Design Automation for Delay Insensitive Circuits

Feedback overview

Your application has not been successful in this competition.
Scores and written feedback from each assessor can be found below.

Project title

Design Automation for Delay Insensitive Circuits

Application number

48709

Lead organisation

PLUMSTEAD PUBLISHING HOUSE LTD

Partners

Project timescales

Project start date:
1 June 2020

Duration:
18 months

Total project cost

£50,015

Application details

Assessors do not provide scores on these sections of the application.

Application team (/application/48709/question/12701/feedback)

No feedback provided

Research category (/application/48709/question/12703/feedback)

No feedback provided

Project summary (/application/48709/question/12704/feedback)

No feedback provided

Public description (/application/48709/question/12705/feedback)

No feedback provided

Scope (/application/48709/question/12706/feedback)

In scope? 5/5

Application questions

Each question has been assessed by several independent assessors. They have given a score and feedback for each.

1. Need or challenge (/application/48709/question/12707/feedback)

Average score 4.8 / 10

2. Approach and innovation (/application/48709/question/12708/feedback)

Average score 4.0 / 10

3. Team and resources (/application/48709/question/12709/feedback)

Average score 4.4 / 10

4. Market awareness (/application/48709/question/12710/feedback)

Average score 2.0 / 10

5. Outcomes and route to market (/application/48709/question/12711/feedback)

Average score 4.2 / 10

6. Wider impacts (/application/48709/question/12712/feedback)

Average score 4.6 / 10

7. Project management (/application/48709/question/12713/feedback)

Average score 2.2 / 10

8. Risks (/application/48709/question/12714/feedback)

Average score 3.2 / 10

9. Added value (/application/48709/question/12715/feedback)

Average score 2.6 / 10

10. Costs and value for money (/application/48709/question/12716/feedback)

Average score 3.2 / 10

Average overall: **35.2%**

Finance

Close all

Finances summary

	Total costs	Funding level (%)	Funding sought (£)	Other public sector funding (£)	Contribution to project (£)
PLUMSTEAD PUBLISHING HOUSE LTD Organisation	**£71,450**	70.00%	50,015	0	21,435

Funding breakdown

	Total	Labour (£)	Overhead costs (£)	Materials (£)

	Total	Labour (£)	Overhead costs (£)	Materials (£)
PLUMSTEAD PUBLISHING HOUSE LTD Organisation View finances (/application/48709/form/FINANCE)	**£71,450**	48,000	0	0

Terms and conditions

View award terms and conditions (/application/48709/form/question/12732)

Assessor feedback

Assessor 1
There is no clear business motivation to this project; market need is not apparent. Applicant himself either says or strongly implies that economic considerations are of secondary importance. Most of the sections are weak and do not provide confidence in delivery.

Assessor 2
This is an interesting proposal that offers some prospects for eventual social benefits. However, the proposal has some significant weaknesses, most notably in the absence of a convincing commercial justification for the work, or a clear indication of how the participant will establish a market position and generate sufficient income from this project. The work plan lacks detail of the tasks to be undertaken or any quantified targets for the work. The risk analysis is very limited and does not provide evidence of any technical risk.

Assessor 3
The project is suitable for funding consideration. However the ROI aspect is unclear and the business model vague. The proposal lacks the appendices which allow the proposer to demonstrate the well considered technology/management/planning expected.

Assessor 4
The outcome of this proposal, as described, is contingent upon changes being made to FPGA design. The means by which these changes are made are not discussed. This is a major shortcoming, and hence the low scores. The planning of the deliverables, which themselves are ill defined, is absent. The eventual market seems not to be understood.

The proposal could be improved by the proper scoping of the deliverables, and the inclusion of a strategic, perhaps academic, partner who can demonstrate the associated changes in hardware.

Less combative language would create a better impression of the ideas being put forward.

Assessor 5
The concept behind this project in raising the awareness of technical alternative in design of automation delay insensitive circuits has merit and the cultural argument is followed, however InnovateUk funding is not for this purpose. The proposal needs a business case and how ROI might be achieved, even if the education is the first step.

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Application questions for 48709

Scope

How does your project align with the scope of this competition?

Your answer:

Many innovative projects about integrated circuits and semiconductor devices have been funded in previous Innovate UK competitions, especially for improving energy efficiency, but the key enabling technology of electronic design automation (EDA) software is distinctly under-represented with scarcely more than a few instances to be found. Yet, the economic benefit of any hard won advances in circuit materials and manufacturing remains partly untapped without commensurate advances in engineering capability and productivity. As a neglected topic with a growing legacy of unchallenged assumptions, design automation is poised for disruption in line with the competition brief, and it diversifies the grant portfolio at relatively low cost.

There are at least four good reasons to call the proposed project a "game changer" in the EDA business.

* Engineers and most academics have been complaining for years that nobody can figure out how to design asynchronous circuits or that doing so is too hard. This project will make that position untenable to an informed and honest observer.

* As a result of this project, lower power dissipation than what is possible for conventional synchronous circuits will be available for the taking to anyone bold enough to retool.

* An ample lead time to develop this software is all but guaranteed as long as the big electronics companies are free to choose between dedication to their

established customer base and a wild foray into uncertain emerging markets hinging on unconventional ideas.

* The rigorous theoretical foundations for delay insensitive circuit design raise the bar in one stroke for specification, verification, optimization, scalability, and performance analysis, eliminating many of the opportunities for bugs, glitches and bottlenecks that plague conventional synchronous circuits.

Your assessors' feedback

Assessor 1
The applicant argues that the field is wide open to the development of asynchronous circuit design and circuits being a game changer. Evidence presented is not convincing, but the project may have merits; thus deemed in scope.

Assessor 2
The proposal is in the scope of the call addressing the development of electronic design automation (EDA) software for the educational and hobbyist hardware developer markets. The proposed work will produce free software tools. The applicant is a UK based SME.

Assessor 3
Strong statements are made to imply that the project is within the scope of the call.

Assessor 4
The work seems to be an attempt at exploiting the ideas published in the reference work by creating marketable software products. It is not testing those ideas, and so is not a feasibility study.

Assessor 5
Yes in scope as this is a highly technically innovative concept for the design of automation delay insensitive circuits and an understanding of the inertia to be overcome.

Previous
Public description

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Application questions for 48709

Need or challenge

1. What is the business need, technological challenge or market opportunity behind your innovation?

Your answer:

The digital circuitry in every phone, tablet, computer, medical instrument, or vehicle dashboard affects all of our lives, but its design and development tend to be dominated increasingly by an oligopoly of large American and Asian companies. The core motivation for this project is to open the market to genuine competition from less established but potentially more innovative participants by easing the technological barriers to entry.

The major vendors of electronic design automation tools (Cadence, Mentor Graphics, Synopsys) and FPGA development suites (Intel/Altera, Lattice Semiconductor, Xylinx) evidently deem it safe to ignore the educational and hobbyist hardware developer markets. The high licensing costs and steep learning curves of proprietary offerings are likely to leave this space wide open to any moderately innovative company for the foreseeable future.

Cost savings are possible through free software design tools (KiCad, gEDA, Yosys, nextpnr, Verilator, Icarus, SymbiFlow) and open source FPGA development kits (iCEBreaker, ULX3S). Various third party prototyping boards (Papilio, TinyFPGA, *etc*.) package low end proprietary FPGA chips from the major vendors whose specifications have been reverse engineered no thanks to the vendors. However, these solutions tend to lag the top of the range. Reverse engineering efforts (*e.g.*, Project X-Ray) are subject to obsolescence whenever the FPGA vendors decide to change their proprietary specifications or discontinue them. Moreover, by imposing similar methodologies to those of traditional proprietary offerings, open source language based or graphical

development tools as conceived until now impose similar cognitive burdens on the designer.

This project focuses on exploring an alternative paradigm of electronic design automation based on the theory expounded in the recently published textbook *Delay Insensitive Circuits : Structures, Semantics, and Strategies*, whose author is the principal investigator. As a mature research area with an active community spanning academia and industry, it may take only a small additional impetus under the right circumstances to achieve mainstream status.

The cultural challenge to this opportunity stems from a dogma decreed almost from day one in engineering education and seldom reappraised thereafter: all practical circuits need a timing signal wired from a central source to each and every component to ensure they march step-by-step in unison, or else chaos would reign. For students and professionals alike, training and tool support relentlessly reinforce this notion as a universal organizing principle. Whatever the cost in materials, performance, power dissipation, or design effort, the alternative is almost never considered.

Average score: 4.8/ 10

Your assessors' feedback

Assessor 1
The applicant needs to better describe the business opportunity and show how it may be realisable, with significant potential, for large and / or global markets. The user needs of various electronic equipment manufacturers and designers does not appear to be well represented in the narrative. The business motivation needs more clarity to show a compelling reason for progressing under grant.

Assessor 2
The identified business opportunity is described as the need for EDA software in the educational and hobbyist sectors. However, the applicant dos not convincingly demonstrate that significant demand exists for this. Current state of the art is not adequately discussed, either for commercial design software or freeware applications. The work builds on the applicant's recent textbook on circuit design.

Assessor 3
There is no clear business motivation stated. The state-of-the-art is well understood and there is a clear previous work aspect to build upon in the

project. The opportunity in terms of addressing a market is not well presented.

Assessor 4
An answer to this question requires some statements of need or opportunity, expressed in commercial terms. The answer given here does not do that - it seems to be justified in terms of righting wrongs perpetrated by industry and academia. It would be useful if some analysis was offered to support the assertion that the market would be opened, and what the benefit of doing that would be.

Assessor 5
This is a highly technically interesting project and could be disruptive, however the advantages of this for business and citizens needs to be better articulated so a demand can be seen and not just the technical ability to make changes.

Next
Approach and innovation

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Application questions for 48709

Approach and innovation

2. What approach will you take and where will the focus of the innovation be?

Your answer:

The priority in responding to this need is to dispel the perception of unclocked circuits being impractical, inscrutable, or unimaginable, by a simple demonstration to the contrary. Unlike the decades-long accumulated legacy of proprietary tooling and its derivatives, a workflow built on a straightforward delay insensitive circuit description language can be taught to novice designers no more arduously than an introductory programming lesson.

When artificially imposed timing conditions are jettisoned, they take a multitude of common stumbling blocks with them. Circuits become more modular and their modules more interchangeable without tedious retrofitting. Questions of correctness and compatibility become unambiguous and possible to settle computationally. The designer is freed to understand the circuit in terms of causal relationships rather than the rise and fall of every individual timing signal. These features improve on the state of the art by boosting the productivity of circuit designers of any ability and enabling more ambitious projects.

This approach is disruptive insofar as industry standard FPGA technology would need certain minor enhancements before it could support the components used in delay insensitive circuits. This issue in principle does not affect custom silicon regarded as a blank slate, but most likely precludes the use of any existing standard cell libraries or IP blocks.

The principal investigator is free to undertake this project unencumbered by any prior legal, contractual, or financial obligations, and acts with full executive

authority and voting control of Plumstead Publishing House, Ltd..

The company's current product line consists of the textbook *Delay Insensitive Circuts : Structures, Semantics, and Strategies* in hardbound and ebook formats. The book will serve as a companion reference and theoretical primer for the software resulting from this project.

An immediate competitive advantage will be the expansion of the publishing catalog to a broad audience of educational and hobbyist customers, with a view in the long term to industrial customers. Because circuit verification becomes computationally intensive for large systems, a possible future revenue stream may come from cloud based verification as a service using distributed parallel algorithms.

A minimum viable tool suite using a delay insensitive circuit description language is the intended output from this project, if not to an industrial standard then at least to that of a teaching aid and proof of concept. By automating much of the workflow, this result will effect a clear and accessible demonstration of the feasibility of delay insensitive circuit design.

Average score: 4.0/ 10

Your assessors' feedback

Assessor 1
The applicant describes how asynchronous design will be a positive output / new paradigm, how the IP is owned by him and that he has FtO. It is difficult to see how the applicant plans to get the industry on board, with this being a development for the hobbyist. The project output needs to be clearer - whether it is of industry standard, or for teaching only. To whom this tool will be targeted eventually needs to be better described, and how that would happen. Challenges of achieving this are not mentioned.

Assessor 2
The planned innovation is described in terms of new approaches to asynchronous circuit development using a novel circuit synthesis algorithm. However, insufficient information is provided on what these are or how they might result in improved circuits. The potential benefits anticipated over existing state of the art are therefore not evident. Freedom to operate is claimed, but potential competitor blocking IP for new design approaches is not adequately considered.

Assessor 3

The opportunity to append a supporting document was not taken. The prose promotes the merit of asynchronous logic over synchronous but doesn't describe the dominant software development aspect of the proposed project. Neither the innovations resulting from the project activity or the risks associated with it are explained. Little innovation is evident.

Assessor 4
This approach seems sound on the surface. However the 'certain minor enhancements' that industry would need to make would need to be motivated, especially if the use of standard libraries is precluded. The approach, therefore would need to include implementing the enhancements in some way, certainly with a partner.

Assessor 5
The technical approach is no doubt sound and has credibility. However the adjustments need more explanation and business side to this technical innovation needs more explanation. Otherwise it is just supporting a technically interesting and possible project for toolset to play with. If the toolset if a teaching aid and/or POC then this needs to be have explanation for how either or both of these ideas have merit or financial gain.

Previous
Need or challenge

Next
Team and resources

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Application questions for 48709

Team and resources

3. Who is in the project team and what are their roles?

Your answer:

The principal investigator Dennis Furey will be responsible for all aspects of the project, including software output, system administration, web development, and accounting.

* 1985 B.S. Computer Engineering, Rochester Institute of Technology

* 1990 M.Sc. Computer Science. New York University

* 1994 Ph.D. Computing, Imperial College

* 1996-1998 postdoctoral researcher in asynchronous circuits, Queensland University of Technology

* 1998-2000 senior research fellow in concurrent systems, London South Bank University

* 2003-2004 quantitative software developer, Vantage Derivatives

* 2006 visiting faculty member, California Institute of Technology

* 2010-2011 web developer, Proper Computing

* 2011-2012 technical writer on FPGA products, Maxeler Technologies

* 2013-present independent author and publisher, Plumstead Publishing House, *Delay Insensitive Circuits : Structures, Semantics, and Strategies*

Equipment, resources, and facilities consist of a single high end GNU/Linux workstation on site and Amazon Web Services accessed remotely via broadband connection for backups, web hosting, and distributed computing.

There are no external parties or subcontractors.

There are no other project partners.

There are no roles in need of recruitment. However, participation from the free software community will be welcome though not essential, and will be enabled by the Github platform. Cultivating relationships in a geographically distributed and neuro-diverse talent pool is an important step toward effective recruitment to build the company in the future after this project.

Average score: 4.4/ 10

Your assessors' feedback

Assessor 1
This single-person project has a long career in academia, with limited industry experience; the latter being needed for exploitation and commercialisation, and partnership building to effect the same. Unclear if the applicant possesses the project management skills to bring the project to a successful conclusion, for example within time and budget, and management of risks.

Assessor 2
Only limited background information is provided for the proposing company, and, whilst it appears to bring some of the necessary software development skills, there is no information on experience with commercial software development or marketing. No sub-contracting is envisaged. End user involvement is limited to possible participation in Github, though even this is not deemed essential, and there is no description of interaction with the educational sector. This lack of end user involvement is a concern.

Assessor 3
The opportunity to append a supporting document was not taken. As this proposal is from a single applicant there are no doubts regarding working well together. Required resources are readily available and need little advance planning, which is positive.

Assessor 4
The approach as described is vague. Thus the work to be done is ill described. It is therefore difficult to map the experience offered to the tasks proposed.

Assessor 5
There seems to be only one member of staff and this in itself is of concern. The risk of staff loss has no mitigation. The concept behind this project and articulation of the technical understanding is good but this is a complex project and commercialization and the team needs to cover all these aspects with credibility and appropriate skillsets.

Previous
Approach and innovation

Next
Market awareness

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Application questions for 48709

Market awareness

4. What does the market you are targeting look like?

Your answer:

This project pertains in the long term to the global semiconductor market, for which quantitative data are well known, and in the short term to an emerging market of UK educators and hobbyists that is more difficult to quantify.

* According to IBISWorld report C26.110 from March 2019, the UK semiconductor sector is in decline due to foreign competition despite strong global demand, in contrast to its growing American and Chinese counterparts. Revenues of £1.949 billion in 2019 are down from £2.019 billion in 2018, and are expected to fall further to £1.900 billion in 2020. UK exports in the sector show an average annual decline of 3.8% over five years with imports increasing at a similar rate, especially from Germany and America. The American semiconductor manufacturing sector is worth $55 billion and the Chinese $148 billion.

* There are 20,000 schools in the UK sharing an £80 million government grant earmarked for computing education over the coming four years from the NCCE professional development program. 70,000 students took the GCSE in Computer Science in 2018, up from 4,000 in 2013.

Semiconductor manufacturers' business models are based either on operating their own fabrication facilities or being "fabless". The latter entails outsourcing the manufacture of their proprietary circuit designs, especially to Asia, for lower wages and for the avoidance of an initial capital outlay on the order of $3 billion to build a fab. Newport Wafer Fab Ltd. and Seagate Technology PLC both continue to operate UK facilities at present. Incumbents work hard to maintain a barrier to entry through patent "protection" and a culture of secrecy.

Average score: 2.0/ 10

Your assessors' feedback

Assessor 1
The applicant describes the semiconductor market and its behaviours at a high level. There is no clear indication how much of that market would be addressed by this development, which segments are directly relevant and over what time frame that could occur, years or decades, for example. How take-up may/would happen by the semiconductor industry is not described; how the school curriculum would be accessed to take up the proposed tool is not explained.

Assessor 2
The overall markets and likely evolution for global semiconductor market is presented. However, the consequent market for the proposed circuit design software is not considered. In particular, the value of the targeted educational and hobbyist sectors are not addressed. The applicants therefore have not adequately demonstrated relevant market awareness, with no data on market size or potential evolution.

Assessor 3
There is no tangible link between the proposed software EDA product and the cited market statistics. Routes to market are not identified. It is not clear how and in what order potential customers and markets will be addressed.

Assessor 4
If indeed this innovation is aimed at the education and hobbyist markets, despite the difficulties, the markets need to be described in more quantitative terms. Moreover the likely costs of the products being developed need to be factored in to any market analysis. The fact that the existing players protect their investment is not unusual - this is likely to continue, and working with them in introducing innovation to the market is often beneficial.

Assessor 5
These comments are interesting but there is no comprehensive market detailed for this toolset and business plan. The linking of the comments to

this project is not clear. The computer education is good but how does this relate to this project for example.

Previous
Team and resources

Next
Outcomes and route to market

Need help with this service? Contact us (/info/contact)

Application questions for 48709

Outcomes and route to market

5. How are you going to grow your business and increase your productivity into the long term as a result of the project?

Your answer:

The company's current position is that of a book publisher. This project will establish a position as software publisher.

The target customers are educators and hobbyists. They will use the software for teaching or experimentation.

The route to the market is by collaborating with teachers on school activities or lessons, participating in technology meetups or user groups, and maintaining an active web presence.

By creating awareness and interest in an alternative approach to digital circuit design, this project will create demand for the hardware needed to put it into practice. Private investment and recruitment subsequent to the completion of this project will enable the company to profit from hardware sales.

In the short term, there will be no effect on the company's productivity because it is not yet in the hardware business. In the long term, the project will enable the recruitment of developers and engineers having some prior familiarity with the subject area, thereby enabling a team effort to expand the product line with shorter times to market.

At this stage, raising awareness of these innovations is a bigger problem than "protecting" them, hence the initial strategy of free software distribution. By the time the market grows enough for established players to take notice, the

company's business model will have diversified in two ways. One is to offer cloud based circuit verification or optimization as a service using advanced concurrent distributed algorithms that need not be published, and the other is to develop and license IP blocks for customers to integrate into their products, for example to support industry standard protocols or signal processing operations. The company's know-how will make these services difficult for a latecomer to copy.

Targeting the commercial market after the project is finished will be done by attending and presenting at academic conferences and industry trade shows.

Average score: 4.2/ 10

Your assessors' feedback

Assessor 1
How the target customers will be reached is not mentioned; the collaboration with teachers as proposed requires further detail to explain how this would be achieved, which may be limited due to there being only one staff within the company. Achieving collaboration with partners on h/w is unclear. The route to market needs more detail to be convincing. Benefits to the initial customers (hobbyists) and large market players, eventually, are not described.

Assessor 2
The applicant's current market position is pre-revenue. An outline route forward is presented for taking this product to market by collaborating with teachers, though this lacks sufficient details of specific actions or indicative timescales. The applicant does not adequately discuss how this design software could generate income, particularly with the stated intention to adopt a free software distribution model. There is no data provided on projected revenue streams or potential RoI to confirm the commercial viability of the proposed project. Marketing & publicity activities are not sufficiently elaborated.

Assessor 3
The value proposition offered to the cited target is unclear. Methods for growth are vague and un-evidenced.

Assessor 4

If the various problems of implementation in silicon are overcome, this is not an unreasonable model for development. The possibility for competition is understated.

Assessor 5
It seems that the whole project is predicated on raising awareness of the technical possibilities in students for the future, rather than a project to provide a toolset to upset the technical market today. This is laudable but not really the reason for InnovateUK funding.

Previous
Market awareness

Next
Wider impacts

Need help with this service? Contact us (/info/contact)

Application questions for 48709

Wider impacts

6. What impact might this project have outside the project team?

Your answer:

Current electronics industry leaders are neither short sighted nor technically inept, but have achieved success through careful attention to the demands of their most profitable customers. Custom hardware development amenable to non-specialists using free open source software tools, whose performance at least initially need not be cutting-edge or nanometer-scale, will eventually unseat the major players not by surpassing these core competences, but by gradually accumulating mindshare in an emerging market whose demands are different. The less adaptable established firms might attempt to postpone the inevitable by doubling down on their proprietary offerings, with technological progress bypassing them in the end as it always does. The UK economy would stand to gain by this outcome because the industry leaders are elsewhere. A few other predictions naturally follow.

* Custom or semi-custom hardware development in-house will become viable for a segment of UK businesses whose current options are either to outsource the job to specialist foreign entities or to settle for less competitive off-the-shelf solutions.

* A project to make digital circuit design more effective and accessible at the professional level has implications for secondary and even primary education in keeping with the government's NCCE initiative. Rating only a single bullet point in one stage of the official curriculum at present, this topic in future may warrant broader coverage.

* It is easy to envision a future class of university students balking at the prospect of tedious, abstruse, and purposely incompatible tool chains and formalisms for their engineering course work when their prior educational exposure to digital circuit design has been nothing but straightforward and enlightened. By voting with their feet, they would put pressure on curriculum reform in higher education as well.

* Some of those students subsequently will attain positions of influence in industry with recruitment needs of their own, potentially arresting or reversing the brain drain of engineers from the UK insofar as it becomes known as a hospitable place for techniques that are more up to date.

With regard to environmental impact, this project has none in itself, but it may effect some small influence toward reducing the carbon footprint of the world's data centers. According to a recent International Energy Agency report, data center usage now stands at 198 TWh or 1% of global energy demand. This project promotes self-timed circuit design techniques, for which low power dissipation is an undisputed advantage.

Average score: 4.6/ 10

Your assessors' feedback

Assessor 1
The applicant needs to show credible links from his project to the wider benefits claimed. It may be helpful (to him) if the applicant considered realistic time scales to attempt to achieve what he believes to be possible.

Assessor 2
A limited account of the economic, and societal benefits offered by this work is provided, though lacking sufficient quantified projections. Environmental benefits are not identified beyond those derived from lower power consumption circuits. No alignment with specific Governmental policies is identified. No regional socio-economic benefits are identified.

Assessor 3
Negative impacts are ignored and not mitigated. There is limited consideration of environmental impact, however, the stated link is tenuous. The positive impact of the project when considered alongside current design management practice is low.

Assessor 4
The impact of a true disruptor is undoubtedly very significant. Here the principle of dramatically increasing and diversifying the brainpower engaged in innovative product development is described well. These benefits will accrue of the project is successful; because of the evident implementation problems, this is unlikely.

Assessor 5
The added benefits are the students and their future input to design of the circuit boards. Laudable but other benefits should be explained - the business or cost benefits for example of changing the designs in the first place and then to the future circuit board uses need to be detailed.

Previous
Outcomes and route to market

Next
Project management

Need help with this service? Contact us (/info/contact)

Application questions for 48709

Project management

7. How will you manage the project effectively?

Your answer:

Project management is especially simple due to there being only a single partner, who is accustomed to working independently on long term projects.

Anticipated development tools include C and Zig programming languages for performance critical code, LaTeX document preparation utilities, Git source control with frequent updates distributed via the Github web site, and whatever free open source software libraries that may prove convenient on a GNU/Linux development platform.

Remote backups will be stored using Amazon Web Services, which will also be the platform of choice for any required distributed computing facilities and for hosting the project home page.

Web development tools for the home page may include Bootstrap Studio or Pinegrow for the front end, and the Go programming language and libraries for any needed server side features.

A layered software architecture is envisioned with the main components listed roughly in order of precedence below, and documentation of all phases to take place concurrently with development.

* core data structures in support of delay insensitive processes, hierarchical networks and related algebraic transformations and optimization

* strongly performance critical algorithms for model checking, design space exploration, and state enumeration, with possible consideration of cloud based

distributed solutions

* moderately performance critical algorithms for circuit synthesis covering state based, direct mapped, and special purpose modules

* an intermediate interpretive language encapsulating the core abstractions for flexible treatment of less performance critical operations

* a user-facing front end circuit description language, with syntax directed translation targeting the intermediate form

* a user-facing drag-and-drop GUI schematic editor front end for pedagogical purposes

Average score: 2.2/ 10

Your assessors' feedback

Assessor 1
Whilst it may be believed that the project management of the project is simplified through there being only one partner and only one individual, the project plan lacks detail to understand what is actually being done. No work packages are clearly presented; there are no deliverables / milestones defined; none of the bullet-point tasks, assuming that these are individual, self-contained tasks, are costed. What particular circuit models, with specific functionality, that are to be developed is missing. There is no interaction mentioned with target customers/stakeholders.

Assessor 2
The proposed work plan is not adequately described, with insufficient information provided on the specific tasks to be performed or their objectives. There is no identification of work packages or their associated resource level, no information on project timings or task interdependencies (e.g. a Gantt chart), and no defined technical or administrative targets or milestones/deliverables for the work. The proposed management approach is briefly mentioned with just a statement that it will be simple.

Assessor 3
The opportunity to append a supporting document was not taken. The proposal lacks any statement of time-activity planning.

Assessor 4
This is a description of some technical approaches to the work, not a project management description. What is required in answer to this question is how the work is to be broken up; what milestones will there be; what decisions need to be made; what provisions for risks have been made.

Assessor 5
There needs to be a project plan with detailed work packages. The one partner is actually on person and this is too limited for such a project. Some of the technical content is interesting. There actually needs to be a project, with a prototype for example with a commercial future. If it is just for education then this innovation must have much stronger drives behind it.

Previous
Wider impacts

Next
Risks

Need help with this service? Contact us (/info/contact)

Application questions for 48709

Risks

8. What are the main risks for this project?

Your answer:

This project is immune to commercial, managerial, and regulatory risks. It is ethically and environmentally neutral, it is not contingent on any form of certification, and it does not rely on any resources other than basic utilities for its completion.

Low probability risks include a natural disaster or the death of the principal investigator with insufficient time to brief a successor during the eighteen month project duration. The former risk can not be mitigated, but the latter will be mitigated by a well documented and frequently updated public source code repository.

A medium probability risk is that of a rival group outside the UK getting up to speed on the published theory and attempting to exploit it. The disadvantage of this outcome is that its benefit to the UK economy is less direct, but the risk is mitigated mainly by the time needed for an outsider to master the subject area. An estimate on the order of one year for a professional engineer is based on informal correspondence with participants in the asynchronous mailing list following the initial announcement of the current reference on the subject published by the PI this past summer (*Delay Insensitive Circuits : Structures, Semantics, and Strategies*, Plumstead Publishing House, 2019). Lacking both the first mover advantage and anything in the nature of IP "protection", rival groups taking any interest at all in this area would face an uphill path toward funding from their respective agencies or senior management.

With regard to IP, patent trolling is a plausible risk because it demands no engineering talent or credible legal argument from a fittingly ruthless and well heeled adversary. This risk is mitigated by several factors. As noted above, essentially all theoretical foundations of the work are publicly disclosed already. To the extent such ideas are patentable at all, any future patents on them would be subject to invalidation due to prior art. Previously filed patents pertaining to asynchronous circuits exist but most are trivial or overly broad. Their relevance to the proposed project is tenuous at best, and in any case their time to expiration is finite. However, if worse comes to worst, these issues impede only the commercial aspirations of an investigator, not the project's ultimate contributions to knowledge and technological progress.

Average score: 3.2/ 10

Your assessors' feedback

Assessor 1
The applicant's last sentence explains why this project is not suitable for funding; this competition and grant funding is about creating economic growth for the UK economy; the applicant implies that this is a secondary consideration. Ongoing risk management is not described. No technical / technology development risks are mentioned, calling into question as to what is innovative about this project. Unclear if the applicant has considered some usual, but sometimes overlooked, risks, such as, completing within time and budget. Risk analysis is generally weak.

Assessor 2
Only a very high-level consideration of risks is presented and with only competitor action being identified. There is no formal risk assessment to indicate probability or impact, and specific mitigation measures are not elaborated. There is no identification of any specific technical risk items, and indeed it is unclear if the work involves any significant level of technical risk. The risk management methodology is not adequately presented.

Assessor 3
The opportunity to append a supporting document was not taken. An industry-standard-style risk register is missing. However, key risks are cited alongside mitigation pathways.

Assessor 4

It is conventional to represent risks in terms of their magnitude, derived from their probability and their impact. This is not well done here. The risks of exploitation of the ideas in the reference work are high if they are good ideas - underestimating those risks seems to suggest a lack of confidence. The initial statement regarding immunity is naive and out of place.

Assessor 5
InnovateUk is for technically innovative and risky projects which have strong commercial reward if successful. This project is a single person pursuing their technical ideas to offer as part of computer education teaching in the future - or so it seems. The project is risk free - it is one of the most risky projects - one member of staff, no commercial output or ROI so why fund in the first place.

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Added value

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Application questions for 48709

Added value

9. What impact would an injection of public funding would have on the businesses involved?

Your answer:

Without public funding, the only form in which this project might go ahead is as a hobby on the part of the PI. Public funding would enable and oblige it to be a full time occupation.

If the project is funded and completed successfully, the business will be in a strong position to attract private investment for upgrading the deliverable from an initial working prototype to a marketable product.

Currently the company's only income is from book sales, which are insufficient to support a full time developer. The time horizon to a return on investment makes this project unattractive to private investors at its current stage, and can not be shortened by throwing money at it because recruiting a large team experienced in this subject area is impossible. If the application is unsuccessful, the project will be less actively promoted and significantly postponed, perhaps to be overtaken in due course by better resourced and more timely investigators elsewhere.

R&D activity prior to this project has focused on establishing, documenting, and publishing a firm theoretical foundation. This project would change the nature of the activity to a more applied direction. The activity will also change from essentially an individual effort by the PI to a more collaborative one.

Average score: 2.6/ 10

Your assessors' feedback

Assessor 1
Whilst it is likely that private investment would not be achieved, the applicant has also not made a good case for public funds, here. There are no clear benefits described that would help to show grant funding is justified.

Assessor 2
The added value offered by public funding is explained in terms of restricted access to alternative capital, and this appears justified. Other factors, such as reduced time to market, or risk reduction are not adequately discussed. The impact of this funding on the applicant's R&D activities is not adequately elaborated.

Assessor 3
The lack of a return-on-investment analysis (or similar) makes it hard to justify that public funding will be given with an expectation of value-for-money. The funding will provide R&D activity, but no commitment to self-funded future R&D is made in the proposal. Alternative sources of funding are not cited/discounted.

Assessor 4
As the deliverable seems to be software whose utilisation depends upon developments elsewhere, the business impact is tenuous. Public funding is only being applied to part of the necessary developments, and this co-dependence is unresolved in this proposal.

Assessor 5
Public funding would pay an PI to complete his hobby. This is not appropriate.

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Application questions for 48709

Costs and value for money

10. How much will the project cost and how does it represent value for money for the team and the taxpayer?

Your answer:

The total cost of the project will be £71,450, with £48,000 to fund a software developer's salary for eighteen months, £1,800 for computer equipment, £450 for broadband access, £19,200 for office accommodation, and £2,000 for expenses including travel to conferences or professional meetings, web hosting, cloud services, and consumables.

Plumstead Publishing will cover the costs of office accommodation, computing equipment, and broadband access in the amount of £21,450. The total grant requested is £50,000.

The project represents value for money for the taxpayer because it is undertaken by an extremely lean organization and the salary is well below the market rate for a Ph.D. level software engineer in a research capacity. Moreover, the research output will be freely available to any member of the public through an open access policy. The value to the applicant is in growing the company enough to justify private investment on more favorable terms when it is sought subsequent to the project.

The project cost exceeds that of any activities on which Plumstead Publishing would otherwise spend money.

One hundred percent of the costs accrue to a single partner.

There are no subcontractor costs.

Average score: 3.2/ 10

Your assessors' feedback

Assessor 1
The project costs are relatively low and therefore are likely to be good value for money in conducting the project. What is not so clear is any strong rationale for conducting the project and spending taxpayers' money on it.

Assessor 2
The overall project costs are stated and broken down by cost category but not by work package activity. There is a good account of the additional 'Other', capital, and travel costs. However, the overall lack of detail in the provided work plan makes it difficult to judge if the costs are appropriate for the proposed plan or sufficient to successfully complete the project There is insufficient discussion of value for money of the project, and, in the absence of supporting information on cost benefit trade-offs or RoI, value for money has not been adequately demonstrated.

Assessor 3
The project costs are appropriate, however, not put into context of what the costs would be should alternative approaches be taken. The costs as stated are likely to be sufficient to complete the proposed project.

Assessor 4
As the deliverables are not clear, the overall dedicated costs are hard to justify. It is not understood why travel is required.

Assessor 5
As there is no project plan, the costs are not justified

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Added value

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