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POLICIES FOSTERING THE PARTICIPATION OF BUSINESSES IN TECHNOLOGY TRANSFER

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1. The Annexes to this document contain (i) a Study on Policies Fostering the Participation of Businesses in Technology Transfer, undertaken in the context of the Project on Intellectual Property and Technology Transfer: 'Common Challenges – Building Solutions' (CDIP/6/4 Rev.), by Mr. Philip Mendes, Principal, Opteon, Brisbane, Australia, and (ii) a Peer Review of the above Study by Mr. Nikolaus Thumm, European Commission Joint Research Centre, Seville, Spain.

2. *The CDIP is invited to take note of the information contained in the Annexes to this document.*

[Annexes follow]

Note: The views expressed in this study are those of the author and do not necessarily reflect those of the WIPO Secretariat or any of the Organization's Member States.

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TRANSFER

Study by Mr. Philip Mendes, Principal, Opteon, Brisbane, Australia

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EXECUTIVE SUMMARY

1. Knowledge driven businesses dominate today's economies, and businesses that innovate, creating new knowledge, overtake their competitors. There are many challenges or obstacles to businesses, particularly SMEs, that seek to innovate. Amongst them are a lack of special skills, lack of financial resources, and lack of specialist research and development equipment. (summary of paragraphs 17 to 21).
2. Technology transfer mechanisms will help a business that lacks these skills and resources obtain access to them from universities and research organisations, and will help them capture the research and development outcomes that result. (summary of paragraph 22)The technology transfer that emerges can take many forms, including the formation of spin out companies, the assignment or license of intellectual property, contract research or collaborative research, as well as the provision of contracted services. Each of these can additionally catalyse more of such activity. (summary of paragraphs 23 to 26).
3. These processes of technology transfer to innovate and to overcome technical obstacles are well recognised. However, they are not necessarily well utilised. Many factors influence that under-utilisation including the absence of a technology transfer framework, the expense of contracting research and development, the perceived risk of sharing information and the loss of confidentiality and competitive advantage that may occur by doing so, lack of knowledge as to where to access expertise, previous negative experiences, asymmetric information, and simply the intervention of market forces. (summary of paragraphs 27 to 29).
4. When these obstacles are overcome, the benefits to the enterprise can be many, such as the following:
 - (a) developing new products and processes, or new services;
 - (b) solving technical problems and improving quality and ability to reference;
 - (c) improving business operations and coherence of services;
 - (d) shortening the time to market and reducing the long lead-time and cost for internal research and development;
 - (e) the flow of intellectual property from the technology creator to the business, such as by way of a license, allowing the business to commercialise that intellectual property;
 - (f) the flow of knowledge more broadly from the technology creator to the business, knowledge that may be useful in the business to make it more efficient, increase its profitability, decrease its costs, etc;
 - (g) access to new ideas that the business might not otherwise have learned;
 - (h) accessing special skills that the business may not have;
 - (i) accessing specialist equipment and infrastructure which the business may not have;
 - (j) networking with innovators and technology creators, who can be called upon as future needs may arise, either in a consulting capacity, or in a research and development engagement;
 - (k) leveraging research and development expenditure by accessing additional public funding sources or by utilising taxation incentives, and so being able to further support research and development; and

(l) identifying students that may become prospective employees. (summary of paragraph 30).

5. SMEs account for a very large proportion of a nation's businesses and employers, and they contribute a sizeable proportion of a nation's gross domestic product. Yet, SMEs' participation in technology transfer processes can range from casual to not at all. For most businesses, particularly SMEs, the speculative investment in research and development is not an expenditure that can be readily justified or afforded. An SME's smaller scale of profits, and therefore its more limited financial resources, means that SMEs struggle to participate in research and development, collaboration, and therefore in technology transfer processes. This also means that regrettably, SMEs can sometimes be less attractive commercial partners for universities and research organisations. (summary of paragraphs 31 to 33).
6. The under-utilisation of technology transfer processes can be addressed by policy intervention, and that is the subject of this paper. (summary of paragraphs 35 and 36).
7. Taxation policies in many countries intervene to encourage research and development, and as a result, technology transfer. These can range from special tax deductions, to tax credits and tax exemption for technology transfer related income. These are described in Section 2.
8. Section 3 considers the role of demand side research grants, that is, grants for research and development that are driven by the prospect of the industrial application of research outcomes arising from the funded research.
9. Access to finance can be an impediment to technology transfer efforts, and policies addressing this are described in Section 4.
10. Section 5 considers policies that have the objective of de-risking research and development, and technology transfer, such as providing for proof of concept funding.
11. Section 6 describes the important role that government procurement programs can have in fostering research and development, and technology transfer.
12. Section 7 considers policies that have as their objective the nurturing of linkages between, and encouraging, university / business engagement, which can be a catalyst for more research and development, and in turn more technology transfer.
13. Sometimes, negotiations between universities and businesses can have the unfortunate result of deterring further interactions. This can occur when each has an insufficient appreciation of the needs of the other. Section 8 describes some initiatives that are aimed at addressing this.
14. Section 9 focuses upon international technology transfer and Article 66.2 of the TRIPS Agreement.
15. Section 10 concludes by commenting upon the application of some of these policies to least developed and developing countries, and offers some suggestions and recommendations, including in relation to policy measures that might assist the implementation of the objectives of Article 66.2.
16. Each section describes the objectives of policy intervention, and proceeds to provide selected examples in various countries of some the successful implementation of the policy intervention described.

1. HOW TECHNOLOGY TRANSFER CAN HELP BUSINESSES

1.1 Introduction

17. In our knowledge driven economy where knowledge driven businesses dominate, there is the critical need for businesses to innovate. A business which does not innovate will stagnate, and will be overtaken by competitors that do innovate.

18. There are at least three critical things that a business must have in order to be innovative:

- (a) a desire to innovate (“I want to be innovative”);
- (b) the ability to innovate (“I can generate innovative ideas”);
- (c) the resources to translate an innovation from an idea to something useful (“I have the people, skills, equipment, and capital to bring innovations to fruition”).

19. Assuming the desire to innovate, not all businesses have the ability to innovate. They may want innovative ideas, but lack the means to generate them. Additionally, not all businesses have the resources to translate an innovation from an idea into something useful. In each case, technology transfer mechanisms may help.

20. A business must also have:

- (a) an ability to recognise its technical obstacles (“I see the technical problem”);
- (b) the desire to solve the technical obstacles (“I want to solve the technical problem”);
- (c) the ability to formulate technical solutions (“I have ideas to solve the technical problem”); and
- (d) the resources to translate an idea to solve a technical problem to a technical solution (“I have the people, skills, equipment, and capital to solve my technical problem”).

21. Assuming the ability to recognise technical obstacles, and the desire to do something about them, not all businesses have the ability to formulate technical solutions. They may want technical solutions, but again may lack the means to generate them. As well, not all businesses have the resources to translate an idea to overcome a technical obstacle from an idea to a solution. In each case again, technology transfer mechanisms may help.

22. A business may face any one or more of the following challenges in its desire to innovate:

- (a) lack of special skills;
- (b) lack of financial resources; and
- (c) lack of specialist research and development equipment.

23. Technology transfer mechanisms will help a business which lacks these skills and resources obtain access to them from universities and research organisations, and will help them capture the research and development outcomes that arise.

1.2 What technology transfer processes are

24. Technology transfer refers to the process by which knowledge and technology flows between organisations, on a national or international level. Any mechanism by which knowledge sharing takes place between a business and another organisation will, in broad terms, be a technology transfer process.

25. For example:

Technology transfer process	What is transferred	From	To
Spin out company	Intellectual property assigned or licensed to the spin out company	University or other research organisation	Spin out company
Intellectual property assignment	The subject of the assignment: patent, copyright, trade secrets, know-how, etc	Assignor	Assignee
Intellectual property license	The subject of the license: patent, copyright, trade secrets, know-how, etc	Licensor	Licensee
Research and development collaboration	Inventions, discoveries, data, know-how, trade secrets etc arising in the collaboration	Each collaborator	Each other collaborator
Research sponsored	Inventions, discoveries, data, know-how, trade secrets etc arising in the research	Researcher	Company sponsoring the research
Contracted research	Outcomes from the contracted research, data, designs, technical information, new products and processes	Contracted researcher	Its customer
Contracted professional or technical services	Outcomes from the services provided	Contracted researcher	Its customer

26. In each case there is:

- (a) access to a technology creator, an innovator or an expert with technical knowledge;
- (b) access to people, skills, equipment, and capital that the business may not have;
and
- (c) the aim of developing an innovation or formulating a solution to technical obstacles, and as a result, a flow of knowledge, or technology transfer, takes place.

1.3 Under-utilisation of technology transfer processes

27. These processes of technology transfer to innovate and to overcome technical obstacles are well recognised. However, they are not necessarily well utilised. Many factors influence that under-utilisation. Amongst them:

- (a) Lack of a technology transfer framework within research organisations. Some research organisations produce new knowledge that could be beneficial for businesses, and able to be the subject of a technology transfer process, but the absence of a technology transfer institutional framework, such as a technology transfer office, means that that new knowledge is not recognised, not protected, and not commercialised;
- (b) Contracting research and development can be expensive. This is so even when contracting research and development to be undertaken by universities, research institutes, or government laboratories. Normally the expense of research is greater when a company is engaged to undertake contract research and development. Businesses cannot always afford the cost of contracting out in this way. That can be particularly so for small and medium enterprises (SMEs). This expense, and what is sometimes an unaffordable expense, deters research and development, and that precludes technology transfer opportunities arising;
- (c) Collaborating with others may be perceived as putting confidentiality and competitive advantage at risk. Collaborating or engaging contract researchers necessarily must involve disclosure of intellectual property, or at least of confidential information. While confidentiality and non-use agreements and confidentiality and non-use obligations in contracts address the issue, there is sometimes a lack of confidence about their effectiveness, and a deterrent perception that protecting intellectual property or confidential information necessarily must involve expensive litigation that cannot be afforded. In what may be misunderstood efforts to maintain confidentiality, engagement with potential collaborators, such as universities and contract researchers is deterred, and that in turn deters, or obstructs collaboration and technology transfer;
- (d) Lack of knowledge on where to access expertise. A business may have no experience in dealing with or contracting a research organisation such as a university, and so may have no knowledge of how it might be able to assist the business. Where there may be an expectation that a research organisation such as a university might be able to assist the business, there may be no knowledge of how to go about accessing that assistance;
- (e) Previous experiences with research organisations. Some businesses that have dealt with research organisations such as universities have regrettably sometimes come away from the engagement deterred from engaging again. This has not been because of lack of scientific or technical success, nor even the engagement at the scientific or technical level. Sometimes the deterrence arises because the process of negotiating the terms of contracts was reported to be slow moving, characterised by risk averseness, and this made it expensive and time consuming. Other times, the deterrence arises because

in previous engagements the business and the university or other research organisation had conflicting positions on fundamental issues such as ownership of new intellectual property, the ability to publish etc., which were irreconcilable;

(f) Asymmetric information: A technology developer such as a research organisation, and a business may lack the same information, and that can hinder technology transfer proceeding between them. For example, a business may not have the same information about a technology as its developer, and lacking the same information, its ability to make an assessment of it may be impeded, and in turn that impedes technology transfer occurring. Or, a research organisation may lack the same information as a business in relation to the market readiness of a technology, or the obstacles that may need to be overcome to make the technology market ready, and that may again operate to impede technology transfer taking place.;

(g) Market forces. There are many practical impediments to successful technology transfer that are dictated by the market, and which are subject to little or no control or influence. These include prevailing economic conditions, access to capital, regulatory approval and compliance, and the time to market generally.

28. All these factors impact upon all types of businesses and their ability to utilise technology transfer processes. That under-utilisation is even more pronounced amongst businesses which are SMEs, where the expense, perceptions, lack of knowledge, and previous negative experiences operate with a bigger deterrent impact.

29. There are many myths affecting SMEs, and others about research and development and technology transfer processes. In its 28 March 2013 issue, Forbes magazine included an article called "Eight Myths That Keep Small Businesses From Claiming the R&D Tax Credit". The eight myths reported were:

- (a) the research and development (R&D) tax credit is only for companies that are inventing something brand new;
- (b) the R&D tax credit is only for companies with laboratories and test tubes;
- (c) the R&D tax credit isn't for companies in my industry;
- (d) the R&D tax credit is only for the big companies;
- (e) the R&D tax credit won't help me with my state taxes;
- (f) the R&D tax credit won't help my bottom line;
- (g) it's all too good to be true – it must be snake oil;
- (h) we are going to have tax reform and the R&D tax credit is going to go away.

Myths such as these also contribute to the under-utilisation of technology transfer processes.

1.4 The benefits of engagement in technology transfer processes

30. When a business engages with a technology creator, such as a university or research organisation, the benefits to the business can be many:

- (a) developing new products and processes, or new services;
- (b) solving technical problems and improving quality and referenceability;

- (c) improving business operations and coherence of services;
- (d) shortening the time to market and reducing the long lead-time and cost for internal research and development;
- (e) the flow of intellectual property from the technology creator to the business, such as by way of a license, allowing the business to commercialise that intellectual property;
- (f) the flow of knowledge more broadly from the technology creator to the business, knowledge that may be useful in the business to make it more efficient, increase its profitability, decrease its costs, etc;
- (g) access to new ideas that the business might not otherwise have learned;
- (h) accessing special skills that the business may not have;
- (i) accessing specialist equipment and infrastructure which the business may not have;
- (j) networking with innovators and technology creators, which can be called upon as future needs may arise, either in a consulting capacity, or in a research and development engagement;
- (k) leveraging research and development expenditure by accessing additional public funding sources or by utilising taxation incentives, and so being able to further support research and development; and
- (l) identifying students that may become prospective employees.

1.5 Do businesses need incentives to participate in technology transfer processes?

31. The benefits to business of engagement with technology transfer processes being so clear, is there a need for policies to foster, even incentivise, businesses to participate in technology transfer processes? SMEs in particular are identified as a category of businesses whose greater participation in technology transfer processes needs to be fostered.

32. In developed countries, SMEs broadly:

- (a) make up over 90% of the number of a nation's businesses;
- (b) employ 50% to 75% of a nation's workforce; and
- (c) contribute 20% to 40% to a nation's gross domestic product.

33. Yet, SMEs' participation in technology transfer processes can range from casual to not at all. Engaging in research and development, engaging in collaborations, and engaging consultants with technical skills and expertise are expensive endeavours. More than that, they can also be speculative endeavours. By its nature, research and development is speculative. The achievement of the technical outcome that is sought in research and development is not a certainty. For most businesses, particularly SMEs, the speculative investment in research and development is not an expenditure that can be readily justified or afforded. An SME's smaller scale of profits, and therefore its more limited financial resources, means that SMEs struggle to participate in research and development, collaboration, and therefore in technology transfer processes. This also means that regrettably, SMEs can sometimes be less attractive commercial partners for universities and research organisations, than larger businesses, whose greater financial resources make it more able to invest in research and development, collaboration, and technology transfer processes.

34. Other reasons for the lesser participation of SMEs in research and development, collaboration, and technology transfer processes may include:

- (a) the lack of technical expertise or knowledge within the SME, and its inability to recognise the scope to innovate, or the need to find technical solutions to technical problems; and
- (b) lack of awareness of how to access technical expertise within universities and research organisations.

1.6 Should governments provide incentives for businesses to participate in technology transfer processes?

35. In a free market economy, amongst the purposes and objectives of government policy is

- (a) to fix something that is not working, or;
- (b) to improve something that is not working well enough.

36. Underspending on research and development and as a result the under-utilisation of technology transfer processes is an area that many governments throughout the world focus upon in their policy making. Some policies are aimed at direct support for research and development, such as the awarding of grants. Policies that affect research and development so directly have the advantage that they can foster and encourage research and development in priority areas for a particular country, such as climate control, fostering a particular manufacturing sector, or a particular export industry. Some policies operate to foster a broader objective which includes fostering technology transfer, such as tax incentives for research and development. In this case, all companies incurring research and development expenditure will benefit. Some will wholly use the research and development outcomes in house, and never engage in technology transfer processes. Others will engage in technology transfer processes with their research and development outcomes, and others will do both. All are worthwhile objectives justifying the tax incentive. These policies are also available to all that meet the eligibility criteria for the incentive, in all fields. Some policies aim to foster an improvement in relationships between businesses and technology creators, so that in turn technology transfer relationships can be fostered. In the following sections, some of these policy initiatives are described, and by way of illustration, their implementation in selected countries is also described.

2. TAXATION POLICIES

2.1 Policy objective

37. The policy objective underlying the provision of fiscal incentives to tax payers to undertake research and development is to foster and encourage that research taking place. The policy objective arises as a result of what is perceived to be a market failure, when insufficient research and development is conducted by businesses, with as a result, little or no innovation, or not the extent of innovation which might have occurred. As a result the economic benefits that may have arisen from research have either not taken place to the extent they might have been, or have not taken place at all. By providing fiscal incentives, policymakers aim to encourage businesses to do more of what they do not do at all, or to do more of what they do not sufficiently do, which is to carry out research and development. This is a broader policy objective than the fostering of technology transfer processes. This is because a business may incur research and development expenditure wholly “in house”, and innovate wholly “in house”. When that occurs, no technology transfer at all may have taken place. This in itself achieves the objectives of the fiscal incentives. But additionally, fiscal incentives to businesses to

undertake research and development can at the same time foster technology transfer processes.

38. Businesses that are incentivised to undertake research and development can do this by:

- (a) undertaking research and development themselves;
- (b) outsourcing research and development and thereby engaging others to undertake the required research and development, such as a university or other research organisation; or
- (c) collaborating with others to jointly undertake research and development.

39. The first of these does not of itself foster technology transfer. The second and third do. They necessarily involve the transfer of knowledge from one organisation to another. Beyond the undertaking of research, what the business does with the outcomes can also lead to technology transfer by the business with successful outcomes from its research and development efforts licensing out those outcomes:

- (a) in other fields;
- (b) in other territories;
- (c) sometimes, even to their competitors.

40. Normally, any non-capital expenditure incurred by a business in the course of its business operations is tax deductible. However, where research and development is sought to be encouraged, a greater rate of tax deductibility is prescribed. Tax deduction rates of 125%, 150%, 200% and more, have been adopted in many countries. As a result of the greater tax deduction, a government's treasury forgoes tax that it might otherwise have collected. In that way it contributes to

- (a) research and development expenditure;
- (b) innovation; and
- (c) to the extent to which there is engagement with collaborators and contractors, also contributes to technology transfer processes.

2.2 Singapore - tax deduction for research and development expenditure

41. One of the most generous rates of tax deductibility for research and development expenditure is that which operates in Singapore. The rate of tax deduction is 400% for the first SGD\$400,000 of research and development expenditure annually, with 150% for research and development expenditure over this amount.

42. The result of such a generous rate in Singapore is that the deduction more than covers the research and development expenditure itself, and continues to offset income. In Singapore therefore, the government's treasury effectively pays for the whole of the research and development expenditure, on the first SGD \$400,000 of research and development expenditure, and returns a financial reward to the business, in the form of greater deductibility, for having incurred the research and development expenditure. That surplus the business can use to fund further research and development.

43. In Singapore, as in most countries offering a tax deduction for research and development expenditure on monies paid for contracted research and development, for example to a

university or other research organisation, are eligible. There are precise eligibility criteria to be met to obtain the greater tax deduction.

44. Examples of similar tax deductions in other countries are:

<u>Country</u>	<u>Rate</u>
United Kingdom	225% for SMEs, 130% for large companies.
Sri Lanka	200%
Malaysia	200%
Thailand	200%
China	150%
South Africa	150%.

2.3 Australia - tax credit for research and development expenditure

45. Operating in a very similar way to a tax deduction, is a tax credit. A tax deduction enables tax to be reduced, so a criticism sometimes directed is that a business that does not make profit has no income against which to get the benefit of the greater tax deduction. This means that some businesses, like technology start up companies, are neglected by policies limited to enabling the claiming of tax deductions. This is addressed by the tax credit incentive.

46. In those countries where the incentive operates, a percentage of research and development expenditure by the business is either:

- (a) applied as a tax credit offsetting the tax otherwise payable; or
- (b) to the extent that the credit is not fully applied because there is no tax, or no further tax to pay, it is repaid back to the business.

In this way, even a business that earns no profit, such as a startup company, will benefit. A business that receives a tax credit in this way effectively has more money resources for further research and development.

47. By way of example, the tax credit in Australia is:

- (a) 45% for businesses with revenue under \$40 million, and takes the form of a payment back to the business; and
- (b) 40% for businesses with revenue over \$40 million, and takes the form of a carried forward credit to be offset against the following year's taxable income.

48. In Singapore, a business entitled to a greater tax deduction (see 2.1) can elect to convert up to SGD\$100,000 of the tax deduction to a refundable tax credit, at the rate of 60%.

49. Examples of similar tax credits in other countries / regions are:

<u>Country</u>	<u>Rate</u>
Portugal	32–50%
France	30-40%
Canada	20% (35% for SMEs)
Ireland	25%
South Korea	20% (30% for SMEs)
Norway	18% (20% for SMEs)
Taiwan (Province of China)	15%
Japan	8-12%.

50. A study evaluating the operation of the tax credit scheme in Norway concluded that:

- (a) businesses that took advantage of the tax credit had stronger growth; and
- (b) businesses that did not previously invest in research and development were more likely to start doing so.

2.4 Malaysia, France, United Kingdom - Tax exemption for technology transfer related income

51. Some countries allow income tax exemption, to some degree, for companies whose income is derived from the commercialisation of intellectual property. By making income derived from commercialisation tax exempt, either wholly, or in part, the commercialisation objective is fostered and encouraged, and in turn that fosters and encourages technology transfer from technology creators, such as universities, to technology commercialisers, such as startup companies, SMEs, and others. In some countries, companies which provide contract research and development services can also enjoy tax exemption. Contract research and development services providers are also directly linked to the technology transfer process, being technology creators, transferring the technology to the technology customers that engage them.

Malaysia

52. In Malaysia, companies that provide contract research and development services, are eligible for pioneer status, which enables them to enjoy a 100% tax exemption on their income from providing those contract research and development services for a period of 5 years. Also in Malaysia, commercialisation income received from commercialising the results of research enjoys a 50% tax exemption for a period of 5 years. Companies that enjoy these tax exemption privileges are sometimes set up as result of technology transfer from a technology creator, such as a university, which may spin out the technology into a spinoff company. The process by which the technology is transferred is often through a license of intellectual property to the new company, or through the assignment of the intellectual property to the new company, being the intellectual property which has arisen from the contract research and development that was undertaken. These tax exemption policies being specifically designed for companies that are part of the technology transfer process, they operate directly to foster and encourage technology transfer.

France

53. In France, those who license out technology benefit from a reduced company income tax rate of 15% on the income, including royalties and other license payments they receive under their license agreements. They still pay the usual company tax rate of 33.33% on other income. This applies to licenses granted not just to French licensees, but also to licensees in other countries. It therefore strongly fosters international technology transfer.

United Kingdom

54. The United Kingdom in April 2013 commenced the phasing in of a lower corporate tax rate for income derived from the commercialisation of patents. Profits earned from the commercialisation of patents will attract a reduced corporate tax rate, lowering it from 24%, progressively over 4 years, until it reaches 10% in April 2017. The usual tax rate will continue to apply to a company's other income.

2.5 Targeting SMEs for tax incentive policies

55. Some countries target their tax incentive policies for SMEs, or they apply their tax incentive policies more generously to SMEs. For example, SMEs may benefit from a higher rate of tax deduction for research and development expenditure, or may be eligible for a higher rate of tax credits. Or, tax incentive policies may place an upper limit on the amount of research and development expenditure that is eligible for the greater rate of deduction. The reasoning here is that large businesses are more likely to reach the upper limit, and SMEs are less likely to do so.

2.6 Volume of expenditure or incremental expenditure

56. Most countries apply their tax incentives to all research and development expenditure incurred in the relevant year by the taxpaying business. A few countries apply their tax incentives only to the incremental increase in research and development expenditure incurred in the relevant year, over and above a base amount. The base amount may for example be an average of research and development expenditure in past years, or the base may be fixed by amount, or by reference to a period. A criticism of the volume approach, applying tax incentives to all research and development expenditure, is that it effectively subsidises research and development that would have been done anyway, without any tax incentive, and therefore needlessly confers a tax benefit to some. But a criticism of the incremental approach is that a business which was incentivised in one year may become disincentivised the following year.

57. Ireland has a 25% tax credit scheme. Up to 2012 the scheme operated on an incremental basis, allowing the credit to be claimed in relation to research and development expenditure that exceeded the level in 2003. In 2013 Ireland abandoned the incremental basis of the scheme, and now allows the tax credit to apply for all research and development expenditure.

58. Portugal operates both a volume based as well as an incremental based tax credit scheme. A 32.5% tax credit is available for all research and development expenditure in the current year, and an additional 50% tax credit is given for incremental research and development expenditure. The trend appears to be countries moving more towards the volume approach.

2.7 Types of eligible research and development expenditure

59. Some countries allow a range of expenditure to be eligible as research and development expenditure for the purpose of tax incentives, including:

- (a) wages and salary payments to research and development staff;
- (b) contract payments to another organisation to which research and development has been contracted, such as a university or other research organisation;
- (c) capital expenditure on capital equipment purchased to undertake the research and development; and
- (d) cost of consumable items used in the research and development.

60. Other countries are more restrictive in what they will allow as eligible research and development expenditure. A few countries for example, only allow wage and salary payments to research and development staff.

2.8 India – exemption from import taxes on capital equipment

61. In India an additional tax exemption applies. Research and development laboratories need expensive laboratory equipment. The Department of Scientific and Industrial Research (DSIR) can issue a DSIR recognition, which recognises a research and development laboratory. The benefit of this is that that recognition entitles the laboratory, including laboratories owned by businesses, to exemption from customs and excise duties of 25% on capital equipment.

2.9 Prevalence of tax incentive policies

62. According to the OECD in its 2011 report OECD Science, Technology and Industry Scoreboard 2011 there were at that stage 26 OECD countries that used tax incentives to foster business expenditure in research and development. This compares to only 18 in 1995, and 12 in 2004. Clearly, more and more countries are choosing to implement this form of incentive to encourage research and development, as well as technology transfer.

2.10 The mix of indirect incentives (tax deductions and credits) and direct incentives (grants)

63. Fiscal policies are sometimes described as being less efficient than other policies, such as grant policies. This is because:

- (a) fiscal incentives are available to all businesses that are eligible for them, whether or not the research and development undertaken:
 - (i) is the most likely to achieve policy objectives;
 - (ii) at the same time fosters technology transfer

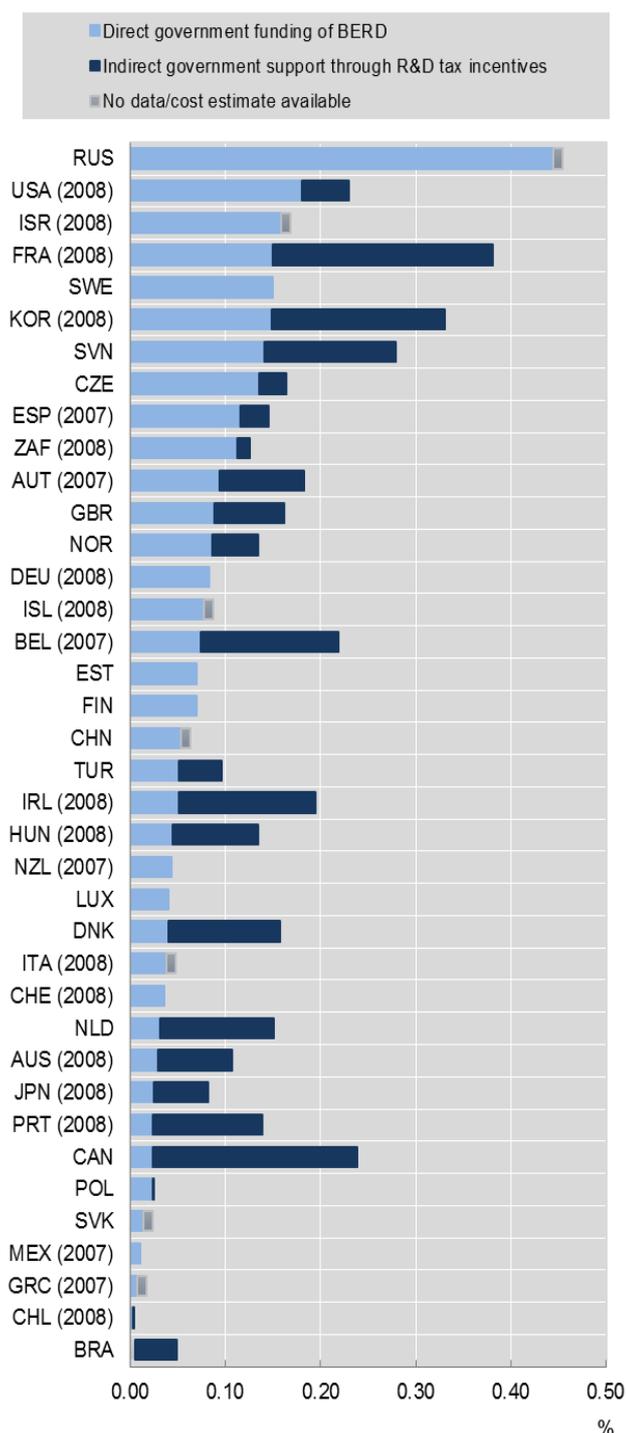
- (b) some fiscal policies operate to offset a business' income, so that a business without income, such as a start up company, does not immediately benefit from the fiscal policy, and may not do so for some time, or may not do so at all.

64. Most countries however adopt the dual approach of addressing the perceived market failure by pursuing both indirect fiscal policies, as well as more direct grant policies. Grant policies are described as providing a direct incentive because the incentive is provided directly for a project that has met a criteria or selection process. In this way, the direct support focuses on specific areas, industries, or organisations that the policy has identified to be targeted in the efforts to foster research and development and technology transfer process, such as climate control, fostering a particular manufacturing sector, or a particular export industry, or even providing preferential support for SMEs. On the other hand fiscal policies are described as providing an indirect incentive because in contrast, any tax paying entity that incurs the research and development expenditure, in any field, for any purpose, is entitled to the incentive. These indirect incentives are therefore not so easily targeted to any specific policy objectives.

65. Not unexpectedly, some countries have a policy emphasis on direct grant incentives, while others may have a policy emphasis on indirect tax incentives, and yet others have policies to achieve a balance between the two. Some countries provide modest, or no fiscal incentives, preferring instead to promote grant policies. And some counties provide modest or no grant incentives, preferring instead to rely on indirect tax incentives.

66. The table opposite contains the most recent available data from the OECD, and shows the extent of direct government support in the form of grants for business expenditure on research and development (BERD), and indirect government support in the form of research and development tax incentives, each expressed as a percentage of a country's GDP. Some OECD countries focus entirely on direct grant support, and do not offer indirect fiscal support at all, such as Germany, Finland, Estonia, and Sweden. Some countries focus predominantly on indirect fiscal incentives, with a comparatively lesser or no focus on direct grants such as Brazil, Canada, Portugal, Japan, Australia, and The Netherlands. Some countries instead implement both, achieving an approximate balance on supporting both direct and indirect incentives, such as France, South Korea, Slovenia, Austria, United Kingdom, Norway and Belgium.

67. One country, Mexico, has abandoned all research and development tax incentives, preferring instead the more direct policy of grants. For each country it is a matter of determining its own policy objectives.



OECD (2011), "Tax incentives for business R&D", in *OECD Science, Technology and Industry Scoreboard 2011*, OECD Publishing. Page 148.

68. Many factors come into play in deciding to focus on direct grant incentives, or indirect taxation incentives to achieve a balance. For some countries, their policy objectives may be to support specific industries or sectors, or specific objectives, and that will be best achieved by grants that will directly impact on those industries or sectors. For example, in some countries there are grants that are available only to agribusiness industries, manufacturing industries or export industries. These grants are intended to support not just research and development but as well to support other objectives such as growing employment, or improving the balance of trade.

69. Some countries support grants that are available for specific objectives, such as climate change or environmental remediation. These grants support not just research and development, but as well support the social objectives that relate to those areas.

70. In countries where there is a low corporate tax rate for example, tax incentives will not have as high an impact, compared to those countries that have a higher corporate taxation rate. The tax incentive is effectively worth more in the latter case.

71. All these factors, including many unrelated to technology transfer come into play in a country's decision to implement tax incentives, grant incentives, or both, and the extent to which they are implemented.

3. DEMAND-SIDE RESEARCH GRANTS POLICIES

3.1 Policy objective

72. Applications for grants to carry research and development were once assessed by granting bodies principally on the criteria of scientific merit. This ensured that only "cutting edge" research was undertaken, and that was a worthwhile objective. These types of grants continue. But in more recent years new categories of grants have emerged which place emphasis additionally, on the prospect of industrial application of results arising from the funded research. An indicator of the potential for industrial application is the joining in the application for funding by a company as a co-applicant.

73. Some grant schemes therefore prescribe the eligibility criteria for the award of the grant to include that:

- (a) there be co-applicants, at least one of which must be a technology creator, such as a university or research organisation, and one or more of which must be an industrial partner which will be a commercialiser or technology user; and
- (b) the industrial partner must co-invest in the research to be undertaken, for example, by providing monies that match the amount of the grant, or contributing "in kind", or both.

An "in kind" contribution is a non-monetary contribution of something useful to the research, and of value. For example, an industrial partner may provide an in kind contribution in the form of:

- (a) time of its own staff to a collaborative research project;
- (b) provision of equipment and facilities not otherwise available to the research project;
and
- (c) provision of consumable items.

The rationale for an in kind contribution is that its provision is a cost saving to the research project, and this reduces the amount of the grant that would otherwise have had to be made.

One of the advantages of awarding research grants in this way is that they directly foster the involvement and support of business in the technology transfer process.

74. The policies prescribing these grants are described as demand-side policies, indicating that the emphasis is upon funding applied research and development that industry participates in, where industry participation indicates that the applied research and development is of industrial merit. This is compared with supply-side policies, where the emphasis is upon funding the research proposed by scientists. The main assessment criterion in supply-side policies is scientific merit.

75. A grant awarded with demand-side features necessarily will concern:

- (a) a technology creator which will generate intellectual property; and
- (b) a technology commercialiser or user, which will commercialise or use the intellectual property created.

Necessarily, there will be a process of technology transfer from the technology creator to the technology commercialiser or user. This makes this category of policy one of the most effective to foster the participation of businesses in the technology transfer process. Where the technology creators in a collaboration include research organisation from other countries, the technology transfer that will take place will be international. Similarly, where the technology commercialisers or users include businesses in other countries, the technology transfer that will take place will also be international.

3.2 United Kingdom – LINK Projects

76. By way of example, one of the United Kingdom's Research Councils will accept applications for research grant funding for projects sought to qualify for LINK status. To be eligible:

- (a) the project must involve collaborative research;
- (b) there must be at least one research organisation collaborator;
- (c) there must be at least one business collaborator;
- (d) the business collaborator must provide cash or in kind contributions to the project which must be at least 50% of the full cost of the project;
- (e) the grant sought from the Research Council's must be for no more than 50% of the full cost of the project; and
- (f) there must be an agreement between the collaborators by which they agree upon matters concerning the ownership and exploitation of the intellectual property arising from the project, as well as the management framework for both the research and commercial objectives to be achieved.

77. Projects that are awarded grant funding as LINK projects, having satisfied that eligibility criteria will necessarily be projects that concern industrially relevant research, since the business collaborator would be unlikely to expend monies and dedicate in kind resources to research projects that were unlikely to lead to industrially relevant outcomes. Further, given that it is likely that the business collaborator either will own, or have a license to the intellectual property arising from the research, technology transfer from the technology creator collaborator to the technology commercialiser or technology user collaborator will necessarily take place.

78. A 2012 study evaluating the LINK scheme reported that the level of new intellectual property arising from LINK projects was higher than that arising from projects funded in other ways. The study observed that this was to be expected, given the participation of a business collaborator in the project, which made it more likely to be industrially relevant and applicable. A business collaborator was presumed not to be motivated to participate and to partly fund the LINK Project, unless it was relevant to the business collaborator's business, with the business collaborator naturally, being the technology transfer recipient in that relationship. (The study also observed that in the period evaluated, 10% of projects had led to the formation of start up companies, and an additional 12% were expected to do so.

79. The LINK scheme facilitates the collaboration between a technology creator and a business which will be a technology commercialiser or user right from the very beginning. That is, from project scoping stages, project budgeting and resources stages, right through to project implementation stages the technology creator and the commercialiser will be intimately involved with each other. Their relationship might even start earlier, at the project inception stage.

3.3 Australia – Cooperative Research Centers

80. The Australian Cooperative Research Centres (CRC) program has been in operation since 1991. Currently, there are 37 CRCs operating. To be eligible, a CRC must have at least one university participant, or a research institute affiliated with a university, and at least one end user participant. In practice, most CRCs attract 10 to 20 participants, which means multiple universities and multiple end users. An end user is a participant that will be a user of the CRC's research outcomes. By way of example, an end user may be:

- (a) a company that will commercialise the research outcomes by manufacturing and selling products;
- (b) a company that will itself use the research outcomes in its own operations; or
- (c) an entity that promotes the needs of an industry or sector, and disseminates the research outcomes to the whole industry or sector, for the use of all companies in that industry or sector.

81. The average amount of grant funding, for each CRC, is \$3.7 million per year. For a CRC application to be successful, the participants between them must contribute cash and in kind contributions that will match the grant that is made. There is an emphasis on cash contributions. Under the program, a grant is made for a period of up to 10 years (subject to periodic reviews). This ensures commitment to long term collaboration between technology creators, and technology commercialisers and users. CRCs are funded across all fields of science. For many CRCs, their projects span the spectrum from basic research that can be a platform upon which more applied research will rest, to projects with focused industry relevant applied outcomes as their intended outputs.

82. Whether an end user participant is granted a license to commercialise, or to use in the course of its own operations, or to disseminate to a whole industry or sector, will necessarily involve technology transfer between the technology creator participants and the end user participants. One of the incentives that is given to a business that participates in a CRC is that it has, either formally in agreements, or informally by reason of its participation, "first in line rights". This means that being CRC participants, they have the opportunity to obtain a license to commercialise the CRCs research outcomes, before any of their competitors outside the CRC. These "first in line" rights to invoke technology transfer processes from the CRC, to the company participant is one of the most valued reasons for industry participation in CRCs. When an end user participant or commercialiser participant exercises these "first in line rights", typically, the following technology processes occur:

- (a) a license of the CRC's intellectual property in relation to which the right is exercised, is granted;
- (b) further research undertaken, either contracted research, or collaborative research, with the further outcomes also licensed.

83. Sometimes research is not only carried out by universities and research organisations, but in some projects, inventive and other creative contributions may be made as well by the industry participants. When this research collaboration occurs, technology transfer may occur in the opposite direction, from business participants, to universities and research organisations.

84. A 2012 report assessing the economic impact of CRCs concluded that since 1991 (when the program began) the measurable economic impact arising from the transfer of technology arising from CRCs, in the form of new products and services, and cost savings, had been \$14.45 billion. This was measured from only 62% of CRCs as data was not available from CRCs earlier in the program.

3.4 European Union – Joint Technology Initiatives

85. One of the European Union's Seventh Framework Programme components is encouraging collaboration between companies, universities and other research organisations, and government agencies. This is achieved by Joint Technology Initiatives (JTIs), which are aimed specifically at supporting large scale international research collaborations. The catalyst for the initiative was the report from industry representatives: JTI Sherpas' Group of High-Level Industry Representatives designing together the 'ideal house' for public-private partnerships in European research. JTIs were formed in response to the conclusion that individual research projects with a small number of collaborators resulted in research efforts being fragmented, and that research collaboration efforts organised on a larger scale, with coordination and integration were likely to result in better outcomes. There are five research themes that have been identified for JTIs, and these are:

- (a) Innovative Medicines Initiative (IMI);
- (b) Aeronautics and Air Transport (Clean Sky);
- (c) Fuel Cells and Hydrogen Initiative (FCH);
- (d) Embedded Computing Systems (ARTEMIS); and
- (e) Nanoelectronics Technologies 2020 (ENIAC).

JTIs are funded by:

- (a) the European Commission;
- (b) for some JTIs, some Member states that have joined particular JTIs; and
- (c) for some JTIs, some company participants.

86. Company participants in JTIs must provide by way of in kind contributions, at least 50% of each JTI's project's needs. Each JTI is a separate legal entity, with its own governance and management. Each JTI also calls for proposals for research, which are competitively assessed. By joining a JTI, industry participants effectively pool their resources, and as a result are able to achieve more by doing so, than by solely working on their own. Stressing international collaboration effort, while most participants in JTIs are European, there are many projects where collaborators from outside the European Community are included. Notwithstanding the large scale of each JTI and the participation of multinational companies, the participation of SMEs is

also sought and encouraged. Facilitating collaboration and networking between multinational companies and SMEs is also an objective of JTIs. JTIs being large scale research collaborations, there is also large scale technology transfer that takes place, by which the research outcomes of their collaborative efforts are licensed and made available for commercialisation.

3.5 China and Hong Kong – Guangdong–Hong Kong Technology Cooperation Funding Scheme

87. The aim of the Guangdong–Hong Kong Technology Cooperation Funding Scheme is to foster collaboration between enterprises, universities and research organisations in Hong Kong and the adjacent Guangdong Province. The scheme funds the following types of collaborations:

(a) Platform Projects. These must include at least two company collaborators which provide cash and or in kind of at least 10% of the project's costs. Intellectual property arising from a Platform Project must be owned by the lead applicant, which in practical terms will always be a research organisation, since company collaborators cannot be applicants for the funding of a platform project. Technology transfer processes in platform projects include:

(i) the grant of a license from a research organisation collaborator, to a company collaborator; and

(ii) the transfer of knowledge from the research organisation collaborator, to the licensed company collaborator, as a result of that license.

(b) Collaborative Projects. These must include at least one company collaborator, and all company collaborators between them must provide cash and or in kind contributions of at least 50% of the project's costs. Where a collaborator, including a company collaborator, contributes at least 50% of the collaborative project's costs, it may own the intellectual property arising from the project. In that case, technology transfer processes will be the transfer of knowledge from the research organisation collaborators, to the company owner of the intellectual property. Where no collaborator has contributed at least 50% of the project's costs, the intellectual property will be owned by the lead collaborator. In that case, technology transfer processes will include, for example:

(i) the grant of a license from a research organisation collaborator, to a company collaborator; and

(ii) the transfer of knowledge from the research organisation collaborator, to the licensed company collaborator, as a result of that license.

88. Some of the funded projects can be quite large. Any project which has a budget over HKD \$21 million must be approved by Hong Kong's Legislative Council.

89. There are two innovative features of the Guangdong–Hong Kong Technology Cooperation Funding Scheme:

(a) it mandates how intellectual property arising from the collaboration will be owned by the collaborators;

(b) it mandates that the criteria for ownership to pass from the research organisation collaborators to the company collaborators is that the company collaborator must have contributed cash and in kind more than 50% to the project's total cost.

The ownership of intellectual property can often be a sensitive, even a contentious issue amongst collaborators. Mandating an intellectual property ownership regime takes this

sometimes time consuming issue out of the negotiation. The collaborators, having to accept the imposed intellectual property ownership regime as a parameter, are left to focus on the more important terms of their technology transfer processes, that is, the terms of the license between them.

3.6 Ireland – Innovation vouchers

90. An innovation voucher operates like a cheque, drawn by a government agency, entitling the holder of the voucher, an SME, to use the “cheque” to pay for services provided to the SME, by a university or other research organisation.

91. The object of the innovation voucher is to build links between SMEs and universities and research organisations. A stated objective of innovation voucher programs is to create a cultural shift in SMEs’ approach to innovation. The voucher is for a relatively modest amount of money, but the modesty of the amount of the innovation voucher grant has contributed to it having become a very successful initiative. By way of example, in Ireland, vouchers are for €5,000. Only Small Enterprises are eligible for an innovation voucher. A Small Enterprise is a company with less than 50 staff, and with an annual turnover of less than €10m. Small Enterprises may apply for up to three vouchers, for three separate projects. One of the vouchers must be used in a project where the Small Enterprise co-funds half the project costs. Where Small Enterprises have a common concern, up to ten of them may pool their vouchers so that the amount funded becomes up to €50,000. The voucher is used by the Small Enterprise to pay for services from a university or other research organisations in Ireland, or Northern Ireland. There are 38 such universities or research organisations that have registered with Enterprise Ireland and are available under the program.

92. Some projects funded by the vouchers will assist the development or assessment of specific innovations and will therefore provide the opportunity for knowledge and technology transfer from the university or research organisation to the Small Enterprise. These may include the:

- (a) development of a new product or process;
- (b) development of a new business model; and
- (c) developing a new services.

Other projects are focused on training the Small Enterprise in innovation management, which is itself a knowledge transfer exercise. Other projects funded are the undertaking of an audit of a Small Enterprise’s innovations or technology.

93. The innovation voucher initiative commenced in Holland and has since spread throughout the world. Amongst the countries (or states or provinces) that have introduced a similar innovation voucher system are:

<u>Country-Province-State</u>	<u>Voucher Amount</u>
Alberta (Canada)	\$15,000
Austria	€5,000
Connecticut (USA)	\$10,000
Czech Republic	Kč 75,000 (~ €3,000)
Lebanon	€10,000
Lithuania	Lt 10,000 (~ €3,000)
Singapore	\$5,000
Victoria (Australia)	\$25,000
United Kingdom	£5,000.

94. The amount of the voucher has not been an impediment to the scheme's use or success. The innovation voucher has been described as an "icebreaker" which facilitates collaboration between small businesses and universities and research organisations, and therefore facilitates technology transfer between them. The "ice having been broken" as it were, many countries that have an innovation voucher program report a high level of follow on collaboration that proceeds after the initial innovation voucher funded project. But more than just follow on collaboration has occurred. Some countries report that 50% of innovation voucher projects additionally led to collaboration on new projects between the same collaborators. Innovation vouchers have as a result facilitated the following technology transfer processes:

- (a) the transfer of knowledge between a university or other research organisation, and the Small Enterprise, for each voucher issued;
- (b) the transfer of knowledge that occurs in follow on collaboration on the same project, and any resulting technology transfer, such as licenses, that may arise; and
- (c) the transfer of knowledge that occurs in new projects, and any resulting technology transfer, such as licenses, that may arise.

3.7 United States – Small Business Technology Transfer Program

95. The Small Business Technology Transfer (STTR) Program¹ has been operating in the United States since 1992. Under the program, each Federal Government Department whose research and development budget exceeds \$1 billion annually must apply 0.3% of its budget to the program. In coming years, that percentage will increase progressively until it reaches 0.45% in 2016.

96. There are five Departments which participate in the program: Department of Defence; Department of Energy; Department of Health and Human Services; National Aeronautics and Space Administration; and National Science Foundation. These Departments have very large budgets, so even a modest 0.3% increasing to 0.45% of the budget, is a very large amount of funding dedicated to the program. The Departments themselves administer the awards that they make, so the fields in which the awards are made are the fields that those Departments administer. Only small businesses with less than 500 employees can apply for funding under the program. To succeed in obtaining the competitive funding, the small business applicant must propose a project that must involve collaboration with a university or other non-profit research institution. The stated aim of the program is to expand private sector / public sector partnerships. In other words, the stated aim of the program is to foster the technology transfer processes that occur when collaboration occurs between business and universities.

97. The program operates in three stages. In the first stage, successful applicants are funded up to \$100,000 for one year, to establish the technical merit, feasibility, and commercial potential of the project. During this first year, the performance of the small business is also assessed. If the technical merit, feasibility, and commercial potential of the project is established, and the assessment of the performance of the small business in the first year is a positive one, funding in the second stage may be awarded of up to \$750,000 for up to 2 years. The third stage is not funded by the STTR program. It involves commercialisation efforts, and may involve funding from other sources.

98. A striking feature of the STTR program is that unlike other collaborative arrangements, where an industry collaborator sometimes only contributes money or in kind, a requirement of the program is that the small business and the research institution collaborate together at a

¹ <http://www.sba.gov/content/small-business-technology-transfer-program-sttr>

scientific or technical level. The program requires that the small business undertake not less than 40% of the required research and development, and that the research institution undertake not less than 30% of the research and development. The program therefore requires a scientific or technical contribution from the small business, not just monetary or in kind contributions. This feature perhaps makes the STTR program generate more technology transfer than other programs that promote collaboration between businesses and research institutions. A second striking feature of the program is the two phase structure of the program: a first phase which is modestly funded where the technical merit, feasibility, and commercial potential are assessed, as well as the small business's performance; and a significantly more generous second phase where the actual project is undertaken.

3.8 United Kingdom – Knowledge Transfer Partnerships

99. The Knowledge Transfer Partnership (KTP) program and its predecessor programs have operated since 1975. A KTP is a partnership between:

- (a) a company;
- (b) a university; and
- (c) an “associate” or “associates” who is or are postgraduate researchers, a university graduate, or another qualified person.

100. The purpose of the KTP is to facilitate the transfer of technology and skills that the company does not otherwise have access to. The associate is employed in a project for a period between 12 and 36 months. During that period, the associate is supervised by the university, as well as by the company. The dual supervision ensures that the Associate has access to the university's resources and supervision, for the project's benefit. As a result, there is ongoing transfer of knowledge, for the duration of the project, from the associate, and the university, through its resources and supervision, to the company. At any one time there are 800 to 1000 KTPs operating in the United Kingdom. Each KTP is funded an average of £60,000 per year. This represents approximately two thirds of the total project costs.

101. According to the UK's Technology Strategy Board, in the 2010-2011 year, companies that participate in KTP experienced, on average:

- (a) an increase in annual profit of over £240k;
- (b) 8 new jobs created;
- (c) investment in plant and machinery of over £105k;
- (d) commercial benefits from the application of intellectual property (27% of companies); and
- (e) plans for further collaboration (74% of companies).

102. The commercial benefits from the application of intellectual property appear to be a modest 27%. However, KTP is a broad program. Some associates can have business management, finance and human resource management expertise, while others have expertise in more technical areas such as manufacturing processes, product development and design, and more broadly research and development. All these are areas of knowledge transfer, although some lend themselves more than others to the development of intellectual property.

4. POLICIES FACILITATING ACCESS TO FINANCE

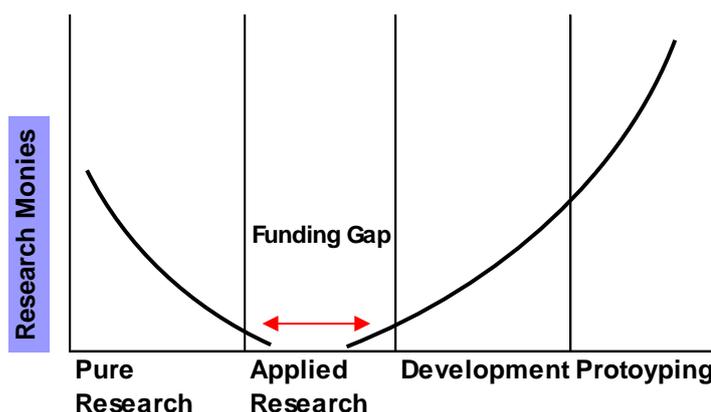
4.1 Policy objectives

103. A mature venture capital sector had existed in the United States for many years, and its interest extended to new technologies arising from cutting edge research and development. In the early 1980s however, there was an explosion of venture capital firms in the United States that invested exclusively in new technologies arising from such research and development efforts. Some specialised in investing in information technology projects, and others in biotechnology projects. This happened almost spontaneously in the United States, being the result of:

- (a) the mature venture capital sector that was accustomed to the unique funding model;
- (b) the rapid rate at which research and development pushed the boundaries into new technologies;
- (c) the passing of the Bayh-Dole Act in 1980, which for the first time allowed US universities to own the intellectual property that they created in projects funded by federal government funds, and therefore allowed them to protect it, manage it, and commercialise it; and
- (d) an entrepreneurial culture and willingness to take risks.

104. While the rapid rate of technological change was global, and while other countries did not necessarily need a Bayh-Dole Act, since grantees of government funding already owned the intellectual property they generated, there was not the same explosion in venture capital. This can be attributed to the absence of the mature venture capital sector that the United States already had, and a more cautious and risk averse entrepreneurial approach. A venture capital sector that is experienced and willing to assess and then take risks is critical to research and development and technology transfer.

105. The often referred to funding gap can be illustrated as follows:



106. The funding gap lies between:

- (a) public grant monies for research and development, most of which is available for basic or pure research, or theoretical research, and less of which is available for applied research, so that for most research and development, public money simply runs out before a stage where the research and development outcomes would be attractive to industry funders; and

(b) industry funding, which can be plentiful from licensees which license in technology that has reached a mature stage, but which are less likely to financially support and license in technology which is at a more infant stage of development.

107. At the funding gap:

- (a) there are no more public sources of funding for research and development;
- (b) there are not yet industry sources of funding; and
- (c) debt funding from banks and traditional lenders is not available.

108. It is at the funding gap that the venture capital sector plays a critical role. It steps in to fund research and development at a time when funding to progress research and development is generally not available from elsewhere. It is expensive money. This is in the sense that the rate of return that venture capitalists require, and the mechanisms to achieve that rate of return, will often result in the lessening of the value or stake of other stakeholders. Nevertheless the venture capital sector plays a critical role in innovation. But for the venture capital sector stepping in when there are no sources of funding elsewhere:

- (a) a worthwhile research and development project would have to cease; and
- (b) the technology transfer that would have happened had it continued, will not happen.

109. Witnessing the success of the explosion of venture capital investment into technology projects in the United States since the 1980s, other countries have sought to replicate that success. That has meant that they have had to adopt policies to ignite a non-existent local venture capital sector or a local one unaccustomed to speculative technology investment. An active venture capital fund sector helps to bridge the funding gap, while not for all, certainly for a lot of worthwhile research and development projects. As the research and development

continues with venture capital funding, technology reaches a stage where it can be applied to new products and services, whether by technology transfer processes to the staff of the company itself, or to licensees or assignees.

4.2 India – Policies fostering a venture capital sector

110. There have been a number of progressive policies in India over the years to ignite, and then nurture a local venture capital sector that would invest in research and development which would develop intellectual property that could be the subject of technology transfer processes and commercialisation. The beginnings of a venture capital sector in India can be traced back to the 1986-1987 budget, which introduced a levy of 5% on technology import payments. In other words, a withholding tax was introduced of 5% on royalty and other payments that Indian licensees had to make to licensors outside India. The monies raised by this levy or withholding tax formed the corpus of the first venture capital fund in India, which was managed by an Indian Government bank, the IDBI Bank. This was followed up in 1988 by the lowering of the capital gains tax rate payable by venture capital funds on the realisation of their investments.

111. In 1995 there was a further tax concession, and that was tax exemption on dividends and long term capital gains realised by venture capital funds from their investment in the manufacturing and information technology sectors.

112. In 2000 the venture capital regulatory environment was substantially reformed in India:

- (a) tax exemptions extended to all investments made by venture capital funds in all industry sectors;

- (b) venture capital funds could form as limited partnerships;
- (c) options granted to employees in technology companies would be taxed at the time of exit, and not at the time of the options being granted; and
- (d) restrictions on share swaps and option swaps from Indian companies to foreign companies were removed for the employees of a technology company.

113. This encouraged foreign venture capital funds to set up funds in India. It is understood that today there are some 300 active venture capital firms in India.

4.3 Australia – Innovation Investment Funds

114. Australia's venture capital sector was kick-started in 1998 when the Australian Government as a result of a competitive merit and skills based process selected five new venture capital funds that it would co-invest in, dedicated to investing in Australian technology companies. While there was up to that time a venture capital sector in Australia, its investment in technology research and development was very casual and infrequent, preferring to invest in management buy outs and other mezzanine financing opportunities. The first round of the Innovation Investment Funds (IIF) program selected five funds into which the Australian Government co-invested up to \$20 million, matching private sector investment into the fund. One fund's exclusive interest was investment in information technology. Another fund's exclusive interest was investment in biotechnology projects. The three remaining funds had broader interests across those and additional sectors.

115. This first round 1998 initiative was followed up in 2001 with a second round when the Australian Government co-invested with four new funds. A round styled a 3(a) occurred in 2010 when there was co-investment with 10 new funds. Another round styled as 3(b) occurred in 2011 when there was co-investment with 7 new funds. There have therefore been altogether 25 IIFs formed in Australia since 1998, with co-investment from Australian Government. That co-investment by Australian Government has been the kick-starting factor, without which the venture capital sector investing in technology may not have occurred. It has provided very attractive leveraging for investors into the venture capital fund, since each \$1.00 of their investment purchases \$2.00 of funds for investment by the fund. The IIF program kick-started a venture capital sector in Australia not just by funding 25 funds. The creation of those funds was the catalyst for more venture capital funds being formed, entirely with private sector funding, and without any Australian Government financial support at all, and today, these non IIF funds, by number, exceed the number of IIF funds.

116. Along the way, other incentives to nurture a venture capital sector have been implemented, including:

- (a) allowing limited partnership structures for venture capital funds;
- (b) concessional tax treatment of profits realised by venture capital funds; and
- (c) share and option schemes that tax at the point of realisation of profit, instead of when the shares and options are first granted.

5. POLICIES ASSISTING THE DE-RISKING OF R&D AND TECHNOLOGY TRANSFER

5.1 Policy objectives

117. From one point of view, all policies that provide incentives assist in the de-risking of research and development. The grants that are made, and the tax that is foregone, all underwrite research and development and therefore assist businesses to de-risk, or to lessen

the risks that are necessarily involved in undertaking uncertain research and development. But those policies described so far apply whatever the risk profile of a project, whether it is a low-risk project with a predictable outcome in the “late D phase” of research and development, or a high risk project with an unpredictable outcome in the “early R phase” of research and development.

118. The earlier the stage of research and development:

- (a) the greater the speculative nature of the research and development;
- (b) the greater the uncertainty of the course, and the outcome, of the research and development;
- (c) the higher the risk of technical failure; and
- (d) correspondingly, the greater the disincentive to proceed.

119. This makes an investment decision to support early stage research and development a difficult one to make. Or, for some businesses, a very easy decision to make: the decision being not to dedicate money and resources to the speculative research and development at all. These earlier stage projects need more de-risking if they are to be undertaken. Some policies are therefore aimed at providing incentives focused on these earlier phases of research and development, which unsupported, might be neglected. Again, supporting research and development supports collaboration, and in turn, supports technology transfer processes.

5.2 United Kingdom – Smart – Proof of concept funding

120. In the United Kingdom, the Smart program assists businesses de-risk their speculative research by making grants available for proof of concept work. Work that qualifies as proof of concept work includes:

- (a) initial feasibility studies;
- (b) proof of technical feasibility;
- (c) basic prototyping; and
- (d) in the area of biotechnology, pre-clinical research, including target identification and validation.

121. The duration of projects can be up to 18 months, and successful projects are funded up to 60% of the total project cost, with a maximum grant of £100,000. Businesses that are awarded proof of concept funding and establish the feasibility of their project, having de-risked their project, become more attractive investees for venture capitalists, and more attractive research collaboration partners for potential licensees. In these ways, proof of concept funding contributes to later technology transfer processes.

5.3 Europe – Proof of concept funding from European Research Council

122. The European Research Council (ERC) was formed in 2007 by the European Commission to fund competitive research in Europe. In 2007 the ERC launched its proof of concept program, recognising the need for follow on funding to its previous funded projects, which were not yet ready for technology transfer or commercialisation, and were not yet necessarily attractive for venture capital investment, or for potential licensees. Proof of concept funding is only available for current ERC projects, or projects funded by the ERC in the previous 12 months. The follow on proof of concept funding can award up to €150,000 for the purpose of bridging the gap between research and the earliest stage of a marketable innovation. The

purpose of the proof of concept funding is not limited to scientific or technical proof of concept. It extends to “commercial” proof of concept. Funds can be used for:

- (a) establishing the viability of a project, addressing technical impediments, and a project’s overall direction;
- (b) clarifying intellectual property rights;
- (c) obtaining advice and feedback;
- (d) connections for later stage funding; and
- (e) initial expenses of setting up a company.

6. GOVERNMENT PROCUREMENT POLICIES

6.1 Policy objectives

123. Governments are often the largest buyers of goods and services in a nation. As a large, or the largest buyer of goods of services, Governments are therefore uniquely placed to support innovation, and technology transfer, by those from which it purchases goods and services. By encouraging innovation amongst its suppliers, from which it would have to buy goods and services anyway, a large buyer like Government achieves a number of objectives simultaneously:

- (a) it acquires the goods and services it needs;
- (b) it can support particular groups in its economy, such as SMEs;
- (c) it can nurture and support innovation and entrepreneurship and be a catalyst for innovation;
- (d) its purchasing monies paid to a supplier can:
 - (i) provide capital to that supplier to complete an innovation and fully develop a product or service; and or
 - (ii) facilitate the supplier obtaining capital from other sources;with in each case this being capital which the supplier might otherwise have had difficulty in securing, or not have been able to secure at all, and
- (e) it facilitates technology transfer processes in at least two ways:
 - (i) some part, or even a major part of the procurement monies it pays to the supplier may be used as contract payments to universities and other research organisations or sub-contractors, who are engaged to complete the development, and from which there will be technology transfer to the supplier; and
 - (ii) there having been an innovation developed, there is the prospect of it being licensed in other fields, and to licensees in other countries.

124. For some sectors, such as defence, Governments might be the only buyers of goods and services. For these sectors, this places Governments as the only catalysts for innovation and technology transfer. Sometimes, innovations developed for defence purposes can have civilian applications, and this will involve technology transfer processes. Another way that Government

procurement influences research and development and technology transfer is that it may provide the funding for new industries, and therefore new technology transfer opportunities.

6.2 Finland – Innovations in Public Procurement Program

125. In Finland, a statutory body formed to promote innovative research and development in companies and research organisations, Tekes, administers the Innovations in Public Procurement Program. With €27 billion spent annually on procurement by Finnish government purchasing agencies, the aim of the Innovations in Public Procurement Program is to facilitate new products and services being developed, in three ways:

- (a) procuring new products and services that are not in the market at all, where the government purchasing agency requires an improved existing product or service (such as to meet more stringent environment or other requirements), or completely new products and services;
- (b) procuring pre-commercial products and services, when the government purchasing agency purchases research and development services aimed at developing a new product or service that it needs; and
- (c) the government purchasing agency assists in generating more extensive demand elsewhere in the market for a new product or service that may for example be in a prototype phase, by being the lead user and providing the test environment for the new product or service.

126. Tekes (which is itself a government agency) will fund up to 50% of the government purchasing agency's purchasing costs for approved projects, in that way de-risking the project, from the perspective of the government purchasing agency. A criteria upon which Tekes assesses funding applications is that the proposed project must impact upon the development of the sector that the project is in. The areas in which projects have been funded are energy and the environment, built-up environment and health and wellbeing.

6.3 Canada - Canadian Innovation Commercialization Program

127. The Canadian Innovation Commercialization Program was commenced with amongst its goals being that Canadian Government procurement processes would enable:

- (a) the award of procurement contracts to entrepreneurs with pre-commercial innovations;
- (b) Government to test the innovative goods and services and provide valuable pre market feedback to improve the products and services; and
- (c) entrepreneurs to have opportunity to enter the marketplace with successful new products and services.

128. At the same time as Government buying its required goods and services, the program also encourages:

- (a) the development of pre-commercialised goods and services by engagement and collaboration with universities and research organisations, therefore resulting in technology transfer processes; and
- (b) new innovative technologies that are candidates for commercialisation by technology transfer processes such as being licensed in other fields, or to licensees in other countries.

129. The program evaluates the stage of development of an innovation, and ranks what it calls an innovation's technology readiness level, with scores between 1 to 9, where a score of 1 indicates that the project is at basic concept stage. The program supports innovations in the following stages:

- (a) stage 7 – prototype ready for demonstration in an appropriate operational environment;
- (b) stage 8 – actual technology completed and qualified through tests and demonstrations; and
- (c) stage 9 - actual technology proven through successful deployment in an operational setting.

130. The projects that are supported are therefore late stage projects. There are four priority areas for funding under the program, which are:

- (a) environment;
- (b) safety and security;
- (c) health; and
- (d) enabling technologies.

6.4 Sri Lanka – ICT procurement and international technology transfer

131. Sri Lanka's ICT Agency (ICTA) is the country's largest buyer of ICT services, most government procurement of ICT services in Sri Lanka being channelled through it. This has given ICTA the opportunity to understand the ICT sector in Sri Lanka, and by its procurement policies, to foster and nurture that sector, as well as to internationalise it, with that resulting in the international technology transfer of knowledge and skills to benefit the Sri Lankan ICT sector. In tender evaluations, ICTA has allowed up to 15% of the total available score to local firms. This is permitted under the World Bank's rules in relation to tender evaluations in public procurement. This has given local firms a competitive advantage over international firms, and in turn, has operated to encourage local firms and international firms to form joint ventures to bid for ICTA's tenders. In turn, those joint ventures have resulted in international collaborations that have resulted in technology transfer from the international firms, to the local Sri Lankan firms. Local Sri Lankan firms have, as a result, benefitted from the knowledge and skills acquired as a result of that technology transfer having taken place. The United Nations 2013 Report "Promoting Local IT Sector Development through Public Procurement" reports that as a result, over 90% of ICTA's projects are delivered with a local Sri Lankan ICT firm. More than this, Sri Lankan ICT businesses compete internationally to be engaged to undertake ICT related work. Sri Lanka's ICT sector has therefore become an exporter.

6.5 United Kingdom – Small Business Research Initiative

132. Under its Small Business Research Initiative, United Kingdom's Government departments are encouraged seek out new innovative solutions to public sector needs, by

- (a) setting a challenge requiring an innovative solution;
- (b) inviting applications from small business for new ideas and technologies;
- (c) assessing the applications, and awarding developing contracts to the most promising, with awards up to £100,000 for a feasibility phase of generally two to six months; and

(d) assessing the results of that feasibility phase, and selecting the most promising for the award of a second stage contract of up to £1,000,000 over a period up to two years, which generally will be to develop a prototype.

The small business that successfully develops the prototype is then expected to proceed to commercialise it.

7. POLICIES ENCOURAGING UNIVERSITY / BUSINESS ENGAGEMENT

7.1 Policy Objectives

133. An obstacle to technology transfer occurs when there is a limited or only a casual interaction between research organisations and businesses, or, on some occasions, no interaction at all. The limited or no interaction means that technology transfer that might otherwise have occurred, does not take place. As a result, opportunities for technology transfer, whether formal opportunities such as licenses and research collaborations, or less formal opportunities such as human resource development, do not occur.

134. When interaction or engagement between research organisations and businesses takes place, each naturally becomes better informed about the other. Research organisations become better informed about the technical and scientific needs of businesses, and will be able to recognise and instigate opportunities for providing consulting or technical services, providing contract research services, undertaking research collaborations, as well as opportunities for licensing their technology, and spinning out companies. Each of these has the potential to leverage each of the others. The provision of consulting services or contract research services often acts as a catalyst for research collaboration, license, or spinning out more companies. The grant of a license could act as a catalyst for ongoing contract research.

135. Similarly, a business becomes better informed about the capabilities of the research organisations in proximity to it, so that when a need arises for technical or consulting expertise arises, or for contract or collaborative research, the business knows which research organisations are best placed where it can access these.

136. The key is to promote engagement between research organisations and businesses. With that engagement, each becomes better informed about the other, and its needs and capabilities. Policies that either directly or indirectly foster and promote engagement between research organisations and businesses, while perhaps not directly fostering technology transfer, nevertheless foster the creation of a climate or landscape where technology transfer opportunities can arise, that otherwise might not have arisen.

7.2 Directory of expertise

137. Many universities and research organisations maintain a directory of expertise, or some other similarly named database. The directory or database contains details of their staff that are available to undertake consultancy services, or research services, often with links to the profile pages of staff members which expands upon the description of their expertise, and describes their past research and consultancy assignments. These directories or databases are an excellent resource for businesses to locate accessible researchers with expertise in the areas sought. Without these directories of expertise, businesses may not find the expertise that they may need to seek. With these directories of expertise, consulting engagements occur, and very often, these act as a catalyst for more consulting services, research services, and research collaborations all of which involve technology transfer. As well, all of these can act as catalysts for licenses and spin out companies.

7.3 South Africa - Science and technology park

138. Another way that universities and research organisations promote industry engagement, and therefore opportunities for consulting services, research services, collaborative research, licensing, and spinning out companies, is by having a science and technology park located in proximity to their own campus. The proximity between the two is inevitably a catalyst for interaction and engagement between the companies located in the science and technology park, and the nearby university or research organisation. The proximity can make that interaction a very intimate one. That intimacy can lead to opportunities for consulting services, contract research services, and collaborative research. That intimacy, as well as those engagements, can also lead to license opportunities and the spinning out of companies. Science and technology parks located in proximity to a university or research organisation are also sites that are naturally attractive for the location of the university's or research organisation's spin out companies. That proximity between the spin out company and the campus from which it was spun out can also ensure that the intimate relationship between the spin out company and the campus remains a close one, again encouraging continued technology transfer between them.

139. An outstanding example of such a science and technology park is Technopark, located in Stellenbosch, South Africa. It was started in 1985 at the suggestion of nearby Stellenbosch University's Dean of Engineering. Today, it boasts 40 technology companies, 19 engineering companies, 11 design companies, 8 manufacturing companies, and 22 software companies, which either already do, or have the prospect of collaborating with the nearby Stellenbosch University, which is only 4 kilometres away. The companies at Technopark not only support research and technology transfer with the university, but support their own local economy as well, with other non-technology business being located within the park, including hotels, restaurants, banks, lawyers and accountants etc).

7.4 Saudi Arabia – Industry “first peek” rights and engagement

140. The King Abdullah University of Science and Technology in Jeddah has a program it calls the Centre Industry Affiliates Program. Under the program, companies are able to join as members. Each company pays an annual membership fee of \$30,000. Company members enjoy a number of rights, including:

- (a) “first peek” rights, that is the right to be informed about invention disclosures before any company that is not a member;
- (b) access to research outcome and research results in projects; and
- (c) the ability to support research of their interest, either solely or in collaboration with others.

141. “First peek” rights means that the company members are first in the cue to assess and consider any commercialisation opportunity that arises from the university's research outcomes. Access to research outcomes means that company members may, in relation to specific projects, be granted limited use rights to research outcomes. The ability to support research can take a number of forms, supporting university research non-financially, contributing a part of the costs of research, or contributing the whole of the costs of research, with different levels of contractual rights, depending upon which of these is selected. A fourth indirect benefit for both company members and the university is that the program is the focal point for relationships between the university and industry to be built and nurtured. These networking opportunities result in the informal engagement between the university and businesses that can be a catalyst for more technology transfer opportunities.

7.5 Tanzania – SME incubators – “incubators without walls”

142. The University of Dar Es Salaam has a College of Engineering and Technology (CET) which has developed and nurtured an extensive incubator network for small and medium enterprises (SMEs). Rather than an incubator focused in a building, that is, an “incubator with walls”, CET instead has implemented an “incubator without walls”. As a result, rather than SMEs being co-located in a physical building and nurtured and technically assisted, reaching a point of graduation from the incubator, at which time they are expected to leave the incubator to make room for another business, CET’s incubator takes the mentoring and the technical assistance to the SME’s existing physical location, from which it grows its business.

143. There are three incubator centres: Kibaha located 40 km from Dar es Salaam (serving some 4500 SMEs); Morogoro located 200 km from Dar es Salaam (serving 19 SMEs), and Lushoto located 600 km from Dar es Salaam (serving 32 SMEs). Each Centre is the focal point of a large group of entrepreneurial SMEs, whose businesses are mostly in agricultural products, and food processing.

144. The technology transfer that takes place between CET and the SMEs is principally good manufacturing practice and production techniques. Additionally, technical advice is given, including in relation to the development of new manufacturing products. An example of such a new product that has emerged from the “incubator without walls” is a solar powered vegetable drier. CET also provides to the SMEs courses on entrepreneurship, access to markets, and access to finance.

7.6 Thailand – Access to biodiverse resources

145. Countries with biodiverse resources of interest to biotechnology and pharmaceutical companies for drug discovery can leverage their resources to assist them to secure an increased level of engagement with businesses, and with that increased engagement, the transfer of technology. Sometimes, countries with biodiverse resources simply permit biotechnology and pharmaceutical companies to take extracts and samples of their biodiverse resources, with little or no compensation, or only the prospect of compensation, in the form of a modest royalty, if 10 to 15 years later a drug might be developed. The prospect of financial reward can therefore be quite remote. Thailand’s agreement with Novartis AG provides a good case study of how biodiverse resources can be leveraged for more immediate technology transfer benefits.

146. Thailand is a country rich in biodiverse resources. It is estimated that Thailand has 7 to 10% of the world’s biodiverse resources. This is a significant national resource for Thailand. Thailand adopted a policy that it would require companies seeking to exploit its biodiverse resources to enter into a Benefit Sharing Agreement. But the Benefit Sharing Agreement was not to be confined to the relatively remote long term prospect of royalties if a drug should be developed. Additionally, Benefit Sharing Agreements would make provision to enable Thailand to capture immediate and short term technology transfer benefits. The Benefit Sharing Agreement between Thailand’s National Centre for Genetic Engineering and Biotechnology (BIOTEC) and Novartis provides an excellent example of immediate and short term technology transfer benefits. Under the agreement:

- (a) Novartis provides specialist training to nine of BIOTEC’s scientists, training them in the areas of drug development chemistry and screening, with that training taking place at Novartis’ research laboratories in Basel, Switzerland;
- (b) Novartis provides its staff to visit BIOTEC in Thailand to provide training to them at BIOTEC’s laboratories in Thailand; and

- (c) Novartis makes payments to BIOTEC for its collaboration with Novartis, which BIOTEC can apply in the purchase of specialist laboratory equipment.

The technology transfer benefits to BIOTEC include:

- (d) increased skills of the 9 staff trained by Novartis;
- (e) skills transfer to the colleagues in BIOTEC of those 9 staff trained by Novartis; and
- (f) the application of those skills at BIOTEC to develop new and improved testing assays, microbial extract management systems, and screening systems.

147. The benefit sharing arrangements between Novartis and BIOTEC enable technology transfer in the form of new knowledge and skills that are immediate, and which benefit all of BIOTEC's research efforts.

8. POLICIES FOSTERING INTERNATIONAL TECHNOLOGY TRANSFER

8.1 Policy objectives

148. Technology transfer from one country to another has the prospect of improving the economy of the recipient country, generating employment, earning export income, as well as increasing the recipient country's income base from which it can levy taxes. It also skills up the workforce of the recipient country, enabling the skilled up workforce to transfer its skills to additional applications or industries. It may also be a platform for research and development in the recipient country, to improve it, or to modify or adapt the imported technology to local conditions. All of these will further improve the economy of the recipient country, providing more employment, earning more export income, and further increasing the recipient country's income base from which it can levy taxes.

149. There are four principal ways that international technology transfer takes place:

- (a) Licensing. The most direct form of international technology transfer occurs when a licensor grants a license of its technology to a licensee in another country;
- (b) International trade. The import of goods, particularly capital goods and technological goods into a country gives the importing country to opportunity to imitate the technology, reverse engineer it, decompile it, or otherwise to learn and acquire knowledge about it. That knowledge might then be employed to replace the import, or it might spillover into other industries, benefitting those other industries. Indirect international technology transfer in this way is credited with contributing to the rapid technological advancement of Japan, South Korea and Taiwan (Province of China) which developed beyond being technology imitators to become technology innovators;
- (c) Foreign direct investment. This occurs when international businesses set up facilities or a subsidiary in another country. The recipient country's employees working in those facilities will be likely to learn and acquire knowledge which again might spillover into other applications and other industries; and
- (d) Mobility of skilled labour. When skilled workers move from one employer to another employer, they take with them the skills and experiences that they acquired with their former employer, and apply those skills and experiences in the new position with their new employer.

150. International technology transfer from business in one country, to business in another country, is normally driven by commercial objectives. Businesses therefore normally need a commercial or economic basis for their decisions, and this is all their decisions, including

decisions to transfer technology from one country to another. To consider the fostering of international technology transfer, we therefore need to consider policies in recipient countries (developing countries and least developed countries) as well as transferring countries (developed countries).

8.2 The role of the TRIPS Agreement - Article 66.2

151. Article 66.2 of the Agreement on Trade Related Aspects of Intellectual Property Rights (“TRIPS”) provides:

Developed country Members shall provide incentives to enterprises and institutions in their territories for the purpose of promoting and encouraging technology transfer to least-developed country Members in order to enable them to create a sound and viable technological base.

152. As a statement of an objective, Article 66.2 is well framed. But Article 66.2 specifically, and the TRIPS Agreement more generally, lack any substantive provisions dealing with how that objective is to be achieved. As a result it leaves many questions unanswered, including what exactly does “technology transfer” encompass, as that phrase is employed.

153. In developed countries, technology transfer is often associated with patent licensing. But very often, in developing and least developed countries, patents have not been sought by the multinational companies which between them own some 90% of patents, and therefore have not been granted in those countries. From the perspective of these multinational companies, they cannot engage in technology transfer by licensing technology to developing and least developed countries when they have no patents in those countries to license. However, in developing and least developed countries, technology transfer is considered in broader terms, not confined to patents nor to licensing, but to the acquisition of technology related know-how, and most importantly, of technology related skills. Neither Article 66.2 nor TRIPS are helpful in relation to these aspects.

154. Technology transfer, particularly in this broader sense, encompassing the transfer of technology know-how and technology skills can occur when a foreign company establishes manufacturing facilities in developing and least developed countries. This contributes to economic growth by providing employment, earning export income, increasing the tax base, and does the same over again when that know-how and skills spills over to other industries. But multi-national companies will not just set up manufacturing facilities anywhere. They need prospective country locations to meet certain criteria for them to be incentivised to make the investment of constructing a new manufacturing facility in a developing or least developing country:

- (a) A strong intellectual property regime in a country of interest will be critical. It will not by itself provide the whole incentive to establish in that country, but its absence will operate as a strong disincentive to do so;
- (b) A reliable legal framework and court system similarly will also be critical. Again, it will not by itself provide incentive, but their absence will again operate as a strong disincentive;
- (c) A stable economy and a stable political system will again be critical. And again, these will not by themselves provide incentive, but their absence will operate as a strong disincentive;
- (d) The size of the market to be satisfied by the proposed facility will determine the economic viability of establishing the manufacturing facility;

- (e) Access to a skilled workforce, or a workforce that can be skilled up, supported by the required school and higher education systems, as well as research and development capability, is a strong factor influencing the selection of one location over another; and
- (f) Having natural resources, reliable utilities and a reliable transport network are also essential in the selection of one location over another.

Fiscal incentives by themselves will not incentivise a foreign company to set up manufacturing facilities in a developing or least developed country when these essential criteria are absent. At best, fiscal incentives will assist in the selection of one country amongst several, all of which meet these essential criteria.

155. Article 66.2 has not lived up to the expectations that developing and least developed countries were given by its inclusion in TRIPS. This has generated much disappointment. Efforts since the TRIPS Agreement to bring clarity to Article 66.2, and to explore ways of implementing the objective it states have sometimes been modest only, again generating much disappointment. If the laudable objective expressed in Article 66.2 is to be achieved, greater effort needs to be made to formulate pragmatic and workable ways to implement that objective.

8.3 Kenya – Export Processing Zones

156. In Kenya, there are over 40 Export Processing Zones. Businesses are attracted to locate within these zones by their infrastructure, which has been designed to meet the needs of manufacturing and exporting businesses, the operating environment in the zones, as well as an attractive package of fiscal incentives, which include the following:

- (a) income tax exemption for 10 years, followed by a reduced corporate tax rate of 25% for a further 10 years;
- (b) withholding tax exemption on dividends paid to foreign shareholders for 10 years;
- (c) withholding tax exemption on royalties paid under intellectual property licenses, for 10 years;
- (d) Value Added Tax exemption and customs duty exemption on imported raw materials, plant and equipment, building materials etc;
- (e) Value Added Tax exemption on goods and services purchased domestically, including utilities;
- (f) stamp duty exemption on leases and other legal documents; and
- (g) investment allowance deduction on capital expenditure for buildings and plant and equipment.

157. Some 40,000 workers are employed in the Export Processing Zones, contributing to 10% of Kenya's exports. Domestic Kenyan companies are eligible to locate in the Zones, but so are foreign companies, and 80 such foreign companies have been attracted to Kenya and to locate within the Zones. These foreign companies bring technology and know-how with them, and skill up their workers with skills that they can apply later in other industry sectors.

8.4 Africa Knowledge Transfer Partnerships

158. The Africa Knowledge Transfer Partnerships is an initiative of the British Council involving British universities transferring technology to companies initially in Ghana, Uganda, Kenya and Nigeria. The program is expanding to Rwanda and South Africa. The aim of the Knowledge

Transfer Partnerships is to transfer technology, scientific knowledge, and skills to companies in those African nations, to improve their productivity and competitiveness. The British Council is a charity, but the Knowledge Transfer Partnerships is wholly funded by the British Government.

159. Under the program, a partnership is made between a British university and an African company to implement a selected innovative project. The project is undertaken in Africa by one of the university's recent graduates. A project needs to be initiated by an African company, so it is a demand driven program. Typical projects may involve the improvement of a product's quality, new product innovations, or the improvement of a production process. The graduate, supervised by both the university and the company, undertakes the project as an employee of the African company for a two year period, transferring knowledge and skills from the British university to the African company. The areas where projects have been undertaken include information technology, agriculture, chemical engineering, and food processing.

8.5 Tunisia – USAID funded skills development expanding manufacturing capability

160. USAID is the United States' foreign aid program, providing aid to developing and least developed countries. A large number of its projects are in the areas of health, education, and agriculture. Increasingly, attention is focused upon funding projects that will promote economic development. The Plastic Electromechanic Company (PEC) is a company in Tunisia which commenced in 2003, manufacturing automotive parts and components for the European car industry.

161. A USAID project aimed at improving employment opportunities, particularly for women, and accelerating economic growth in Tunisia was commenced with PEC. The project funded training and skills development for 300 new staff, 80% of which were women, for new product lines in the medical products sector. The program was therefore responsible for the transfer of new skills and know-how to the 300 new staff, and the creation of 300 new jobs. A spillover of the project is that the performance of other parts of PEC's manufacturing operations improved with the efficiencies learned, and the introduced culture of continuous improvement.

9. POLICIES ASSISTING UNIVERSITY / INDUSTRY NEGOTIATIONS

9.1 The need for assistance

162. Two Government reports in two countries, almost a decade apart, examined the major obstacles to university / industry collaboration. The obstacles in both countries were not dissimilar, despite the passage of time.

163. In the United Kingdom, the Lambert Report in December 2003 attributed a major obstacle to university / industry interactions being their perceptions and expectations about intellectual property.

164. When establishing collaborative research partnerships it is important to determine at the outset the ownership and exploitation rights for any intellectual property (IP) that may be generated. Business and universities both report that negotiations on the terms and conditions of IP ownership and exploitation can be extremely lengthy and costly... Smaller companies may be deterred from establishing such research partnerships because of the high legal costs and time involved. (Lambert Review of Business-University Collaboration, Final Report, December 2003, paragraph 3.36)

165. In Australia, the Advisory Council on Intellectual Property, in its September 2012 report made not dissimilar observations:

Respondents often confused IP with other issues involved in collaborations. They were using IP as a catch-all term to describe problems associated with many of the commercial

issues that arise in transactions and negotiations. Where the issues raised did relate to IP, they involved the underlying negotiation position and lack of knowledge about IP. (Collaborations between the Public and Private Sectors: The Role of Intellectual Property, Final Report, September 2012, p5)

166. The Lambert report made this observation:

Business told the Review that universities could be more dynamic in their approach to collaboration. The perception is of a sector that can be slow-moving, bureaucratic and risk-averse. One business leader, describing a collaborative research project, said: "It took three years to get off the ground and required old-style influencing and persuading to bring all the necessary university people to agreement. While this was just possible for a company of our size, it would have been impossible for small and medium-sized enterprises". (Lambert Review of Business-University Collaboration, Final Report, December 2003, paragraph 8.03).

167. In Australia, the Advisory Council on Intellectual Property in its report identified the following as amongst the sensitive issues that caused obstacles in the formation of university / industry collaborations, where there was a lack of alignment between them:

- (a) how intellectual property arising from the collaboration should be owned;
- (b) the commercial rights that might attach to the intellectual property arising from the collaboration;
- (c) the scientist's ability to publish;
- (d) the allocation of commercialisation risks;
- (e) inexperience on IP issues generally amongst those tasked to negotiate the terms of collaborations; and
- (f) inflexible position setting amongst those tasked to negotiate the terms of collaborations.

168. These are just some of the matters that are impediments to university / industry relationships being formed. The degree to which they impede, regrettably, sometimes deters some businesses from seeking to engage with universities again. If these impediments could be removed, or at least lessened, to assist universities and industry to efficiently reach a fair agreement, then:

- (a) the extent of collaboration and engagement between universities and business would increase; and
- (b) necessarily, as a result of that, there would be an increase in the technology transfer that would take place between them.

9.2 United Kingdom – Lambert Toolkit

169. There are policies that promote increased awareness and skills amongst IP professionals to better equip them in the process of negotiating the terms of collaborations. There are also many programs that provide the skills development that is sought. One innovative policy that arose in the United Kingdom as a result of the Lambert Report, was the formulation of the Lambert Toolkit, which comprises:

- (a) model agreements to assist both universities and businesses in their negotiations;
- (b) agreement outlines that describe the major issues that need to be addressed in collaborative relationships; and
- (c) a decision guide tool that in a question and answer format helps a user assess certain aspects of the relationship between a university and a business for a specific project (whether contract research, consultancy, collaborative research) and suggests how universities and businesses might consider dealing with some of the sensitive issues that would need to be addressed in their agreement.

170. The model agreements are sometimes used. Their major value is that they are an example of how to provide for and deal with sensitive issues between universities and industry. That, combined with the decision guide tool and agreement outlines is understood to have provided much assistance to universities and business, and facilitated their negotiation of their collaborative relationships. In turn, those collaboration agreements have effectively provided for the technology transfer that will take place between the university and the business. Each time universities and business collaborate and deal with each other, they each obtain a better understanding of the other, and they develop models that will assist them to deal with and find solutions to sensitive matters in future transactions. Regrettably, this seems to rarely become part of the corporate knowledge of organisations, as knowledge of these models and strategies to navigate solutions for sensitive issues seem to dissipate when staff move on. New staff, without the benefit of that corporate knowledge, enter the field of negotiating university / industry relationships, and have to re-invent these models. It is for those new staff that the Lambert Toolkit can be particularly valuable.²

10. CONCLUDING REMARKS AND RECOMMENDATIONS

171. In each country there are competing needs for the financial support that Government is able to allocate. A difficult task is seeking to balance financial support to immediate and short term needs such as health, education, agriculture, and long term needs, such as economic development. The financial support of research and development and technology transfer is a long term need, but investment into it can help alleviate future immediate and short term needs. Supporting research and development and technology transfer, in the long term will help, for example:

- (a) create jobs;
- (b) earn export revenue;
- (c) replace imports; and
- (d) enable a broader base from which to raise taxation revenues.

Least developed countries and developing countries undertake the balancing task referred to with greater difficulty than other countries.

172. All the categories of policies described, to some degree, with or without modification, can be applied to least developed countries, as well as to developing countries. The task of balancing support for immediate and short term needs, and support for long term needs, can perhaps be made easier for least developed countries and developing countries by prescribing some of the policies considered here, with modification.

² The Lambert toolkit can be found at <http://www.ipso.gov.uk/lambert>

173. In doing so it is important to remember that not all developing countries are at the same stage of economic development, nor are all least developed countries at the same stage of economic development. There is therefore no “one size fits all” policy that they can all adopt and benefit from. For example, a developing country that has capacity to take foreign innovations, imitate them, improve them and adapt them, may well consider fiscal incentives and demand side grants as a way of stimulating new novel local innovations, particularly those with employment creating and exporting potential. But implementing fiscal incentives and demand side grants in a least developed country without the industrial capacity to imitate, improve and adapt might not yield the same economic advantages.

174. In developed countries some of the policies described are implemented with varying degrees of assessment of the merit of specific projects that seek to benefit from the policy. They vary between:

- (a) no assessment at all, leaving all eligible applicants to benefit from the policy, without any merit assessment, with the result that some might not have been able to demonstrate merit;
- (b) assessment at the outset, but lack of ongoing assessment while the funded project is being undertaken, with the result that ongoing merit may not have been able to be demonstrated; and
- (c) assessment at the outset, as well as during a project, so that for the project to continue to be supported, ongoing merit needs to continue to be demonstrated.

175. Two programs described earlier illustrate the assessment of a project at the outset, as well as in the course of the project. In the United States the Small Business Technology Transfer Program (see 3.7) operates with:

- (a) an initial assessment of merit to select projects to enter the first phase,
- (b) a first phase of funding, which is modest, during which assessments continue of:
 - (i) technical merit, feasibility, and commercial potential; and
 - (ii) the performance of the small business; and
- (c) a second phase of funding where the actual project is undertaken.

176. In the United Kingdom, the Small Business Research Initiative (see 6.5) works in a similar way:

- (a) applications for funding are assessed on merit, from which projects for funding are selected;
- (b) in the first phase awards are made to fund an initial feasibility phase of two to six month; and
- (c) subject to the results of that feasibility study, a second phase may provide funding for up to 2 years.

177. In least developed and in developing countries, to help the difficult task of balancing support for immediate and short term needs with support for long term needs, the implementation of some of the policies described could be undertaken with similar phases:

- (a) an initial assessment of merit to select projects that will receive modest funding for feasibility studies;

- (b) funding in a first phase being confined to a testing or feasibility stage; and
- (c) subject to an assessment of the results of the testing or feasibility, that funding continues.

178. An approach such as this would ensure that businesses and research organisations that sought to benefit from the policies had projects with the greatest likelihood of achieving the long term benefits sought. It would also help to screen candidate projects so that those projects with the greatest likelihood of success, and which were therefore more likely to achieve economic benefits, were preferred to those which were assessed as less likely to accrue those benefits. This two stage assessment approach would concentrate the financial support of projects to those with the greatest merit and likelihood of success. The assessments would have to be robust and objective. If the assessments failed to be robust and objective, then apart from failing to concentrate the available financial support for projects with the most merit, and as a result perhaps funding projects that lacked merit, the cost of carrying out the assessments would of itself deplete the available financial support. All the policies mentioned, and the examples of their implementation could be adopted by least developed, and developing countries. They could be adapted to introduce robust assessment processes, not just in the project selection phase, but during the project as well.

179. As well, developing countries and least developed countries could seek to collaborate with European Union (EU) research organisations in the European Commission's framework program for research and innovation. The Seventh Framework, which ends on 31 December 2013 has had, as one of its objectives, international collaboration between EU and non-EU countries. This is expected to be a feature of the European Commission's new Horizons 2020 program, which in 2014 replaces the Seventh Framework.

180. In relation to international technology transfer from developed countries to developing and least developed countries, so little having been done, so much needs to be done. A significant impediment is that given the factors in paragraph 151, companies in developed countries cannot easily assess opportunities in developing and least developed countries. Another significant corresponding impediment is that developing and least developed countries cannot easily assess what opportunities they might have, or which they could create for foreign companies. In other words, companies may just simply not know where their opportunities in developing and least developed countries might lie, and developing and least developed may similarly not know what opportunities there may be.

181. This is an area where the international aid programs of developed countries could play a role. Their programs supporting projects in the areas of health, education and agriculture etc could be complemented by a program that aims to:

- (a) identify:
 - (i) opportunities in developing and least developed countries for foreign companies to enter, where their doing so will bring technology transfer, employment opportunities, export opportunities, etc;
 - (ii) foreign companies that may be both capable of, as well as willing to take advantage of those opportunities
- (b) match the opportunities with the companies; and
- (c) facilitate the introduction of the company to the opportunity and facilitate the company's implementation of the opportunity, for example;

(d) where the opportunity is to set up a manufacturing facility in a developing or least developed country, facilitating compliance and administrative requirements in the developing or least developed country where the opportunity will be pursued; and

(e) where the opportunity is to license intellectual property, broadly considered, including know-how, facilitate the negotiation and completion of the license.

182. Additionally, developed countries could consider providing incentives to support and encourage companies to participate in such a program, such as foreign earnings from those opportunities being exempt from income tax for say 10 years. This foregone taxation revenue would otherwise not have been received anyway, so in a sense it is a “free” incentive, nothing having been foregone. But the foreign company, as well as the developing and least developed country, benefit.

183. Article 66.2 of the TRIPS Agreement having been so neglected for so long, it may be time for new and imaginative programs to be formulated to implement the laudable objective that Article 66.2 states.

FURTHER READING

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[Annex II follows]

REVIEW OF STUDY (D): PHILIP MENDES, “POLICIES FOSTERING THE PARTICIPATION OF BUSINESSES IN TECHNOLOGY TRANSFER”

REVIEWER: DR. NIKOLAUS THUMM, EUROPEAN COMMISSION JOINT RESEARCH CENTRE, SEVILLE, SPAIN

STRUCTURE

The report is clearly structured and comes up with a good readability. The executive summary could be expanded. As the executive summary reads now it is more an introduction. Very good overview on means of technology transfer in general.

MAIN IPR CONTRIBUTION

The focus is on technology transfer. In case WIPO would like to have a more specific focus on the role of IPR with technology transfer, this would still have to be elaborated.

ELEMENTS MISSING

Most examples are on government incentives for investments in research and development not technology transfer mechanisms specifically. More R&D might transform into more technology transfer but this is not necessarily the case given that the innovation process is not a linear input/output process. More complex structures are at stake. This is precisely where e.g. the role of IPR comes into the play. These elements could be elaborated further.

IPR GUIDANCE FOR POLICYMAKERS

More IPR focus if desired by WIPO, cf. above.

OVERALL ASSESSMENT/RECOMMENDATION

Good overview and country samples.

Please revise the executive summary and include the main findings of the report.

If desired by WIPO, please elaborate further the specific role of IPR for technology transfer.

[End of Annex II and of document]