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What could cognitive capital mean for China's children?

Cognitive capital for China's children

认知资本对中国儿童可能意味着什么?

认知资本之于中国儿童

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目录
TABLE OF CONTENTS

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摘要

认知资本是一种新兴范式，旨在强调当神经增殖和大脑结构发育处于峰值时投资于儿童的关键性。不同于金融资本，认知资本是指通过对营养、卫生、教育、儿童保护和社会福利制度等方面进行干预，使大脑得到充分发育，是一种对人的未来潜能所进行的投资。发育中的大脑具有可塑性，在积极刺激作用下，投资回报率极为显著。投资于大脑发育将带来健康和福祉、教育成效、技能技巧、就业状况和生活质量等方面的改善。反之亦然。负面刺激则会导致认知资本贬值、身心健康受损、教育成效下降以及人生机会减少。认知资本或可成为中国下一发展阶段全面建成小康社会的一种组织框架。由于政府的高度承诺，随着公共资金支持的社会服务的不断扩大，在过去几十年间，中国在五岁以下儿童死亡率、识字率、接受基础教育的机会、人口预期寿命和国内生产总值等方面均取得了显著成效。但是，在社区或地区内部以及不同社区或不同地区之间，不平等现象依然存在。2015 年，中国的人均国民总收入在世界排名第 97 位，中国人口仍面临各种挑战。以具有前瞻性的一揽子政策为依托来发展认知资本，将能够促进当前和未来资源的公平、高效及有效利用。这与联合国《儿童权利公约》的精神相符。"认知资本"被定义为通过对相关干预措施进行投入，从而使儿童大脑得到充分发育、实现儿童权利，进而推动未来经济增长。这一概念体现了在改善中国儿童生活、加强国民建设和促进未来经济增长方面的重大机遇。

关键词：中国 ; 认知资本 ; 儿童早期发展 ; 公共财政

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中国在儿童发展方面所取得的进展

近几十年来，中国经历了前所未有的发展，推动了全国范围内的减贫行动；并在全面普及九年义务教育以及帮助超过 5 亿人获得安全饮用水等方面提前实现了千年发展目标（中华人民共和国外交部及联合国驻华系统，2015; World Health Organization & United Nations Children's Fund [UNICEF], 2015）。自 1978 年改革开放以来，中国已有 8 亿多人脱离贫困，今日的中国已成为世界第二大经济体（World Bank, 2016）。儿童的生存状况发生了翻天覆地的变化。中国五岁以下儿童死亡率从 1991 年的千分之 61 降至 2015 年的千分之 10.7（《2016 中国卫生和计划生育统计年鉴》）。人口预期寿命由 1981 年的 67.8 岁提高到 2015 年的 76.3 岁（中国国家统计局（2016a）），人均国内生产总值（GDP）年增长率从 1981 年的 3.8% 提高到 2015 年的 6.4%（World Bank, 2015）。

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中国所取得的成就不仅为在全球范围内实现千年发展目标作出了重大贡献，中国还在可持续发展目标的制定和采纳方面发挥了主导作用，同时为到 2030 年实现可持续发展目标作出了强有力的承诺（中华人民共和国外交部（2016））。

然而，发展并不均衡。2015 年，中国农村地区尚有 5575 万人生活在国家贫困标准以下，占全部农村人口的 5.7%，同期农村儿童贫困发生率为 7.1%（中国国家统计局（2016b）），说明贫困对儿童的影响更大。2014 年，农村地区五岁以下儿童死亡率为城市地区的两倍多（联合国开发计划署和国务院发展研究中心（2016））。不平等现象体现在儿童的社会发展指标上（United Nations Children's Fund [UNICEF], 2014b），也体现在一些因城乡差距而导致的收入不平等上（Xie & Zhou, 2014）。2013 年，部分省市的三年学前教育毛入园率不到 50%，而同年全国平均水平为 67.5%（United Nations Children's Fund, (2014b)）。此外，中国的人均国民总收入（2015 年为 7930 美元）在世界排名第 97 位，全国人口仍面临各种挑战（World Bank, 2017）。

中国承诺将坚定不移地解决不平等问题。习近平主席指出，在消除贫困、保障民生的同时，要维护社会公平正义（Xi Jinping, 2015）。在 2017 年 3 月召开的第十二届全国人民代表大会第五次会议和政协第十二届全国委员会第五次会议上，全面脱贫的迫切愿望也被纳入议程（中国人民政治协商会议（2017）；全国人民代表大会（2017））。

中国当前的政策着眼于精准的、有针对性的干预措施，这既是对当前不平等现状的应对，也是受"新常态"的驱动——即在增长预期下调的同时，希望了解全民健康保险等社会服务领域新增的公共投资是否以最低的经济成本为大多数人带来了最大的利益。财政收入预期增长率下滑，加之大量剩余的社会需求导致消费相对强劲增长，促使中国提升投资的公平性、提高投资效率并增强投资的有效性。

中国的一项关键的增长策略便是通过投资于儿童的未来，帮助下一代的每一位儿童实现其权利并使其潜力得到充分发展。中国要实现从中等到高等收入国家的转变目标，诸如认知资本这样的组织框架或将推动出台一揽子政策，并能促进公共投资的公平性、高效率和有效性。

认知资本

认知资本是当神经增殖和大脑结构发育处于峰值时投资于儿童的一种新兴范式和组织框架。该名词是联合国儿童基金会（UNICEF）在亚太地区最近使用过的，旨在强调儿童早期干预措施对儿童发展结果和经济增长的联合效应——通俗来讲，即"孩子越聪明，经济越健康"（UNICEF, 2016）。方框 1 展示了投资认知资本可获得的回报。

方框 1 – 认知资本的回报

"认知资本无法通过开采或贸易交换获取，而须依托最具前瞻性的政策来悉心培育。对儿童、尤其是最年幼的儿童的投资所产生的回报不仅有利于人权的实现，也将遏制如今因不平等现象、遭受剥夺和经济停滞不前所带来的巨大障碍。这些投资有助于为以实现人的潜力为特色的经济繁荣铺平道路。"（Samson, 2016, p. 4）

不同于金融资本或社会资本，认知资本着眼于人的潜力，代表着通过对营养、卫生、教育、儿童保护和社会福利制度等影响大脑发育的方面进行早期儿童干预所获得的经济回报。发育中的大脑具有可塑性，神经连接具有复杂性，在积极刺激作用下，认知资本的经济回报十分显著。投资于大脑发育将带来健康和福祉、教育成效、技能潜能、就业状况和生活质量等方面的改善。反之亦然。负面刺激则会导致认知资本贬值、身心健康受损、教育成效降低以及人生机会减少。

一般认为，认知资本与认知功能、智力、认知能力、认知潜能以及认知储备等概念在范畴上有所重叠（Bynner & Wadsworth, 2010）。基于纳菲尔德基金会 2007 年的一系列关于儿童认知能力的决定因子与发展结果的讲座，以及英国于 1946 年到 2000 年所做的一系列基于人群的抽样调查（Richards & Schoon, 2010），认知资本此前曾被定义为"一种可籍以发挥创造、把握时机、绵延福祉，以应对环境挑战和压力

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的累积资产”（Richards & Deary, 2010, p. 198）。这一定义指出，认知技能的重要性与日俱增，其对提高生活质量和应对逆境也有诸多益处。其后发表的一些论文谈及了儿童早期发展的重要性（Schoon, Hope, Ross, & Duckworth, 2010），并指出从教育等方面投资的角度出发，这一 “资本” 在增加未来就业收入方面所具有的价值（Bynner & Wadsworth, 2010）。但是，该定义并未完全体现在生命最初几年大脑发育的黄金期进行投资的重要性，也未充分关联到相应的宏观经济影响。

关于认知资本的定义还有如下表述：

“主要在孕期和儿童早期培育出的、决定人能力的全套智力技能……[它] 驱动着现代经济增速最快的领域……[并且] 那些享有良好营养、积极刺激，在支持性的、安全的家庭和社会环境中成长的男孩和女孩们，他们的这一资产能够得到最充分的培育”（Samson, Fajth, & François, 2016, p. i20）。

上述定义虽不够简洁，但抓住了投资儿童大脑发育有助于促进经济增长这一要点。

近年来，中国的快速发展使得儿童状况显著改善，认知资本可成为中国持续发展的一种组织框架。根据认知资本先前的框架，从权利和经济角度出发，为了既能体现在大脑发育期进行投资的重要性，也能反映这一投资对于经济的影响，特此提出下述适合中国国情的认知资本定义：“用于可确保儿童大脑发育最优化、实现儿童权利、促进未来经济增长的干预措施的、公平的资源投资”。

大脑发育

认知资本在大脑发育的最初阶段开始积累。在生命最初的 1000 天里（从怀孕到出生后 2 岁），大脑发育与诸多环境因素的相互作用较强，对儿童的干预措施通常集中在卫生、营养和早期启蒙上。同样，对看护人及其子女的教育支持，以及针对父母和看护人的正向、非暴力的育儿教育，也会对促进大脑发育产生关键的影响。

在生命早期，神经细胞发育处于峰值（每秒钟有 700 至 1000 个新的神经连接形成；Bourgeois, 1997; Huttenlocher & Dabholkar, 1997; Shonkoff & Richmond, 2009; UNICEF, 2014a, 2014c）。随着时间推移，这一速度逐渐减缓，而当既定的神经回路模式形成之后，要将其改变十分困难（Shonkoff & Richmond, 2009），充分说明在幼龄阶段采取干预措施的重要性（Feldman, 2000; Zheng & Knudsen, 2001）。在三到六岁期间，大脑发育已经逼近脑重最大值的 90%。（Dekaban & Sadowsky, 1978; Dobbing & Sands, 1973; Reiss, Abrams, Singer, Ross, & Denckla, 1996）。

由于发育中的大脑可塑性强，其受到正面和负面塑造的可能性都很高。然而，实施最佳干预的窗口期是短暂的。突触的数量大约在 6 岁时达到峰值，其后十年间不断减少（Nelson, 2000）。这成为公平投资在生命早期开发认知资本的有力佐证。

在 2007 年、2011 年和 2016 年，《柳叶刀》杂志发布了三期关于儿童早期发展的系列报告（“Advancing Early Childhood Development,” 2016）。近年来，儿童早期发展已远远超出一项运动，而被纳入了全球各政府部门的日程。通过投资于儿童早期发展的干预措施以增加认知资本可提供最有利的投资机遇，而这一过程远不止于此。认知能力在整个童年期、青少年期乃至成年以后继续发展，并有可能在以后尝试修正早期经验对大脑的损害（Center on the Developing Child at Harvard University, 2016）。不仅如此，由于高水平的神经回路在儿童后期仍然可塑造，大脑不同类型的可塑性在整个生命周期会持续，也就意味着机会窗口期保持开放（National ScientiÞc Council on the Developing Child, 2007）。在青少年期对认知发展进行干预能否带来显著效果尚缺乏证据。如何确保这一年龄组人群在进入成年期前能够得到充分的认知能力发展，仍需进一步研究。

投资回报

从非专业人员到半专业人员，再到技能型专业人才，就业市场的代际转变受到一系列社会经济因素的影响。非常有必要看到：中国的劳动力性质正在发生变

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化，与其他亚洲国家情况类似——从农业劳动力和工业岗位，逐渐过渡到商业、数字和技术导向的各种机遇，这些新的机遇需要各种不同的技能，严重依赖于大脑的充分发育以及高质量的医疗保健、营养和教育投入（Noble, Blight, Fajth, & Woodhouse, 2016）。 保护儿童免受暴力和忽视同样重要，并需要准确的数据来确定问题的严重程度。

童年时期的干预措施能带来社会、经济和环境方面的高回报。在减少营养不良和免疫促进方面每投入1美元，回报分别约为45和60美元（Copenhagen Consensus Center, 2017）。此外，有关儿童早期教育的大量经济分析显示，针对大脑发育处于高峰期的0-3岁儿童的项目投入，最高可获得7-10%的人力资本回报 率（Heckman, 2008, 2012; Heckman & Masterov, 2007）。针对0-5岁弱势儿童的高质量的干预项目可产生每年13%的投资回报率（García, Heckman, Leaf, & Prados, 2016）。另一项分析表明，在中国，针对儿童的暴力会导致健康受损、生产力下降等不良后果，从而给国家造成高达1010亿美元的损失，相当于国内生产总值的1.7%（Fang et al., 2015; Fry & Blight, 2016）。

母乳喂养除了对于母亲和新生儿之间亲密关系的建立具有重要意义，还与大脑更好的发育有关（Belfort et al., 2016; Deoni et al., 2013）。投资母乳喂养可能会使全世界的国民总收入每年至少提高0.49%，相当于3020亿美元，同时有助于提高孩子智商，且较之于配方奶粉喂养的方式，不会留下环境足迹（Rollins et al., 2016）。近期的一项荟萃分析研究显示，母乳喂养不仅有助于提高智力，还有增强对于传染病的免疫力、降低肥胖几率并增加生育间隔（Victora et al., 2016）等积极效果。巴西的一项出生队列研究显示，控制了一系列混杂因素后，母乳喂养与智商、受教育程度以及收入都具有正向相关性（Victora et al., 2015）。

研究显示，母亲孕期缺铁可能会导致婴儿贫血（Wang et al., 2015），从而影响儿童早期发展（Chang, Zeng, Brouwer, Kok, & Yan, 2013），这些可以通过孕期摄入铁和叶酸补充剂加以矫正（Christian et al., 2010）。孕期缺碘与儿童智商低相关，但其对于儿童早期发展的影响尚未明确（Black et al., 2013）。为确保儿童的最佳发展，推荐在生命的第一个1000天内为其提供包含营养、刺激和保护措施等关键要素的关爱性养育干预包（Britto et al., 2017）。据估计，在儿童时期受益于综合公共营养干预的成年人，收入比未接受干预的高11.3%（Hoddinott, Alderman, Behrman, Haddad, & Horton, 2013）。考虑到诸如未来税收、就业机会和公共医疗保健服务的使用等因素，这些发现有着重要的经济意义。

全民医疗保健体系对家庭有着直接的经济益处（Beattie, Yates, & Noble, 2016）。对某个国家模式的梳理表明了这样的体系能够减少灾难性的卫生支出以及由此导致的贫困问题（Health Insurance System Research OfÞce, 2012）。

为儿童提供安全网和公共资金支持的保护体系对于认知资本的开发也至关重要。反之，若未能为儿童创建安全的环境，甚至致使其遭受暴力困扰，则会降低智力功能（Samms-Vaughan & Lambert, 2017）。一些高收入国家的研究表明，儿童遭受暴力会导致智力功能受损和学业成绩下降（Gilbert et al., 2009; Jonson-Reid, Drake, Kim, PorterÞeld, & Han, 2004; Lansford et al., 2002）。针对儿童的暴力可能会降低学习能力，影响行为及社会情感功能（Fry & Blight, 2016）。

在更广泛的层面，社会保护可以赋权家庭，促使其投资于教育及其他服务，从而为经济增长奠定基础（Samson, 2016）。表1小结了一系列干预措施以及可能带来的投资回报。在中国，还需进一步对被证明有效的适合儿童各年龄段的干预措施进行系统量化研究，以带动公平、高效和有效的公共投资。

中国需要一支具有专业技能和良好认知能力的劳动力队伍，来增加税收、减少对养老金的依赖，以应对不断加剧的人口老龄化问题。基于有证可循的干预措施，投资于儿童大脑发育，为人们日益关注的这一问题提供了最强有力的解决方案。

在人口抚养比快速上升的背景下，对认知资本的投资为中国政府提供了一条发展之道，确保需要的劳动生

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表格 1

投资回报示例

领域	干预措施	投资回报
健康	免疫促进	• 免疫促进方面每投入 1 美元，回报最高可达 60 美元
	母乳喂养	• 在母乳喂养方面的投资可能会使全世界的国民总收入每年至少提高 0.49%，相当于 3020 亿美元
营养	综合公共营养	• 在儿童时期受益于综合公共营养干预的成年人，收入比未接受干预的高 11.3%
	减少营养不良	• 减少营养不良方面每投入 1 美元，回报最高可达 45 美元
儿童保护	防止和应对针对儿童的暴力	• 遭受暴力可导致智力功能和学业成绩下降，并可导致相当于中国 GDP 1.7% 的生产力损失。
教育	针对弱势儿童的高质量儿童早期发展项目	• 针对弱势儿童的高质量儿童早期发展项目每投入 1 美元，回报可达 7-13%

产率能够实现长期快速增长，保障人民生活水平日益提高。

在全球范围内，关于在特定领域对认知资本的投资产生高回报的证据正在确立。投资于发育中的大脑将带来就业机会和经济收益的增加，并将推进整体国民建设。

中国的下一步

在中国政府的坚强领导和政治承诺之下，通过将基础设施投资与卫生、营养、教育和社会保护干预措施等定向投资相结合的发展模式，中国在推动增长、减少贫困、实现人的发展等方面取得了前所未有的巨大成功。现如今，在增速减缓、人口和环境需求日益紧迫、不公平模式长期存在等背景之下，中国正面临从中等收入转为高收入国家的挑战。经济要持续增长，最终需要改善社会公平。失去对公平问题的关注，经济增长将难以持续。认知资本正是应对这一困境的一个有力的平衡手段。应对当前挑战最大的机遇之一，便是继续在儿童大脑发育可塑性最强的阶段对其进行投资。

认知资本是一个新兴范式和组织框架，它能够为前所未有的第二次“人口红利”创造潜力，从而使中国跨越“中等收入陷阱”，[1] 结束贫困和剥夺的代际传递。

认知资本的开发需依托于一揽子前瞻性政策，最大程度地利用现有和未来资源。中国需要保护当前对儿童的投资，确保公共资金公平、高效、有效地运行，与《联合国儿童权利公约》的精神相符 (The United Nations, 1989)。这就需要更好的问责机制、绩效监测和政策评估，包括通过纵向数据追踪儿童多维度贫困方面的进展。

要实现公平投资，需进行财政改革，加强对通货膨胀的理解，将财政补贴由城镇精英群体转移，重新分配给农村社区，扩大全民社会保护，并对儿童及家庭给予优先待遇。

然而，仍然存在许多未知领域。尽管当前已有些相关研究，仍缺乏在中国背景下关于儿童早期干预措施和经济增长关系的研究，包括缺乏对干预的影响和成本效益的分析。结合中国特点和儿童权利视角，关注投资回报率最高的干预措施，将有助于推动该领域的研究与政

[1] “中等收入陷阱”是指中等收入国家因成本上升、缺乏竞争力等原因未能实现向高收入国家转变的情况（Grifþth, 2011）。

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策议题。例如，尽管母乳喂养等干预措施与智力发展的关系已经明确，仍需在中国开展课题研究，探讨如果在母乳喂养促进方面不采取行动，会对经济产生怎样的影响，以便继续为政府推动针对儿童的战略性、有重点的投资创造条件。

在教育财政和利贫政策方面已有一些研究证据，但相应的政策措施还不到位，导致较大的地区差异和不平等状况。在儿童保护等特定领域，数据工作有待加强。无论是从获得新知识，还是从根据已有研究采取行动的角度来看，这些都是重点领域。相关研究不仅将有助于在中国决策者心目中巩固认知资本这一范式，也将有助于推动中国在 2030 年实现可持续发展目标。

还有更广泛的因素需要考虑。大脑发育以不同的方式在青少年时期持续进行，需要开展更多研究，以找到能够在人生第二个十年最大程度地激发潜能的干预措施。也不应忽视其他一些 "资本"，社会资本和金融资本为认知资本的最佳发展提供了背景条件。

近几十年来，尽管一些不平等现象仍然存在甚至加剧，中国在儿童事业方面的进展和承诺还是取得了诸多的改善。进行持续、有重点的、有助于儿童实现大脑最佳发育的公平投资，是中国保持前几十年发展成果的一大关键。"认知资本" 被定义为对促进儿童大脑最优发育、实现儿童权利及推动未来经济增长的干预措施的投资，这一概念体现了在改善中国儿童生活、加强国民建设和促进未来经济增长方面的重大机遇。

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本论文仅代表作者的个人观点，并不一定代表联合国儿童基金会的官方立场。

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What could cognitive capital mean for China's children?

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Abstract: Cognitive capital is an emerging paradigm that captures the criticality of investing in children whilst neural proliferation and development of brain architecture are at their peak. Distinct from financial capital, cognitive capital represents investment in future human potential from interventions in nutrition, health, education, child protection, and social welfare systems that optimize brain development. The return on investment is significant given the plasticity of the developing brain in response to positive stimuli. Investment in brain development results in improved health and well-being, educational outcomes, skills, employment, and quality of life. The inverse is also true. Negative stimuli lead to depreciating cognitive capital, poorer mental and physical health and educational outcomes, and decreased life chances. Cognitive capital could be an organizing framework for China's next phase of development to ensure the building of a prosperous society. Through significant commitment from the government, China has seen remarkable improvements in under-five mortality, literacy rates, access to basic education, life expectancy, and gross domestic product in the past few decades as the result of an expansion of publicly funded social services. Yet, inequities remain within and across communities and regions. In 2015, China had a country ranking of 97 for gross national income per capita, highlighting remaining challenges across the whole population. Cognitive capital relies on a package of forward-looking policies that lead to equitable, efficient, and effective use of existing and future resources. This is consistent with the United Nations Convention on the Rights of the Child. Investments in interventions that maximize optimal brain development in children, realize children's rights, and contribute to future economic growth, defined as "cognitive capital," represent a significant opportunity for improving children's lives, nation-building, and future economic growth in China.

Keywords: China; cognitive capital; early childhood development; public finance
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China's progress in development for children

China's development in recent decades has been unprecedented and has helped drive poverty-reduction nationwide. The Millennium Development Goals' successes were ahead of schedule, including fully achieving 9 years of compulsory school education and increasing the number of people with access to safe drinking water by over 500 million (Ministry of Foreign Affairs, People's Republic of China, & United Nations System in China, 2015; World Health Organization & United Nations Children's Fund [UNICEF], 2015). More than 800 million people in China have moved out of monetary poverty since market reforms began in 1978, and today China boasts the world's second largest economy (World Bank, 2016). Children's lives have been transformed. In 1991, the under-five mortality rate stood at 61 per 1,000 live births whilst by 2015 it had plummeted to 10.7 (National Health and Family Planning Commission, 2016). Life expectancy rose from 67.8 years in 1981 to 76.3 years in 2015 (National Bureau of Statistics of China, 2016a) and per capita gross domestic product (GDP) growth increased from an annual rate of 3.8% in 1981 to 6.4% in 2015 (World Bank, 2015).

China's national achievements not only made a substantial contribution to global progress against the Millennium Development Goals, China also played a leading role in the

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development and endorsement of the Sustainable Development Goals and there is strong commitment to achieving these goals by 2030 (Ministry of Foreign Affairs, People's Republic of China, 2016).

Yet, inequities persist, with 55.75 million people (5.7%) in China's rural areas living below the national poverty line, and poverty disproportionately affecting children, with 7.1% of rural children affected by monetary poverty (National Bureau of Statistics of China, 2016b). In 2014, under-five mortality rates in rural areas were more than twice those in urban areas (United Nations Development Programme in China & Development Research Center of the State Council of China, 2016). Inequities are reflected in social development indicators for children (UNICEF, 2014b), and also in income inequalities driven by the rural–urban divide (Xie & Zhou, 2014). The gross enrolment ratio in 3-year pre-primary was close to 50% in some provinces in 2013, in contrast to the average national gross enrolment ratio of 67.5% in the same year (UNICEF, 2014b). Also, China is ranked number 97 by country for gross national income per capita (2015: $7,930 U.S.), highlighting remaining challenges across the whole population (World Bank, 2017).

China's commitment to addressing inequities is unwavering and President Xi Jingping has indicated China's desire to eliminate poverty and to improve people's livelihoods, whilst ensuring equity and social justice (Xi, 2015). This desire to comprehensively tackle poverty was also reflected in the recent 2017 National Lianghui annual plenary sessions of China's top legislature and body of political advisers (Chinese People's Political Consultative Conference, 2017; National People's Congress of the People's Republic of China, 2017).

China's current policy focus on accurate and targeted interventions is a response to current levels of inequity and is also driven by the "new normal"—a reduction in growth forecasts, combined with an interest in understanding whether increased public investments in social services, such as universal health insurance, have delivered the maximum gains for the most people at the lowest possible economic cost. The expected decline in the fiscal revenue growth rate, combined with the relative strength of spending growth in the face of substantial remaining social demands, drives the case for China to improve equity, efficiency, and effectiveness of investment.

A key growth strategy for China is to realize the rights and harness the full potential of every girl and boy in the next generation by investing in their future. For China to realize the ambition of moving from a middle- to a high-income country, an organizing framework, such as cognitive capital, could drive a package of policies along with equitable, efficient, and effective public investment.

Cognitive capital

Cognitive capital is an emerging paradigm and organizing framework for investing in children whilst neural development and reorganization are at their peak. The term was most recently used by UNICEF in the Asia–Pacific to capture the combined power of early childhood interventions on both developmental outcomes for children and economic growth—coined in lay terms as: "smarter children, healthier economies" (UNICEF, 2016). Box 1 captures the dividends possible by investing in cognitive capital.

BOX 1

THE RETURN FROM COGNITIVE CAPITAL

"Cognitive capital cannot be mined or traded but rather must be carefully cultivated by the most forward-looking of policies. Investments in children, particularly in the earliest years, yield dividends that not only realize human rights but also slay today's giants of inequality, deprivation and economic stagnation. These investments help pave the way to an economic prosperity characterized by the achievement of human potential." (Samson, 2016, p. 4)

Distinct from financial or social capital, cognitive capital captures the idea of human potential, based on the economic returns from investment in childhood interventions in nutrition, health, education, child protection, and social welfare systems that affect brain development. The return is significant given the plasticity of the developing brain and the complexity of neural connections in response to positive stimuli. Investment in brain development results in improved health and well-being, educational outcomes, skills, employment, and quality of life. The inverse is also true. Negative stimuli lead to depreciating cognitive capital, poorer mental and physical health and educational outcomes, and decreased life chances.

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It is recognized that cognitive capital has overlap with cognitive function, intelligence, cognitive ability, cognitive capability, and cognitive reserve (Bynner & Wadsworth, 2010). Based on a series of lectures at the Nuffield Foundation in 2007 on determinants and consequences of cognitive ability in children, and related to a series of population-based surveys in the United Kingdom between 1946 and 2000 (Richards & Schoon, 2010), cognitive capital has been previously defined as: "[an] accumulating asset that can be drawn upon to create and to take advantage of opportunities and to sustain well-being, in response to environmental challenge and stress" (Richards & Deary, 2010, p. 198). This definition captures the incremental weight of cognitive ability over time and its advantages for quality of life and responding to adversity. Subsequent papers touch on the importance of early childhood development (Schoon, Hope, Ross, & Duckworth, 2010), and discuss "capital" as an investment, educational or otherwise, with value in terms of future income from employment (Bynner & Wadsworth, 2010). But, the definition does not fully reflect the importance of investment in the early years when brain development is at a premium, nor does it relate sufficiently to the macroeconomic implications.

Cognitive capital has also been described as representing:

> [T]he complete set of intellectual skills, primarily nurtured prenatally and in early childhood, that determines human capabilities … [it] drives the most rapidly growing sectors of the modern economy … [and] develops optimally in boys and girls who benefit from good nutrition, stimulation and a supportive and secure family and social environment. (Samson, Fajth, & François, 2016, p. i20)

This definition, whilst not concise, captures the essence of investment in brain development for children for economic growth.

Given the remarkable pace of development in recent years leading to much progress for China's children, cognitive capital could be an organizing framework for China's ongoing development. Drawing on previous framings of cognitive capital, whilst seeking to reflect both a rights- and economic-based definition that captures the importance of investment during brain development and also the economic implications of such investment, the following definition of cognitive capital is appropriate in China's context: the equitable investment of resources in interventions that maximize optimal brain development in children, realize children's rights and contribute to future economic growth.

Brain development

Cognitive capital accumulates during the earliest phases of brain development. During the first 1,000 days of life, interventions for children often focus on health, nutrition, and early stimulation as the environment for brain development with this interplay of factors is high. Education support to caregivers and their children, and positive, nonviolent parenting education for parents and caregivers also play a critical role in the developing brain.

Neuronal development is at its peak during the early years (700–1,000 new neural connections form per second; Bourgeois, 1997; Huttenlocher & Dabholkar, 1997; Shonkoff & Richmond, 2009; UNICEF, 2014a, 2014c). This rate falls over time, and when given circuitry patterns are established it is problematic to change them (Shonkoff & Richmond, 2009), highlighting the importance of interventions in the early years (Feldman, 2000; Zheng & Knudsen, 2001). Between the ages of 3 and 6 years, up to 90% of a developing brain's final weight is established (Dekaban & Sadowsky, 1978; Dobbing & Sands, 1973; Reiss, Abrams, Singer, Ross, & Denckla, 1996).

The malleability of the developing brain to be shaped positively and negatively is therefore high; however, the window for optimal intervention is short. Levels of synapses are at their peak by about 6 years of age, decreasing over the next 10 years (Nelson, 2000). This makes a compelling case for equitable investment in developing cognitive capital during the early years of life.

The Lancet has published three "Early Childhood Development" series: in 2007, 2011, and 2016 ("Advancing Early Childhood Development," 2016). Early childhood development has become more than a movement in recent years with the approach being embedded across government ministries globally. Investment in early childhood development interventions to increase cognitive capital offers the optimal opportunity for investment, but the journey does not end at that point. Cognitive capacities continue to develop throughout childhood, adolescence, and in adult life and it is possible to try to rectify earlier brain insults in later life (Center on the Developing Child at Harvard University, 2016). Moreover, different types of brain

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plasticity continue across the life course, meaning the window of opportunity remains open given that later in a child's life higher-level circuits can still be shaped (National Scientific Council on the Developing Child, 2007). Cognitive development in the adolescent years is not as well defined in terms of evidence-based interventions that lead to significant change, and further research is needed to ensure this age group benefits from maximum cognitive development prior to adulthood.

Returns on investment

The generational changes from unskilled and semi-skilled workers to skilled professional employment are influenced by a range of socioeconomic factors. This is important given the changing nature of China's workforce, which is similar to other parts of Asia—an ongoing shift from agricultural labor and industrial occupations to business-, digital-, and technology-orientated opportunities that require different skills, relying heavily on optimal brain development and the input of high-quality health care, nutrition, and education (Noble, Blight, Fajth, & Woodhouse, 2016). Prevention of violence and neglect is also important, and accurate data are needed to determine the extent of the problem.

Interventions in childhood have high rates of social, economic, and environmental returns. For every $1.00 U.S. invested in reducing malnutrition and promoting immunization, the returns are approximately $45.00 U.S. and $60.00 U.S., respectively (Copenhagen Consensus Center, 2017). And, extensive economic analysis in early childhood education has demonstrated that the highest rate of return of 7–10% in human capital is during the period of maximal brain development in programs targeted towards the first 3 years of life (Heckman, 2008, 2012; Heckman & Masterov, 2007). High-quality birth-to-five programs for disadvantaged children can deliver a 13% per year return on investment (García, Heckman, Leaf, & Prados, 2016). Another review has shown that violence against children in China can lead to health consequences and productivity losses that may cost the country upwards of $101 billion U.S., equal to 1.7% of GDP (Fang et al., 2015; Fry & Blight, 2016).

Breastfeeding, in addition to the importance of the intimacy between a mother and newborn, is associated with enhanced brain development (Belfort et al., 2016; Deoni et al., 2013). Investing in breastfeeding may increase world gross national income by at least 0.49% or $302 billion U.S. per year, lead to improvements in IQ, and will not leave an environmental footprint, in contrast to formula feeding (Rollins et al., 2016). A recent study of meta-analyses showed increased intelligence from breastfeeding, as well as other positive effects, such as protection from communicable disease, possible reductions in obesity, and increases in birth spacing (Victora et al., 2016). A cohort study in Brazil controlling for a range of confounders showed associations between breastfeeding and higher IQs, educational attainment, and income (Victora et al., 2015).

Maternal iron deficiency has been shown to be associated with anemia in offspring (Wang et al., 2015), leading to suboptimal early childhood development (Chang, Zeng, Brouwer, Kok, & Yan, 2013), which can be corrected by maternal iron and folate supplements (Christian et al., 2010). Maternal iodine deficiency is associated with lower IQ in children, but effects on early childhood development are not firmly established (Black et al., 2013). Intervention packages combining key elements of nurturing care, including nutrition, stimulation, and protection in a child's first 1,000 days, are recommended for optimal child development (Britto et al., 2017). Adults who as children benefited from comprehensive public nutrition earn incomes an estimated 11.3% higher than their counterparts who did not receive the intervention (Hoddinott, Alderman, Behrman, Haddad, & Horton, 2013). These findings have significant economic implications when factors such as future taxation, employment opportunities, and state-funded health care usage are considered.

Universal health-care systems have direct economic benefits for households (Beattie, Yates, & Noble, 2016). A review of one national model showed how such a system leads to less catastrophic health expenditure and impoverishment (Health Insurance System Research Office, 2012).

Creating safety nets and publically funded systems for children also has a key role to play in developing cognitive capital. Failing to create safe environments for children and subsequent exposure to violence reduces intellectual functioning (Samms-Vaughan & Lambert, 2017). In high-income countries, exposure to violence is associated with reduced intellectual functioning and academic achievement (Gilbert et al., 2009; Jonson-Reid, Drake, Kim, Porterfield, & Han, 2004; Lansford et al., 2002). Violence against children may reduce learning and behavioral, social, and emotional functioning (Fry & Blight, 2016).

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Table 1
Examples of Return on Investments.

Sectoral area	Intervention	Return on investment
Health	Promoting immunization	For every $1.00 U.S. invested in promoting immunization, returns range up to $60.00 U.S.
	Breastfeeding	Investments in breastfeeding may increase world gross national income by at least 0.49% or $302 billion U.S. annually
Nutrition	Comprehensive public nutrition	Adults who as children benefited from comprehensive public nutrition interventions earn incomes an estimated 11.3% higher than those who did not
	Reducing malnutrition	For every $1.00 U.S. invested in reducing malnutrition, returns range up to $45.00 U.S.
Child protection	Preventing and responding to violence against children	Exposure to violence associated with reduced intellectual functioning and academic achievement and can lead to productivity losses that may cost China 1.7% of gross domestic product
Education	High-quality early childhood education programs for disadvantaged children	Every dollar invested in quality early childhood development for disadvantaged children can produce a 7–13% return

More widely, social protection empowers households to invest in education and other services thereby creating a foundation for economic growth (Samson, 2016). Table 1 summarizes a selection of investments and the possible returns. Further research is needed in China to systematically quantify the suite of age-appropriate evidence-based interventions to steer equitable, efficient, and effective public investment.

In China, a professionally skilled and cognitively developed workforce that can increase tax revenues and reduce pension liabilities is needed to support the rising population of elderly dependents. Investment in brain development of children with evidence-based interventions offers the strongest solution to this growing concern.

Investment in cognitive capital offers the Government of China a path to ensuring the rapid increase in long-term labor productivity required to guarantee rising living standards in the face of a rapidly rising dependency ratio.

The evidence for high returns from investment in cognitive capital in specific areas is building globally. Investment in the developing brain results in increased employment and economic gains, and can contribute to overall nation-building.

Next steps in China

China's historically unprecedented success in promoting growth, reducing poverty, and achieving human development outcomes with strong government leadership and commitment has been delivered by a development model combining investment in infrastructure with targeted investments in health, nutrition, education, and social-protection interventions. China now faces the challenge of moving from a middle- to a high-income country in the context of slowed growth, pressing demographic and environmental demands, and persistent patterns of inequity. Sustained economic growth ultimately requires improved equity. Economies on the rise that do not pay attention to equity lose their gains. Cognitive capital is a powerful equalizer tackling this dilemma. One of the biggest opportunities to meet current challenges continues to be investment in children when brain development is at its most malleable.

Cognitive capital is an emerging paradigm and organizing framework that creates the potential for a historically unprecedented second "demographic dividend," lifting China out of the "middle-income trap"[1] and ending the inter-generational transmission of poverty and deprivations.

Cognitive capital relies on a package of forward-looking policies making the best use of existing and future resources. China needs to protect current investment in children and ensure that public financing is equitable, effective, and efficient, consistent with the United Nations Convention on the Rights of the Child (1989). This will require better accountability, performance monitoring, and evaluation of policies, including longitudinal data tracking the progress of children across multiple dimensions of poverty.

Equitable investment relies on fiscal reform, understanding inflation, redistribution of subsidies away from the urban elite to rural communities, expansion of universal social protection, and prioritization of children and families.

[1]"Middle-income trap" refers to the situation when a middle-income country fails to transition to a high-income country because of rising costs and lack of competitiveness (Griffith, 2011).

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Yet, there are still unknowns. Although there is some existing research there is a lack of contextualized research in China on interventions in childhood and economic growth, including a lack of impact and cost–benefit studies. A China-specific lens on interventions with the highest return on investment with a rights orientation could help drive the research and policy agenda in this area. For example, while the relationship between interventions such as breastfeeding and intelligence is established, studies showing links between non-action in breastfeeding promotion and how this affects the economy are needed in China to continue to make the case across government for strategic and focused investment in children.

There are policy gaps in response to existing evidence on educational financing and pro-poor policies, with resulting wide geographical variations and inequities. In certain sectors, such as child protection, data need to be strengthened. These are important areas to both develop new knowledge and act on existing research. Not only will this solidify the cognitive capital paradigm in the minds of China's policymakers, but it will also play a role in China's accomplishment of the Sustainable Development Goals by 2030.

There are wider factors to consider. Brain development continues in the adolescent years in a different way and more research is needed on the interventions that best harness the potential of the second decade. There are other "capitals" as well that must not be forgotten. Social and financial capital provide a backdrop for optimum development of cognitive capital.

China's progress and commitment to children have seen many improvements in recent decades, despite some inequities remaining and growing. Continued and focused equitable investment in children that optimizes brain development is a critical focus for China in order to sustain the gains of previous decades. Investments in interventions that maximize brain development in children, realize children's rights, and contribute to future economic growth, defined as "cognitive capital," represent a significant opportunity for improving children's lives, nation-building, and future economic growth in China.

Disclosure of conflict of interest

The authors declare that there are no conflicts of interest.

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K. M. and L. Q. conducted a literature review and edited and contributed to the manuscript. D. N. wrote the first version of the manuscript and edited later versions. All authors commented, contributed, and edited the manuscript.

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