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国 际 高 等 教 育

中国大陆地区建设世界一流大学

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过去 30 年间，中国的社会经济发展和转型引发了高等教育史无前例的变革。无论是政府还是大学，在政策上都很重视“世界一流大学”这个概念。中国的高等教育改革有很多理念，提高顶尖大学的自身能力和国际竞争力就是其中之一，相关的政策计划包括“211 工程”和“985 工程”。

不过，中国其实早在 19 世纪末就怀有建设发展世界一流大学的梦想，并一直持续至今。在中国最早的一批大学中，部分大学曾以强国强教为己任，如北洋大学（建于 1895 年，现名为天津大学）、南洋公学（建于 1896 年，现名为上海交通大学）、京师大学堂（建于 1898 年，现名为北京大学）和清华学堂（建于 1911 年，现名为清华大学）。而国家对顶尖大学的支持和重点建设则可以追溯到 20 世纪 50 年代，当时教育部确立了六所“重点大学”。从那以后，“重点大学体制”开始形成发展，并对中国的高等教育结构和改革产生了深刻影响。一直以来，这些重点大学为提高中国高等教育的质量做出了重要贡献，它们也成为经济转型中对接国家需求的工具。

20 世纪 80 年代即中国改革开放之初，政府就将“科教兴国”纳为基本国策。90 年代，高等教育开始扩招和改革，大批高技术人才走出校园，在某种程度上满足了经济发展对技术和人才的需求。然而，政府同时也意识到国家在知识创造和创新上相对缺乏竞争力，这就要求国家全面地提高高等教育的质量。这就是中国提出建设世界一流大学和高水平研究型大学的背景。

“211 工程”

“211 工程”从 1995 年开始启动，目的是到 21 世纪初建设 100 所大学和一批重点学科，为中国的社会经济发展和全球竞争做准备。该资助计划主要集中在四个方面：学科建设和交叉学科建设，校园信息化建设，师资建设，以及大学基础设施建设。与新中国成立后的其它重点大学的建设计划相比，这不仅是对高等教育领域资助面最广、规模最大的一个计划，它的整体财政拨款额度及层次也是最高的。

在前两个阶段，即 1996～2000 年以及 2002～2006 年，中央政府、地方政府和相关大学共投入 368.3 亿人民币（约 54.4 亿美元），其中中央政府出资 78.4 亿人民币（约 11.6 亿美元）。45%的经费被用于学科发展，29%的经费被用于基础设施建设，19%的经费被用于校园信息化建设，7%的经费被用于师资建设。

在“211 工程”的支持下，中国的高水平大学在基础设施等办学条件上得到极大的改善，大学的整体实力得到显著提升。然而，由于该工程资助的大学和研究中心过多，单个大学能够获得的经费其实相当有限，这就降低了该工程的影响力。

“985 工程”

为了进一步加大对高等教育的公共拨款，中国政府于 1998 年启动了“985 工程”。该重点建设计划再一次反映出政府在提升中国高等教育国际地位上的愿望和努力。教育部发布了《面向 21 世纪教育振兴计划》，确定实施“985 工程”，其目的是建设一批世界一流大学和卓越的研究机构。“985 工程”旨在“通过管理体制创新，运行机制创新，积极探索世界一流大学建设的新机制；造就和引进一批具有世界一流水平的学术带头人和学术团队；重点建设一批科技创新平台和哲学社会科学创新基地，促进一批世界一流学科的形成。”目前，“985 工程”已经完成两期建设（前两期分别为 1999～2001 年及 2004～2007 年），进入第三阶段（2009 年至今）的建设。

至今，“985 工程”已经资助了 39 所大学，中央政府和地方政府都进行了资金投入。最终目标为：建成若干所世界一流大学和一批国际知名的高水平研究型大学。在“985 工程”建设的初期，国家重点支持了九所大学。此后，重点支持的学校数增加掷 39 所。在前两期建设中，中央政府分别投入 140 亿人民币（约 20.7 亿美元）和 189 亿人民币（约 27.9 亿人民币），经费的一半被集中投入到了最初所支持的九所大学。

在“985 工程”的第一阶段，教育部几乎没有对大学的预期目标和任务提出明确的文件要求。换句话说，被选中的大学对经费的使用有相当大的自主权。学校则可以根据自己的实际情况决定经费的分配，所以不同大学的经费使用情况也不同。从“985 工程”二期开始，教育部对相关高校提出了五个方面的建设任务，包括机制创新、队伍建设、平台建设、条件支撑和国际交流与合作。

从大量国际可比指标来看，“985 工程”的实施提高了相关高校的国际竞争力，与世界一流大学的差距明显缩小。例如，“985 工程”大学发表在“科学引文索引”（Science Citation Index）和“社会科学引文索引”（Social Science Citation Index）所收录期刊上的论文数从 1998 年的校均 240 篇提高到 2007 年的校均 1200 篇。其中，首批九所高校的校均论文数更高达 2300 篇，超过了英国“罗素大学集团”（Russell Group）和澳大利亚“八校联盟”（Group of Eight），这些学校的校均为 2200 篇；逼近“美国大学协会”（Association of American Universities）60 多所成员学校的平均水平 2800 篇。从论文质量上看，汤森路透公司（Thomson Reuters）开发的“基本科学指标”（Essential Science Indicators）数据库收录了在 22 个学科内论文被引次数位居世界前 1%的机构。2001 年，“985 工程”学校仅有 40 个学科被选进入“基本科学指标”数据库，而到 2008 年底，进入“基本科学指标”数据库的学科数量就翻了近两番，有 34 所大学的 140 个学科被选进入“基本科学指标”数据库。

“985 工程”的实施也大大提升了中国的科技创新能力——这也是“985 工程”二期的主要任务。国家希望通过建设跨学科平台来发挥大学学科综合的优势，提高它们承担具有全局性和带动性的重大科研任务的能力。1999～2008 年,“985 工程”学校承担的

国家重点基础研究发展计划（“973 计划”）项目数从初期的每年十多项上升到近两年的每年 30 多项。“985 工程”学校的专利数量在过去十年间增加了十倍，2008 年“985 工程”学校持有的专利数占全国专利总数的十分之一。因此，“985 工程”学校在中国的知识创新中拥有十分重要、不可替代的地位。

此外，经过“985 工程”建设，“985 工程”学校在中国高等学校中的优势地位进一步巩固和加强。在各项能够代表质量与水平的指标中，占中国高校总数仅 2%左右的“985 工程”学校占全国总量的份额几乎都在一半以上。这也相继提高了这些学校的国际竞争力。

对“211 工程”和“985 工程”影响的思考

“211 工程”和“985 工程”的实施对中国高等教育的发展和高技术人才的培养有重大影响。这两个重点计划的实施对未来高等教育改革如何提高质量、选择怎样的道路及机制提供了开放讨论的契机。

尽管上文回顾了它们所取得的成就，但研究显示，“985 工程”学校和世界一流大学之间仍然存在巨大差距。例如，这些高校每年发表在世界顶级综合性科学杂志《自然》（*Nature*）和《科学》（*Science*）上的论文数量并没有显著提高。大学努力招聘合格的教师，但是顶级学者，如高引用科学家的数量仍然非常有限。为了解决这些问题，财政支持只是其中的一个方面，挑战仍然存在，例如缺少理想的科研文化、学术自由以及有益的外部环境。

中国建设世界一流大学的趋势也引发了一些问题，并反映出中国高等教育体制在管理上的缺陷。目前的政策制定缺乏良好的公共参与机制。“自上而下”的政策制定方式可以减少成本，但也可能潜在地忽略了社会、大学和学生的需求。更广泛的公共参与可以提高政策的问责和包容性。同时，对重点大学选择及其评估过程缺乏透明的管理和组织机制，公众看不到明确的标准和要求。而且，选择和评估过程的透明度在保障政策实施公平和鼓励公共参与上都是关键因素。

台湾地区的“研究卓越计划”及其对台湾高等教育的影响

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国际竞争力与台湾地区的政府政策

从 20 世纪 90 年代开始，台湾高等教育机构的数量和在校生的数量都迅猛扩张。到 2011 年，高校数量增长为 165 所，在校生数量高达 130 万，总入学率达 78.6%。很明显，数量的增长已经将台湾从大众高等教育阶段转向全民高等教育阶段，总体上减少了教育不平等。但是扩招也引发了一些问题，如怎样才能提高台湾的全球竞争力。

为了回应高等教育竞争力的问题，台湾地区政府从 20 世纪 90 年代末开始实施改革，改革的重点是投资、法规和财政。2002 年台湾地区政府成立高等教育宏观规划委员会，目的是促进台湾高等教育追求卓越。2003 年，高等教育宏观规划委员会提出一份计划，提议政府对若干所大学和研究中心进行集中投入。之后，教育部启动了许多目的不一的卓越行动，其中包括“发展国际一流大学及顶尖研究中心计划”（后来被称作“卓越计划”）、“教学卓越行动”、“产学合作”等大型项目。本文主要围绕“卓越计划”展开。

意图和目标

“卓越计划”是台湾教育部于 2005 年启动的第一个卓越行动。2011 年进入第二阶段建设，现在它的名称已经被改为“建设顶尖大学计划”。

政府每年会为该计划投入 3.3 亿美元，一直持续十年 。接受拨款的大学将以跻身世界顶级大学为目标，升级基础设施、招聘海外杰出教师并参与国际学术合作。除此之外，政府也鼓励这些大学整合各种研究资源，打造教学和研究能力，与外国的著名大学开展实质性的合作。

“卓越计划”的第一阶段以扩大台湾高等教育的国际能见度为重心，十年内至少将一所大学发展成世界百强的大学，五年内将十个研究机构或研究领域发展进亚洲前 50 名。为了加快人才培养和对外招聘，加强研究实力，鼓励创新，第二阶段设置了五大目标，即推动顶尖大学的国际化和扩大学生的全球视野、提高大学的研究和创新质量、建设教师和学生的国际能力、巩固校企合作、提高毕业生对社会和市场需求的胜任力。

大学筛选的程序、标准和管理模式

在第一阶段，“卓越计划”将所有院校平等对待，鼓励每一所满足基本条件的院校申请，这个条件就是生均支出超过 1 万美元。然而，为了促进 “国立大学法人化”和“大学合并”这两大政策的推行，公立大学申请者必须保证他们会将大学公司化成自治机构并发挥自身的教育主动性。这些大学还必须做出一个单独的方案作为补充。无论是公立大学还是私立大学，只要是愿意合并在一起

增强全球优势的大学，政府都建议它们做战略规划以实现目标。

由于备受大学非议，教育部在第一阶段并没有继续强制推行“法人化”和“大学合并”，教育部在第二阶段也修改了对申请者的资格要求。在第一阶段成功申得拨款的大学直接获得申请资格。但是，新的申请学校还必须满足以下四个条件中的三个：85%的教师在助理教授以上；生师比低于 25:1；过去 11 年的全部引用数必须进入世界前 1%；90%的教育项目通过了认证或接受“教学卓越计划”资助。

总而言之，无论是在第一阶段还是第二阶段，所有合格的申请者都必须提交一份计划书，计划书里写明自评机制、绩效标准、目标导向的战略规划、定量和定性标准这四个方面的内容。计划书的内容涉及大学管理和运营、基础设施、师资、论文发表数、提高教学质量的战略、学生选拔度、国际化以及毕业生表现。在第二阶段，政府采用了一个以结果为导向的评估模式。申请者除了要维持第一阶段的标准，还要特别的在社会问责和校企合作上通过评审。

为了有效地管理和执行“卓越计划”，教育部推出了一套结构良好的政策制定和实施模式。咨询委员会、大学战略联盟、大学咨询委员会要分别对国家的、大学之间的和大学内部的政策制定承担责任。在政策实施环节，评审委员会主要负责设定评审标准、评审计划以及拨款分配方案；评估委员会要帮助评估大学的绩效，并支持实地考察团队。专业的外部评审委员会要在评估相关领域的研究绩效上协助评估委员会，并为评估委员会提供评估结果以供其参考。为了提高单个院校的效率，教育部还成立了一个中央管理办公室和一个工作小组，他们要负责政府和大学层面的政策实施质量控制。工作小组由所有大学的代表组成，它辅助管理办公室在大学之间进行协调、讨论质量控制的标准并对教育部逐一汇报各大学的政策实施进展。

拨款计划

在第一阶段，大学是按年接受拨款的。换句话说，拨款的金额依赖于大学每年的表现。有人建议教育部，稳定持续的拨款将促进大学的长期战略规划。所以，在第二阶段，教育部每五年修订一次拨款计划，不过大学还是逐年接受拨款。这意味着大学在资金分配和使用上被给予了更多自主权。

第一阶段共有 12 所大学获得拨款。国立台湾大学获得了 5 亿美元，占总经费的 30%。成功大学获得的拨款占总经费的 17%，新竹交通大学 8.6%。有五所大学获得的拨款总额低于总经费的 5%。12 所大学中只有两所是私立大学，其中一所还是到 2008 年以后才开始接受拨款。

第二阶段共有 30 所大学申请。在对每个申请者的成就进行了仔细的定量和定性评估之后（包括评估大学的世界排名、研究和教学质量、第一阶段取得的效果），共有 12 所院校获得资助资格。

成效和影响

从“卓越计划”在第一阶段取得的成效来看，获得拨款的大学的论文发表数量显然得到大幅提升。根据教育部的数据，2005～2010 年，11 所获得拨款的大学年均发表的“科学引文索引”（Science Citation Index）论文数量增加了 49%，“社会科学引文索引”（Social Science Citation Index）论文数量增加了 172%。五年内高引用论文数量也增加了 129%。此外，跻身世界前 500 强的大学数量

也增加了。根据一些全球排名，如“世界大学学术排名”（Academic Ranking of World Universities）、“QS 世界大学排名”（QS World University Ranking）和“世界大学科学论文绩效排名”（the Performance Ranking of Scientific Papers for World Universities），台湾有 7～8 所大学跻身世界 500 强，所有这些大学都接受卓越计划资助。

让公众感到意外的是，唯一一所私立大学成功大学只获得 4000 万美元的拨款，但其绩效却优于其它公立大学。但总的来看，三大全球排名结果和教育部拨款之间有很强的相关性。大学获得的拨款越多，在排名中的位置越靠前。

一方面，越来越多台湾大学进入世界大学排名 500 强的事实表明了“卓越计划”的效果和成功。另一方面，越来越多的台湾大学，包括那些教学型大学，受到政府鼓励，要将卓越计划的评审标准作为自己的标杆，为自身设立长期目标。最重要的是，公众注意到，新的奖励体制将无法权衡且牺牲大学的教学。

的确，台湾的卓越计划增加了大学之间资源分配的不平等。这些大学所获得的资助越多，就越富有；反之亦然。这意味着，“卓越计划”很可能会把大量台湾高校边缘化。在这种情况下，“卓越计划”在某种程度上确实激起了大多数没有获得拨款的大学校长对指标和目的的批评。

挑战和远景

总之，“卓越计划”确实帮助那些受到资助的大学扩大了国际知名度，发展了学术能力，因此提高了学校的全球排名。伍焜玉博士是台湾国立卫生研究所的主席，他观察到，“卓越计划”对台湾高等教育产生了三个主要影响。首先，“卓越计划”大力支持了大学创新和人才培养。其次，大学有更多资源发展自身的研究能力。第三也是最重要的影响在于，“卓越计划”鼓励台湾社会多元思考，特别是从社会和人文视角思考怎样追求学术卓越。

然而，财政的可持续性仍然是所有受到资助的大学面临的大挑战。各个院校一直都非常担心“卓越计划”资助的研究项目能否持续下去。除此之外，台湾的案例显示，其他对大学之间不平等的担忧正在变成事实。不过，台湾院校研究实力的大幅提升也是不容否认的，彰显了台湾对全球知识生产的学术贡献。尽管顶尖大学和其他大学之间的差距在拉大，台湾社会却正在形成一个共识——台湾需要一流大学和研究中心支持其经济发展和全球竞争力。

韩国建设世界一流大学的努力

金善雄

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过去十年，韩国顶尖大学的首要目标是达到所谓“世界一流大学”的水平。众所周知，韩国高等教育在过去几十年间取得了巨大的进步。高等院校中，20 岁年轻人所占的比例从 20 世纪 70 年代的 5%以下提高到世纪之交的 80%以上。同时，高校的质量也发生了戏剧性的改善。特别是一些重点大学，由于政府政策的扶持和大学之间的市场竞争，他们的研究能力得到大幅提升。韩国的顶尖大学在国际排行榜上的地位也一直在稳步上升。

最近，韩国政府下拨了大量竞争性拨款给研究型大学以提高其研究能力。最著名的是 1996 年启动的“面向 21 世纪的智力韩国计划”（Brain Korea 21）和 2006 年启动的“世界一流大学计划”（the World Class University program）。这里首先介绍韩国高等教育体制的背景信息。

背景

韩国的高等教育体制私有化程度很高。80%以上的学生就读于私立大学，2.6%的国内生产总值（gross domestic product）用于高等教育，只有 0.6%由政府提供。在私人经费的比重上，韩国位居经济合作与发展组织（OECD）国家之首。

公立大学获得了大量政府补贴，一些顶尖私立大学（如浦项工大［POSTECH］、延世大学［Yonsei University］和高丽大学［Korea University］）与顶尖国立/公立大学（如首尔国立大学［Seoul National University］和韩国科学技术院［Korea Advanced Institute of Science and Technology］）在国际国内声誉上不相伯仲，他们之间就生源、师资和研究经费展开了有力的竞争。

在韩国高等教育的发展过程中，国际化扮演了重要角色。出国留学在韩国有悠久的传统，也是韩国在相对短的时期内成功积累高水平人力资本的主要渠道。1950 年爆发的朝鲜战争及美国参与战后建设等都为 20 世纪 70 年代以来韩国学生赴美留学创造了许多机会，许多研究生学成后回到韩国。据估计，1970～1990 年间，在美国获得博士学位的韩国学生中三分之二都回国了。韩国和台湾是少数没有经历“人才流失”之痛的国家和地区，因为它们已经成功吸引了许多受教育程度很高的专业人才回国。

在“人才引进”的过程中，韩国政府扮演了十分积极的角色。1965 年，韩国科学技术学院（the Korea Advanced Institute of Science and Technology，KAIST）在美国的帮助下成立，该校努力想招聘那些已经在美国功成名就的研究人员，付给他们三倍、四

倍于国内同行的工资，并为他们提供住房和教育津贴等其它附加福利。海外留学的高回报吸引了大量研究生流出。许多有才华的韩国学生去美国和其它发达国家的著名大学攻读博士学位，他们希望在回国以后能得到一份好工作。

“人才库计划”

招聘海外著名研究型大学刚毕业的博士生，面临的一个主要问题是人才的实用性。尽管这些人有扎实的教育背景，但在韩国一些组织得不那么好的工作环境中，他们常常表现很差。可能是因为缺乏一些设施，也可能大学的官僚结构不利于他们有效地开展活动，他们没有足够的经验主持有潜力的新的研究项目。

那时，注意力被集中到了更成熟的研究人员身上。“人才库计划”（the Brain Pool program）开始于 1994 年，该计划允许韩国的大学和研究所引进国外有经验的研究人员。引进的人必须拥有超过五年的经验，承诺在韩国工作三个月到两年不等。充足的资金被下拨到科学技术部支持该计划，但计划的进展并不成功，只引进了几十个人，而且这些人的能力也不强。

该计划的设计存在几个重要问题。首要问题是支持的力度。引进的人才每月工资约 2000～3000 美元，附加来回机票。尽管该计划的主要目的是吸引在国外工作环境中历练好的中层研究人员、让他们在韩国也能硕果累累，但是没有多少移居海外的韩国人对此感兴趣。如果他们在韩国以外的国家特别是美国、德国等非常发达的国家有丰富的工作经验，这点支持力度完全是不足以打动他们的。

第二个问题是邀请时间的长短。职位较低的研究人员一般负担不起两年那么长的离职，也不可能在不牺牲定期外聘和正在进行的研究计划的前提下回到原来的工作岗位。本质上，该计划完全不适合吸引有潜力的中层研究人员。计划只对那些考虑永久归国的研究人员或那些报酬低于韩国水平的研究人员有强烈的吸引力。最后，该计划虽然没有被完全取消，但减小了规模。

“面向 21 世纪的智力韩国计划”

1998 年，执政的金大中政府是韩国第一个中偏左的政权。1999 年，该政府启动了“面向 21 世纪的智力韩国计划”，每年批准两千亿韩元（约 1.7786 亿美元）预算支持该计划。计划的主要目标是培训国内的学者和研究人员，而不是引进国外受过教育的研究人员。

这是对之前倾向海归人员政策的反应，新政策更倾向国产博士毕业生。政策方向转变的原因有几个方面。首先，刚从国外毕业的博士数量和从最富盛名的国外大学毕业的博士数量都下降了。其次，尽管之前 20 年中顶尖韩国大学的研究生教育师资有一定的改进和增加，但学生们仍然希望出国念博士。第三，由于意识形态在向平等主义转变，政府开始越来越关注那些来自底层和中等收入家庭、无法负担出国费用的研究生。

根据“面向 21 世纪的智力韩国计划”，各院系和专业都能申请国家对研究生教育发展进行多年资助。资金可以被用于研究生奖学金、招聘临时教员或研究人员，以及开展一些与研究有关的活动如研讨班、学术会议、购买书籍和期刊、充实实验室设备等。

“面向 21 世纪的智力韩国计划”的战略有三个基柱。第一，资金被下拨给专业而不是直接发给学生。第二，重点是选择和聚焦一些更小的研究生专业。第三，相关支持主要针对研究生教育而不是研究活动。“面向 21 世纪的智力韩国计划”的规模很大，含两个三年预算周期，计划一直持续到 2005 年。“面向 21 世纪的智力韩国计划”曾在左倾的卢武铉政府和中间偏右的李明博政府治下继续推行。现在，预计该计划将持续到 2012 年，而预算也将增加到每年三千亿韩元（约 2.6651 亿美元）。

“面向 21 世纪的智力韩国计划”执行的最初七年之间，九万学生、博士后和教师受惠于“面向 21 世纪的智力韩国计划”。期间，韩国的学术产出有实质性的增长。例如，“科学引文索引”（Science Citation Index）发表论文数量从 1998 年的 9444 篇增加到 2005 年的 23515 篇。其中来自“面向 21 世纪的智力韩国计划”资助的机构的论文 1998 年有 3765 篇（40%），2005 年有 7281 篇（30%）。同时，该指标的韩国国家排名也从 1998 年的第 18 位上升到 2005 年的第 12 位。

尽管我们不清楚研究产出的进步与政府政策有多大的联系，但政府政策是韩国的顶尖大学更加关注研究产出的关键推力。尽管“面向 21 世纪的智力韩国计划”的初衷是支持研究生教育，其主要的受益者是研究生，但该计划将经费拨给一些经过筛选的专业（而不是学生），这在大学之间营造了浓厚的竞争氛围。大学之间的竞争中，以研究产衡量的教师质量成为最重要的标准。尽管大型院校获得的拨款其真实数目非常大，但选拔（或不选拔）可能决定着研究生生源的高低。因此，各个大学都大量投入自有资源，吸引高研究产出的教师并刺激现有教师产出更多研究成果。

在此期间，许多大学开始实施以绩效为基础的工资政策，终身教职和晋升对研究产出的评估也变得越来越严厉。直到 20 世纪 90 年代中期以前，韩国所有大学的工资事实上还都以工龄为基础。此外，尽管评估程序和重新竞聘上岗的制度已经到位，但除强制 65 岁退休外，教师的保留率一直是 100%，晋升也是自动的。随着韩国科学技术院从 2007 年开始实施严格的终身教职标准，许多顶尖大学引入了相似的手段。横向运动（如中层研究人员的校际流动）在此前的几十年里相当罕见，但当更多的大学用更高的工资从别处挖走顶尖的教师以立刻提升研究产出时，这种现象就变得普通多了。

除了“面向 21 世纪的智力韩国计划”以外，2004 年卢武铉政府还启动了“区域创新新大学”计划（the New University for Regional Innovation）。该计划是一个政府资助计划，目的是提高首尔都会区以外的院校的能力。该政策是对“面向 21 世纪的智力韩国计划”偏好首尔都会区大学政策的反应，也是政府对经济活动去中心化的承诺。经费被用于研究生奖学金、课程发展、训练项目、实习项目、教员和研究人员照片、实验室设备采购等。“区域创新新大学”也通过给当地政府和企业界加分来鼓励当地政府和企业界对大学进行配套资助。

“世界一流大学计划”

最后，韩国政府启动和实施的“世界一流大学计划”计划，目的是将韩国大学的研

究能力提高到世界顶尖研究型大学的水平。尽管 2006 年韩国的研究产出已经上升为世界第 11 位，研究质量却没有那么大的提升。2006 年，单篇论文引用率的世界排名第 28 位；韩国只有三位高引用率的明星研究人员，而美国有 3923 位，德国有 256 位，日本有 253 位。

知识经济的兴起和韩国技术前沿的发展都呼唤原创新研究和发展，而不是赶上已有技术，因为韩国的大企业如三星、现代、LG 早就赶上了世界顶尖的制造水平。2006 年，亲企业的李明博政府启动了“世界一流大学计划”。

该计划扶持三类项目。第一是资助新成立的专业招聘教师，以此鼓励新建院系。第二是资助已有的联合研究项目和联合培养项目招聘外国学者（至少三年，每年一学期）。第三是支持引进世界一流的学者（除诺贝尔获得者以外，其它引进人才至少在韩工作两个月）。从 2008～2012 年，政府每年为该计划辟出了 1650 亿韩元（约 1.4658 亿美元）预算。

正如“面向 21 世纪的智力韩国计划”一样，政府下拨的经费只给学术单位，以坚持“少而精”的原则。第二个初衷是鼓励“网络外部性”。政府大力支持韩国研究人员与世界顶级研究人员展开合作研究。资助要求外国研究人员延长在韩国停留的时间。但是“面向 21 世纪的智力韩国计划”的初衷比“人才库计划”更务实。工资水平相当高（比他们一般的工资要高），目的是吸引他们访问韩国，这样的工资水平也为他们的职业和个人生活安排增加了弹性。

在实施“世界一流大学计划”的过去三年里，该计划招聘了 351 位外国学者（163 位美国学者，53 位韩国学者，28 位日本学者）。同时，计划引进了 10 位诺贝尔奖获得者、35 位美国国家工程院（the US National Academy of Engineering）的院士和 29 位美国国家科学院（National Academy of Science）院士。其中许多人来自世界顶尖大学：八位来自哈佛大学（Harvard University），六位来自斯坦福大学（Stanford University），八位来自密西根大学（the University of Michigan），五位来自美国麻省理工学院（Massachusetts Institute of Technology）。和“面向 21 世纪的智力韩国计划”一样，“世界一流大学计划”也是高度竞争性的。在 2008 年的第一轮申请中，三类申请人分别有 92 个、222 个和 161 个，最终选上的分别只有 26 个、26 个和 79 个。由于竞争很残酷，此后几轮的申请人数下降了。

结论

近些年，韩国政府投入大量公共资源建设它的“世界一流”顶尖大学。尽管韩国尚无一所大学跻身世界研究型大学百强，但大学的研究产出已经在过去 20 年中大幅增加。背后的原因除了政府对研究活动的直接补助之外，还有大学之间越来越激烈的竞争。大学的竞争让人事政策产生了若干重要的创新。教授的工资越来越以业绩为导向；韩国顶尖大学的终身教职和晋升也变得严格得多，与美国的大学相似。

新加坡建设世界一流的大学体制

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近来，新加坡总理李显龙先生被问及：如果他重回 25 岁他会做什么。他回答说，他会在回新加坡之前游历三个世界上经济最活跃的地方——美国、中国和印度。这话抓住了新加坡教育下一代的理念核心。而教育是这个在 700 平方公里国土拥有 500 万城市人口的小岛国家唯一可获得的资源。通过从世界各地吸取发展高等教育的经验，新加坡培养出了追求卓越的文化。大学的国际化、生源的全球化和研究经费的竞争性是新加坡建设世界一流教育体制的核心原则。

大学的国际化

新加坡拥有四所公立大学以及一些小而精的私立大学。全国 26%的教育支出用于公立大学。新加坡的大学非常鼓励与国际同行的国际合作，例如新加坡国立大学（the National University of Singapore）与美国杜克大学（Duke University）在医学研究生教育上的合作，与美国耶鲁大学（Yale University）在东西方文化优势上合作发展博雅教育（liberal arts education），南洋理工大学（National Technological University）与美国沃顿商学院（the Wharton Business School）的合作等。另外，整合美国麻省理工学院（Massachusetts Institute of Technology）和中国浙江大学最好的学术资源而成立的新学校新加坡技术和设计大学（Singapore University of Technology and Design）也已经成形。同时，一个多样化的人才库可以被视为新加坡大学国际化的另一个方面。例如，新加坡国立大学有约 50%的教师、25%的本科生、70%的研究生和 70%的研究人员来自其它 100 多个国家。这一情况发生的背景是世界高校版图的剧变。

培养学生的全球意识

对那些即将加入全球劳动力大军的学生来说，在一个多元文化、多元社会背景的团队中工作并担任领导角色是最重要的能力。此外，自信、独立和终身学习能力也是他们在这个信息互联、彼此依赖、快速变化、竞争激烈的世界经济上安身立命的本领。不断更新课程和教学方法是为了给学生提供最好的机遇。约 50%的本科生参与了时间长短不一的海外交换生项目。学生们也受益于 60 多个与海外顶尖大学合作的联合培养计划和双学位计划。多年以来，新加坡的大学也一直致力于改进课程和教学方法，以转变旧的教学，创造非规范性的、以学习效果为重点的学习环境。

培养追求卓越的文化

新加坡为四所公立大学提供了更大的自治权。成功的校友们在塑造大学治理结构的资源管理方式上扮演了更积极的角色。大学

治理、愿景、内部结构、办事流程和资源被汇聚起来，以为社会贡献最好的教育、研究、创新和服务成果。大学都以国际标准为标杆，在大学、教师、院系和个人层面就基础设施、学术和收入水平实施了同行评议，并不遗余力地培养现有人才、吸引全球最好的人才。各大学都一直强调研究产出，强调经过同行评议的论文和引用率，在此之上还增加了对领导力、改革思想、科研影响力的重视。新加坡现在正在大力促进保护知识产权，以更好地推动大学至商业和社会知识转化的流水线发展。为了支持创新价值链，各种各样的中介机构已经各就各位，如国家研究基金会（the National Research Foundation），新加坡标准、生产力与创新局（SPRING Singapore），经济发展委员会（the Economic Development Board）和科学技术研究局（the Agency for Science, Technology and Research）。

研究发展投入

自 20 世纪 90 年代以来，新加坡逐渐增加对研究发展（research and development，简称 R&D）的投入。1991～1995 年间投入约 20 亿美元。预计 2011～2015 年间投入将达到 160 亿美元。如果以研究发展投入占国内生产总值（gross domestic productivity，简称 GDP）的百分比来测算一国的研究强度，新加坡已经达到 3%; 每百万人口拥有的研究科学家和工程师人数也已经有约 6500 人。这使得新加坡成为世界上的研究强国。根据马丁繁荣研究所（Martin Prosperity Institute）的研究报告，新加坡在全球创新指数上排名第九，在全球人才指数上排名第三，在全球技术指数上排名第十。未来若干年，新加坡希望研究强度达到 3.5%，而且其中三分之二要来自私人部门。美国和欧洲国家的经验表明，保持高水平的研究发展既需要公共支持，也需要经济活力和实力。世界其他国家的经验也显示，引导竞争性拨款的个人投资者也是提高大学质量的有效工具，而对关键领域进行大宗投入也对达到明确具体的卓越目标很有助益。

近年来，交叉学科领域和应用多学科解决难题涌现了大量创新机遇。具备多学科优势和青年人才的研究型大学已经准备好为新的、突破性的科学思想和创新提供所需的生态系统。新加坡已经意识到科学研究和创新的全球性和革命性，并已经引入了以下新行动。这些新行动将更大的提升各个大学的能力和它们在世界上的地位。

全球研究合作伙伴关系

“卓越研究与科技企业学园”（the Campus for Research Excellence and Technological Enterprise）已经开辟了一个 65 万平方英尺（约六万平方米）的新研究空间。其目的是邀请国际顶尖的研究型大学在那里建立大量世界一流的研究中心，这进而将鼓励这些大学与新加坡的大学进行密集的研究合作。“卓越研究与科技企业学园”已经成为许多新加坡的大学及其国际同行共建的研究中心的家园。这些研究中心涉及的领域包括：与麻省理工学院合作的传染病、环境模拟和传感、生物系统和为管理学、未来城市流动和低能耗电子系统研究中心，与瑞士联邦技术学院（Swiss Federal Institute of Technology）合作的全球环境可持续研究中心，与德国慕尼黑工业大学（the Technical University of Munich）合作的大都会电子移动研究中心，与中国北京大学合作的可持续低碳未来研究中心，以及与美国加州大学伯克利分校（the University of California－Berkeley）合作的太

阳能和节能建筑研究中心。“卓越研究与科技企业学园”预计将容纳约 1000 名研究人员。

“卓越研究中心”

启动“卓越研究中心”（Research Centers of Excellence）项目的目的是在新加坡的大学中建立世界一流的研究中心，吸引世界顶尖研究人才，增强大学的研究生教育和本科教育，以及为新加坡国家经济发展培训合格的研究人才。新加坡已经对五个“卓越研究中心”进行了资助。平均对每个“卓越研究中心”投入约一亿美元的资助，每个中心拥有 100～150 位研究科学家和工程师。这五个“卓越研究中心”分别是量子科技中心、新加坡癌症科学研究所、新加坡国立大学力学生物学研究所、新加坡地球天文台以及位于新加坡国立大学的新加坡环境生命科学工程中心。

“竞争性研究项目”

启动“竞争性研究项目”（Competitive Research Programme）的目的是在新加坡的大学中建立起研究能力，确定新加坡未来可以投入发展新产业的潜在战略性研究领域。这一资助计划对所有科技领域开放，包括一般性的和主题式的项目。每笔“竞争性研究项目”资助约 500 万～1000 万美元，历时三至五年不等。启动“竞争性研究项目”的研究计划要通过自下而上的筛选，希望能在一个统一的框架下包含多个多学科的项目。这一资助计划设有两级评审程序。首先，研究申请要通过当地评审委员会的评估。筛选出的研究计划要按要求进一步深化，发展成一份完整的研究计划，再经过国际同行评议。国家研究基金会将以“竞争性研究项目”国际评审委员会的评估意见为基础进行拨款决策。

“国家研究基金会奖学金资助计划”

为了打造研究发展能力，新加坡启动了“国家研究基金会奖学金资助计划”（National Research Foundation Fellowships），以吸引、招聘和扶持青年科学家和研究人员在新加坡的大学和研究所中开展独立研究。这些资助开放给所有国籍、所有科技领域的所有研究人员。资助是全球竞争性的，对个人和研究都有吸引力。每一个入围的研究者将在五年内获得高达 300 万新元（约 239 万美元）的研究经费，这样做的目的是支持那些很有可能取得研究突破的研究计划。研究者的工资则另算，并超过他们所获得的研究经费，约等于新加坡大学助理教授的工资。被资助的研究者具有完全的研究独立性和自由。

结论

“世界一流大学”这个比较新的概念已经引起世界上许多国家的关注。现在，要培养世界一流大学就要进行大量持续的资源和精力投入，已经成为常识。新加坡的例子表明，在每个层面对各个细节给予更大关注——学习最好的实践经验、发展追求卓越的文化以及合适的态度——对于建设一个世界一流的大学体制也同样重要。全球大学之间的竞争，包括私立大学和公立大学，意味着要对大学进行大量、持续的投入才能维持世界一流的声誉。各所大学和大学的建设者都会竭尽所能保持追求卓越的文化。一所世界一流大学最主要的产出就是人力资本——在这个超级互联、彼此依赖、竞争激烈的世界，这也是任何社会的资产。

同时，新加坡的案例也说明，即使是小

国，只要有合适良好的实践活动、治理政策、资助举措、基础设施、学术文化建设和态度等，也能重拳出击，孕育出世界一流的教育体制，打破世俗认知。

澳大利亚学术研究卓越计划

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绩效文化（performance culture）在澳大利亚高等教育中根深蒂固，这是持续了 25 年的新公共管理改革（new public management reform）带来的结果。这一文化与 20 世纪 80 年代英国撒切尔夫人内阁的政策同时发展起来。那时候，互联网还没有普及，高等教育的全球竞争时代也尚未到来；“绩效”的定义被局限于一国内部各大学之间的竞争，而不是各国的标杆。

澳大利亚的政策制定过程引入全球思维，与澳大利亚的留学生教育有关。澳大利亚是留学生教育大国，多年占全球 7%的市场份额，这对经济发展非常重要。在 2009/10 学年，国际教育带来 185 亿澳元（约 199 亿美元）的收入，2010 年国际学生为大学贡献了 17.5%的经费，为政府节省了一大笔支出。

“世界一流大学”的概念没有被正式引入澳大利亚的国家政策。在澳大利亚，没有像中国 985 高校那样指定的顶尖高校阶层。不过，约 60%的科学论文、超过三分之二的澳大利亚研究委员会（the Australian Research Council）和国家卫生和医学研究委员会（the National Health and Medical Research Council）的竞争性科研拨款事实上都与一批顶尖高校有关，包括墨尔本大学（the University of Melbourne）、澳大利亚国立大学（Australia National University）、昆士兰大学（the University of Queensland）、悉尼大学（the University of Sydney）、西澳大利亚大学（the University of Western Australia）、新南威尔士大学（the University of New South Walse）、莫纳什大学（Monash University）和阿德莱德大学（the University of Adelaide），这些大学自发组成了“八校联盟”（Group of Eight）。这些大学主导了研究基础设施的配置，并在 2009 年一次性的“超级科学计划”（Superscience projects）中收获颇丰。但官方而言，澳大利亚的 38 所公立大学的研究都具有国际竞争力，以此维持这些学校在学生心中的地位，特别是在去年全球教育市场的影响之下。政府认为，澳大利亚在教育市场上的份额是由所有大学共同努力来保障的，而不是靠少数几所顶尖大学的声誉维系。但实际上这两方面都很重要。

澳大利亚的高校和联邦科学与工业研究组织（the Commonwealth Scientific and Industrial Research Organization）的政府实验室在很多研究领域都拥有全球声誉。不过，研究产出的量仍然强于质。2007 年澳大利亚发表了 17831 篇论文，数量上居全球第 13 位。然而，在汤森路透的 2001～2011 年索引影响因子的排名中，澳大利亚只名列第 17 位，篇均引用率为 12.1。这部分是澳大利亚长期按数量分配研究拨款的政策造成的结果。20 世纪 80 年代以来，澳大利亚大学按照其发表论文和著作的数量获得额外的经费，这些拨款

并不考虑期刊的选择性或影响力。这虽然发展了研究文化的基本层面，但并没有推动研究质量方面的发展。

不过，澳大利亚在某些领域也表现得很好。根据汤森路透的“基本科学指标”（Essential Science Indicators）数据库，1999～2009 年联邦科学与工业研究组织在三个领域都被列为世界前十的研究机构，这三个领域是农业、动植物科学和生态学。而在临床医学和动植物科学领域，澳大利亚的六个机构都进入了世界前 10%。汤森科学引文索引数据库更详细的数据表明，澳大利亚的研究人员在数学、自然科学、地球科学、技术和医学领域的被引用率都在世界各国平均水平 1.4 左右。澳大利亚科学家 11 次赢得诺贝尔奖，包括 2005、2009 年的医学奖以及 2011 年的物理学奖。

这样的纪录对于澳大利亚科研发展是个很好的基础。问题是将来怎么办？从国家政策来看，澳大利亚的高等教育体制是一个市场竞争的体制，大学在其中凭自己的实力冲锋陷阵。政府拨款的目的是购买特定的产出，而不是维持大学的运转或达到明确的目标。政府的这种心态与东亚和西欧大相径庭，更像美国的“自由主义国家”（liberal states）概念。因此，澳大利亚维持科研的世界影响力大部分靠的是学科共同体自身以及各个大学提高全球排名的决心（部分原因仍然是为了保持他们对全球学生的吸引力），而不是国家和政府的系统管理。

其结果之一就是，澳大利亚的科研绩效评估仍停留在全国范围——而在其他大多数国家科研绩效评估是进行全球范围比较，全球排名也是国家作出科研投入决定的重要参考。

2010 年启动的澳大利亚“研究卓越”（the Excellence in Research）计划表面上和英国的高等教育研究评估（Research Assessment Exercise）相似。第一次“研究卓越”计划评估调查了澳大利亚高等教育中 55000 名研究人员的 33 万项研究产出。其目的在于按领域和大学对研究组织进行评分，满分是 5 分。在某个领域取得 5 分的大学，其研究人员“远高于世界水平”（well above world standard）；4 分的大学“高于世界水平”（above world standard）；3 分的大学“处于世界水平”（world standard）。但是，“世界水平”本质上是一个很主观的定义，实际是采取折衷的办法，由管理“研究卓越”计划的 149 个学科委员会来制定。其中，部分委员来自更为全球性的学科领域。所有委员会委员都对提高其所在学科领域地位有强烈的兴趣，这样可以改善他们在澳大利亚的竞争地位，并提升澳大利亚在全球市场的形象。

许多学科都重视世界引文情况，不过不是所有学科都如此。“研究卓越”计划集合了 500 多位国际评估人士，并将他们按学科分类组成评估委员会，但这样的管理也存在不公平、不一致的情况。不出所料，评估中大量涌现 4 分和 5 分的情况，不过多数出现于那些以自然科学为基础的学科和专业。一所在“世界大学学术排名”（Academic Ranking of World Universities）中约 100 位的大学，它的研究有 88%被评价为“高于世界水平”；八所研究型大学中，有七所大学一半以上的研究领域被评为 4 分或 5 分。此处要提出观点是：“研究卓越”计划并没有把澳大利亚以外的国家和大学的科研表现系统地作为“世界水平”来参考。“研究卓越”计划建立了一个澳大利亚研究绩效等级制度，这个等级制度为不平等的研究拨款和声誉赋予了正当性。但是，区别于“世界大学学术排名”或单纯

的篇均引用排名的是，“研究卓越”计划并不能对澳大利亚大学将科研水平发展到“世界水平”产生明确的刺激效应。

“研究卓越”计划并不具备建设性地改进绩效的能力。它被设计出来的目的是把大学科研管理的重点从出版物数量上转移到出版物的质量上。第一次评估使用了期刊排名作为质量评估的基础。期刊排名在很多领域都存在争议。其中具有代表性的一个问题是：在一些领域，全国性的期刊相对于国际性期刊被赋予了过高的地位。期刊排名也带来一些负面影响，使科研人员更青睐普通的、主流的出版物，而将专业的、创新的期刊排除在外。今年将进行的“研究卓越”计划第二轮评估已经抛弃了期刊排名。科研质量和标准的评估仍然由那些委员会负责，但是这再一次回避了“什么是世界一流”的问题。

2011 年发布“研究卓越”计划 2010 年评估结果的时候，创新部（Ministry for Innovation）部长建议，支持科研活动的拨款要以研究产出为基础。到目前为止，对于是否将资源集中在一些有潜在实力的领域以此在更广泛的基础上提升实力，还是将资源平衡差距，仍然没有定论。如果“研究卓越”计划的评估结果被用来作为拨款依据，这也可能只在小范围展开。澳大利亚政府现在考虑按学生人数拨款，即根据各大学的教学分配一笔额外的研究经费。这一通行做法可能与“研究卓越”计划以绩效为基础的不平等的拨款方式相排斥，也与英国高等教育研究评估将大笔研究经费根据评估结果进行分配的方式明显相反。在英国资助不足的体制中，这也一直是影响其顶尖大学维持研究绩效的关键。

与其他澳大利亚政府推崇的竞争计划一样，如历史已久的科研经费竞争、基于申请的发展性项目和基建工程项目，以及为推进学生机会公平的项目，“研究卓越”计划也旨在推动大学建立起不断自我改进的组织文化，将结果责任从政府身上转移到大学身上，同时也对国内竞争进行了规范。研究是现代大学声誉最主要的来源。“研究卓越”计划同时也维护了那个“优雅”的平等主义谎言，即澳大利亚的高等教育中不存在等级制度，因此优秀的研究可能出现在任何地方。

正如之前所说，与“研究卓越”计划联系更紧密的可能是政治，而不是澳大利亚高等教育体制的全球竞争力。要正式确立澳大利亚的精英大学阶层非常困难，因为很多人反对政府以其他大学为代价提拔最强的那几所大学。澳大利亚人本能地反对固定的地位差异，无论这种差异可能会带来多少好处——这是英国阶级制度留下来的后遗症。37 所公立大学中的每一所都有足够的规模和社会影响力去调动选举力量。其中一些大学则位于那些决定联邦选举结果的摇摆州。迎合全球排名文化和“世界一流”都有政治风险。澳大利亚政府不敢那么做。

其结果就是，澳大利亚的知识经济有一部分已经很强，但对于另外一部分知识经济仍未有所发展。澳大利亚在“世界大学学术排名”500 强中有 19 所大学上榜，这对于一个只有 2200 万人口的国家来说是了不起的成就。这表明澳大利亚的研究能力具有广阔的基础。澳大利亚在“世界大学学术排名”百强学校中有四所大学上榜，分别是墨尔本大学、澳大利亚国立大学、昆士兰大学和悉尼大学。但是，澳大利亚排名最高的大学墨尔本大学只排在全球第 60 名。澳大利亚最近的竞争对手是加拿大，该国有两所大学跻身世界前 40 位，分别是多伦多大学和英属哥伦比亚大学。所以，澳大利亚在知识经济发展

中仍有缺陷，如有全球影响力的大型研究中心，以及对知识、人才和投资的吸引力。澳大利亚的人均收入在世界排名第 12 位，所以澳大利亚具备维持这些大学的经济实力。但是，到目前为止，差的是政治上的决心。

如果没有政府的帮助，各领域研究者组成的学术团体、公民社会和业界并不能独立发展全球性中心。即使是在奉行亚当斯密式、有限的自由主义的美国和英国，大笔国家拨款也是其不断提升研究实力的坚强后盾。政府对高校研究能力建设的作用，比其对其他方面的作用要为重要。东亚各国现在正在建设全球性中心。新加坡国立大学（the National University of Singapore）、首尔国立大学（Seoul National University）、香港地区的顶尖大学、国立台湾大学、清华大学和北京大学——虽然这些学校还没有跻身“世界大学学术排名”前 50，但他们正在国家政策和资助的支持下朝前努力。澳大利亚则陷入地方主义（localism）的泥潭，国家不愿直面研究的全球性。除非政策发生变化，否则澳大利亚的大学将被甩在后面。

Building World-Class Universities in Mainland China

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Socio-economic transformation and growth in China have led to unprecedented changes in higher education in the last three decades. The notion of "world-class university" is high on the policy agenda at both governmental and institutional levels in China. National initiatives to further enhance leading universities' capacity and competitiveness is among the many ideas regarding higher education reform, including the 211 and 985 Project.

Yet, the idea of developing such universities is not new and has been a dream of the Chinese people since the end of the nineteenth century. A few of the earliest Chinese universities were established to develop the nation's competitiveness and to promote higher education. Peiyang University (founded in 1895, now Tianjin University), Nanyang Public School (founded in 1896, now Shanghai Jiao Tong University), Imperial University of Peking (founded in 1898, now Peking University), and Tsinghua College (founded in 1911, now Tsinghua University) are among the earliest intuitions. The history of national initiatives to support leading universities can also be traced back to the early 1950s when the Ministry of Education recognized six universities as the term "key universities". Since then, "a system of key universities" has been formed and developed, which has greatly influenced and shaped the higher education structure and its reform in China. The leading universities have been contributing to improving the overall quality and playing an instrumental role in meeting the country's demands in the economic transition.

Since the start of China's reform and opening up in early 1980s, the government has consistently upheld the basic idea of using science and education in nation building. Higher education sector has undergone expansion and restricting reform since the 1990s, which has produced a large quantity of highly skilled workers and to some extent has served the skill demands of economic development. However, the government realized the country's relatively weaker competitiveness in terms of knowledge creation and innovation, which required overall quality improvement in its higher education sector. It was in this context that the notion of building world-class universities and high-level research universities are reiterated.

The 211 Project

Initiated in 1995, the 211 Project aims at developing about 100 universities and a number of key disciplines by the early 21st century, so as to take a leading position in the country's socio-economic development and in international competition. This funding scheme focuses mainly on four aspects of development: disciplinary and interdisciplinary programs, digital campuses, faculty, and university infrastructure. Compared with other key state projects since the founding of the new China, it was not only the largest scale project in the field of higher education but also the highest level of block grant. Currently, the 211 Project is in its third phase (2007-present), with 112

universities supported by the project so far.

In the first two phases (1996-2000 and 2002-2006), the central government, local governments and selected universities themselves invested altogether ¥36.83 billion (about US$5.44 billion), of which the central government provided ¥7.84 billion (about US$1.16 billion). 45% of the total financial support was invested in disciplinary development, 29% in infrastructure development, 19% in digital campus development, and 7% in faculty development.

With the project support, the infrastructure and other conditions improved significantly at high-level Chinese universities, markedly enhancing the overall strength of the institutions. Due to the large number of universities and research centers supported, however, the investment received by each individual university has been rather limited, which has tended to reduce its institutional impact.

The 985 Project

To further enhance the public funding for higher education, the government launched the 985 Project in 1998. This project again reflects the government's goal and efforts to develop a tertiary education system of international stature. The Ministry of Education issued "The Action Plan for Education Revitalization for the 21st Century" and implemented the 985 Project to establish a number of world-class universities and to develop a number of key research centres of excellence. This project aims at exploring new mechanisms for higher education governance, improving universities' global competitiveness, and developing a path for building world-class universities, but with Chinese characteristics. The 985 Project has been implemented in two phases (1999-2001 and 2004-2007) and is currently undergoing its third phase (2009-present).

The 985 Project has thus far supported 39 selected universities, with financial investment from both the central and the local governments. The accompanying policy document identified nine of the selected universities as being at the top of the list and designated to be developed into "world-class universities". The remaining institutions are expected to develop the slightly lower status of being of "international repute". The total financial support from the central government amounted to ¥14.0 billion (about US$2.07 billion) and ¥18.9 billion (about US$2.79 billion) respectively in the first two phases. More than half of the central government funding in this project was concentrated in the top nine universities.

During the first phase, the Ministry of Education issued little documents concerning the specific objectives and tasks for each university to achieve. In other words, the selected universities had a significant level of autonomy in using the funding. They were able to determine their projects according to their specific situations, and different institutions showed different project content. Unlike the more general requirements of the first phase, the Ministry of Education clearly delineated five tasks for the selected institutions: innovating institutions, enhancing faculty quality, building up research platforms and bases, providing supporting conditions, and creating international exchanges and cooperation.

The implementation of the 985 Project has significantly improved selected universities' international competitiveness and narrowed down the gap between themselves and world-class universities, according to a number of internationally comparable academic indicators. For example, the average number of the Science Citation Index (SCI) and the Social Science Citation Index (SSCI) paper published by each 985 universities increased from 240 in 1998 to 1200 in 2007. The top nine universities produced an average of 2300 papers, exceeding that of the UK Russell Group universities and Australia's Group of Eight universities (both 2200), and closing to that of the Association of

American Universities' sixty member schools (2800). In terms of quality, research shows that 140 fields from 34 of the 985 universities were included in the Thomson Reuters' Essential Science Indicators database in 2008, compared with 40 in 2001.

The implementation of the 985 Project has also significantly enhanced capacity for scientific and technological innovation, which is a primary task of the second phase. The state hoped to build interdisciplinary platforms that could facilitate major research and develop key disciplinary strength. From 1999 to 2008, the 985 universities increased the number of projects under the National Program on Key Basic Research from 10 to more than 30 per year. The number of patents produced by the 985 universities has gained a tenfold increase in the last ten years, comprising almost one tenth of all invention patents in China in 2008. Thus, the 985 universities assume an important and irreplaceable role in knowledge creation in China.

Furthermore, the selected universities have consolidated and strengthened their dominance in Chinese higher education. While the number of the 985 universities only comprises 2% of all Chinese higher education institutions, they account for nearly half of national totals in terms of academic achievement, research performance, and science innovation, which in turn improve their international competitiveness.

Reflections on the Impact of the 211 and 985 Projects

The implementation of the 211 and 985 Project have had significant effects on the development of higher education in China and of higher skills. It offers opportunities for an open discussion to improve quality and explore potential routes and mechanisms to adopt in future higher education reform.

Despite the achievements reviewed in the previous section, research shows that a gap remains between the 985 universities and world-class universities. For example, there has been no significant increase in the annual number of papers from these universities in Nature and Science, two comprehensive scientific journals with high reputations. Effort has been made to recruit quality faculty, however, the number of top academics, such as highly cited researchers, is still limited. To solve these issues, financial support is only one of the many conditions. Challenges still exist, including relatively lack of optimal research culture, academic freedom, and conducive external environment.

The trend of building world-class universities in China, however, also raises certain issues and reflects weaknesses in governance in the Chinese higher education system. The current policy-making mechanism lacks well-designed public participation. A top-down policy-making approach can save costs, but may potentially ignore demands from the society, universities and students. Greater public engagement could enhance accountability and inclusion. Also, the elite sector development in general is managed and organized with little transparency in the process of institutional selection and evaluation and with no publicly available clear criteria and requirements. Transparent selection and evaluation processes are critical factors in assuring an equal policy implementation and to encourage public participation in return.

Development of Taiwan's Research Excellence Initiative and Its impact on Taiwan Higher Education

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International competitiveness and Taiwanese government policy

Since the 1990s, Taiwan's higher education has expanded dramatically with respect to both the number of institutions and the number of enrolled students. As of 2011, the number of higher education institutions has increased to 165 with a total student enrolment of 1.3 million, representing a gross enrolment ratio of 78.6%. It is clearly evident that these quantitative increases have lifted Taiwan from the stage of mass higher education to that of universal access to higher education and generally reduced education inequality. But the expansion has also caused several concerns, such as how to enhance Taiwan's global competitiveness.

In response to competitiveness issue in higher education, the Taiwan government has started to reform its higher education system in the late 1990s, with a particular focus on provision, regulation and financing. In 2002, Taiwan's Higher Education Macro Planning Commission (HEMPC) was founded by the government with the aim of promoting Taiwan's higher education excellence. In 2003, HEMPC proposed a national plan to the government to assist a number of selected universities and research centres through concentrated investment. Afterward, the Ministry of Education (MOE) launched various types of excellence initiatives with different intended objectives, including three big projects: "Development Plan for World Class Universities and Research Centers of Excellence" (hereafter the Excellence Program), "Teaching Excellence Initiative", "Academia-Industry Collaboration". This paper will focus on the Excellence Program.

Purpose and objective

The Excellence Program was the first excellence initiative launched by the Ministry of Education in 2005. The second phase started in 2011and its title changed to "Moving into Top Universities".

With a yearly total funding of US$330 million for 10 years, the recipient universities were expected to reach the rank of the top institutions around the world through infrastructure upgrading, the employment of outstanding faculty from overseas and participation in international academic collaboration. Besides, selected universities were encouraged to integrate various research resources, build teaching and research capacity, develop substantial collaborations with foreign prestigious universities, etc.

The first phase mainly aimed at enhancing the international visibility of Taiwan higher education by developing at least one university that would reach the world's top 100 universities within 10 years and 10 outstanding research centres or fields in the Asian top 50 within five years. In order to accelerate talent cultivation and foreign recruitment, strengthen research advantage, and foster innovation, the second phase sets five specific goals, including internationalizing top universities and

expending students' global perspectives, promoting university's research and innovation quality, building international capacity of faculty and students, strengthening collaborations between universities and industry, and enhancing graduates' competence in response to social and market demands.

Selection process, review criteria and management Model

In the first phase, all universities and colleges were equally encouraged to apply for the excellence program, though they ought to meet the basic requirement of at least US$10,000 expenditure per student first. However, to promote two major national polices of "National University Corporation" and institutional mergers, the public university applicants ought to promise that they would incorporate themselves as an autonomous institutions and develop their own educational initiatives. They are also required to make a separate proposal as supplements. Those who are willing to merge together to strengthen their global edge, no matter public or private universities, were advised to make a strategic plan to realize their intention.

Criticized by many universities, the MOE did not adopt "incorporation" and "merger" in the first phase as requirements anymore and revised the eligibility of applicants in the second phase. Those who were granted in the first phase are all eligible to apply. But the new applicants meeting three of the following four criteria will be able to submit proposals, too. The qualifications are as follows: 85% of teaching faculty are above assistant professors; student/faculty ratio is below 25:1; total number of citations in the last 11 years should be in the top 1% of the world; 90% of programs are accredited or the recipients of "Teaching Excellence Program".

To sum up, in the both phases, all eligible applicants have to submit a proposal with four major items, including self-assessment mechanism, performance criteria, strategic plans to achieve their objectives, and a five-year financial planning. The MOE reviews the proposals according to both qualitative and quantitative standards and criteria. They include institutional management and operation, infrastructure, faculty quality, number of papers published, strategies to enhance teaching quality, student selectivity, internationalization, and graduate performance. In the second phase of the plan, the government has adopted an outcome-based review model. In addition to maintaining the criteria from the first phase, the applicants will be under review particularly on their social accountability and collaborations between universities and industry.

In order to manage and execute the Excellence Program effectively, the MOE developed a well-structured model in terms of policy making and implementation. The Advisory committee, the University Strategic Alliance, and the University Advisory Committees are responsible for policy making at the national, cross campus and institutional levels respectively. At the implementation stage, the review committee is mainly in charge of setting up review standards and criteria, reviewing proposals, and determining funding amount; the assessment panel helps to assess the performance of institutions and supports the on-site visit teams. The professional external review committee assists the assessment panel in evaluating research performance by individual field and provides the assessment panel with review outcomes as references. To increase the efficiency of individual institutions, the MOE also set up a main management office and a working group, which are responsible for quality control of implementation at the governmental and institutional levels respectively. The working group which consists of all institutional representatives assists the management office in coordinating with institutions, discussing standards of quality control, and reporting the implementation progress by institutions to the MOE.

Funding Scheme

In the first phase, the funding received by recipients was on an annual basis. In other words, the amount of funding the recipients would get depended on their performance annually. The MOE was advised that stable and sustainable funding will facilitate institutional long term strategic planning. In the second phase, the MOE revised the funding scheme with approval of a total of five-year block grants at one time, but the recipients still receive appropriations year-by-year. It means that the institutions are given more autonomy over funding allocation and uses than ever.

Twelve universities received a grant in the first phase. National Taiwan University received US$500 million, up to 30% of the total funds available, compared to National Cheng Kung University with 17%, National Tsing Hue University with 11.2% and National Chiao Tung University with 8.6%. There are five recipients funded with less than 5% of the total. Only two private universities were funded initially, but one was not funded after 2008.

A total number of 30 universities applied for the grant in the second phase. After careful evaluation of the quantitative and qualitative achievements of each applicant, including a meticulous assessment of its world ranking status, research and teaching quality, and effectiveness in the first phase, 12 institutions were awarded subsidies through block funding.

Outcomes and Impact

Examining the outcomes of the program in the first phase, it is clear that the number of publications by the grant beneficiary universities increased significantly. According to the Department of Education, the number of Science Citation Index (SCI) papers produced each year by the 11 recipients grew by 49% and Social Science Citation Index (SSCI) papers by 172% between 2005 and 2010. The number of highly cited papers increased by 129% within five years. In addition, the number moving into the top 500 is steadily growing. According to a few global rankings, such as the Academic Ranking of World Universities, QS World University Ranking and the Performance Ranking of Scientific Papers for World Universities, there are around seven to eight Taiwan institutions in the top 500, which are all recipients of the program.

To the public's surprise, Chang Gung University, as the only private recipient, with lesser total funding of US$40 million, performed better than the other national recipients did. However, generally speaking, there is a high level of correlation between the three global ranking outcomes and the MOE funding. The more funding the institution gains, the higher it ranks.

On the one hand, the fact that an increasing number of Taiwan universities have been moving into to top 500 in the global rankings demonstrates the efficacy and success of the Excellence program. On the other hand, more and more Taiwanese institutions, including teaching-oriented universities, are encouraged to use the review criteria of the program as a benchmark to set their institutional long-term goal. Most important of all, the public was also concerned that teaching would be sacrificed due to the new reward systems.

Indeed, Taiwan's Excellence program increases inequality in resource distribution among institutions. The more funding the winning institutions gain, the richer they will be, and vice versa. This means that the program might likely marginalize a large proportion of Taiwan's higher education institutions. Under this circumstance, the Excellence program, to some extent, has indeed provoked severe criticism over its indicators and purposes from most Taiwanese college presidents whose institutions were not awarded.

Challenges and Future Perspective

To conclude, the program did assist recipients to enhance their international

visibility and develop positive academic features, and as a result improve their ranks in global rankings. As President of the National Health Research Institutes (NHRI), Dr Kenneth Kun-Yu Wu observed that there are three major impacts of the program on Taiwan's higher education. First, the program strongly supports university innovation and talent cultivation. Second, universities are given more resources to develop their research capacity. Third, and perhaps most importantly, it encourages multi-dimensional thinking in Taiwanese society, particularly from the social and humanistic views in pursuit of academic excellence.

Financial sustainability, however, remains a big challenge for all recipients. The institutions have been quite worried that the research projects funded by the program might not be supported continuously. Besides, Taiwan's case demonstrates that the other worries about inequality among institutions are being turning into reality. However, it cannot be denied that the research capacity by Taiwan's institutions has been developed steadily, which obviously shows Taiwan's academic contribution to the global knowledge production. Although the gap between leading and following universities is growing gradually, a consensus that Taiwan needs world-class universities and research centres to support its economic development and global competitiveness is being built in Taiwan society.

Public and Private Endeavours to create World-Class Universities in Korea

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One of the primary objectives of top universities in South Korea (hereafter Korea) for the last decade or so has been to reach the level of so-called world-class university. It is widely known that Korea has made a very significant progress in the development of higher education during the last few decades. The proportion of 20 year-old in higher education institutions increased from less than 5% during the 1970s to more than 80% in the turn of the 21st century. At the same time, the quality of higher education institutions has improved dramatically. In particular, the research capabilities of major Korean universities have enhanced substantially because of the government policy initiatives as well as the market competition among universities. Top Korean universities have been moving up steadily in international rankings.

Recently, the Korean government has allocated substantial resources in order for research universities to enhance their research capabilities by offering competitive grants. Most notable programs are Brain Korea 21 (BK21) that started in 1996 and the World Class University (WCU) program that started in 2006. Before going into the detail of those two major initiatives, some background information on Korean higher education system would be helpful.

Background

The higher education system in Korea is highly privatized. More than 80% of students are enrolled in private universities, and out of 2.6% of gross domestic product (GDP) devoted to higher education, only 0.6% is by the government. In terms of the share of the private funding, Korea ranks the first among the OECD countries.

While public universities receive substantial government subsidy, and several top private universities (such as POSTECH, Yonsei, and Korea University) are on a par with top national/public universities (such as Seoul National University and Korea Advanced Institute of Science and Technology) in terms of domestic and international reputation, and effectively compete with them for students, faculty members, and research funds.

In the development of Korean higher education, internationalization has played a major role. The phenomenon of study abroad has a long tradition in Korea, and it has been a major channel for the successful accumulation of high-level human capital in a relatively short period. The outbreak of the Korean War in 1950 and the consequent US involvement created many opportunities for Korean students to study in the US since the 1970s, many of the graduate students who studied abroad came back to Korea. It is estimated that about two thirds of those who received Ph.D. degrees in the US returned to Korea during the period between 1970 and 1990. Korea, along with Taiwan, is one of the few countries that have not suffered from "brain drain", as they have successfully attracted many highly educated professionals back to the home country.

In this "brain gain" process, the Korean government played a very active role. When the Korea Advanced Institute of Science and Technology (KAIST) was established in 1965

with the American help, deliberate attempts were made to recruit talented researchers who already had been established in the US., by offering the salary three or four times higher than the domestic counterparts and other fringe benefits such as housing and education allowances. High returns to study abroad generated a large outflow of graduate students. Many talented Korea students went to the US and other advanced nation to obtain Ph.D. degrees in major universities with the hope that they will get favourable employment upon returning.

Brain Pool program

One of the main problems identified in hiring freshly moulded PhD degrees from major research universities abroad was their practical utility. While their educations were considered to be solid, they tend to function poorly in less organized Korean working environment. Certain equipment may be missing, and the bureaucratic institutional structure may not be amenable to perform their activities effectively, and they do not have enough experience to initiate promising new research projects.

Attentions were shifted to more established researchers. The Brain Pool program that started in 1994, allowed Korean universities or research institutes to invite experienced researchers abroad. The invitees must have a prior experience of more than five years, and are committed to work in Korea for the period between 3 months and 2 years. The Ministry of Science and Technology was allocated substantial funds to support the program, but the program has not been very successful, reaching only a few dozen invitees who are not considered to be high calibre.

There were several major problems in the design of the program. The first significant problem was the level of support. The invitee was paid about US$2,000 - 3,000 per month and round trip airfare. Although the main purpose was to attract mid-level researchers who are established in foreign workplaces and be productive in Korea, not many Korean expatriate would be interested in it. If they are established outside of Korea, particularly in a very advanced nation, such as US or Germany, the level of support was simply not enough an incentive.

Second problem was the length of the invitation. Established researchers in mi-career typically cannot afford to be away for two years, and come back to the original jobs without sacrificing the regular employment and ongoing research projects. In essence, the program was not geared to attract promising mid-level researchers at all. Effectively, it was only desirable to those who are thinking about permanently move back to Korea or those researchers whose pay is lower than the amount paid in Korea. Consequently the program has been downsized, although it was not dismantled completely.

Brain Korea 21 (BK21)

The Kim Dae-Joong administration that captured the power in 1998 was the first left-centre regime in Korea. In 1999, it initiated BK21 program with the annual budget of KRW 200 billion (about US$177.68 million). The main objective of the BK21 program was to groom domestic scholars and researchers rather than inviting foreign educated researchers.

It was a reaction to the previous policy favouring returnees to domestically produced Ph.D. degree holders. The change in policy direction was due to the several reasons. First, the utility of the fresh Ph.D. degree holders from abroad, even the ones from very well known institutions, has declined. Second, despite of the improvement and expansion of the graduate faculty of leading Korean universities over the previous two decades, students still wanted to go abroad for their Ph.D. studies. Third, due to the ideological shift toward egalitarianism, the government started to pay more attention to the graduate students from low and moderate income households

who cannot afford study abroad.

According to the program, departments or programs apply for multi-year grant for the graduate program development. The fund can be used to subsidize graduate student scholarship/stipend, hiring temporary instructors or researchers, and some research related activities, such as funding seminars, attending conferences, books, journals, lab equipment and so on.

The strategy of BK21 was based on three pillars. First, the prizes were awarded to programs not to students directly. Second, the emphasis was to select and concentrate smaller group of graduate programs. Third, the support was primarily on graduate education, not research activities. The size of the program was substantial. With two three-year budget cycles, the program continued until 2005. The BK21 program has been authorized to continue in the succeeding left-leaning Roh Moo-Hyun administration and right-centre Lee Myung-Back administration. Currently, it is supposed to continue until 2012 with increased budget to KRW 300 billion (about US$266.51 million) per year.

During the seven years, 90,000 students, post-docs, and faculty members received benefits. During the time period, scholarly output of Korea has increased substantial. The number of papers published in the journals listed in Science Citation Index (SCI) increased from 9,444 in 1998 to 23,515 in 2005. Among those, 3,765 (40%) papers in 1998 and 7,281 (30%) in 2005 are from the BK21 centres supported by the government fund. At the same time, national ranking of Korea improved from the 18th in 1998 to 12th in 2005.

Although it is not clear that how much of this improvement of research output can be attributed to the government policy, it played a pivotal role in making top universities pay more attention to research productivity. While the BK21 program was designed to support graduate education and the major beneficiaries were graduate students, the program design that awards funds to selected programs (not to students) created substantial competition among institutions. In the competition among institutions, the quality of faculty members in terms of their measured research output becomes the most important criterion. While the actual amount of the prize was quite insignificant for large institutions, the selection (or non-selection) may determine the success in recruiting good graduate students. Hence, institutions invest substantial amount of their own resources to attract faculty members with noticeable research output, and provide incentives for more research output to the existing academic staff.

During the time period, many universities started to implement merit-based salary scheme, and tenure and promotions became much more rigorous in evaluating research output. Up until the mid 1990s, virtually all universities in Korea have length of service based salary scheme. Moreover, although evaluations and reappointment procedures were in place, virtually 100% of all faculty members were retained until the mandatory retirement age of 65 and promotion was almost automatic. As soon as KAIST employed much rigorous tenure standards and started to implement in 2007, many top universities introduced similar measures. The lateral movements (i.e. switching positions from one university to another in mid-career), which was extremely rare in previous decades, become much more common as more universities take away top faculty member with bigger salaries from others in order to boost their research output immediately.

In addition to BK21, the Roh administration initiated the New University for Regional Innovation (NURI) in 2004. NURI is a government funded project to strengthen the capabilities of colleges and universities located outside of the Seoul Metropolitan Area. The policy initiative was a reaction to the fact that

most of the BK21 beneficiaries are located with the Seoul metro area, and government's commitment for decentralization of economic activities. The fund can be used for graduate student scholarships, curricular development, training program, on-site internship program, hiring teaching and research staff, purchase laboratory equipment, and so on. NURI also encouraged matching fund from local governments and industry by giving them extra points in the evaluation.

World Class University

The recent World Class University program (WCU) started as a government initiative to increase the research capability of Korean universities to the level of leading research universities in the world. While Korea's research output increased to the world rank of 11th in 2006, the research quality has not increased as much. The number of citation per paper in 2006 was still 28th in the world, and the number of "star" researcher whose publications are cited most frequently around the world in Korea was only three, where US has 3,923, Germany 256, and Japan 253.

The emergence of knowledge-based economy and Korea's advancement to the technology frontier demand original research and development than catching up with existing technology, as major Korean companies such as Samsung, Hyundai, and LG caught up with the leading manufactures of the world. The pro-business Lee Myung-Back administration started WCU program in 2006.

The program supports three types of projects. Type 1 supports the establishment of new department of specialized major by providing fund to hire new faculty members. Type 2 supports the recruitment of foreign scholars to existing programs for joint research and/or teaching (for minimum of three years, one semester per year). Type 3 supports the invitation of distinguished world-class scholars (for minimum two months except Nobel laureates). The government allocated the annual budget of KRW165 billion (about US$146.58 million) between 2008 and 2012.

As is in BK21, the prize is given to academic units to preserve the principle of "selected few". Second important design element is to encourage "network externality". The cooperative research projects with leading researchers of the world with Korean researchers were very much promoted. The funding requires extended stay of foreign researchers. But the specific design of the program is much more realistic than the previous Brain Pool program. The level of salary support was quite high (higher than their regular appointment) in order to attract them to visit Korea, and allows flexibility for them to arrange their profession and personal lives.

For the three years in implementation, WCU was able to recruit 351 foreign scholars (163 US, 53 Korea, 28 Japan). Also, it invited 10 Nobel Laureates, 35 members of the US National Academy of Engineering and 29 US National Academy of Science. Many of them are from top universities in the world: 8 from Harvard University, 6 from Stanford University, 8 from the University of Michigan, and 5 from Massachusetts Institute of Technology. As was in BK21, WCU has been highly competitive. In the first round of 2008, 26 out of 92 Type 1 applications, 26 out of 222 Type 2, and 79 out of 161 Type 3 applications were selected. While the competition remains stiff, the number of applications decreased in the subsequent rounds.

Conclusion

Recently Korean government has invested substantial amount of public resources in order to make its top universities "world-class". While not a single Korean university has yet to be recognized as one of the top 100 research universities in the world, their research output has grown quite substantially for the last two decades. The reason for the advancement is not only the direct government subsidy for research activities, but also increasing competition

among universities. The institutional competition made several important innovations in personnel policy. Salaries of professors are becoming more merit-based, and tenure and promotion of top Korean universities become much more vigorous, similar to American universities.

Building a World-Class University System: Singapore's Experience and Practices

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Recently the Prime Minister of Singapore Mr Lee Hsien-Loong was asked what he would do if he was 25 all over again. He said that he would spend time in three of the most economically vibrant parts of the world – US, China and India – before returning to Singapore. These words capture the essence of Singapore's approach towards educating next generations, the only source available in a small island nation of five million urbanites and about 700 square kilometres land mass. Facilitating culture of excellence by adopting best practices of higher education from around the world, internationalization of universities, global orientation of students, and competitive funding schemes on research are central tenets of Singapore's path to building world-class education system.

Internationalization of Universities

Singapore is home to four public universities and a number of boutique private universities. About 26% of national education expenditure is spent on public universities. International collaboration with international counterparts has been largely encouraged in Singapore universities, such as the National University of Singapore's (NUS) partnership with Duke university in graduate medical education, with Yale University to nurture liberal arts education on the strengths of Western and Eastern cultures, and Nanyang Technological University's (NTU) partnership with the Wharton Business School. In addition, a new university, Singapore University of Technology and Design is shaped by the best academic practices of Massachusetts Institute of Technology (MIT) and Zhejiang University in China. A diversified talent pool can also be observed as another perspective of internationalization in Singapore universities. For example, NUS has nearly 50% of faculty members, 25% of under graduate students, 70% of graduate students and 70% of researchers coming from over one hundred nations. This occurred on the backdrop of changing of landscape of universities worldwide.

Global Orientation of Students

Abilities to work in teams with members from diverse cultural, social backgrounds and to lead them are essential for students who will join the global workforce. Moreover, confident, independent, life-long learning ability is an asset for students to be economically active in hyper-connected, interdependent, fast-paced, and competitive world. Curriculum and pedagogies are updated to provide best opportunities for students. Nearly 50% of undergraduate students study overseas on exchange programs for different length of periods. They also benefit from more than sixty joint and double-degree programs with leading overseas universities. Also, over the years Singapore universities have embarked on fine-tuning curriculum and pedagogical methods so as to move from prescriptive teaching to non-prescriptive, outcomes focused

learning environment.

Facilitating Culture of Excellence

Singapore provides greater autonomy to all four public universities. Successful alumni have taken on more active role in shaping the university's governance and management of resources. University governance, vision, internal structures, processes and resources have been aligned to generate best outcomes in education, research, innovation, and service to the society. Universities adopt international benchmarking and peer review exercises at university, faculty, department and individual level for infrastructure, academic processes and salary packages. Efforts have been made to nurture existing talent and attract best available talents globally. Universities have emphasized the need for strong leadership, transformative ideas, and broader impact of scientific research in addition to research income, peer reviewed papers and citations. Efforts are being made to streamline processes for protection of intellectual property and transfer to businesses and society. Various Singapore agencies such as the National Research Foundation (NRF), SPRING Singapore (a statutory board under the Ministry of Trade and Industry of Singapore), the Economic Development Board, and the Agency for Science, Technology and Research have put in place schemes to support innovation value chain.

Investments in Research and Development

Since 1990s Singapore has been steadily increasing its investments in scientific research and development (R&D). During 1991-1995 the investments were in the range of two billion dollars. For current five year cycle i.e. 2011-2015 the estimated investments are in the range of 16 billion dollars. Singapore's research intensity measured in terms of percentage of gross domestic product reached 3% level and the number of research scientists and engineers per million residents is around 6500. They place Singapore among the research-intensive nations. According to Martin Prosperity Institute, Singapore is ranked at number nine in Global Creativity Index, number three in Global Talent Index and number ten in Global Technology Index. In coming years Singapore's desired research intensity is 3.5% of gross domestic product (GDP) with two thirds coming from private sector and the remaining from public funds. The experience of US and European nations suggests that sustaining high levels of research intensity needs the support of public as well as vibrant and strong economy. World-wide experience also indicates that individual investigator led competitive grants are instrumental in raising the quality across the university, while large investments in focused areas are helpful in building specific peaks of excellence.

In recent years the opportunities for new innovations are emerging at the interfaces of disciplines and by application of multiple disciplines to challenging problems. Research-intensive universities with a diverse range of disciplines and young talents are well placed to provide the needed ecosystem for new scientific break thoughts and innovations. Recognizing the global and changing nature of scientific research and innovation, Singapore introduced the following new initiatives which strengthen universities further and contribute to their world standing.

Global Research Partnerships

The Campus for Research Excellence and Technological Enterprise (CREATE) has built a new research space of 650,000 square feet. It aims at inviting selected elite international research universities to establish a number of world-class research centres in Singapore, which in turn encourage intensive research collaborations with Singaporean universities. CREATE has already become home to joint research centres between Singapore universities and its international peers. These research

centres include the collaboration with MIT in areas such as infectious diseases, environmental modelling and sensing, biosystems and micromechanics, future urban mobility and low energy electronic systems; with Swiss federal Institute of Technology in the area of global environmental sustainability; with Technical University of Munich in electromobility in megacities; with Peking University in sustainable low carbon future; and with UC Berkeley in solar energy and energy efficient building systems. CREATE is expected to host about 1000 researchers.

Research Centers of Excellence

Research Centers of Excellence (RCEs) program is launched to establish world-class research centres in Singapore universities, to attract top academic research talent and to enhance graduate education as well as undergraduate education in the universities and train quality research manpower for Singapore. Five RCEs have been thus far funded, with an average input of about 100 million dollars. Each RECs has about 100 to 150 research scientists and engineers. These five funded programs include the Center for Quantum Technologies, the Cancer Science Institute of Singapore and the Mechanobiology Institute at NUS, and the Earth Observatory of Singapore and Singapore Center for Environmental Life Sciences Engineering at NTU.

Competitive Research Programs

Competitive Research Programme (CRP) was launched to build up research capacity and capability in Singapore universities, as well as to identify potential strategic research areas in which Singapore can invest to develop new industries for the future. This Funding scheme is open to all areas of science and technology and involves two types of calls, i.e. general and scenario/thematic-based calls. Each CRP award is in the range of five to ten million dollars for a period of three to five years. CRP proposals are solicited through a competitive bottom-up approach and expected to contain multiple related multidisciplinary projects under a unifying theme. This funding scheme involves two stage evaluation processes. Applications will be evaluated and shortlisted by a local evaluation panel in the first stage. Only shortlisted submissions will be asked to further develop into a full research proposal for international peer review. Based on the CRP international evaluation panel's comments, the National Research Foundation will evaluate and make final decisions.

National Research Foundation Fellowships

With the goal of building R&D capacity, Singapore National Research Foundation Fellowship Scheme (NRF) was launched to attract, recruit and root young scientists and researchers to conduct independent research in Singapore universities and institutions. Open to all researchers of all nationalities in all areas of science and technology, these fellowships are globally competitive with attractive personal and research packages. Each fellow will be provided with a research grant of up to S$3 million (about US$2.39 million) over five years, to support projects that exhibit high likelihood of a research breakthrough. The salary of a NRF fellow will be covered over and above the research grant awarded, and pegged to that of an Assistant Professor at a Singapore university. Fellows are given complete independence and freedom to pursue their own research directions

Conclusions

The relatively new concept "world-class universities" has captured the attention of various governments around the world. It is common knowledge now that substantial and sustained resources and reinforcing efforts are necessary for nurturing world-class universities. Singapore example suggests that greater attention to details at every level, adoption of best practices, facilitating culture of excellence, and appropriate attitudes are also equally

important in building a world-class university system. Competition among universities, both private and public universities worldwide, means investment of substantial resources on sustained basis to maintain world-class reputation. Universities and their promoters may spare no efforts to sustain the culture of excellence. The main outcome of a world-class university is the human capital, which is an asset for any society in this hyper-connected, interdependent, competitive world.

Meanwhile, Singapore's case also has demonstrated that with appropriate best practices, governance, funding, infrastructure, academic culture, and attitude, even smaller nations can punch beyond their weight and nurture world-class education system, and defy the conventional wisdom.

Research Excellence Initiatives: The Case of Australia

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In Australia there is a well-entrenched performance culture in higher education, the product of a 25-year process of new public management reform. This culture, which developed concurrently with the UK Thatcher government policies in the 1980s, predates the Internet and the present era of global comparisons in higher education. Performance is defined more in terms of competition among institutions in the national system than by benchmarking against other nations.

The sole area where global thinking predominates in Australian policy making is in relation to the education of foreign students, where Australia is one of the leading countries and the maintenance of its 7% share of the global market is a matter of primary economic importance. In 2009-2010 international education generated AUD$18.5 billion (US$19.9 billion) in export earnings, and in 2010 it provided 17.5% of the total funding of universities, thus saving the government billions of dollars per annum in expenditure on higher education.

The concept of "world-class university" does not enter official Australian policy. There is no designated layer of leading universities like the 985 university group in China. In practice almost 60% of science papers, and more than two thirds of competitive research grant funding from the Australian Research Council and the National Health and Medical Research Council, are associated with the leading universities: Melbourne, Australian National, Queensland, Sydney, Western Australia, New South Wales, Monash and Adelaide, self-organized as the "Group of Eight". These institutions also dominate allocations for research infrastructure and did well in the one-off Superscience projects funded in 2009. But officially, all 38 universities on the public schedule are presented as internationally competitive in research, partly to sustain their nominal position in the global market for fee-paying students. As government sees it, Australia's market share in teaching is secured more by the aggregate of all its universities than the reputations of the leading few, though in reality both are important.

Australian higher education institutions and the government laboratories in the Commonwealth Scientific and Industrial Research Organization (CSIRO) have a global presence in most areas of research. Research output is stronger in quantity than quality. In 2007 Australia produced 17,831 papers, ranking 13th in the world in volume. However, in the Thomson-Reuters data on citation impact for 2001-2011 Australia was at 17th with 12.10 cites per paper. In part this is the outcome of the long-standing use of a quantity indicator in funding. Since the 1980s universities receive an additional funding increment on the basis of their number of papers and books, regardless of journal selectivity or impact. This has generalized a base level research culture without driving quality improvement.

Despite this, in some fields the nation performs very well. In the Thomson Essential Science Indicators for 1999-2009 CSIRO was one of the top ten institutions in the world in three fields: agriculture, plant and animal science and ecology. In each of clinical

medicine, and plant and animal science, there were six Australian institutions in the world's top 10%. More specific Thomson Web of Science data on citation indicate that in each of mathematics, physical sciences, earth sciences, technology and medicine Australian researchers have citation rates at around 1.4 of the world average. Australians have won 11 Nobel Prizes, most recently in medicine (2005), medicine (2009) and physics (2011).

This record is a good base on which to build. The question is, how? In national policy the Australian higher education system is conceived as a market competition of competing firms in which universities stand or fall by their own efforts. Government funding is applied in order to buy specific outcomes rather than sustain whole institutions or achieve broad objectives. It is a different mind-set to that of government in East Asia and Western Europe and more akin to American notions of the role of liberal states. Thus the worldwide impact of Australian research is maintained largely by the disciplinary communities themselves and by the determination of individual universities to move up in the global rankings (again, partly to sustain their position in the global market for students), rather than through system management by national government.

One result is that in research performance assessment in Australia takes a predominantly national form—in contrast with most other nations, where research is imagined in much more global terms than is teaching, and where global rankings have been transformative in building research investment.

The Excellence in Research in Australia (ERA) initiative, which began in 2010, is ostensibly similar to the British Research Assessment Exercise. The first ERA assessment investigated 330,000 research outputs produced by 55,000 researchers in higher education. The goal was to rate research groupings by field and by institution on a scale of one to five. This entailed global benchmarking in most fields. A rating of five indicated that a university's cluster of researchers in that field was "well above world standard". A rating of four indicated the research was "above world standard". Three meant "at world standard". But in essence "world standard" was subjectively defined. It was interpreted in eclectic ways by the 149 members of the discipline-based panels that managed ERA. Some were from fields more globally engaged than others. All of them had a prima facie interest in inflating their discipline's standing, to improve their competitive position within Australia and to boost Australia's market image abroad.

World citation performance was referred to in many but not all disciplines, and in varying ways. More than 500 international assessors were drawn on by ERA but again were factored into disciplinary panel judgments in a partial and inconsistent manner. Not surprisingly, large numbers of fours and fives were handed around, though mostly in the science-based disciplines and professions. In one university ranked near the bottom of the top 100 in the Academic Ranking of World Universities, 88% of its research was said to be "above world standard". In all but one of the top eight research universities, at least half of the broad research areas were rated at four or five. The point here is that in ERA the research performance of institutions and national systems outside Australia was not factored into the "world standard" in a systematic manner. The ERA process produced a defensible hierarchy of Australian research performance that legitimated unequal research funding distributions and reputations within Australia. But unlike the ARWU, or even a simple league table of cites per paper, the ERA failed to create a coherent incentive to improve against world standards.

The ERA does have some potential for constructive effects on performance. It has been

designed to shift the emphasis in university research management from the earlier focus on quantity of publications to better quality. The first assessment used a ranked hierarchy of journals as the basis for assessing quality. The journal rankings were contested in many fields. One problem, emblematic of the whole process, was that in some fields national journals were given undue standing in comparison with international journals. The journal rankings also generated perverse incentives to shift work away from specialist and innovative journals in favour of the generic mainstream publications in each field. Journal rankings have been discarded from the second round of ERA, which takes place later this year. The panels will still make assessments about the quality and standing of the work. But this again begs the question of "what is world-class?"

When the 2010 ERA results were released in 2011, it was suggested by the Minister for Innovation that the outcomes might be used as the basis for funding allocations to support research activity. So far this has not happened, whether to concentrate resources in areas of potential strength, to build capacity on a broader basis, or to plug gaps. If ERA results are linked to funding this is likely to be on a small scale. The Australian government is currently considering a review of funding for student places that recommends an extra allocation for research at the base of teaching in all institutions. Such a universal approach would probably rule out unequal merit-based funding allocations using the ERA; in marked contrast with the UK RAE, which distributed large-scale funds on the basis of its ratings. Arguably this has been key to the maintenance of the research performance of leading UK universities in an otherwise underfunded system.

Like other forms of competition engineered by the Australian government, including longer-standing contests over research project funding, and submission-based funding for developmental projects, capital works and programs to enhance equity in the student body, the ERA helps to install a self-improvement culture within universities, transferring responsibility for outcomes from government to universities while regulating the status element in national competition. Research is the principal modern element in the prestige of universities. The ERA also maintains the polite egalitarian fiction that there is no domestic hierarchy in Australian higher education so that fine research can spring from anywhere. As the last point suggests, the ERA might be more about politics than the global competitiveness of the Australian system. It is difficult to formalize a layer of elite universities in Australia because official elevation of the strongest universities at the expense of the rest would be broadly opposed. Australians instinctively oppose fixed status differentials, however functional, as a hangover from the British class system. Each of the 37 universities on the public schedule has enough size and social weight to mobilize electoral support. Some are located in swinging seats that habitually decide the outcome of federal elections. To embrace the global rankings culture and "world-classness" would be to enter this dangerous territory. No Australian government has dared to do it.

The result is that Australia has one part of a strong knowledge economy but is yet to fully equip itself with the other. It has 19 universities in the ARWU top 500, an excellent achievement for a nation of 22 million people. This delivers a broad based research capacity. It also has four universities in the top 100, Melbourne, Australian National, Queensland and Sydney. But its highest ranked institution, Melbourne is at 60th in the ARWU. The nearest national comparator to Australia, Canada, has two universities in the top 40, Toronto and British Columbia. Thus Australia lacks the other part of a strong knowledge economy, large research concentrations with

global weight, magnets of attraction drawing major flows of knowledge, talent and investment capital into the nation. As the nation ranked 12th in the world in per capita income Australia has the economic capacity to sustain such universities. Up to now it has lacked the political will.

Disciplinary communities of researchers, together with civil society and industry, cannot create such global concentrations unaided. Even in the US and UK, which are led by Adam Smith style limited liberal states, stellar national funding underpins research capacity. The role of government is more vital in building research than in any other aspect of higher education. East Asian nations are building global concentrations in the present period. The National University of Singapore, Seoul National University, the top universities in Hong Kong SAR, National Taiwan University, and Peking and Tsinghua Universities, are not yet in the ARWU top 50 but they are heading there, with national policy and funding behind them. Trapped in localism, Australia's failure to officially embrace the global nature of research will ensure its universities are left behind unless its policy changes.