached, or even breached, when mathematical theories, theorems, fields, models, techniques, softwares, and applications originally developed in the context of western secular cultures for tackling their problems as they conceived them in line with their worldviews and value systems, are simply adopted without examination for use in the contexts of cultures adhering to totally different value systems, beliefs, and worldviews, and belonging to totally different sociohistorical backgrounds. An end result of such uncritical borrowings from one by another (specifically from the West by Muslims) is the proliferation of third rate mathematical journals publishing third rate articles of little or no use and meaning to anybody (even to the authors themselves!), and which serve no particular purpose except perhaps that of exhausting as efficiently as possible the valuable public funds allocated for scholarly publishing in university annual budgets.

As a brief case in point, we know that many scientists and mathematicians supportive of neodarwinian evolution in the west have developed quite sophisticated mathematical techniques (call it biomathematics) for modelling gradual, random change over time, or for demonstrating the phenomena of spontaneous self-organization in natural phenomena.<sup>27</sup> But what exactly is the relevance of these techniques and models that from the very beginning have simply assumed the truth of evolutionary theory for Muslim scientists and mathematicians who believe in the divine creation of nature and who wish to develop a new theory (or a new biomathematics) to account for the diversity of life based on the counter-assumption of the world as being created by a transcendent deity of wisdom and power? Is it not self-destructive for Muslims if these ostensibly exact, objective, and value-free mathematical techniques and models are simply learned, taught, and applied in biology without first exposing and criticizing the not too subtle atheistic assumptions underpinning them? Since mathematical theories, techniques, and models are only as true or as false as the value-laden assumptions underlying them, Muslim mathematicians have to develop a new biomathematics based on the fundamental assumption of creationary rather than evolutionary origins and diversity of life.<sup>28</sup>

Another thing to bear in mind is that upstream research need not be totally theoretical in nature or only involve “pure” science or mathematics, such as can be seen in the remarkable but largely ignored and misunderstood case of David Bohm in the field of theoretical physics.<sup>29</sup> In many

cases, upstream research may involve appropriate and readily available conceptual and methodological aspects of applied science and mathematics to tackle problems arising from a radical rethinking of certain key concepts and approaches prevalent in the natural and human sciences. For instance, many of the biomathematical tools already developed are more amenable for use in the empirical clarification of design rather than descent, regardless of the original intention of the inventors of those tools. This is because mathematics is essentially concerned with discovering, describing, and analyzing *patterns*<sup>30</sup> in nature, and this notion of patterns has much more *conceptual affinity* with the notion of creation by intelligent design<sup>31</sup> rather than evolution by blind chance.

Another example is pressing the tools of financial, fiscal, and monetary mathematics<sup>32</sup> into serving the global movement for reviving the Islamic gold dinar and silver dirham as real money with intrinsic value to replace the fiat money system of paper and electronic currency<sup>33</sup> which have no intrinsic value whatsoever. This creative, critical appropriation of the tools of mainstream financial mathematics will most certainly in time generate a new econometrics to model and facilitate the new monetary reality gradually spreading on the ground. This new econometrics will benefit not only Muslim but also non-Muslim economists and scholars who are now active in promoting the return to gold and silver as a more equitable, non-hegemonic means of local, regional, and global exchange. This will result in a new conception of the meaning of ‘money’, which will in turn generate a new monetary economics founded upon an authentic Islamic philosophy of money.<sup>34</sup>

In short, upstream mathematical research will be motivated by theoretical or cognitive change (e.g., from descent to design theory), or ethical change (e.g., from toxic to green chemistry<sup>35</sup>), or legal change (e.g., from fractional to full reserve banking<sup>36</sup>). So, at times, upstream mathematical research is directed at discovering new, better theories or methods, at other times at applying existing theories and methods to tackle problems arising from radical rethinking of prevalent ideas and concepts, and at other times yet to formalizing the empirical and practical implications of a heightened awareness of the cognitive and ethical imperatives of scientific work.<sup>37</sup>

In the remainder of this article I shall briefly outline some examples of upstream mathematical research that should be pursued by Muslim mathematicians concerned about operationalizing the worldview and value system of Islam in their ostensibly “value-free” mathematical dis-

ciplines, and thus in the process discovering and developing new mathematical theories, methods, and models for tackling non-trivial problems they themselves have identified and chosen due to that very concern. This will constitute their intellectual liberation (*al-tahrīr al-‘aqlī*) from alien and alienating and trivial (even pseudo-) problems having little or no relevance to the religious and cultural contexts of the communities in which they live and find social and material support for their work. Their liberation will itself liberate their communities who look up to them for guidance.

In short, they should know the fine art of identifying true problems for themselves and for their communities and then go on to formulate and implement their own mathematical research programs for finding novel effective solutions to those problems amenable to clarification in mathematical terms. That dynamic, proactive attitude constitutes *mathematical emancipation* (*al-tahrīr al-riyāḍī/al-ḥisābī*) from the straightjacket of secular, western mindframes which care not a jot for the role of religion, the sacred, and the transcendent in scientific and technological endeavors. The modern western mindset cannot control nor manipulate the transcendent, and so it marginalizes, expels, and even *coopts* and *smothers* it out of objective existence altogether.<sup>38</sup>

### **Modelling the Islamic Monetary System**

When invited to present a paper<sup>39</sup> at a mathematics conference last year<sup>40</sup> I was rather taken aback by a spirited presentation of a mathematician<sup>41</sup> who revealed in some detail that the so-called Islamic banking and finance (IBF) system did not possess its own home-grown financial mathematics for modelling and clarifying, and hence truly instituting, a non-usurious banking and finance architecture. On the contrary, the financial model it uses is more or less plagiarised (or replicated) from conventional banking and finance models (which is in turn premised on the totally usurious fractional reserve banking principle = FRB<sup>42</sup>) and modified here and there in an *ad hoc* fashion and applied to Islamic banking and finance, which is then projected in the public eye to be non-usurious and hence equitable.<sup>43</sup> To put this issue in a nutshell, we may quote Meera and Larbani at some length:

Fractional reserve banking (FRB) is the basis of the present-day monetary systems. In most countries, Islamic Banking and Finance too operates under this principle. This article argues that the FRB has effects on the ownership structure of assets in the economy, and that this effect violates the Islamic principles of ownership. It argues that money creation through FRB is creation of purchasing power out of nothing which brings about

unjust ownership transfers of assets in the economy, to the bank effectively, paid for by the whole economy through inflation. This transfer of ownership is not based on human effort by taking on legitimate risks and neither with the knowledge nor the consent of the initial owners. These violate the ownership principles in Islam and tantamount to theft. It also has the elements of *riba*. On the same basis, Islamic governments should not create fiat money since this is equivalent to taking assets of the people, rich and poor alike, forcefully without compensation. It is, therefore, important that Shariah scholars come up with a fatwa on both the fiat money and the fractional reserve banking system. Such a fatwa is urgent and pertinent before Islamic banking and finance, that operate under these systems, takes a course that may prove to be difficult to reverse later. The Islamic economic and finance system cannot be founded upon a money system that is fundamentally equivalent to theft and *riba*.<sup>44</sup>

After five decades or so<sup>45</sup> of the global Islamic banking and finance movement, one should have thought that by now the movement's financial mathematicians, if it has any, would have already systematically developed and matured a viable non-usurious financial architecture, but this did not happen. This, however, is not surprising, given the stifling global hegemony of the US dollar and the Euroamerican controlled international institutions set up to ensure that hegemony.

This failure exposes both the moral and intellectual bankruptcy of Islamic banking and finance (IBF), which, in reality, serves only to facilitate a very crude and clumsy (pick-and-choose) cooption of traditional *fiqh al-mu'amalah* categories into an alien, thoroughly *riba*<sup>2</sup>-infested macroeconomic framework. I mean, for instance, what precisely is FRB (fractional reserve banking) but creating money out of hot air (if that is not *riba*<sup>2</sup>, then nothing is!), and how can you have IBF embedded in a FRB financial, fiscal, and monetary meta-architecture?<sup>46</sup>

Apart from the promising start seen in the works of Masudul Alam Choudhury on 'endogenous money' in the Islamic context,<sup>47</sup> I have so far yet to find in the "expert" literature any thorough, systemic meta-*fihi* deconstruction of the dense network of neoliberal economic concepts underpinning the modern monetary system. The result of this foundational intellectual failure is the fact that IBF has become ever-more coopted and embedded into the mainstream usurious system instead of charting out a vigorous, autonomous, parallel course of its own, which, in time, would supercede the mainstream system. Anyone with even an iota of sound *fi'ri* intelligence (*'aql salim*) will see the obvious fact that the only reason why

IBF is so popular with the big western banks is that it provides a “window” into which flow the wealth, savings, earnings, and investments of a large segment of the Ummah who sincerely care about organizing their finances along authentic Islamic lines.<sup>48</sup> And so our duty and mission as financial mathematicians are to revive an authentic independent Islamic economic system which can stand on its own feet while interacting with, and eventually superceding, the mainstream system, *not* to crack our brains in rushing to fit Islamic *mu‘amalah* categories into what is essentially an utterly usurious economic meta-architecture founded on dogmatic growthism and developmentism that are clearly responsible for so much of the desolation of the social and natural landscape we see and suffer today.<sup>49</sup>

Hence it is not surprising at all to observe the appearance of many vocal thinkers and financial experts who argue that the Islamicity of mainstream IBF is only skin-deep if not highly suspect, whereas, behind the veils of Arabic-sounding terminologies befuddling and seducing the lay public, it is still very much usurious at its core. This group of thinkers and experts<sup>50</sup> call for a return to the Islamic gold dinar and silver dirham as real money to replace paper and electronic money (fiat, notional money), a call made more poignant by the ongoing financial meltdown affecting the world’s usurious banking system.<sup>51</sup>

Clearly, a new financial and economic system founded on the gold dinar and silver dirham<sup>52</sup> will entail a new financial mathematics and a new econometrics to model, clarify, and institute the new, emerging financial and economic dynamics. This will in turn promise many fruitful avenues for upstream mathematical research for mathematicians, Muslim and non-Muslims alike, who thirst for demanding yet meaningful intellectual and academic challenges, especially if such upstream research is directed toward operationalizing (i.e., realizing in reality on the ground of daily life) one’s value-system and worldview, in this case in the practical financial, economic, and commercial realities at the local, regional, and international levels of voluntary and contractual exchange.

Such a radical reconceptualization of finance and economics so that they accord with the Islamic value-system, which rejects all forms of usurious transaction, covert or overt, will also bring about new physical and mathematical models of wealth and poverty.<sup>53</sup> These new models will no longer refer to paper or electronic money, itself bereft of any intrinsic value, as the measure of wealth, but will rather refer to real wealth as wealth, such as the wealth of unexploited natural resources in the form of minerals, lands, forests, farms, and general ecological well-being. These

resources will then be seen rather as ‘natural capital’.<sup>54</sup> For instance, to be wealthy a “developing” nation need not liquidify and hence irreparably deplete its natural real estate, but will wisely utilize it sustainably to generate liquid income in perpetuity. It is not out of place here, in this respect, to find affinity, and perhaps to forge an alliance, with the Buddhist economic<sup>55</sup> outlook described by Schumacher:

Another striking difference between modern economics and Buddhist economics arises over the use of natural resources. Bertrand de Jouvenel, the eminent French political philosopher, has characterised “Western man” in words which may be taken as a fair description of the modern economist: He tends to count nothing as an expenditure, other than human effort; he does not seem to mind how much mineral matter he wastes and, far worse, how much living matter he destroys. He does not seem to realize at all that human life is a dependent part of an ecosystem of many different forms of life. As the world is ruled from towns where men are cut off from any form of life other than human, the feeling of belonging to an ecosystem is not revived. This results in a harsh and improvident treatment of things upon which we ultimately depend, such as water and trees.<sup>56</sup>

All these natural resources, now re-envisioned as capital assets<sup>57</sup> (rather than operational expenditure<sup>58</sup>) will be new indicators of wealth to be measured with new measures appropriate to them and to their roles in the promotion of long term holistic well-being, leading in turn to a global economic emancipation (*al-tahrīr al-iqtisādī*) of nations and the final overthrow of neoliberalism masking itself as globalization.<sup>59</sup>

### **Waqf and the Revival of the Islamic Gift Economy**

I was reading an article in a recent issue of *The Ecologist*<sup>60</sup> (*The Economist*’s nemesis) about what is called the pre-modern “gift” economy,<sup>61</sup> and that set in motion the following train of thought. As Muslims we do not have to dig overly far into some pre-historical, pre-urban “hunter-gatherer” societal set-up for an existential instance of the gift economy in order to learn how to *give* again, and indeed to give more than to take as a matter of principle and practice.

The Islamic Gift<sup>62</sup> Economy (IGE)<sup>63</sup>—through *zakāt*, *ṣadāqah*, *hibah*, *qard ḥasan*, *hadiyah*, *farā’id*, venture capital (*muḍārabah* and *mushārahah*)<sup>64</sup> and, especially, *waqf*<sup>65</sup>—was systemically realised in history as a central civilizational feature of highly complex urbanised Muslim societies, so much so that, for instance, Ibn Baṭṭūtah would marvel at the astonishing array of various *awqāf* (private charitable trusts and endowments) he

found operative in Damascus. There were *awqāf* for feeding stray cats, for compensating masters for losses caused by their servants' mistakes, for the *madāris* and hospitals, for the caravanserais and travellers' inns, for providing municipal services and upkeeping mosques, and so on.<sup>66</sup>

The impression one immediately gets from Murat Cizakca's well documented detailed study of the *waqf* institution in the Ottoman period is that almost all public goods and services—educational, municipal, social welfare, health, etc.—were funded and provided by private, largely de-centralised community based *awqāf*, so much so that the State needed to spend next to nothing for provisioning these and the concomitant bloated bureaucracy they would entail, but concentrated its resources almost solely on defense, war, and public security.<sup>67</sup> What we have here in effect is an Islamic form of what modern economists call 'privatization', except that in this case public goods and services were taken care of by members of the ruling elite and the rich in society, in their private capacity, as an act of perpetual charitable giving—*ṣadaqah jāriyah*—through the august institution of *waqf*.

Now, contrast that scenario with today's runaway, self-interested privatization happening all over the world, in which public services (e.g., public utilities) are taken over by the well-connected business elite not to serve the people but to take, or rather, to scoop, more from the people—the *scoop economy*. To rub salt into a raw wound, many of these privatization projects are subsidized by the state or financed through bank loans, which means by taxpayers' money or public savings, and, in many cases, these projects are also bailed out by the state when they fail—in effect, a *scoop-thrice economy*!<sup>68</sup> The net result of this is a lop-sided system in which it has been estimated that “the richest 225 people own more wealth than the poorest 2.5 billion”.<sup>69</sup>

It is of course in the interest of both the people and the state that the central government be as minimal, limited,<sup>70</sup> and unintrusive as possible, and hence avoid overburdening the population by various taxes to fund inefficient, centralized, and overly bureaucratic public services. But robbing the people thrice through ill-conceived privatization projects modeled on the neoliberalism of the Thatcher-Reagan-Mahathir<sup>71</sup> era is not the solution, and even more so if this involves fire-sales of public assets to foreign predatory multinationals, such as has happened in Indonesia.<sup>72</sup> The solution is to revive the Islamic institution of *waqf* as a major socio-economic force in contemporary Muslim societies, in which private economic surpluses are systematically recycled back into the public domain instead of

accumulated for the sake of accumulation, or worse, siphoned out of the country altogether. *Fuqahā*<sup>2</sup> and economists will have to work together creatively to re-realise the Islamic gift economy. Surely there is more to Islamic Economy than profiteering Islamic Banking and Finance.

Privatization is a neoliberal macroeconomic policy in which public goods and services like water supply, electricity, telecommunications, education, health, public transport, and others are privatized, i.e., sold by the government (public trustee) to private corporations to be run as private, for-profit commercial enterprises. In theory, the point of privatization is quite plausibly altruistic, namely to enhance efficiency in the delivery of those public goods and services and to reduce the fiscal burden of the state and hence the tax burden on citizens under the banner of “minimal government”. But what actually happens in practice in most cases is that privatization becomes a process through which the state engages in the fire-sale of public goods to a select group of the politically well-connected corporate elite. Moreover, the sale is further subsidized through government loans (taxpayers’ money) and bank loans (public savings), and more often than not the government again steps in with public funds to bail out struggling or bankrupt corporations involved in these privatization projects, as has happened in the case of Malaysia with its national airline and steel industry. It turns out that on the whole privatization is premised on what can be called the principles of the “scoop-thrice economy.” The first scoop is when public goods are auctioned off to private interests at fire-sale prices, the second when the sale is subsidized by government and bank loans, and the third when public money is again used to bail out these privatization projects when they lose steam for one reason or another and fail to deliver.

Although the concept of minimal or limited government in itself is well reasoned rationally and historically and hence quite acceptable, yet the privatization of public goods and services is not the way to minimize the state—especially when in practice it opens the door for the takeover of national wealth by foreign corporate interests, as has happened in Indonesia, Russia, Bolivia, and elsewhere. Moreover, when we take the trouble to scrutinize the national budgets of countries like Malaysia, for example, we do not find any significant reduction in the size of the government machinery, despite almost two decades of privatization,<sup>73</sup> but on the contrary it actually increased with the allocation for management and administrative purposes (so-called operating expenditure) amounting to almost three times as much as the allocation for development, i.e., the net

productive amount that actually reaches the people outside of the government bureaucracy itself.<sup>74</sup>

In contrast, we have well documented examples from Islamic economic history (as researched, for instance, by Murat Cizakca) showing how the institution of *waqf* (private charitable trusts) had traditionally performed the pivotal, community-based function of funnelling private wealth for public interest objectives. These charitable trusts were so successful in providing for almost all public goods and services needed by ordinary people that the function of the state was reduced to that of defense and public security, as noted earlier in the case of the Ottoman state. Thus public goods and services such as *madrasahs*, hospitals, and social welfare were funded from incomes generated through property and cash *waqfs* or endowments by wealthy private individuals as well as high ranking public officials of the realm. Here we have a clear historical example of what we now term “civil” or “caring” society<sup>75</sup> in which the well-off in the community take care of the basic human needs of the economically and socially marginalized, thus contributing significantly to local, direct people-to-people self-empowerment. It is in this respect of privately initiated social reciprocity or *civil conviviality* that we are in full accord with Margaret Thatcher when she says:

I think we have gone through a period when too many children and people have been given to understand “I have a problem, it is the Government’s job to cope with it!” or “I have a problem, I will go and get a grant to cope with it!” “I am homeless, the Government must house me!” and so they are casting their problems on society and who is society? There is no such thing! There are individual men and women and there are families and no government can do anything except through people and people look to themselves first. It is our duty to look after ourselves and then also to help look after our neighbour and life is a reciprocal business and people have got the entitlements too much in mind without the obligations...<sup>76</sup>

Except that our response to her challenge would not be through her stick-it-down-their-throats brand of neoliberal privatization but through a creative, systemic revivification of the Islamic institution of *waqf*, as well as encouraging the voluntary re-manifestation of other civic societal aspects of the Islamic gift economy. Surely *waqf* can and should engage and interact with neoliberal privatization, but that on its own autonomous terms, guided by the overriding controlling principle of public interest superseding private interest, which must of course be the principal business of government.<sup>77</sup> In short, the institution of *waqf* should be revived and

promoted as a more viable and equitable alternative to neoliberal privatization in which *waqf* incomes and profits are recycled into delivering public goods and services instead of being scooped up, accumulated, and concentrated in the hands of the few as in the case of runaway neoliberal corporate privatization.

The revival and promotion of the institution of *waqf* in contemporary socioeconomic realities open up a whole challenging and promising area of upstream mathematical research for Muslim mathematical economists, especially in the area of monetary, fiscal and financial economics, taxation, and econometrics, for modelling both the micro- and macro-economics of *waqf* (mathematical modelling of *waqf*).<sup>78</sup> This will in turn pave the way toward the rise and consolidation of a new economic system that is no longer premised on and geared toward (over) accumulation, (over) concentration, and (unsustainable) growth of private wealth (the economics of growthism and developmentism), but one that is premised on mutuality, cooperation and redistribution (zero-growth, steady-state, redistributive economics),<sup>79</sup> or what Schumacher calls “Buddhist economics”.<sup>80</sup>

This radical approach to economic planning is more in line with the Islamic ethico-economic value-system which promotes *giving to*, rather than scooping from, others. This approach can be referred to as the Islamic Gift Economy (IGE) in which the emphasis is on the principles of mutuality, redistribution and cooperation instead of coercion, accumulation and competition. The IGE principles are realised in practice through *ṣadāqah*, *hibah*, *hadiyah*, *zakāt*, *farā'id*, *qard ḥasan* and *waqf*, and other valid and acceptable forms of social and contractual exchange. The Islamic Gift Economy (IGE)<sup>81</sup> will exist in direct opposition to, yet in engagement with, the Neoliberal Scoop Economy (NSE) premised on usury leading to unsustainable growth, over accumulation and over concentration, which leads to a massive transfer of public wealth into private, irresponsible hands.

Neoliberal capitalists like to talk a lot about the so-called ‘free rider’ problem, whereas the free-rider problem is neoliberalism itself as most dramatically amplified by the ongoing global financial meltdown.<sup>82</sup> It has deliberately developed and deployed its own private mathematical language as an intimidating intellectual weapon by which it imposes its policies on the world, much like an economic ring of power which paralyses the ability of people to counter-response by projecting an aura of irrefutable objectivity, universality, and inevitability: *submit or be disowned!*

The goal of upstream research in mathematical economics for Muslims will be to destroy this ring<sup>83</sup> and create a new economic objectivity and *re-*

*ality* for themselves and quite possibly for the world through cross-cultural, socio-economic dialogue of free and thinking peoples, a kind of a global civil societal exchange based on mutual consent (*‘an tarāḍīn*).<sup>84</sup>

As J. K. Galbraith ever so candidly puts it (paraphrased): Neoliberalism is *pushed* from the bottom by motivating the poor to work hard out of desperation and *pulled* from the top by motivating the rich to work hard out of avarice.<sup>85</sup> That way of (mis-)doing business is soon to end in favor of innumerable down-top, informal yet intimately interlinked networks of global “conviviality”.<sup>86</sup>

### **Mathematical Interpretation of Atomistic/Occasionalistic Cosmology**

Mainstream Islamic cosmology, i.e., as articulated through the Ash‘arī-Māturīdī *kalām* of the Ahl al-Sunnah wal-Jamā‘ah, and adhered to by Imām al-Ghazālī, Imām Fakhr al-Dīn al-Rāzī, the Malay-Islamic ‘ulama including the Šūfīs,<sup>87</sup> is what can be described as atomistic/occasionalistic cosmology in which the structures and processes of the cosmos, including bodies, space, time, energy, and light, are viewed as being discrete or discontinuous in nature instead of continuous.<sup>88</sup> This atomistic cosmology is in turn built upon an ontology that uncompromisingly stresses the absolute dependence (*iftiqār*) of the cosmos (*‘ālam*) on the power and will of the Creator (*al-Khāliq*). This cosmo-ontology can be described as the metaphysics of dependence/*iftiqār*.<sup>89</sup>

Muslim physicists who understand and accept this cosmology and ontology as their fundamental conceptual starting point, especially those who are involved in the fields of physical cosmology and theoretical and mathematical physics, shall find it worthwhile to formulate and promote upstream mathematical research programs for constructing mathematical models and techniques that can describe, clarify, and study the discontinuous, atomistic nature of every aspect of natural phenomena.<sup>90</sup> They may thus engage, on similar mathematical and physical terms, opposing models and theories that in one way or another stresses the continuity of nature, and which may (though not necessarily)<sup>91</sup> imply the independence of nature from a higher ontic source. Moreover this kind of upstream research can provide us with the intellectual and scientific tools necessary for intelligent (non-naive, non-simplistic, and non-banal) constructive participation in the ongoing cross-religious, inter-faith discourse on traditional theological responses to, and interpretations of, the discoveries of modern physics and cosmology. I believe that the importance of this kind of work in our present age is already prefigured by the following quotation from al-Imām Sa‘d al-Dīn al-Taftazānī, the great Ash‘arī *mutakallim*

and logician.

If the question is raised whether there is any benefit resulting from this position [of affirming the atomic minimal part] which is different (from that of the Philosophers), we reply that there is. In establishing the pure atom we escape many of the obscurities of the Philosophers, such as the positing of primary matter (*hayūlī*) and form (*sūrah*) which leads to the eternity of the world, the denial of the resurrection of the body, and many of the fundamental laws of measurement (*al-handasah*), upon which obscurities rests the continual motion of the heavenly spheres; and also the denial of the rending (*al-kharq*) of them and their being coalesced together again (*al-iltiḥām*).<sup>92</sup>

For instance, aspects of discrete dynamical systems theory, finite geometry and discrete combinatorial geometry and combinatorics, and modular systems theory, etc., can be further developed and extended to work out and clarify in formal terms the full implications of *kalām* atomistic cosmology for both the physical and the life sciences (e.g., the study of consciousness, mind, and language).<sup>93</sup>

#### **Mathematical Interpretation of Explicate and Implicate Orders**

Islamic cosmology views the physical world as the manifest world (*‘ālam al-zāhir*), the world of sense and sensible experience, which is embedded in a deeper, hidden, unseen world (*‘ālam al-ghayb*), the world of spiritual (noetic) realities that while beyond the reach of the senses is yet accessible through intellectual reflection and spiritual experience (trans-empirical consciousness).

In modern physics, David Bohm is among the few who attempt to see the world of physical realities as constituting an explicate or unfolded order that is embedded in a deeper implicate or enfolded order of a higher degree of reality.<sup>94</sup> He promotes his notion of an implicate order underlying, integrating, and unifying the diverse discrete and seemingly autonomous and fragmented phenomena of the explicate order as an ontological interpretation of relativity and quantum mechanics, and hence as a conceptual approach toward unifying or rather reconciling the two theories in terms of a higher theory of the nature of ultimate reality. In books such as *The Undivided Universe* and *Wholeness and the Implicate Order* he attempts to build a new physics and also a new mathematics or algebra to clarify in more precise terms the nature of the interrelation and interaction between the explicate and implicate orders of existence.<sup>95</sup>

In my opinion, Muslim physicists and mathematicians should seriously study the Bohmian approach to physics since (i) it is explicitly clear,

honest and upfront about its underlying metaphysical assumptions; and (ii) it is more in line with major aspects of Islamic cosmology and ontology, and hence can be critically appropriated into the context of an empirical and mathematical Islamic Cosmology Research Program (ICRP).<sup>96</sup> This is a more creative move than to allow oneself to be continually caught in trivial downstream research whose upstream flows out of the mainstream secular, naturalistic, reductionist framework that either implicitly or explicitly deny as a matter of principle the ontological reality of a higher yet deeper implicate order underlying and influencing the manifest explicate order of sense and sensible experience.

Critical appropriation and further creative development of the Bohmian cosmo-ontological approach to physics and cosmology will most certainly lead to the formulation of novel upstream research programs in mathematics, physics, and cosmology for developing new mathematical and physical models for describing in more precise conceptual and empirical terms the ontic reality of the dependence of the explicate order on the implicate order and hence on a transcendent creator of power and wisdom.

Also, the theological “transcendent creator of power and wisdom” corresponds, at least in formal terms, to what Bohm and Hiley mean by the super-implicate order, or rather the super-order, of a descending series of implicate orders in which the higher enfolds the lower, and in which the lower is unfolded with respect to the higher, until we reach the lowest order,<sup>97</sup> which is the explicate, unfolded, manifest order of the physical, material world of sense and sensible experience of seemingly autonomous, separate and fragmented entities and processes.<sup>98</sup>

### **Mathematical Interpretation of Creationary Theory**

It is often claimed by neodarwinists that creationism or creationary theory is merely religious metaphysical dogma not amenable to scientific, empirical inquiry, i.e., not testable against observed facts of the extramental physical world. Well, the same can be said for evolutionary theory, which has a long and chequered pre-darwinian history as a more or less fact-free metaphysical idea before Charles Darwin rearticulated it in more or less experiential terms rendering it amenable to empirical testing against physical, biological observations. Whether it has actually passed the test of empirical observation is quite another question.

The real question about creationary theory is not about its metaphysical nature or lack thereof, but whether it could be infused with experiential content sufficient enough for it to be *re-expressed* as a physical, scientific

theory amenable to rigorous systematic empirical inquiry. In other words, if an originally metaphysical, meta-scientific theory (religious or otherwise), such as creationary theory, can be consistently re-conceptualised in physical, experiential terms, then it becomes a scientific theory subject to the same stringent empirical tests as the opposing evolutionary theory. If evolution can be allowed to go from metaphysical to the physical, I cannot see why that privilege should be denied to creationism, in the name of objective scientific fair play.

Therefore the real problem with creationary theory is then really this: *If the world is created by a transcendent intelligence of power and wisdom, then what precisely are the observable physical features of the world indicating it as being a product of intelligence rather than of chance?*<sup>99</sup> In the end, as far as science is concerned, the question boils down to whether the given empirical evidence is weighted in favor of one rather than the other theory.

Michael Behe in his influential book *Darwin's Black Box* has proposed a powerful empirical theory of creation or design that I believe can be further developed, extended, and explicated in more exact (i.e., mathematical) terms to eventually supercede completely the mainstream neo-darwinian consensus. His quasi-formal, physical definition of design can be briefly paraphrased and restated in the following terms: *design is the arrangement of parts to realise a structural and/or functional whole beyond the capacity of the individual, separate parts, such that the absence or removal of any one of those parts destroys the structure and/or function.*<sup>100</sup> This definition has I think captured in a brief sentence the essential, formal elements of anything that can be described as having been designed, thus rendering it possible for its logical implications to be further worked out mathematically and then tested empirically against any aspect of biological or non-biological phenomena.

Thus, our foundational conceptual standpoint here is that (following al-Fakhr al-Rāzī and al-Nūrsī<sup>101</sup>) *if anything in nature is created/designed, then everything is, including the whole of nature itself,*<sup>102</sup> thus leading to what Robert A. Herrmann calls a General Intelligence Design (GID) theory,<sup>103</sup> already implied in qualitative terms by al-Nūrsī in his remarkable *Nature: Cause or Effect.*<sup>104</sup> Right now, the standard creationary theory as articulated by Behe and Dembski (call it the Behean-Dembskian synthesis) is arbitrarily restricted to biological function. Muslim mathematicians should be able to raise the stakes of the creation-evolution debate by formally generalising the design theory to all natural phenomena, biological or

physical, i.e., to both biotic and abiotic systems.

I believe that Muslim mathematicians who reject neodarwinian evolution will be able to draw from systems and information theory, as well as other relevant branches of mathematics, to formulate upstream research programs for developing new mathematical techniques to describe, clarify, and bring into more precise analytic focus the design features so self-evident in both biological and non-biological phenomena, from the subatomic to the cosmic, from inanimate rocks to animate brains.<sup>105</sup>

### **Accountancy and Actuarial Mathematics**

Accountancy and the actuarial sciences are part of the larger field of financial mathematics. The eventual replacement of the mainstream fiat money system with the Islamic gold dinar system will certainly entail radical reforms to, and even total replacement of, the accountancy and actuarial principles, standards, and models now in use, in line with foundational changes in the way money, wealth, risks, costs, benefits, and the very notion of “accountability” are conceptualized and defined in a dinar-dirham economy, which is in turn embedded in a larger Islamic Gift Economy meta-architecture.<sup>106</sup> The reconceptualization of wealth and money will in turn open up new avenues of upstream research programs in the actuarial and accountancy sciences.<sup>107</sup>

For instance, the dynamic and creative revival of the august institution of *waqf* can provide, *inter alia*, a system of communal (i.e., decentralized, community-based) social welfare “insurance” for the economically marginalized. Now, a social welfare net within the framework of *waqf* and *tabarru'* principles will entail a thorough rethinking of mainstream actuarial methods of assessing ‘risk’, which are largely based on rent-seeking arbitrage rather than mutuality structures, even in the so called *takāful* (mutual support and solidarity) insurance business.<sup>108</sup> Maybe the very concept of insurable “risk” will have to be rethought very thoroughly indeed, at least as to what extent it has been decoupled from its roots in the uncertainty of gambling.<sup>109</sup> I wonder if today’s *takāful* industries have properly thought out this and similar foundational issues and come out with its own actuarial science—assuming that is possible, given the traditional fiqh objection to insurance?<sup>110</sup> As noted by Bill Maurer in his sensitive anthropological economic study:

[Though] Self-consciously positioned as a moral and ethical alternative to conventional insurance, it [*takāful*] employs the same actuarial tables and statistical conventions while serving the perceived needs of the faithful, whether those needs be to

provide for family after death or save money for the holy pilgrimage.<sup>111</sup>

Another case in point: the “philosophical base” of actuarial science is secular utilitarianism rooted in 18<sup>th</sup>-19<sup>th</sup> century western capitalism. Therefore, to the extent that this philosophy and its context are incompatible with Islam and its context, at least, the actuarial sciences have to be redefined and reformed.

In the long run, statements on actuarial practices will be erected on principles which in turn are built on fundamental ideas and concepts. These fundamentals will be relatively invariant over time, while standards will respond to current issues facing the actuarial profession. If the standards of practice that are developed are to be consistent, such standards must be related to a coherent intellectual foundation—a set of fundamental actuarial concepts such as set out in this work.<sup>112</sup>

The above quotation reflects an on-going re-examination of the foundations of the actuarial sciences by western practitioners of the art. Is that healthy dose of critical self-consciousness also infused into the minds and hearts of Muslim actuaries and financial mathematicians in the course of their training and practice of the art of risk management and econometric modelling? Or are they efficient but mindless automata, robotic manipulators of tables and models the historical and axiological provenance of which they know next to nothing about?

### **Mathematical Modelling of the Islamic Green Economy**

On another note, a greener,<sup>113</sup> more eco-friendly approach in the way things are being done in the various scientific and technical fields (green chemistry,<sup>114</sup> green engineering,<sup>115</sup> green manufacturing,<sup>116</sup> green industry,<sup>117</sup> organic agriculture,<sup>118</sup> green investment,<sup>119</sup> green energy,<sup>120</sup> the fair trade movement,<sup>121</sup> economic downshifting or simple living,<sup>122</sup> green financing,<sup>123</sup> etc.) will, among other things, require new quantitative models of accountancy and risk management which take into systemic consideration what are now conveniently dismissed as externalities (hence non-existent) in conventional models. What are pushed aside as externalities will then to a large extent be seen as internalities and hence seen also as constitutive components of the costs, benefits, and risks of a project, small or large.<sup>124</sup>

However, in mainstream accountancy and actuarial sciences today, these externalities and by-products are seen as incidentals that need not be seriously and systematically considered in evaluating the impact of a

project on public stakeholders. It is this systemic, irresponsible, self-interested attitude about public costs and benefits that lies at the bottom of widespread social and natural environmental degradation in the wake of physical development and runaway economic growth.

...the entity and monetary measurement concepts, by relegating the damaging effects on the social fabric and environment as externalities, means that accounting hides itself in the clothes of objectivity by not measuring these at all! As *accounting itself creates reality by communicating it*, it leads to certain behavioural consequences, which is in line with the materialistic utilitarian worldview of capitalism. These include competition, conflict and domination.<sup>125</sup>

Hence, a both qualitative and quantitative (i.e., mathematical) thorough and radical review of modern accountancy and actuarial sciences along authentic Islamic lines will make sure that the spirit and practice of true accountability (*muḥāsabah*) and responsibility (*amānah*) re-infuse these and related disciplines.<sup>126</sup>

#### **Malay-Islamic Mathematics and Ethnomathematics in General**

Another upstream mathematical research program disregarded by most researchers into Malay-Islamic thought<sup>127</sup> is systematic research into the rich scientific and mathematical heritage of Malay-Islamic scholars between 1500 to 1900 CE. Aspects of this neglected mathematical heritage include texts in astronomy, calendarical reckoning, inheritance division, and mathematics as such.

In this regard I have, in collaboration with INSPEM,<sup>128</sup> detailed a research project to study and produce an annotated translation of a mathematical treatise by the 19<sup>th</sup> century Malay-Islamic mathematician al-Shaykh Aḥmad al-Khatīb bin ‘Abd al-Laṭīf al-Minangkabawī entitled *‘Alam al-Ḥussāb fī ‘Ilm al-Ḥisāb*.<sup>129</sup> The idea here is to work backwards from a relatively late scholar like al-Minangkabawī to earlier pre-colonial Malay-Islamic mathematical writers to eventually produce an overall picture of how pre-Islamic Malay ethnomathematical elements were synthesized with later Malay-Islamic ones and then later still with modern western mathematical ideas.

Apart from enriching our knowledge of the mathematics of a significant ethnogeographical region of the larger Islamic world, which I believe will be a worthwhile objective on its own, it is quite possible that we may find new mathematical concepts and techniques which could have interesting and useful contemporary relevance, and hence be revived and developed further. But this possibility will only be open for exploration by

those of us who are not too obsessed with modern western mathematical achievements as the only standard for evaluating progress or regress in any scientific field whatsoever.

### Conclusion

Mathematics, like all other sciences, exact or inexact, pure or impure, is value-laden. Values, whatever their source, were there before the axioms, and the latter merely embody the former. Hence mathematics can be understood as the *formalization of values* by which they are further clarified and infused into the natural and social sciences and made operative for cognitive and pragmatic purposes. This understanding of the value-ladenness of mathematics has been explored here by suggesting some upstream research programs for *Muslim* mathematicians as a rough guide toward how they could go about embodying and realising Islamic values in, and through, their work, thus operationalizing the Islamization of the sciences through the power of mathematical rigor and objectivity.

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### Endnotes

1. *The Development of Arabic Mathematics: Between Arithmetic and Algebra*, Boston Studies in the Philosophy of Science (Dordrecht: Kluwer, 1994); idem., *Encyclopedia of the History of Arabic Science*, 3 vols. (London: Routledge, 1996); idem., "Metaphysics and Mathematics in Classical Islamic Culture: Avicenna and his Successors," in Ted Peters, Muzaffar Iqbal, and Syed Nomanul Haq (eds.), *God, Life, and the Cosmos* (Aldershot: Ashgate, 2002), 173-193; idem., "Between Philosophy and Mathematics: Examples of Interactions in Classical Islam," in *Islam & Science* (Winter 2005), 153-165; idem., "The Invention of Classical Scientific Modernity," in *Revista Latinoamericana de Historia de las Ciencias y la Tecnología*, vol. 12, no. 2 (May/August 1999), 135-147. For more information about him and his valuable works, see his personal website, <<http://cc.usu.edu/~bekir/rashed/index.htm>>. To me, the main importance of Roshdi Rashed's historically grounded works, at least in regard to this article, lies in their detailed documentation and explication of the fruitful symbiosis between philosophy (including theological and metaphysical ideas) and mathematics in the works of classical Islamic mathematicians.
2. Imre Lakatos, *Mathematics, Science and Epistemology* (Cambridge: Cambridge University Press, 1980); idem., *The Methodology of Scientific Research Programmes* (Cambridge: Cambridge University Press, 1984); idem., *Proofs and Refutations: The Logic of Mathematical Discovery* (Cambridge: Cambridge University Press, 1989). I have borrowed the Lakatosian framework in my "Islamic Science as a Scientific Research Program," *Islam & Science* (Summer 2005); and "Three Meanings of Islamic Science," in *Islam & Science* (Winter 2007).
3. Including Brian Martin, "Mathematics and Social Interests," in *Search*, vol. 19, no. 4 (July-August, 1988), 209-214; and, especially, Michael Polanyi, *Personal*

*Knowledge: Toward a Post-Critical Philosophy* (Chicago: University of Chicago Press, 1974). My deliberate first-person tone in this article is simply to support Polanyi's emphasis on the importance of recognizing and acknowledging the scientist's personal, passionate involvement in the discovery and validation of his knowledge, which he then presents to the world as impersonal and objective. His basic message is that science is not just a matter of impersonal knowing, but more fundamentally, a matter of personal *being*. See also his *Knowing and Being: Essays by Michael Polanyi* (Chicago: University of Chicago Press, 1977); *Science, Faith and Society* (Chicago: University of Chicago Press, 1964); *Tacit Dimension* (Gloucester, MA: Peter Smith, 1983); and idem, with Harry Prosch, *Meaning* (Chicago: University of Chicago Press, 1977).

4. Needless to say, this article is only intended for those who want to *create* rather than merely *do* mathematics. For a brief thought in this regard, see the short paper by Ror D. Follendore, "Mathematical Creativity," at <[http://www.noisetoknowledge.com/mathematical\\_creativity.htm](http://www.noisetoknowledge.com/mathematical_creativity.htm)>. A more academic description of creativity in mathematics is the chapter on "Mathematical Creativity," by Gontran Ervynck, in David Orme Tall (ed.), *Advanced Mathematical Thinking* (New York: Springer-Verlag, 2004), 42-53.
5. Apart from Lakatos's works already cited, for a short overview of foundational philosophical problems in mathematics, see <<http://www.ucl.ac.uk/philosophy/LPSG/Ch22.pdf>> and the references therein. The Wikipedia articles on "Mathematics" (<<http://en.wikipedia.org/wiki/Mathematics>>) and "Philosophy of Mathematics" (<[http://en.wikipedia.org/wiki/Philosophy\\_of\\_mathematics](http://en.wikipedia.org/wiki/Philosophy_of_mathematics)>) are also very helpful.
6. Gontran Ervynck, "Mathematical Creativity," 42.
7. Specifically, reflective studies on Arab-Islamic mathematics by Roshdi Rashed, such as his "Between Philosophy and Mathematics: Examples of Interactions in Classical Islam," in *Islam & Science* (Winter 2005), 153-165.
8. Specifically, the preliminary studies on various aspects of Malay-Islamic ethnomathematics based on the textual evidence by scholars and mathematicians associated with Akademi Sains Islam Malaysia (ASASI = The Islamic Science Academy of Malaysia). Most of their studies are published in the Malay language in local Malaysian scientific and mathematical journals, and I am thinking of writing an English summary of them for a global audience.
9. The Islamization of Mathematics follows from the Islamic Mathematics Research Program (IMRP), which is a component of the Islamic Science Research Program (ISRP) sketched out in my "Three Meanings of Islamic Science: Toward Operationalizing Islamization of Science," in *Islam & Science* (Summer 2007), 23-52; and "Islamic Science as a Scientific Research Program: Conceptual and Pragmatic Issues," in *Islam & Science* (Summer 2005), 93-101.
10. Including Western mathematicians such as ethnomathematicians interested in learning, studying, researching, and promoting the mathematical thought, pedagogy, and practice of non-western peoples and cultures, which they see as having their own, autonomous, intrinsic worth. For a survey of

non-western mathematics, see, for instance, Marcia Asher, *Ethnomathematics: A Multicultural View of Mathematical Ideas* (Pacific Grove, CA: Brooks/Cole, 1991); see also Helaine Selin and Ubiratan D'Ambrosio (eds.), *Mathematics Across Cultures: The History of Non-Western Mathematics* (New York: Springer, 2000). Here, the word "western" is understood in the intellecto-cultural sense elaborated by Serge Latouche, *The Westernization of the World: The Significance, Scope and Limits of the Drive towards Global Uniformity* (London: Polity Press, 1996). In this book, Latouche makes a forceful, intellectually impassioned case for his thesis that the West is now a masterless machine on a wild rampage through the globe, devouring all, culture and nature, in its path. See also Syed Muhammad Naquib al-Attas, *Islam & Secularism* (Kuala Lumpur: ISTAC, 1993), especially chapter four on "The Dewesternization of Knowledge," 133-138.

11. For a discussion, see Brian Martin, "Mathematics and Social Interests," in Arthur B. Powell and Marilyn Frankenstein (eds.), *Ethnomathematics: Challenging Eurocentrism in Mathematics Education* (Albany, NY: State University of New York Press, 1997), 155-171; also Liz Bills and Chris Husbands, "Values in Mathematical Education: How Mathematical?" (<<http://cerme4.crm.es/Papers%20definitius/12/BillsHusbands.pdf>>).
12. For a balanced, wide ranging discussion which looks at both sides of the coin, see Harold Kincaid, John Dupre, and Alison Wylie (eds.), *Value-Free Science?: Ideals and Illusions* (Oxford: Oxford University Press, 2007). For a discussion from a Christian perspective, see Michael H. Veatch, "Mathematics and Values: Can Philosophy Guide Projects," in *Journal of Association of Christians in the Mathematical Sciences* (ACMS), 2004 Inagural Issue, 1-14, <<http://www.acmsonline.org/veatch-values.pdf>>. For a Muslim mathematician's perspective, see Shaharir Mohamed Zain, *Symbiosis between Value Systems and the Nature of Mathematics* (Bangi, Malaysia: Penerbit UKM, 2006). The value of this work can be enhanced by drawing on the studies of Roshdi Rashed (which he overlooks completely) to provide *detailed* examples from the fruitful symbiosis between philosophy (including metaphysical ideas) and mathematics in the works of classical Islamic mathematicians. As it is, the thesis is supported mostly by examples from western mathematics and physics with only brief incidental references to classical Muslim mathematicians, despite his call in the conclusion for the Islamization of mathematics.
13. This may smack of extreme relativism, but the fact is that objectivity in mathematics, as in science, arises not out of the *a priori*, unilateral assertion of objectivity on the part of a hegemonic mathematical culture, which is then imposed, directly or indirectly, on the receiving, subjugated or coopted, culture, but out of cross-cultural, critical appreciation on the part of the receiving culture for the intellectual products of the source culture, which then become objectivised and, in some cases, universalised, precisely because that exchange is, as it were, '*an tarāḍin* (Qur'ān, *al-Baqarah*: 233; *al-Nisa*': 29), that is, *by mutual consent*.
14. For instance, Brian Martin, "Mathematics and Social Interests," in *Search*, vol. 19, no. 4 (July-August, 1988), 209-214; reprinted in Arthur B. Powell and

Marilyn Frankenstein (eds.), *Ethnomathematics: Challenging Eurocentrism in Mathematics Education* (Albany: State University of New York Press, 1997), 155-171. For more on the idea of culture-laden mathematics, see Paul Ernest, "Values and the Social Responsibility of Mathematics" (<<http://people.exeter.ac.uk/PERnest/pome22/Ernest%20%20Values%20and%20the%20Social%20Responsibility%20of%20Maths.doc>>) which is an adaptation of chapter eight of his *Social Constructivism as a Philosophy of Mathematics* (Albany, NY: SUNY, 1998).

15. "God and the Future of Mathematics," *World Network of Religious Futurists* (June 27, 2000) at <[http://www.wnrf.org/cms/print\\_math.shtml](http://www.wnrf.org/cms/print_math.shtml)>.
16. Shaharir bin Mohamed Zain, *Symbiosis between Value Systems and the Nature of Mathematics* (Bangi, Malaysia: Penerbit UKM, 2006), 6. His address was delivered on July 5, 1990 at the National University of Malaysia. He is an accomplished mathematician and mathematical physicist, and an important founding member of the Islamic Science Academy of Malaysia (ASASI), for which he has also served as president for many years. Much of the operative orientation of this article is inspired by my many hours of personal intellectual interaction with him, though I must say we do have our sometimes unnecessarily heated differences.
17. Or the 'Worldview of Islam' as elaborated by Syed Muhammad Naquib al-Attas, *Prolegomena to the Metaphysics of Islam: An Exposition of the Fundamental Elements of the Worldview of Islam* (Kuala Lumpur: ISTAC, 2000); idem, *Risalah untuk Kaum Muslimin* (Kuala Lumpur: ISTAC). For al-Attas's own summary of the worldview of Islam, see "Islamic Philosophy: An Introduction," in *Journal of Islamic Philosophy*, 1 (2005), 11-43 (<<http://www.imase.org/images/stories/naquibalattasinrotoislamicphilosophy.pdf>>). For applying the worldview of Islam as articulated by al-Attas to the domain of science and technology, see my various articles in the Canadian journal *Islam & Science*, especially "Al-Attas's Philosophy of Science: An Extended Outline," *Islam & Science* (December 2003), 165-214; and "Three Meanings of Islamic Science: Toward Operationalizing Islamization of Science," *Islam & Science* (Summer 2007), 23-52. See also the important article on Islamic cosmology by Mohd Zaidi b. Ismail, "The Cosmos as a Created Book and Its Implications for the Orientation of Science," in *Islam & Science* (Summer 2008), 31-53. For applying it to the domain of education in general, see Wan Mohd Nor Wan Daud, *The Educational Philosophy and Practice of Syed Muhammad Naquib al-Attas: An Exposition of the Original Concept of Islamization* (Kuala Lumpur: ISTAC, 1998).
18. Shaharir, *Symbiosis*, 61.
19. Here the term is obviously not used for what passes under that name in the oil industry. It refers to what goes by the name of 'fundamental' or 'basic' research in academia, but I want to capture the sense of active, dynamic flow of creative thought and action inherent in authentic research, as in the upstream and downstream flow of a spring or river, for at times we need to *row* upstream *against* the current, and at other times, *flow* downstream *with* the current. The notion of the "flow," as in the flow of a stream, is also promi-

ment in David Bohm's description of the interaction between the explicate and implicate orders of reality. He calls this flowing mode of thinking and speaking the "rheomode"; see David Bohm, *Wholeness and the Implicate Order* (London: Routledge, 1980), 34-60.

20. This can be viewed as practising the Socratic philosophical imperative of "Know Thyself" and the religious injunction implied in the Prophetic saying "*man 'arafa nafsahū 'arafa rabbahū*" ("he who knows his self knows his Lord"). For an explication of this saying in the context of the meaning and practice of 'religion' in Islam, see Syed Muhammad Naquib al-Attas, *Prolegomena to the Metaphysics of Islam*, especially chapter one on "Islām: The Concept of Religion and the Foundation of Ethics and Morality," 41-90.
21. Hence, faced with the choice of either sacrificing a professional career (i.e., money) or cognitive vision (i.e., truth), the critically self-aware researcher of conscience will obviously opt for the former as the much *lesser* sacrifice, but more often than not—as my experience in Malaysian academia so far shows—the circumstances need not be that dire, for it is quite possible to pursue both career and truth and, moreover, to do so in such a way that the pursuit of career serves the pursuit of truth. It requires a lot of tact (at times outright bluntness), patience, and persistence, but it is achievable. All these will obviously demand an inclination for deep cognitive introspection into the meaning and purpose of one's scientific profession, as well as application of the psychospiritual practice of *muḥāsabah*, *murāqabat al-nafs*, *tafakkur*, *tadabbur*, and *dhikr* into the direction of scientific research. For an outline of Islamic psychospiritual introspection, see Malik Badri, *Contemplation: An Islamic Psychospiritual Study* (Kuala Lumpur: Medeena Books, 2000).
22. Roshdi Rashed says the following in his article "Between Philosophy and Mathematics: Examples of Interactions in Classical Islam," in *Islam & Science* (Winter 2005), 153-165 on 157: "We are, in other words, seeking the organising role of mathematics. We will highlight how the philosopher-mathematicians proceed in their search for mathematical solutions to philosophical problems, a fruitful approach which generates new doctrines and even new disciplines." Upstream research in the sense meant here can thus be seen also as an effort to encourage today's Muslim mathematicians to revive in their work that classical Islamic legacy of creative, dialectical symbiosis between mathematics and philosophy.
23. Especially not in opposition if the downstream research itself flows out from the results of an upstream research one has identified and chosen for oneself, or that one self-consciously accepts and adheres to. In other words, one has to be very self-conscious of one's research agenda and its source of inspiration, if one wants to be a true scientist-mathematician instead of a mere number-technician and symbols-manipulator.
24. For the most part, because in this case involvement in downstream research grows out of uncritical acceptance or even blissful ignorance of the higher upstream research agenda served by that downstream research.
25. I certainly cannot claim to speak for the global Muslim mathematical community in general, but I have posted an earlier, very much shorter Malay draft

of this article to a number of prominent Malay-Muslim mathematicians associated with the Academy of Islamic Science Malaysia (ASASI), and so far they do not seem to be protesting this claim. Moreover, my survey of some issues of the research bulletin of the Malaysian Institute for Mathematical Research, at which I am an invited associate research fellow, tends to support this impression of a mostly downstream activity, lacking an upstream, integrative vision that is to be realised in detail at the downstream level.

26. Now, I personally believe that this seductive mantra serves only to retard our understanding of the real goal of academic life, which is to produce “useful knowledge” (*ilm nāfīʿ*) and the wholesome actions (*amal ṣāliḥ*) to be derived therefrom, not produce papers and to push them around to people who do not really care a jot about what you say. In other words, one publishes, if at all, only to promote and clarify the truth, not one’s career or the prestige of the university. Career, money, and prestige may be important, but they are only of incidental importance. What is of foundational importance is truth, and the incidental merely serves the foundational and builds itself on it, otherwise it is just hot air and scattered dust (*habāʿan manthūran*). On this issue, see the eye-popping article by Mohamed Gad el-Hak, “Publish or Perish: An Ailing Enterprise?” in *Physics Today* (March 2004), 62.
27. Such as Suzanne Sadedin, “A Simple Model for the Evolution of Irreducible Complexity,” at <<http://web.utk.edu/~ssadedin/files/Sadedin2006TR.pdf>>; and Stuart Kauffman, *The Origins of Order: Self-Organization and Selection in Evolution* (New York: Oxford University Press, 1993). A favorable review of Kauffman’s book is, by Reilly Jones in *Extropy*, #13, vol. 6 no. 2 (3<sup>rd</sup> Quarter 1994), also at <<http://home.comcast.net/~reillyjones/order.html>>. For Michael Behe’s critical comments, see his *Darwin’s Black Box: The Biochemical Challenge to Evolution* (New York: The Free Press, 1996), 29ff, 155ff, 178ff, 189ff; and his *The Edge of Evolution: The Search for the Limits of Darwinism* (New York: Free Press, 2007), 159. But actually mathematics is a double edged sword, and so there have been mathematicians (not necessarily anti-evolutionists) who argue against the neo-darwinist synthesis on mathematical grounds alone. I dare say that the severe sword of mathematics in fact cuts more easily into evolutionary rather than into creationary theories, so much so that squaring evolution with mathematics is like squaring the circle. For more on this see Paul Moorhead and Martin Kaplan, eds., *Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution*, Wistar Institute Monograph No. 5 (Philadelphia: Wistar Institute Press, 1967); James Coppedge, *Evolution, Possible or Impossible: Molecular Biology and the Laws of Chance in Non-Technical Language* (Grand Rapids, MI: Zondervan, 1973).
28. Here I am not at all advocating extreme mathematical relativism, which is no solution at all, given the fact that we shall continue to engage, and be engaged by, evolutionist biomathematicians. On the contrary, what I have in mind is a meta-mathematical, methodological equivalence of creationary and evolutionary biomathematics as a shared basis for mutual constructive engagement, somewhat along the lines of Stephen C. Meyer, “The Methodological Equivalence of Design and Descent,” in J. P. Moreland (ed.),

*The Creation Hypothesis: Scientific Evidence for an Intelligent Designer* (Downers Grove, Illinois: InterVarsity Press, 1994), 67-112.

29. David Bohm, *Wholeness and the Implicate Order* (London: Routledge, 1980); idem, *The Undivided Universe: An Ontological Interpretation of Quantum Theory* (London: Routledge, 1995); idem, with F. David Peat, *Science, Order and Creativity: A Dramatic New Look at the Creative Roots of Science and Life*, new ed. (London: Routledge, 2000). See also F. David Peat, *Synchronicity: The Bridge Between Matter and Mind* (New York: Bantam, 1987).
30. Lynn Arthur Steen, "The Science of Patterns," in *Science*, vol. 240 no. 4852 (April, 1988), 611-616; also, Keith Devlin, *Mathematics, The Science of Patterns: The Search for Order in Life, Mind and the Universe* (New York: Scientific American Library, 1994).
31. Actually the word 'intelligent' in "intelligent design" is redundant and should be dropped, since design already implies intelligence.
32. Modern monetary economics and the mathematics developed to formalize that economy is basically based on the Berkeleyan idea of *notional* (i.e., specie-less) money as opposed to real (specie-based) money, see C. George Caffentzis, "Algebraic Money: Berkeley's Philosophy of Mathematics and Money," in *Berkeley Studies*, 18 (2007), 3-21. For a brief overview of the nature of money, see Alla Sheptun, "Philosophy of Money," at <<http://www.bu.edu/wcp/Papers/Econ/EconShep.htm>>.
33. More so when we definitely know that paper and electronic money is integral to the global *ribā* (usurious) fractional reserve banking system; further discussion below.
34. To my limited knowledge at the moment, there is as yet no contemporary comprehensive yet intensive treatment of the Islamic philosophy of money that engages closely and critically with western philosophies of money and the institutions and practices derived therefrom, but a good start is M.A. Choudhury, *Money in Islam: A Study in Islamic Political Economy* (London: Routledge, 1997).
35. Which will, inter alia, entail a drastic physical, economic, and mathematical redefinition of, say, the concept of efficiency; see Prabhat Patnaik, "On the Concept of Efficiency," at <[http://www.networkideas.org/econ/jan2003/Concept\\_Efficiency.pdf](http://www.networkideas.org/econ/jan2003/Concept_Efficiency.pdf)>; cf. Richard Wolff, "'Efficiency': Whose Efficiency", *Post-Autistic Economics Review*, no. 16 (September 16, 2002), article 3 <<http://www.paecon.net/PAERreview/issue16/Wolff16.htm>>.
36. In which case, the concept of 'banking' will itself undergo a radical semantic change, and thus become thoroughly Islamized, so much so that a *new term* may have to be coined to describe the new systemic economic and monetary reality.
37. In a recent series of (overly?) spirited discussions with Shaharir Mohamed Zain of ASASI on the meaning of "upstream/downstream research," I realised that the concept of 'research' in Islam needs to be explicated further, and perhaps given a separate treatment called, tentatively, "The Islamic Philosophy of Research" that would draw heavily from Islamic intellectual history while

- engaging closely with the modern conception and practice of the term. Obviously, if we have to talk intelligently and reflectively about the Islamic Science Research Program, then the notion of ‘research’ must be submitted to a rigorous semantic analysis in order to explicate precisely in conceptual and practical terms what we mean when we say we are doing ‘research’, say, by applying aspects of the method of semantic discourse analysis. A brief overview of semantic analysis in Islam is Syamsuddin Arif, “Preserving the Semantic Structure of Islamic Key Terms and Concepts: Izutsu, al-Attas and al-Rāghib al-Isfahānī,” in *Islam & Science* (Winter 2007), 107-116.
38. See, for instance, Hutson Smith, *Beyond the Post-Modern Mind* (Wheaton, Illinois: Quest Books, 1989). For an interview with him by Jeffrey Mishlove on this theme, see <<http://www.williamjames.com/transcripts/smith.htm>>.
  39. On “*Kalām* and Mathematics in the Islamic Intellectual Tradition,” presented in Malay.
  40. *Seminar Sehari Sains Matematik Rumpun Melayu* (One Day Seminar on Malay Ethnomathematics), organised by the Institut Penyelidikan Matematik (INSPERM, Institute for Mathematical Research) in collaboration with the Akademi Sains Islam Malaysia (ASASI, Islamic Science Akademi of Malaysia), Putrajaya, Malaysia, November 21, 2007.
  41. Maheran Mohd Jaffar, with Shaharir Mohamad Zain and Abdul Aziz Jemain, “Perkembangan Model Matematik Pelaburan Islam Berkonsep Musyarakah,” = “Developing a Mathematical Model of Islamic Investment based on the Concept of *Mushārahakah*,” presented by Maheran M. Jaffar at the said one-day seminar. See also the valuable references on the issue listed therein. According to her, Malay Muslim mathematicians are pioneering research into the mathematical modelling of equity finance based on partnership and venture capital.
  42. Ahamed Kameel Mydin Meera and Moussa Larbani, “Ownership Effects of Fractional Reserve Banking: An Islamic Perspective,” 1-25 (<<http://ahamed-kameel.com/FRBEffects.pdf>>); and Bashir Timol and Haitham al-Haddad, “The Credit Crunch: An Islamic Perspective,” *islam21c.com*, November 6, 2008 (<<http://www.islam21c.com/general/the-credit-crunch-an-islamic-perspective.html>>). See also Sir Harry Page, “In Restraint of Usury: The Lending of Money at Interest,” Chartered Institute for Public Finances and Accounts (London: CIPFA, 1985); Michael Rowbotham, *The Grip of Death* (Charlbury, Oxfordshire: Jon Carpenter, 1998); idem, *Goodbye America* (Charlbury, Oxfordshire: Jon Carpenter, 2000); Margrit Kennedy, *Interest and Inflation-Free Money* (Philadelphia: New Society Publishers, 1995).
  43. I really think that it is high time that we view Islamic Economics as being very much wider and deeper than Islamic Banking and Finance (IBF), and even then, on deeper analysis, the Islamicity of IBF is highly suspect, smacking more than anything else of a very crude and clumsy cooption of traditional *mu‘āmalah* categories into an alien, thoroughly ribā infested and infested macroeconomic and monetary framework. Through a well thought out, comprehensive and systematic Islamic Economics Research Program, we shall tell and show all thinking Muslims (the *‘āqilīn*) that they should have

had enough of this nonsensical, intellectually suffocating, window-dressing game passing itself off as IBF, and go all out for the real thing, which is operationalizing authentic Islamization of economics on the ground, immediately even, whenever possible and feasible, thus realizing the salient features of the *The Islamic Gift Economy* (by Adi Setia, forthcoming). But then, possibility and feasibility are things we have to work intelligently and diligently for, rather than hope for in passivity and seething frustration at the West. More below in the relevant sections.

44. Meera and Larbani, "Ownership Effects of Fractional Reserve Banking: An Islamic Perspective," 1.
45. Since 1963, when the economist Ahmad al-Najjar started his Mit Ghamir Savings Bank which functioned as a savings bank based on profit sharing on returns from investments, and hence was basically a form of venture capital company. There are many sources on him, Muslim and non-Muslim; see, for instance, Clement M. Henry and Rodney Wilson (eds.), *The Politics of Islamic Finance* (Edinburg: Edinburgh University Press, 2004), 267-268. Anyone can easily see how far today's mainstream Islamic banking system has deviated beyond redress from this noble beginning rooted in communal mutuality; on the cause of this deviation, see Tarik M. Yousef, "The *Murabaha* Syndrome in Islamic Finance," in Clement M. Henry and Rodney Wilson (eds.), *The Politics of Islamic Finance* (Edinburgh: Edinburgh University Press, 2004), 63-80; cf. Mahmoud A. El-Gamal, "Mutuality as an Antidote to Rent-Seeking Shari'a-Arbitrage in Islamic Finance," <<http://www.ruf.rice.edu/~elgamal/files/Mutuality.pdf>>. It is time for us to *systematically* go back to our roots and start afresh, this time with our vision clearly fixed on the operative principles of *The Islamic Gift Economy* based on *equity* and *mutuality* rather than one-sided profiteering from impersonal, one-size-fits-all debt-financing contracts that financially enslaves the other side more or less for life. These operative principles are nicely presented in Joseph A. DiVanna, *Understanding Islamic Banking: The Value Proposition that Transcends Cultures* (Cambridge: Leornado and Francis Press, 2006).
46. So far I simply have not found in the "expert" literature any thorough, systemic meta-fiqhi deconstruction of the dense network of secular economic concepts underpinning the modern monetary system, specifically the intimately interlinked concepts of fiat money, legal tender, notional money, paper money, electronic money, plastic money (credit cards), and the usurious deception of the principle of fractional reserve banking, but a very good start is definitely the two important articles by Ahamed Kameel Mydin Meera and Moussa Larbani, "Seigniorage of Fiat Money and the *Maqasid al-Shari'ah*: The Unattainableness of the Shari'ah," in *Humanomics*, vol. 22, no. 1 (2006); and idem, "Seigniorage of Fiat Money and the *Maqasid al-Shari'ah*: The Compatibility of the Gold Dinar with the *Maqasid*," in *Humanomics*, vol. 22, no. 2 (2006). See also the interesting insider revelation by David Musa Pidcock at the Beyond Money website, "David Pidcock's View on the State of Islamic Money, Banking, and Finance," <<http://beyondmoney.net/2008/01/21/david-pidcocks-view-on-the-state-of-islamic-money-bank>>

ing-and-finance/>.

47. Masudul Alam Choudhury, *Money in Islam: A Study in Islamic Political Economy* (London: Routledge, 1997); idem, *The Islamic World System: A Study in Polity-Market Interaction* (London: RoutledgeCurzon, 2004). His writings on various aspects of the Islamic Political Economy (IPE) can be accessed at <<http://faculty.uccb.ns.ca/mchoudhu/ipe.htm>>. See also Rodney Shakespeare, "Binary Economics: Linking Money to Productive Efficiency and Justice," <<http://www.globaljusticemovement.net/articles/trisakti-paper-rs-0310.htm>>.
48. See the expose by Muhammad Saleem, *Islamic Banking: A \$300 Billion Deception* (Xlibris, 2006); cf. Mahmoud A. El-Gamal, *Islamic Finance: Laws, Economics and Practice* (Cambridge: Cambridge University Press, 2006); cf. Timur Kuran, *Islam and Mammon: The Economic Predicaments of Islamism* (Princeton, NJ: Princeton University Press, 2004).
49. See Hamza Andreas Tzortzis, "Usury: The Forgotten Terrorism," in *Islam21c.com*, May 2 2007 (<<http://www.islam21c.com/general/usury-the-forgotten-terrorism.html>>).
50. In Malaysia they have formed a *mu'āmalah* council (<<http://muamalahcouncil.com/>>) of which I am an active invited member. The economics part of this article can also be read as providing a degree of objective (meta-*fiqhi*) intellectual substance to my involvement in it. A lot of people like to overly associate the present day revival of the Islamic dinar to the Murabitun movement or rather network (<<http://en.wikipedia.org/wiki/Murabitun>>), but anyone who looked at the issue deeply will see that the concern for an equitable and truly mutual system of exchange symbolized and embodied in the dinar is something trans-sectarian and even trans-cultural, simply because the love for gold is ingrained in human nature by divine fiat.
51. See Michel Chossudovsky, "Global Financial Meltdown," in *Global Research*, September 18, 2008 (<<http://www.globalresearch.ca/index.php?context=va&aid=10268>>); idem, *The Globalisation of Poverty and the New World Order*, new and expanded ed. (Ottawa: Global Reserach, 2003).
52. For Imam al-Ghazali's position on the divinely ordained role of the gold dinar and silver dirham as means of voluntary exchange in the overall context of his economic thought, see the useful study by S. Mohammad Ghazanfar and Abdul Azim Islahi, *Economic Thought of al-Ghazali* (Jeddah: King Abdulaziz University, 1997). For some mathematical economic models of the dinar in action, see Nuradli Ridzwan Shah bin Mohd Dali Abdul Ghafar bin Ismail, "The Flexible Model, Gold Dinar and Exchange Rate Determinism: An Exploratory Study Part 1," <<http://www.kantakji.com/fiqh/Files/Economics/FMGDinarER.pdf>>; Ahamed Kameel Mydin Meera, "Integrating Al-Rahnu with the Gold Dinar: The Initial Building Blocks toward a Gold-Based Economy," <<http://ahamedkameel.com/Rahnu-Dinar.pdf>>; Mansor H. Ibrahim, "Monetary Dynamics and Gold Dinar: An Empirical Perspective," <[http://islamiccenter.kau.edu.sa/english/Journal/Issues/Pdf/19\\_2/192-Mansor\\_05.pdf](http://islamiccenter.kau.edu.sa/english/Journal/Issues/Pdf/19_2/192-Mansor_05.pdf)>; Ahamed Kameel Mydin Meera and Moussa Larbani, "The Gold Dinar: The Next Component in Islamic Economics, Banking and Finance," <<http://ahamedkameel.com/GoldDinarNxtComponent.pdf>>.

53. Including more holistic notions and models of wealth and hence measures of both public and private profit and loss as well; see the must-read book by Mark Anielski, *The Economics of Happiness: Discovering Genuine Wealth* (New Society Publishers, 2007); also, Wolfgang Sachs, "Equity and New Models of Wealth," Wuppertal Institute Paper, <<http://www.wupperinst.org/globalisation/html/equity.html>>; compare Marco Cagetti and Mariachristina De Nardi, "Wealth Inequality: Data and Models" (Federal Reserve Bank of Chicago, 2005), online at <<http://www.nber.org/~denardim/research/Wealthsurvey.pdf>>.
54. Thomas Prugh, Robert Costanza, et al., *Natural Capital and Human Economic Survival* (Solomons, Md.: International Society for Ecological Economics, 1999); AnnMari Jansson, et al., *Investing in Natural Capital: The Ecological Economics Approach to Sustainability* (Washington, D.C.: Island Press, 1994); Gretchen C. Daily, ed., *Nature's Services: Societal Dependence on Natural Ecosystems* (Washington, D.C.: Island Press, 1997); Paul Hawken, Amory Lovins and L. Hunter Lovins, *Natural Capitalism: Creating the Next Industrial Revolution* (New York: Little, Brown and Company, 1999).
55. Now being applied in Bhutan, where the holistic Gross National Happiness (GNH) replaces the materialistic Gross National Product (GNP). Why don't Muslim nations follow suit, since it is obviously a very good example to follow? See also Arthur C. Brooks, *Gross National Happiness: Why Happiness Matters for America and How Can We Have More of It* (New York: Basic Books, 2008); and Andrew C. Revkin, "A New Measure of Well Being from a Happy Little Kingdom," *New York Times*, October 4 2005, <<http://www.gpiatlantic.org/conference/media/nyt1004.pdf>>. For an Islamic religious and philosophical perspective on happiness, see Syed Muhammad Naquib al-Attas, "The Meaning and Experience of Happiness in Islam," in his *Prolegomena to the Metaphysics of Islam*, Chapter II, 91-110.
56. Ernst Freidrich Schumacher, *Small is Beautiful: Economics as if People Mattered* (New York: Harper, 1989), 63.
57. A capital asset is wealth that is retained to generate more wealth, like a rubber tree that is not immediately cut down for its wood but is instead retained to generate latex over many years resulting in extra wealth many times greater than would have been realised if the tree had been cut down immediately for its wood.
58. An operating expense is expense which yields its benefits immediately for running a business, and so it is the cost incurred for running an enterprise. That is precisely the way modern economics views nature: as resources to be spent/depleted immediately to run an enterprise, hence the cost of the modern economy is the whole of nature itself. Modern accountancy assuages the conscience of modern economy by "externalizing" this cost so it does not appear in the balance sheet, and is hence made invisible despite its glaring visibility. When the term 'resources' is then extended to human beings, we can understand why they must be worked to exhaustion, their labor and energy to be totally spent, that the enterprise be efficient and productive. The modern economy grows by exhausting nature and culture, and modern

accountancy's job is to make that growth very objective, universal, and value free indeed.

59. For a discussion of an alternative Islamic vision of wealth, see Masudul Alam Choudhury, "Dispensation of Wealth in Islam," <<http://www.nd.edu/~ethics/wcConference/presentations/Choudhury/Choudhury%20Wealth%20Creation%20in%20Islam.doc>>.
60. Laura Sevier, Mike Henderson, and Nritijuna Naidu, "Ecovillages: A Model Life?," in *The Ecologist* 9, June 3, 2008, <[http://www.theecologist.org/pages/archive\\_detail.asp?content\\_id=1854](http://www.theecologist.org/pages/archive_detail.asp?content_id=1854)>. For a brief, general analysis of the gift economy, see Gifford Pinchot, "The Gift Economy," in *In Context*, no. 41 (Summer 1995), accessible at <<http://www.context.org/ICLIB/IC41/PinchotG.htm>>. A book length treatment in the context of modern industrial societies is David J. Cheal, *The Gift Economy* (London: Routledge, 1988).
61. See the famous study by the French sociologist Marcel Mauss, *The Gift: Forms and Functions of Exchange in Archaic Societies* (London: Routledge, 1990). For a good insight into the intimate link between the gift and the *economy of abundance* instead of scarcity, see Marshall Sahlins, *Stone Age Economics* (London: Routledge, 2003); see also in this regard his seminal article extracted from that book, "The Original Affluent Society," accessible at <<http://www.primitivism.com/original-affluent.htm>>. For a forceful debunking of the "self-interestedness" conception of human nature in modern economics, see also his *The Western Illusion of Human Nature* (Cambridge: Prickly Paradigm Press, 2008).
62. Refers to both voluntary and obligatory giving.
63. Hence an essentially cooperative, redistributive (*ta'āwunī*) economics by mutual consent (*an tarādīn*) rather than a competitive, accumulative (*takāthurī*) one by imposition and coercion (*karhan*). For instance, paper money or fiat money or notional money is money *only* by virtue of the legalised, political coercion (*karh qānūnī/siyāsī*) of the state, hence the phrase "fiat" and "legal tender." But once the the *artificial* political border is crossed, the money *immediately* becomes worthless unless exchanged into another currency, another form of legal tender, the money of the host state. In contrast, specie or real money like the gold dinar and silver dirham are always money purely in virtue of the mutual consent of the parties directly involved in the exchange, and this mutual consent is in turn by virtue of the mutual recognition (*an ta'ārufīn*) of the intrinsic value/wealth of the physical content of the gold or silver in the dinar or dirham; hence a dinar of 4.25 grams of gold shall always be recognized or accepted as money (i.e., as a means of exchange) regardless of its original provenance or place of minting. Unlike notional or artificial money limited by artificial political borders, real money is natural, universal, *fiṭrī* money unlimited by artificial borders, since it does not at all appeal to external coercive political authority but to the innate, natural *fiṭrī* inclination of man, as clearly borne out in the divine declaration, "*Beautiful for mankind is love of the joys (that come) from women and offspring, and stored up heaps of gold and silver, and horses branded (with their mark), and cattle and land. That is comfort of the life of the world, whereas Allah, with Him is a more*

*excellent abode.*” (Qurʾān, *Āl ʿImrān*: 14); translation based on Muhammad Marmaduke Pickthall, *The Meaning of the Glorious Qurʾān* (Makkah: Muslim World League, 1977), 48. As for the US dollar, its “universality” is totally artificial, purely by virtue of it being imposed on the whole globe as international legal tender by the political economic might of the United States exercised through utterly undemocratic institutions such as the World Bank and the International Monetary Fund. Though called “world” and “international” they simply are not concerned with acting in the global public interest, but very much concerned with acting in the euroamerican private interest, especially the global private interest of the industrialised Euroamerican North. Now we are beginning to see that this Global Financial Emperor has no clothes; nay, it doesn’t even have a body. It is only a financial black hole, sucking the life and wealth of the world into its bottomless vacuum. Hopefully by now we have enough sense to rev up our escape velocity to free ourselves from its deadly attraction of utter destruction.

64. Or equity financing based on *mutual consent* (*an tarādīn*) as opposed to the unilateral, shove-it-down-your-throat, one-size-fits-all kind of debt-financing business model of most “Islamic” banks obsessed with short term, risk-free profit making. A true Islamic bank is concerned with creating wealth (i.e., total well-being) for its clients, especially the poor and the economically marginalized, not self-interested profits for itself by systemically sucking wealth from them or worse, selling debts (i.e., credit cards) to them.
65. Abul Hasan M. Sadeq, “*Waqf*, Perpetual Charity and Poverty Alleviation,” in *International Journal of Social Economics*, 29: 1/2, 2002, 135-151; see also Peter C. Hennigan, *The Birth of a Legal Institution: The Formation of the Waqf in Third-Century A.H. Ḥanafī Legal Discourse* (Leiden: Brill, 2004).
66. Ibn Baṭṭūṭah, *The Travels of Ibn Battutah*, trans. H. A. R. Gibb and C. F. Beckingham, 4 vols. with index (London: Hakluyt, 1958-2000), 1: 129 ff. See also Richard van Leeuwen, *Waqfs and Urban Structures: The Case of Ottoman Damascus* (Leiden: Brill, 1999). He says in the conclusion (at 207) that *waqfs* “were a mechanism through which private interests and enterprise could be co-ordinated with the interests of the urban community....*Waqf* networks formed the pattern underlying urban development.” Cf. Ira Marvin Lapidus, *Muslim Cities in the Later Middle Ages* (Cambridge: Cambridge University Press, 1984).
67. Murat Cizakca, “Ottoman Cash *Waqfs* Revisited: The Case of Bursa 1555-1823” (Manchester: FSTC Limited, 2004), online at <<http://www.muslimheritage.com/uploads/cashwaqfs.pdf>>; originally published in *Journal of the Economic and Social History of the Orient*, 38: 3 (1995); see also idem, *A History of Philanthropic Foundations: The Islamic World from the Seventh Century to the Present* (Istanbul: Bogazici University, 2000). See also R. J. Barnes, *An Introduction to Religious Foundations in the Ottoman Empire* (Brill: Leiden, 1987).
68. Or the “profits-over-people economy”; see Noam Chomsky, *Profits over People: Neoliberalism and Global Order* (New York: Seven Stories Press, 1999). In effect, what we have here is that big privatization projects tacitly compel the

government to act as public guarantor, bearing substantial risks for minimal or no returns, based on the exclusively self-serving principle of “privatizing profits and socializing losses.”

69. *United Nations Development Report*, 1998, cited in *Ist Ethical's Guide to Why Islam has Prohibited Interest, and Islamic Alternatives for Financing* (Bolton, UK: Ist Ethical Limited, 2005). Of course, privatization is only part of the picture; the other, bigger part, is the systemic transfer of wealth from the poor to the rich nations due to the usurious monetary policies of the IMF and World Bank imposed on poor countries in Asia, Africa, and Latin America. For an analysis of the reasons for Third World debt, see Susan George, *A Fate Worse than Debt: The World Financial Crisis and the Poor* (New York: Grove Weidenfeld, 1990); see also idem, *The Debt Boomerang* (London: Pluto Press, 1992); and idem, *How the Other Half Dies* (London, Penguin, 1991).
70. In Islamic history, the power of the Sultans was limited by the Sharī'ah through the institution of the 'ulamā'; in secular democracies like the US, it is limited by the constitution through tripartite division of government into the legislative, the judicial, and the executive.
71. See Jomo Kwame Sundaram, *Privatizing Malaysia: Rents, Rhetoric, Realities* (Boulder, CO: Westview, 1995); see also Jomo Kwame Sundaram and Tan Wooi Syn, “Privatization and Re-Nationalization in Malaysia: A Survey,” 1-44 (<[http://www.jomoks.org/research/pdf/IPD\\_Privatization\\_Renationalization.pdf](http://www.jomoks.org/research/pdf/IPD_Privatization_Renationalization.pdf)>).
72. Ross H. McLeod, “Privatisation Failures in Indonesia” (<<http://rspas.anu.edu.au/economics/publish/papers/wp2002/PrivatisationIndonDWP.pdf>>). Specifically, on the water supply privatization fiasco, see Bill Guerin, “Indonesia Losing Its Thirst for Privatization,” <[http://www.worldproutassemblies.org/archives/2007/09/indonesia\\_losin.html](http://www.worldproutassemblies.org/archives/2007/09/indonesia_losin.html)>. See also “Water Privatization in the Asia Pacific Region,” <[http://www.jubileesouth.org/files/water\\_lo.pdf](http://www.jubileesouth.org/files/water_lo.pdf)>.
73. Implemented under the guiding mantra of “Malaysia Incorporated.”
74. 128.8 billion ringgit for operating expenditure and only 48.1 billions for development expenditure; see “Full text of PM's Budget 2008 speech,” *The Star*, September 7, 2007.
75. If, according to the working definition given by the Center for Civil Society at the London School of Economics, “civil society refers to the arena of uncoerced collective action around shared interests, purposes and values,” involving institutional forms distinct from the state, then the institution of waqf has been and shall continue to be the cornerstone for establishing vibrant communities largely socio-economically autonomous, even aloof, from the centralised political apparatus of the state. In other words, waqf allows the socio-creative space for communities to micro-manage their own affairs, instead of surrendering their communal creative rights to the state, which should instead, by virtue of its central power, focus on establishing the macro-framework for such communal creativity to be possible, encouraged, and facilitated. On the idea of the civil and civic in the Islamic context, see the excellent analysis by Mohammed A. Bamyeh, “Civil Society and the

- Islamic Experience,” in *ISIM Review*, no. 15 (Spring 2005), 40-41.
76. “No such thing as society,” interview with Douglas Keay, *Woman’s Own*, September 23, 1987.
77. In practice, this means that the state must shift from the neoliberal “business-friendly” approach to the civil societal “people-friendly” approach, and give all its support (preferably indirect) toward realising local and communal socio-economic self empowerment.
78. Some preliminary research projects being done in this respect are Dian Masyita, Muhammad Tasrif and Abdi Suryadinata, “A Dynamic Model for Cash Waqf Management as One of the Alternative Instruments for Poverty Alleviation in Indonesia,” <[http://www.islamic-world.net/economics/waqf\\_management.htm](http://www.islamic-world.net/economics/waqf_management.htm)>; M. Shoaib Khanzada, “The *Wakala Waqf* Model,” <<http://www.secp.gov.pk/Events/pdf/IssuesInTakafulByShoaibKhanzada.pdf>>; Magda Ismail Abdel Mohsin, “*Awaqaf*: The Social and Economic Empowerment of the Ummah,” <<http://www.jawhar.gov.my/paper%20seminar%20wakaf%20antarabangsa/Paper5.ppt#1>>; Habib Ahmed, “Waqf-Based Microfinance: Realising the Social Role of Islamic Finance,” <[http://info.worldbank.org/etools/docs/library/240137/Paper\\_Microfinance%20&%20Waqf%28Dr.%20Habib%29.pdf](http://info.worldbank.org/etools/docs/library/240137/Paper_Microfinance%20&%20Waqf%28Dr.%20Habib%29.pdf)>; Duddy Roesmara Donna, Mahmudi, *The Dynamic Optimization of Cash Waqf Management: An Optimal Control Theory Approach*,” <<http://paue.ugm.ac.id/ppt/PPP029Duddy.pdf>>; and Hisham Yaacob, “Islamic Accounting Framework in Relation to *Waqf* Accounting and Accountability,” <<http://www.bizcovering.com/Accounting/Waqf-Accounting-Framework.103722/5>>.
79. Herman E. Daly, *Steady-State Economics*, 2<sup>nd</sup> ed. (Washington, DC: Island Press, 1991); idem, *Beyond Growth: The Economics of Sustainable Development* (Boston: Beacon Press, 1977); idem and K. N. Townsend (eds.), *Valuing the Earth: Economics, Ecology, Ethics* (Cambridge, MA: MIT, 1993); Bill McKibben, *Deep-Economy: The Wealth of Communities and the Durable Future* (Oxford: Oneworld, 2007). See also the First International DeGrowth Conference in Paris, 18-19 2008, <<http://www.degrowth.net/>>.
80. When one really comes to think of it, much of E. F. Schumacher’s description of Buddhist economics can be paraphrased in Islamic terms with no loss of conceptual and spiritual rasonance with the original; see his “Buddhist Economics” in his *Small is Beautiful: Economics as if People Mattered* (New York: Harper Perennial, 1989). The more one reflects on this the more one realises the paradoxical soullessness and hence shallowness and cluelessness of modern Islamic (debt-finance-obsessed) economic discourse and practice.
81. For some case studies of the Islamic Gift Economy, see Benjamin Soares, *Islam and the Prayer Economy: History and Authority in a Malian Town* (University of Michigan Press, 2005). See also idem, “The Prayer Economy in a Malian Town”, <[https://openaccess.leidenuniv.nl/dspace/bitstream/1887/9400/1/ASC\\_1293978\\_001.pdf](https://openaccess.leidenuniv.nl/dspace/bitstream/1887/9400/1/ASC_1293978_001.pdf)>. For the Mamluk gift economy and the role of pious endowments within it, see Adam Sabra, *Poverty and Charity in Medieval Islam: Mamluk Egypt, 1215-1517* (Cambridge: Cambridge University Press,

- 2000); also Michael Bonner, Mine Ener and Amy Singer (eds.), *Poverty and Charity in Middle Eastern Contexts* (New York: SUNY, 2003); Amy Singer, *Constructing Ottoman Beneficence: An Imperial Soup Kitchen in Jerusalem* (NY: SUNY, 2002); Holger Weiss (ed.), *Social Welfare in Muslim Societies in Africa* (Stockholm: Nordiska Afrikainstitutet, 2002).
82. See Jamie Morgan, "The Free Rider Principle: How Privilege is Subsidized," in *Sand in the Wheels*, *ATTAC Newsletter*, no. 161 (2003), 4-7, <<http://www.glovesoff.org/pdfs/attacnews161.pdf>>.
83. It is quite possible that this neoliberal ring of power, like Sauron's ring, will be destroyed in the very bowels of Western academia whence it was cast. See for instance the courageous work being done by Jamie Morgan to achieve this objective with his colleagues at the Anti-Capitalist Research Organization at Lancaster University. An excellent incisive overview of the various socio-political currents opposing global neoliberalism is Derek Wall, *Babylon and Beyond: The Politics of Anti-Capitalist, Anti-Globalist and Radical Green Movements* (London: Pluto Press, 2005).
84. Qur'ān, *al-Nisā'*: 29.
85. <<http://www.glovesoff.org/pdfs/attacnews161.pdf>>, 6.
86. Ivan Illich, *Tools for Conviviality* (New York: Harper & Row, 1973).
87. Cf. Mohamed Haj Yousef, *Ibn 'Arabī: Time and Cosmology* (London: Routledge, 2008).
88. See the important, comprehensive and detailed study by Syed Muhammad Naquib al-Attas, *A Commentary on the Ḥujjat Al-Ṣiddīq of Nūr al-Dīn al-Rānīrī: Being an Exposition of the Salient Points of Distinction between the Positions of the Theologians, the Philosophers, the Ṣūfīs and the Pseudo-Ṣūfīs on the Ontological Relationship between God and the World and Related Questions* (Kuala Lumpur: Ministry of Culture, 1986); idem, *The Mysticism of Ḥamzah Fanṣūrī* (Kuala Lumpur: University of Malaya Press, 1970); cf. M. B. Altaie, "Atomism in Islamic Kalam," in *Etudes Orietales*, no. 23/24 (2005). With regard to the origins of Islamic atomism, Josef Van Ess has this to say, "When we want to understand the phenomenon [of Islamic atomism] we have to first forget our Western associations and to take it as such, in its own environment, as an independent and original system; the question of its "sources" has to be answered later"; see his "Atomism in Early Islamic Thought & its Relation to Pre-Islamic Iranian Thinking," <[http://www.mullasadra.org/new\\_site/english/Paper%20Bank/Comparative%20Studies/Josel%20Van%20Ess.htm](http://www.mullasadra.org/new_site/english/Paper%20Bank/Comparative%20Studies/Josel%20Van%20Ess.htm)>.
89. This metaphysics is succinctly summarized in philosophico-theological terms by the Imām Muḥammad ibn Yūsuf al-Sanūsī al-Ḥasanī in his *Matn al-Sanūsīyyah*, also called *Umm al-Barāhīn*, in which he explicates the meaning of *lā ilāha illā Allāh* as the absolute independence of God from all that is other than Him, and the absolute dependence of all that is other than Him on Him. This essentially means that all of creation and every part thereof are dependent on God for their existence, and no aspect of the world can be independent from Him. In short, He is self-sufficient and not in need of anything, whereas all else is in need of Him. See the translation of *Umm al-Barāhīn* (together with its commentary by his disciple, Shaykh al-Malālī)

in Auwais Rafudeen, *The Aqidah of Tuan Guru*, released by <www.marifah.net>, 1428H, <<http://marifah.net/articles/samsiyyahabdullahalmalali.pdf>>; cf. Shaykh Abu Adam al-Narujji, *Al-'Aqidah al-Sanūsiyyah*: Translation and Commentary, released by <www.marifah.net>, 1428H, <<http://www.marifah.net/articles/sanusicreed-abuadam.pdf>>.

90. I have in mind here the kind of work done by, for instance, Henri Poincaré as described in Jeffrey J. Prentis, “Poincaré’s proof of the quantum discontinuity of nature,” in *American Journal of Physics*, vol. 63 no. 4 (1995), 339-350. To quote from the abstract, “Poincaré’s analysis is based on an ingenious physical model consisting of long-period resonators interacting with short-period resonators. A unique formulation of statistical mechanics, based on the calculus of probabilities, Fourier’s integral, and complex analysis, logically unfolds throughout the memoir. Poincaré invents an ‘inverse statistical mechanics’ that allows him to prove a crucial result that no one had proved before: The hypothesis of quanta is both a sufficient and a *necessary* condition to account for Planck’s law of radiation. In a separate, more universal proof, Poincaré proves that the existence of a discontinuity in the motion of a resonator is necessary to explain *any* observed law of radiation.”
91. Simply because, firstly, most modern physicists are agnostics with regard to the ontological interpretations of their theories, and secondly, the ontological import of the problem of continuity versus discontinuity of nature depends ultimately on how the two are reconciled.
92. *Sharḥ Al-'Aqā'id Al-Nasafīyyah*, trans. Earl Edgar Elder, *A Commentary on the Creed of Islam* (New York: Columbia University Press, 1950), 32 (with slight modifications).
93. This will entail, of course, a reconceptualization of what is meant by ‘the minimal part that cannot be further minimized (or reduced?)’ and its extension to animate systems, and ultimately to mental, conscious systems. For instance, one approach will be to describe “The Linguistic Theory of Fakhr al-Dīn al-Rāzī” (forthcoming) and to see how that follows (or does not follow) from his atomic physical theory; cf. John-Michael Kuczynski, *Conceptual Atomism and the Computational Theory of Mind: A Defense of Content-Internalism and Semantic Externalism* (Amsterdam: John Benjamins, 2007). The extension of physical atomism to biology will entail the concept of biological atomism, which, I think, corresponds to the Behean ‘irreducible complexity’, but obviously this is not the place to elaborate further. For a general scientific reflection on modern cosmology in relation to the worldview of Islam, see Bruno Guiderdoni, “Modern Cosmology in the Islamic Worldview,” <<http://www.geocities.com/CapeCanaveral/Station/9720/cosmology.htm>>.
94. Seyyed Hossein Nasr does not seem to be very clear in his understanding of Bohm’s cosmology and ontology; see his *Religion and the Order of Nature* (Oxford: Oxford University Press, 1996), 49. He confuses between the enfolded and unfolded (which latter refers to the explicate *not* implicate) orders, and thinks that Bohm’s implicate order refers to the material world. A proper reading of Bohm will show that he actually affirms the atomic structure of the material physical world, but that this manifest, unfolded world

of apparently independent, separate, fragmented, and discrete entities and processes are actually embedded or enfolded in a deep-structure called the implicate order and ultimately the super-implicate order, in which the principles of discontinuity and continuity, change and permanence, non-linearity and linearity, and indeterminism and determinism, matter and spirit, mind and body, are reconciled. In other words, there is an underlying continuity and permanence but these refer to a higher and deeper implicate order of reality than the physical, material and sensible explicate order. To put it yet again in another way, the physical world is relatively discrete and discontinuous by virtue of it being explicate or *zāhir*, but there is an underlying unity between the separate physical parts of the world because of its embeddedness in the implicate order. Hence the continuity and unity that are to be sought are not at the level of the material but at the level of the spiritual, but even then the continuity and unity at the level of the spiritual is only relative, for absolute continuity (*baqāʿ*) and unity (*wahdāniyyah*) is God's alone, at the level of the super-implicate order beyond the limits of human cognition and intellection. This cosmo-ontological scheme of Bohm's is in general conceptual affinity with the Islamic ontology of the six degrees of existence outlined by Syed Muhammad Naquib al-Attas in his *The Intuition of Existence, On Quiddity and Essence* and *The Degrees of Existence*, which constitute chapters V, VI, VII respectively of his *Prolegomena to the Metaphysics of Islam: An Exposition of the Fundamental Elements of the Worldview of Islam* (Kuala Lumpur: ISTAC, 2001), 177-320 passim. These three tracts (best read and studied together) have been previously published as separate monographs, also by ISTAC.

95. A careful, balanced defence of Bohm's ontological interpretation of relativity and quantum mechanics against his many detractors is Oliver Passon, "Why isn't every physicist a Bohmian?," in *Quantum Physics* (December 2004), <[http://arxiv.org/PS\\_cache/quant-ph/pdf/0412/0412119v2.pdf](http://arxiv.org/PS_cache/quant-ph/pdf/0412/0412119v2.pdf)>. In his words, "This note collects, classifies and evaluates common criticism against the deBroglie-Bohm theory, including Ockham's razor, asymmetry in the deBroglie-Bohm theory, the "surreal trajectory" problem, the underdetermination of the deBroglie-Bohm theory and the question of relativistic and quantum field theoretical generalizations of the deBroglie-Bohm theory. We argue that none of these objections provide a rigorous disproof, they rather highlight that even in science theories can not solely be evaluated based on their empirical confirmation." See also idem, "What you always wanted to know about Bohmian mechanics but were afraid to ask," in *Physics and Philosophy* 3 (2006), <[http://arxiv.org/PS\\_cache/quant-ph/pdf/0611/0611032v1.pdf](http://arxiv.org/PS_cache/quant-ph/pdf/0611/0611032v1.pdf)>; also at <<http://philsci-archive.pitt.edu/archive/00003026/01/bohml.pdf>>. See also Oliver Passon, "How to teach quantum mechanics," in *European Journal of Physics*, 25 (2004), 765-769. See also Peter R. Holland, *The Quantum Theory of Motion: An Account of the de Broglie-Bohm Causal Interpretation of Quantum Mechanics* (Cambridge: Cambridge University Press, 1995).
96. Somewhat along the lines of, say, Michael Anthony Corey, *God and the New Cosmology: The Anthropic Design Argument* (Lanham, Maryland: Rowman

and Littlefield, 1993), whose insights can be critically (i.e., *not* naively in the sense of a simplistic and lazy “concordism”) integrated into Islamic cosmology, as outlined, for instance by Syed Muhammad Naquib al-Attas in his *Prolegomena* and other works; see Adi Setia, “Al-Attas’s Philosophy of Science: An Extended Outline,” in *Islam & Science* (December 2003), 165-214; and Mohd Zaidi Ismail, “The Cosmos as the Created Book and Its Implications for the Orientation of Science,” in *Islam & Science* (Summer 2008), 31-54 and the references therein. I personally believe that the Muslim (creationist) scientist should team up with the Christian (creationist) scientist for the common goal of putting science back on its religious foundations from whence it had slipped off, simply because the religious view, as noted by Sir John Eccles, “is the only view consistent with all the evidence” (cited in M. A. Corey, 287).

97. It is interesting here to note that in traditional Islamic philosophy, the physical world is seen as the lowest order of reality, hence the term *dunyā* in reference to it, and hence the reason why physics or the philosophy of nature is traditionally called *al-falsafat al-suflā*, or *al-‘ilm al-asfal* (the lowest philosophy/science), whereas mathematics (*al-riyāḍiyyāt*) is called *al-‘ilm al-awsat* or *al-ḥikmat al-wustā* (the middle science/middle wisdom), and theology or metaphysics (*al-ilāhiyyāt*) is called *al-ḥikmat al-‘ulyā* (the highest science). Quite clearly this hierarchical order has been inverted in secular academia.
98. David Bohm and B. J. Hiley, *The Undivided Universe: An Ontological Interpretation of Quantum Theory* (London: Routledge, 2002), 378-380; cf. Syed Muhammad Naquib al-Attas’s exposition of the meaning of *zāhir* and *bāṭin* in his *Prolegomena*, 237 ff. If the whole purpose of science is to point the way from the apparent to the underlying reality, then the Bohmian ontological approach must be taken seriously, otherwise one is stuck with a meaningless, instrumentalist “system of formulas” (the Copenhagen approach) that points to nothing. Needless to say, for Muslim physicists and mathematicians (assuming they care enough about the worldview of Islam), an ultimately agnostic, nihilistic approach is a complete no-go area. For Bohm’s view on the relation between religion and science, see David Bohm, “Fragmentation and Wholeness in Religion and in Science,” in *Zygon*, 20: 2 (2005), 125-133, which is based on a talk he gave in September 1983.
99. This is also the salient problem of *kalām*’s natural theology (in fact *kalām* is to a large extent natural theology), and its notion of the minimal, unitary part (*jawhar al-fard/al-juz’ alladhī lā yatajazza’u*) underpinning its extraordinarily rich and creative response to that problem.
100. Although Behe’s original definition deals more or less exclusively with accounting for biological function, my paraphrase of it extends it to biological structure, which can in turn be extended to all natural processes, structures and functions, biological or otherwise, including *any* physical systems, somewhat along the lines of Robert A. Herrmann’s General Intelligence Design (GID) theory (<<http://www.serve.com/herrmann/main.html>>). My inspiration for this is D’Arcy Wentworth Thompson’s brilliant work, *On Growth and Form*, originally published in 1917, which applies mathematical

insights to description and explanation of biological structures, thus effectively founding biomathematics. I recommend the new Dover edition of the work entitled *On Growth and Form: The Complete Revised Edition* (New York: Dover, 1992). Thompson's biomathematical insights can be extended to all inanimate physical systems. Here is not the place to argue why this book should be more at home in creationary rather than evolutionary thinking, but I don't see Behe referring to it in his books. Regardless, Thompson was dissatisfied with the prevalent evolutionary (overly subjective and qualitative) "survival of the fittest" framework for explaining the diverse forms and structures of organisms and the transformations they undergo (including limits to those transformations), and hence, through his book, he wished to promote *structuralism* with its emphasis on physical laws and mechanics and hence mathematics as an explanatory and descriptive alternative more in accord with the principle of Occam's razor (i.e., the principle of elegance and parsimony in scientific explanations). Dissatisfaction with the-survival-of-the-fittest dogma is no conclusive proof that he is an anti-evolutionary thinker, but I do think that his book is *at least* theoretically neutral with respect to both evolutionism and creationism, and *at best* more in conceptual affinity with the latter. In any case, why should evolutionists like Kauffman have exclusive rights to coopt, rightly or wrongly, Thompson biomathematical insights into fleshing out his beliefs rather than those of the creationists? Among the newest developments in biomathematics (or mathematical biology) are Michael Jacob and Sten Andersson, *The Nature of Mathematics and the Mathematics of Nature* (Amsterdam: Elsevier Science, 1998); and Sten Andersson et al., *Biomathematics: Mathematics of Biostructures and Biodynamics* (Amsterdam: Elsevier Science, 1999). William Dembski is doing interesting ongoing work on the interface between biomathematics and the design inference with the tentative title *Mathematical Foundations of Intelligent Design* (<<http://209.85.175.104/search?q=cache:1qOT6pa2ts0J:www.theapologiaproject.org/Mathematical%2520Foundations%2520of%2520Intelligent%2520Design.pdf+mathematical+foundations+of+intelligent+design&hl=en&ct=clnk&cd=4>>). As fellow creationists, Muslim mathematicians should make it their point to follow his work closely and perhaps contribute significantly to that project as an aspect of what I envision as a fruitful Muslim-Christian Creationary Alliance (MCCA). So far he has modelled 'specificity' (see his "Specification: The Pattern that Signifies Intelligence" at <<http://www.designinference.com/documents/2005.06.Specification.pdf>>, and it would be interesting to see how he would model Behe's 'irreducible complexity', but see the potential in Bernard P. Zeigler, "Multifaceted Modelling Methodology: Grappling with the Irreducible Complexity of Systems," in *Behaviorial Science*, vol. 29, no. 3 (1984), 169-178; and especially Abraham Boyarsky and Pavel Gora, "A dynamic system interpretation of irreducible complexity," in *Discrete Dynamics in Nature and Society*, vol. 7, no. 1 (2002), 23-26. See also the discussion at <<http://www.uncommondescent.com/intelligent-design/irreducible-complexity-in-mathematics-physics-and-biology/>>; and <<http://progettocosmo.altervista.org/index.php?option=content&task=view&id=87>>.

101. See Adi Setia, “*Taskhīr*, Fine-Tuning, Intelligent Design and the Scientific Appreciation of Nature,” in *Islam & Science* (Summer 2004), 7-32.
102. Another way to put it is that *if any part of the cosmos is designed then every part is, including the cosmos itself in its totality*.
103. See <[http://creationwiki.org/General\\_intelligent\\_design](http://creationwiki.org/General_intelligent_design)>. As a matter of fact the GID theory as articulated by Herrmann has a high degree of conceptual affinity with *kalām* and *ṣūfī* cosmo-ontology. See his mathematical and logical approach to GID theory in *Science Declares Our Universe is Intelligently Designed* (Longwood, FL: Xulon Press, 2002).
104. Badī‘uzzamān Sa‘īd Nūrsī, *Nature: Cause or Effect*, trans. Sukran Vahide (Istanbul: Sozler Nesriyat, 1997).
105. For recent research into mathematical interpretations of creationary design theories, see Robert A. Herrmann, *Science Declares Our Universe is Intelligently Designed* (Longwood, FL: Xulon Press, 2002); William A. Dembski, *The Design Inference: Eliminating Chance through Small Probabilities* (New York: Cambridge University Press, 1998); Bernard P. Zeigler, “Multifaceted Modelling Methodology: Grappling with the Irreducible Complexity of Systems,” in *Behaviorial Science*, vol. 29, no. 3 (1984), 169-178; and, especially, Abraham Boyarsky and Pavel Gora, “A dynamic system interpretation of irreducible complexity,” in *Discrete Dynamics in Nature and Society*, vol. 7, no. 1 (2002), 23-26. On the role of mathematical information theory in deciding between evolutionary and creationary theories, see anonymous, “Mathematics and the Origin-of-Life Problem,” <<http://progettocosmo.altervista.org/index.php?option=content&task=view&id=87>>. In this regard I believe that the notion of biological irreducible complexity can be further informed and clarified by drawing from the parallel notion of mathematical irreducible complexity; see Gregory Chaitin, “The Halting Probability Omega: Irreducible Complexity in Pure Mathematics,” in *Milan Journal of Mathematics*, 75: 1 (December 2007).
106. Adi Setia, “The Islamic Gift Economy: Outline of a Comprehensive Islamic Economics Research Program,” forthcoming. To paraphrase Benjamin Soares, we can say that the Islamic Gift Economy (IGE) is an operative economy of gratitude (*shukr*) and generosity (*karam*), in which foundational principles of Islamic spirituality thoroughly infuse all aspects of economic activity. For a philosophico-ethical exploration of the “logic of the gift,” see Alan D. Schrift, *The Logic of the Gift: Toward an Ethic of Generosity* (London: Routledge, 1997).
107. For some preliminary research, see R. Haniffa and M. Hudaib, “A Theoretical Framework for the Development of the Islamic Perspective of Accounting,” in *Accounting, Commerce and Finance: The Islamic Perspective Journal*, 6: 1/2 (2002), 1-71. Shahul Hamid bin Hj. Mohamed Ibrahim, “From Conventional Accounting to Islamic Accounting,” <[http://www.ifisa.co.za/Articles/Islamic%20Accounting/From%20Conventional%20to%20Islamic\\_Accounting\\_ifisa.pdf](http://www.ifisa.co.za/Articles/Islamic%20Accounting/From%20Conventional%20to%20Islamic_Accounting_ifisa.pdf)>; Thea Vinnicombe and David Park, “The Implications of Islamic Jurisprudence for the International Harmonization of Accounting Standards,” <[http://www.cbs.curtin.edu.au/files/FRRaG\\_2007\\_6-1\\_](http://www.cbs.curtin.edu.au/files/FRRaG_2007_6-1_)

Refereed\_Vinnicombe\_\_\_Park\_final.pdf>; Malik Mirza and Nabil Baydoun, "Accounting Policy Choice in an Interest Free Environment," <<http://209.85.175.132/search?q=cache:BKQW1eVjNNIJ:www.bus.qut.edu.au/faculty/schools/accountancy/documents/1999-014Mirza.pdf+ISLAMIC+ACCOUNTING+FRAMEWORK+IN+RELATION&hl=en&ct=clnk&cd=8>>.

108. Referring to risk-free profits obtained by manipulating the legal and economic environment instead of by actual trading and producing real wealth through mutual sharing of capital, risks and profits; such is the way conventional IBF and takāful business operate. A recent comprehensive critique is Mahmoud A. Gamal, *Islamic Finance: Law, Economics and Practice* (Cambridge: Cambridge University Press, 2006).
109. See the study by Bill Mauer, *Mutual Life, Limited: Islamic Banking, Alternative Currencies, Lateral Reason* (Princeton: Princeton University Press).
110. Nuh Ha Mim Keller, *Reliance of the Traveller: A Classic Manual of Islamic Sacred Law* (Beltsville, Maryland: Amana, 1997), 942-943.
111. Bill Mauer, *Mutual Life, Limited: Islamic Banking, Alternative Currencies, Lateral Reason* (Princeton; Princeton University Press), 151. Another complication is the lack of mutuality structures in conventional Islamic banking and insurance; see Mahmoud A. El-Gamal, "A Simple Fiqh-and-Economics Rationale for Mutualization in Islamic Financial Intermediation," <<http://www.nubank.com/islamic/mutualize.pdf>>, which also gives some detail on the mechanisms by which conventional Islamic finance and insurance have been hijacked by the secular capitalist credit and risk industry. A further conceptual and operational critique of conventional *takāful* is, unfortunately, beyond the scope and intent of this paper, but I hope what has been said will spur a thoroughgoing rethink of conventional Islamic *takāful* and banking so that they go beyond the name to the substance toward true (re-)mutualization and true *tabarru'* which allow neither front-door nor back-door selling of risk (*bay' al-gharār*) or selling of credit (*bay' al-dayn*). See also Mahmoud A. El-Gamal, "An Economic Explication of the Prohibition of *Gharar* in Classical Islamic Jurisprudence," 8 (2) *Islamic Economic Studies* (April 2001), 29-58; idem, El-Gamal, M. "An Economic Explication of the Prohibition of *Riba* in Classical Islamic Jurisprudence," *Proceedings of the Third Harvard University Forum on Islamic Finance* (Cambridge: Center for Middle Eastern Studies, Harvard University, 2000), 31-44; idem, M. El-Gamal, "Interest and the Paradox of Contemporary Islamic Law and Finance," *Fordham International Law Review* (December 2003), 108-149.
112. Charles Lambert Trowbridge, *Fundamental Concepts of Actuarial Science* (Schaumburg, IL: AERF, 1989), 7. Of course, a thorough review of actuarial science will entail also a concomitant thorough *de-coopting* of mainstream Islamic economics, banking, finance, and insurance (*takāful*) from what Masudul Alam Choudhury calls "neoliberal and neoclassical doctrine," in his "Islamic Economics and Finance: Where Do They Stand," in *International Accounting and Finance*, 1: 2 (2008), 149-167.
113. Adi Setia, "The Inner Dimensions of Going Green: Articulating an Islamic

- Deep-Ecology,” *Islam & Science* (Winter 2007), 117-150, and the references therein.
114. See the journal *Green Chemistry*, <<http://www.rsc.org/Publishing/Journals/gc/index.asp>>.
  115. See the power point presentation on green engineering by David Shonnard and Hui Chen, “Green Engineering, Process Safety and Inherent Safety: A New Paradigm,” <<http://www.mpri.lsu.edu/workshop/David%20Shonnard%20Green%20Engineering.ppt#2>>.
  116. See the website of The Center for Green Manufacturing, <<http://bama.ua.edu/~cgm/>>.
  117. Wendy Pyper, “Emulating nature: The rise of industrial ecology,” in *Ecos*, no. 129 (2006), 22-26; cf. Janine M. Benyus, *Biomimicry: Innovation Inspired by Nature* (New York: Harper Perennial, 2002).
  118. Such as permaculture; see Bill Mollison, *Permaculture: A Designer’s Manual* (Tyalgum, NSW: Tagari, 1992).
  119. See the website of the *Green Money Journal*, <<http://www.greenmoneyjournal.com/>>.
  120. After spending some time browsing through the wonderful <[www.muslimheritage.com](http://www.muslimheritage.com)> website, one might say that it was the Islamic Civilization that initiated and maintained the green energy revolution on a global scale, because much, if not all, of the energy requirements powering its agriculture, communications, industries and manufacturing were drawn from renewable animal, water, and wind power. If “small is beautiful” describes Buddhist economics, then “green is graceful” describes Islamic industry. See also the website of *The International Journal of Green Energy*, <<http://www.tandf.co.uk/journals/titles/15435075.asp>>.
  121. See Mark Hayes and Geoff Moore, “The Economics of Fair Trade: A Guide in Plain English,” (2005) <<http://www.udbs.dur.ac.uk/fairtraderesearch/The%20Economics%20of%20Fair%20Trade%20plain%20guide.pdf>>; cf. Alex Nicholls and Charlotte Opal, *Fair Trade: Market-Driven Ethical Consumption* (London: Sage, 2005).
  122. See for instance, Lynn Huggins-Cooper, *Downshift to the Good Life: Scale It Down and Live It Up* (Oxford, UK: Infinite Ideas Limited, 2007); Polly Ghazi and Judy Jones, *Downshifting: The Best Selling Guide to Happier, Simpler Living* (London: Hodder & Stoughton, 2004).
  123. Stephen Leahy, “Environment: Report Finds Rising Tide of Green Financing,” *IPS*, November 24, 2008.
  124. Especially so in the case of multibillion-dollar megaprojects having large-scale and long-term, cross-generational social and ecological impacts; see Bent Flyvbjerg, Nils Bruzelius, and Werner Rothengatter, *Megaprojects and Risk: An Anatomy of Ambition* (Cambridge: Cambridge University Press, 2003). This searching book is based on empirical case studies of megaprojects in Western Europe. It would be good if investigative Muslim economists undertook similar empirical case studies of megaprojects undertaken in Muslim countries. In the case of Malaysia, I have to say that the Bakun

mega-dam project deep in the rainforests of Sarawak cannot, by any stretch of the economic imagination, be seen to have been undertaken in the best public interest of the country; see Anil Netto, "Dirty dams draw dirty smelters," in *Asia Times Online*, January 25, 2006, <[http://www.atimes.com/atimes/Southeast\\_Asia/HA25Ac01.html](http://www.atimes.com/atimes/Southeast_Asia/HA25Ac01.html)>.

125. Shahul Hameed Mohamed Ibrahim, "Nurtured by 'Kufr': The Western Philosophical Assumptions Underlying Conventional (Anglo-American) Accounting," in *International Journal of Islamic Financial Services*, 2: 2 (2000), 32, also accessible at <<http://www.iiibf.org/journals/journal6/art2.pdf>>, 14 (emphasis mine). See also A. R. A. Rahman, "Accounting and Public Interest: An Islamic Reflection," paper presented at the National Accounting Seminar, Mara Institute of Technology, Malaysia, 1995; M. R. Taheri, "The basic principles of Islamic economy and their effects on accounting-standards-setting," <[http://www.accountancy.com.pk/pr\\_pg\\_article.asp?id=100](http://www.accountancy.com.pk/pr_pg_article.asp?id=100)>; and Meryn Lewis, "Islam and Accounting," *Accounting Forum* 25: 2 (2001), 103-127.
126. Some works along these lines include T. Hayashi, *On Islamic Accounting: Its Future Impact on Western Accountings* (Niigata, Japan: The Institute of Middle Eastern Studies, International University of Japan, 1989); M. K. Lewis, "Islam and Accounting," in *Accounting Forum*, 25: 2 (2001), 103-127; M. K. Lewis, "Islamic Corporate Governance," *Review of Islamic Economics*, 9: 1 (2005), 5-29; Rania Kamla, Sonja Gallhofer, and Jim Haslam, "Islam, Nature and Accounting: Islamic Principles and the Notion of Accounting for the Environment," in *Accounting Forum*, vol. 30 (September 2006) no. 3, 245-265, <http://d.scribd.com/docs/2gxxk064xooweduna7qea.pdf>.
127. Here I specifically refer to historians of Malay-Islamic literature who focus their research on literary works to the near exclusion of philosophical, scientific and mathematical ones.
128. Malay acronym for the Institute for Mathematical Research based in Putra University Malaysia (formerly Agricultural University of Malaysia), Serdang, Selangor, Malaysia. Scholars associated with ASASI, like Drs. Alinor, Mat Rofa and Abdul Latif Samian, have previously written brief research articles on this important work, but what is envisioned through this new research project is a complete translation into modern Malay and a critical commentary, after which a detailed study in English will be undertaken.
129. (Kuala Lumpur: Khazānah al-Faṭāniyyah, 2006).