中国特色现代化创新体系的内涵阐释与关键着力点

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摘　要：中国特色现代化创新体系是实现科技强国战略目标、推动高质量发展和全面现代化的重要支撑。本文从理论层面对中国特色现代化创新体系的内涵与关键着力点进行了系统性探讨。首先，通过回溯创新体系的概念溯源与中国实践，分析了国家创新体系的发展演进及其整体效能提升的理论基础。其次，探讨了中国特色创新体系的内涵嬗变，包括创新路径从引进模仿向自主原创的转型、后熊彼特创新范式的兴起、本土化创新理论的完善以及中外创新体系的比较；阐释了中国特色创新体系的核心表征。最后，分析了构建中国特色现代化创新体系的关键着力点，提出以新质生产力发展为目标引领创新体系高效运转，以科技创新和产业创新深度融合为核心优化创新资源配置，以需求和场景为驱动培育数字化赋能的创新生态，以体制机制创新为依托提升创新治理能力，以优化科技成果转化机制为抓手促进创新价值实现的具体路径。

关键词：中国特色现代化创新体系；后熊彼特创新范式；内涵阐释；关键着力点

JEL 分类号：O31；L52；P48

中国特色现代化创新体系不仅是民族复兴的重要支撑，更是推动全球发展合作、贡献中国智慧的重要平台。2024年6月24日，习近平总书记在全国科技大会、国家科学技术奖励大会、两院院士大会上提出2035年建成科技强国的战略目标，并指出：“我们要以‘十年磨一剑’的坚定决心和顽强意志，只争朝夕、埋头苦干，一步一个脚印把这一战略目标变为现实。”中国特色现代化创新体系的构建，不仅是建设科技强国、推动科技自立自强的战略基石，更是助力产业创新、推动经济高质量发展的重要引擎。党的二十大报告将科技创新摆在国家发展全局的核心位置，明确提出“完善科技创新体系”，党的二十届三中全会进一步提出“构建支持全面创新体制机制”，并强调“教育、科技、人才是中国式现代化的基础性、战略性支撑”。鉴于此，本文拟对中国特色现代化创新体系的概念内涵进行系统性阐述，并剖析其构建的关键着力点，以期在丰富我国创新理论的同

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基金项目：国家社会科学基金重大项目“打赢关键核心技术攻坚战的目标、主攻方向与对策研究”（项目批准号：23ZDA062）。

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时，对促进科技创新与产业创新深度融合有所裨益。

一、创新体系的概念溯源及中国实践

（一）创新体系的概念溯源

创新体系（innovation system）的概念最初来源于国家创新体系（National Innovation System，NIS）。英国经济学家克里斯托弗·弗里曼（Christopher Freeman）于1987年首次提出了国家创新体系的概念，强调该体系是“由公共部门和私营部门中各种机构组成的网络，这些机构通过活动和相互影响促进新技术的开发、引进、改进和扩散”（Freeman，1987；陈劲、李根祎，2024）。随后，学界从系统视角对国家创新体系进行了深化研究，认为国家创新体系是一个强调多要素协同和资源优化配置的动态网络（Lundvall，1992；陈劲、李根祎，2024）。基于此，创新体系的概念逐步泛化，成为涵盖国家、区域和行业等多层次的创新网络结构的理论框架。

经济合作与发展组织（Organizationfor Economic Co-operation and Development，OECD）从系统构成、功能及要素互动等角度将国家创新体系阐释为政府、企业、大学、科研院所、中介机构等公共部门和私人部门组成的、通过分工协作影响技术创新过程的网络（OECD，1997；陈劲、李根祎，2024），该分析框架得到了学界的普遍认同（陈劲、李根祎，2024；杜传忠、李钰葳，2024）。作为透视国家范畴内创新之于经济增长和国家竞争力的分析框架，国内学者从经济增长和国家竞争力的视角对国家创新体系进行了深入分析，认为其核心在于通过政府与市场协同作用，构建一个开放动态的创新网络系统，推动科技创新与经济社会深度融合（陈劲、李根祎，2024；杜传忠、李钰葳，2024）。这一体系涵盖创新主体、创新要素、创新活动与政策保障等多方面内容，其目标是通过优化资源配置，提升创新整体效能。结合中国实践，国家创新体系还突出强调产学研用结合和新型举国体制的作用，通过集中力量解决关键技术瓶颈问题，形成了中国特色的创新体系构建模式（陈劲、李根祎，2024；贺德方等，2023）。

国家创新体系效能作为衡量体系运行效率与价值实现程度的重要概念，近年来受到广泛关注。其核心在于通过创新主体、制度规则和创新环境的协同联动，推动创新资源的高效配置（陈劲、李根祎，2024；孟凡蓉等，2024）。国内外学者和机构围绕体系效能的提升机制展开了深入研究。如OECD从系统构成、功能及要素互动等视角，提出了“创新生态协同”的效能提升路径；国内学者进一步结合中国实际，探讨了新型举国体制下通过资源整合与制度创新提升体系整体效能的可能性（陈劲等，2024；陈劲、李根祎，2024）。本文在现有研究基础上，提出“有组织创新”作为提升国家创新体系效能的新战略范式，以期为新时代创新体系建设提供理论支撑。

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（二）我国创新体系的发展实践

改革开放以前，我国国家创新体系经历了从新中国成立初期在党的领导下快速建立起人才培养体系、以156项重点工程为核心打造工业基础并整合成立中国科学院，到1956年党中央发出“向科学进军”号召，制定科技发展远景规划，形成“五路科技大军”，再到此后探索计划经济体制下集中力量办大事的科研组织模式，在“两弹一星”等国家战略领域取得重大成果的过程，整体上是政府主导型，为后续国家创新体系的发展奠定了基础。

改革开放初期，科技体制改革逐步启动，旨在打破旧有体制束缚，激发科技人员的创新活力。1985年，中共中央发布《关于科学技术体制改革的决定》，推动科技与经济的结合，促进科技成果向现实生产力转化。此后，一系列旨在加强科技创新的政策和举措不断出台，如国家自然科学基金的设立，为基础研究提供了重要的资金支持。进入20世纪90年代，随着社会主义市场经济体制的逐步建立，我国进一步深化科技体制改革，实施了“863计划”“火炬计划”等重大科技计划，大力发展高新技术产业，培育创新型企业。1995年，中共中央、国务院作出《关于加速科学技术进步的决定》，首次提出实施科教兴国战略，强调把科技和教育摆在经济、社会发展的重要位置。2005年，国务院颁布的《国家中长期科学和技术发展规划纲要（2006—2020年）》，首次从政策视角对国家创新体系的概念阐释为“以政府为主导、充分发挥市场配置资源的基础性作用、各类科技创新主体紧密联系和有效互动的社会系统”，并将推进和完善国家创新体系建设作为深化科技体制改革的目标。

党的十八大、十九大和二十大对国家创新体系发展的部署各有侧重和递进。其中，党的十八大明确提出实施创新驱动发展战略，强调科技创新是提高社会生产力和综合国力的战略支撑，要摆在国家发展全局的核心位置，构建以企业为主体、市场为导向、产学研相结合的技术创新体系，加快科技体制机制改革创新。党的十九大提出加快建设创新型国家，瞄准世界科技前沿强化基础研究，加强国家创新体系建设，强化战略科技力量，深化科技体制改革，建立以企业为主体、市场为导向、产学研深度融合的技术创新体系，倡导创新文化，强化知识产权创造、保护、运用。党的二十大强调坚持科技是第一生产力、人才是第一资源、创新是第一动力，以健全新型举国体制为重点提升国家创新体系整体效能，以服务国家战略需求为导向打好科技自立自强主动仗，以提高人才自主培养质量为核心走好人才驱动创新道路，以激发自主创新潜能为目标培育鼓励创新、包容创新的深厚土壤。党的二十届三中全会进一步强调构建支持全面创新体制机制，统筹推进教育科技人才体制机制一体改革，包括深化教育综合改革、科技体制改革、人才发展体制机制改革，健全新型举国体制，提升国家创新体系整体效能，具体举措涵盖加强国家战略科技力量建设、改进科技计划管理、强化企业科技创新主体地位、完善中央财政科技经费分配和管理使用机制、深化科技成果转化机制改革等方面。

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二、中国特色创新体系的内涵演变

（一）创新路径由引进模仿转向自主原创

在全球科技竞争日益激烈的背景下，我国科技创新正处于由科技大国向科技强国转型的关键时期。改革开放以来，“引进、消化、吸收、再创新”和集成创新为我国积累了技术基础，推动了产业升级发展，迅速缩小了与国际先进水平的差距。但随着国际形势的变化，依靠跟随追赶加快科技进步的难度增大，在关键核心技术领域面临着严峻的“卡脖子”问题。同时，新一轮科技革命和产业变革加速发展，全球争夺科技制高点的竞争空前激烈。在此背景下，我国的创新路径经历了从“引进、消化、吸收、再创新”和集成创新向自主创新的重大转型。例如，在量子通信领域，我国成功发射了世界首颗量子科学实验卫星“墨子号”，在高铁技术上，CR400系列复兴号动车组实现了完全自主设计和制造。这不仅体现了我国在原始创新方面的突破，也为产业升级和经济发展提供了强有力支撑（陈劲、李根祎，2024；刘云等，2019；裴哲，2024）。

以原始性科学创新、原始性技术创新和原始性工程创新为主要构成的原始创新作为最根本、最能体现智慧的创新，是科技创新的源头活水。其通常源于基础研究领域的重大突破，能够开辟全新的学科方向、研究领域和技术路径，为后续的技术创新和产业发展提供根本性的支撑，在自主创新体系中具有基础性、关键性作用（陈劲等，2023；陈劲、李根祎，2024）。当前，我国在量子通信、高温超导等领域已经取得了一定的原始创新成果，不仅在科学理论上实现了重大突破，也为我国在相关产业的发展中赢得了先机，提升了我国在国际科技竞争中的地位。然而，我国在原始创新方面仍面临诸多挑战，如基础研究投入相对不足、科研评价体系有待完善、创新人才培养和激励机制需要优化等。

颠覆性创新则侧重于通过全新的技术、产品和商业模式，对现有市场和产业格局产生颠覆性的影响，为后发者提供超越领先者的机会（陈劲、李根祎，2024；曲冠楠等，2023）。在当前的数字经济时代，颠覆性创新的作用愈发显著。以互联网、人工智能、大数据等为代表的新兴技术，不断催生新的业态和商业模式，如共享经济、智能制造等，深刻改变了人们的生产和生活方式。此外，颠覆性创新也能够引领突破现有技术轨道，改变经济发展形态，形成新质生产力。我国在部分领域已经展现出较强的颠覆性创新能力，如移动支付、短视频等应用在全球范围内处于领先地位。但在整体上，我国在颠覆性创新方面仍需加强技术研发与市场应用的结合，提高对颠覆性技术的识别、培育和推广能力，以更好地应对国际竞争。

（二）后熊彼特创新范式的兴起

后熊彼特创新范式在知识时代和数字化时代的背景下应运而生，其多元化主体、开放性治

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理、社会化目标和网络化生态等特征，与中国式现代化创新体系的实践具有高度契合性。一方面，后熊彼特创新范式强调普通用户、创客等非生产者在创新中的重要作用，这与中国近年来推动“大众创业、万众创新”政策形成呼应。通过创新主体的多元化，创新成果更贴近社会需求。另一方面，该范式提出技术创新的社会化目标，强调创新不仅服务于经济增长，还应服务于社会福祉和可持续发展，这与中国特色发展理念中的“以人民为中心”高度一致。此外，中国的新型举国体制通过政策引导和资源整合，为后熊彼特创新范式的实施提供了制度保障，推动了协同创新和网络化生态的构建（陈劲、李根祎，2024）。

从创新主体来看，后熊彼特创新范式着重强调普通百姓、创客等非生产者在创新进程中的关键作用，认为非生产者在技术研发和创新扩散中具有不可替代的作用（陈劲、李根祎，2024；陈劲、李佳雪，2022）。该范式极大地拓宽了创新主体的范畴，推动我国国家创新体系的主体范围从企业和科研机构扩展到普通用户、创客群体及创新社区，使创新活动更加贴近社会需求，实现更加广泛的知识共享与协同创新。通过将非生产者纳入国家创新体系，创新资源的利用效能得到了显著提升。

从创新目标来看，后熊彼特创新范式强调创新目标从单纯的经济导向向社会价值和公共利益延展，突出技术创新的公共属性和社会化功能。后熊彼特创新范式指出，创新不仅是经济增长的驱动力，更是解决社会问题、促进社会公平和提升公共福祉的重要工具。这一特征要求我国国家创新体系在规划创新活动时，将社会需求、生态可持续发展和人类福祉纳入创新目标，通过政策引领和资源配置，推动创新活动更加贴近社会现实和公共需求，从而实现技术进步与社会发展的深度融合。

从创新治理来看，后熊彼特创新范式强调从封闭式管理向多主体协同治理的转变。传统以政府或企业单一主体为主导的创新治理模式难以满足复杂、多元的创新需求，而后熊彼特创新范式倡导搭建开放的平台，协调不同主体之间的利益诉求和创新资源的高效流动。这种创新治理模式要求创新体系在政策设计中注重多主体协同，通过建立共享规则、促进知识流动和激励创新合作，使开放式治理成为推动创新生态系统建设的重要手段。

从创新生态来看，后熊彼特创新范式强调创新生态的网络化和动态化特征，要求创新体系从单一线性模式向复杂的网络化生态转型。创新主体之间的协作不再是单向或静态的，而是通过动态的知识流动和资源共享形成开放的网络生态。我国在新时期的创新体系建设中，通过推动区域协同创新、跨行业知识融合和全球创新合作，逐步构建起开放、互动的创新网络生态。这不仅提升了创新资源的配置效率，也为我国在全球科技竞争中赢得战略优势提供了重要支撑（陈劲、李根祎，2024；陈劲、李佳雪，2022）。

概言之，后熊彼特创新范式强调创新过程中前瞻的需求牵引与正确的问题求解相结合，并将广大人民作为最终用户，能够较好地回应创新的产生与扩散问题，以及贯穿这一过程的逻辑主线。

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（三）本土化创新理论日臻完善

2015年10月，党的十八届五中全会强调必须坚持以人民为中心的发展思想，把增进人民福祉、促进人的全面发展作为发展的出发点和落脚点。2015年11月23日，习近平总书记在主持十八届中央政治局第二十八次集体学习时指出，坚持以人民为中心的发展思想是马克思主义政治经济学的根本立场。以人民为中心的发展思想要求科技创新问需于民、问计于民，尊重人民群众的首创精神，依靠人民推动科技创新，将科技成果转化为人民的福祉，并以实践检验科技创新的实效。近年来，学界围绕创新的价值归旨，基于中国创新实践发展出多种中国特色创新理论，搭建了科技创新“从群众中来、到群众中去”的桥梁。

其一是以人民为中心的创新。以人民为中心的创新（people centered innovation）是一种以人民需求为出发点、以增进人民福祉为目标的创新理念，其核心在于将人民作为创新的主体和受益者，强调创新活动不仅服务于经济增长，更服务于社会进步与人的全面发展。该创新理念以马克思主义人民立场为理论基础，主张“创新为了人民、创新依靠人民、创新成果由人民共享”，通过多主体协同机制，激发全体人民的创新活力，将创新成果转化为社会价值。其注重文化传承与生态平衡，通过融入中华文化“天人合一”的整体观，将创新范式从单一经济导向转向全面关注社会福祉与可持续发展的路径。该理念推动创新活动更广泛地服务于社会发展与民生改善，是后熊彼特创新范式在中国特色社会主义制度背景下的具体化和深化。其一方面强调创新主体的多样性与包容性，有助于提升创新资源的社会化配置效率；另一方面强调创新成果的普惠性，有助于实现创新成果的公平分配与广泛共享；同时，该理念推动创新体系从“生产驱动”向“社会驱动”转变，以满足人民多维度需求为导向，统筹经济、科技、文化与生态的协同发展，为实现科技强国战略与共同富裕目标提供了重要支撑（陈劲、李根祎，2024）。

其二是有意义的创新。有意义的创新（meaningful innovation）是一种新时代的创新范式，强调将“意义”作为企业创新活动的核心要素，旨在通过统筹创新要素的重新组合，对创新产出的内在意义（如满足用户需求、实现情感共鸣）与外在意义（如推动社会福祉、支持国家战略需求、促进人类可持续发展）进行全面表达。从内涵上看，有意义的创新是以创新意义为核心变量，协调短期工具价值与长期战略价值，形成具有经济价值、社会价值、战略价值与未来价值的创新实践（曲冠楠等，2020）。其核心理念在于超越传统以技术与市场为导向的创新范式，回应人文精神与哲学思考在创新活动中的“回归”，推动企业从短期利益的束缚中解脱，聚焦中长期收益与外部社会福利，实现具有引领社会进步和人类发展意义的伟大创新实践（陈劲等，2019）。有意义的创新通过引入“意义”维度，重塑了中国创新体系的理论框架与实践路径。一方面，其促使创新活动从传统的技术驱动与市场导向扩展至关注社会需求与国家战略的综合维度，为中国创新体系的战略升

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级提供了理论支撑(曲冠楠等,2021)。通过推动企业在创新过程中主动融入社会价值与国家需求,有意义的创新强化了企业创新活动的外部性回应能力,助力中国从“模仿型创新”向“引领型创新”转型。另一方面,有意义的创新通过强调“意义发现”和“意义转化”的动态过程,引导企业建立基于意义管理的认知与决策框架,协调效率逻辑与意义逻辑,优化创新要素配置,从而提升中国创新体系的整体协同性与可持续性。在全球竞争加剧与技术变革加速的背景下,有意义的创新为中国构建更具包容性、前瞻性与系统性的创新体系奠定了基础。

(四)中外创新体系的特征比较

当前,国外创新体系以市场为主导,政府政策主要侧重激励研发投资和技术转移,创新目标聚焦经济增长与竞争力提升,创新生态和治理模式相对封闭,主体间协作分散,更多基于熊彼特创新范式,创新活动以技术突破为导向,较少涉及社会福祉和生态可持续发展。我国创新体系则更加注重“有为政府”与“有效市场”的协同作用,构建以企业为主体的新型举国体制,通过强化战略科技力量和产学研用结合,实现从引进模仿向自主原创的转型,突出原始创新与颠覆性创新能力,兼顾经济发展与社会价值、生态可持续目标。同时,我国创新体系强调多主体协同治理与开放动态的创新生态,通过区域协同和全球合作推动创新资源的高效配置,并逐步形成以人民为中心的价值底色和创新文化。中外国家创新体系之比较见表1。

表1 中外国家创新体系之比较

比较维度	中国特色国家创新体系	国外国家创新体系 (基于OECD主要经济体的抽象化归纳)
创新主体	强调企业为主体,推动产学研用结合,普通用户和创客等非生产者也参与创新,实现主体多元化	以企业、大学、科研机构为核心,主体间分工明确,普通用户和非生产者参与较少
创新目标	兼顾经济增长、社会福祉、生态可持续和国家战略需求,突出社会价值导向	主要聚焦于经济增长与国家竞争力提升,较少涉及社会问题和生态可持续发展
创新路径	从“引进、消化、吸收、再创新”转向自主原创,注重原始创新和颠覆性创新,解决关键技术“卡脖子”问题	以渐进式创新为主,依赖技术积累和市场机制,注重技术优化与改进
创新治理	强调政府与市场协同,通过新型举国体制协调多元主体,推动资源流动与利益平衡	以市场为主导,政府通过政策激励创新,但治理模式较为分散,协同机制较弱
创新生态	构建开放、动态、网络化生态,推动区域协同和全球合作,提高资源配置效率	创新生态相对封闭,主体间协作较少,更多依赖市场机制,呈现静态或线性模式
创新范式	偏向后熊彼特创新范式,创新主体多元化,注重社会化目标和协同网络生态	基于熊彼特创新范式,注重企业竞争和技术突破,追求经济效益,范式较封闭单向
政策支持	政府通过政策引导、资源整合和体制创新,促进科技与经济社会深度融合,强化企业创新主体地位	政策主要激励研发投资和技术转移,聚焦经济增长导向,较少涉及社会与文化创新环境
国际合作	通过开放创新提升国际合作水平,聚焦关键技术自主创新,同时推动全球创新资源互联互通	依靠跨国公司和技术联盟实现国际技术流动,合作形式更加市场化,更注重经济效益

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三、中国特色现代化创新体系的核心表征

现代化通常用于描述一个社会、国家或组织的发展过程，包括技术进步、经济结构变革、社会结构演变以及生活方式改变等方面（谢立中，2018）。现代化是动态的历史进程，不仅是物质技术的进步，更是人类文明形态的跃迁，归根结底是人的现代化。中国式现代化的探索表明，现代化不仅是技术追赶的历程，更是文明发展重塑的过程。中国特色现代化创新体系可从科技创新体系、产业创新体系和管理创新体系三个维度予以解构，其现代化的内涵至少包括知识生产的范式重构、创新生态的动态平衡、科技与人文的融合共生。其中，知识生产的范式重构是中国特色现代化创新体系的理论基石，创新生态的动态平衡是其运行保障，而科技与人文的融合共生则是其价值指向。在全球科技竞争加剧、产业变革加速以及社会需求日益多元的背景下，中国特色现代化创新体系应以新型举国体制为依托，通过统筹资源配置、协同多元主体、完善制度设计，构建一个开放、动态、包容的创新生态系统，为中国式现代化的全面推进提供强有力的科技支撑和理论支持（见图1）。

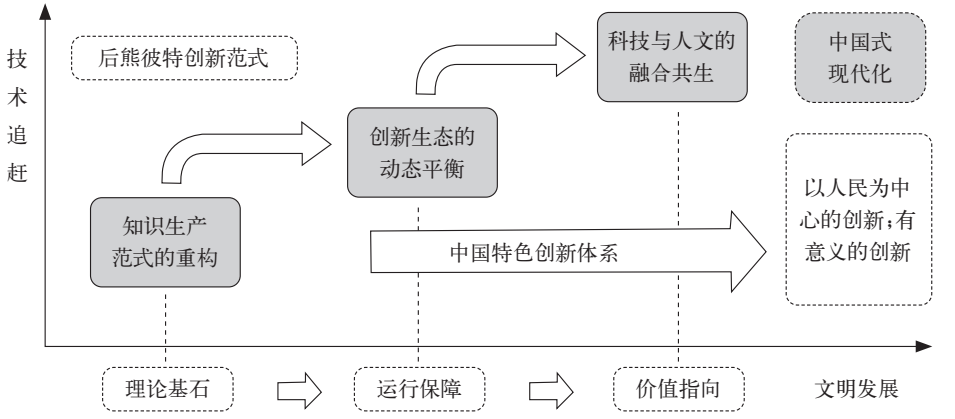

图1 中国特色现代化创新体系的核心构成

具体而言，中国特色现代化创新体系的核心构成的划分以理论研究和中国实际创新体系发展的实践为基础，主要依据如下：理论来源方面，依据源于后熊彼特创新范式、创新生态理论和系统科学思想的综合应用。后熊彼特创新范式强调知识生产的多元化、创新生态的网络化以及创新目标的社会化，为“知识生产的范式重构”和“创新生态的动态平衡”提供了理论依据（陈劲、李佳雪，2022）。创新生态理论则提出，现代创新体系的核心在于动态平衡的生态系统建设，即通过多主体协同和资源高效流动，构建开放的网络式创新体系（Lundvall，1992；陈劲等，2024）。同时，中国特色现代化的核心要求“以人民为中心”，强调科技与人文的深度融合，因此将“科技与人文的融合共生”作为关键构成之一（谢立中，2018）。实践依据方面，主要参考党的二十大报告中关于

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“科技是第一生产力、人才是第一资源、创新是第一动力”的论述，明确了“完善科技创新体系”的核心任务。此外，《国家中长期科学和技术发展规划纲要（2006—2020年）》将“全面推进中国特色国家创新体系建设”作为“当前和今后一个时期，科技体制改革的重点任务”，并从五个方面明确了“中国特色国家创新体系建设重点”；《中华人民共和国国民经济和社会发展第十四个五年规划和2035年远景目标纲要》（简称“十四五”规划）围绕“深入推进科技体制改革，完善国家科技治理体系，优化国家科技计划体系和运行机制”进行了系列部署。这些政策文件为中国特色现代化创新体系的核心构成的划分提供了依据。

（一）知识生产的范式重构

中国特色现代化创新体系的建设，应以知识生产范式的重构为基础，从根本上变革传统创新体系中知识创造与流动的方式。知识生产的范式重构意味着从单一线性、封闭式的知识生产模式向多元协同、开放动态的网络化生产模式转变，强调创新主体之间的深度互动与知识资源的高效流动（陈劲、李佳雪，2022）。后熊彼特创新范式的兴起为知识生产范式的变革提供了有力的理论支持。通过主张普通用户、创客等非传统生产者的全面参与，拓宽了创新主体的边界，推动知识创造从专业机构的垄断中解放出来，使社会化协作成为知识生产的重要特征。这种范式要求知识生产活动更加贴近社会需求，通过创新主体之间的协同作用，充分激发知识的创造力与转化力。

中国特色现代化创新体系还应融入新型举国体制的优势，优化知识生产的组织模式。新型举国体制通过集中优势资源解决“卡脖子”问题，强化基础研究中的原始创新能力，同时注重前沿科技的前瞻布局，推动关键领域知识的深度积累与突破（陈劲等，2023）。这种体系化的知识生产方式，能够充分调动政府、企业、高校、科研院所和用户等多元主体的创新活力，在知识生成、流动与应用的全链条中实现高效协同。通过这一过程，知识生产不再局限于单纯的技术研发，而是逐步扩展为技术、制度、文化等多维度的融合创新，为构建现代化创新体系奠定坚实的理论与实践基础。

（二）创新生态的动态平衡

中国特色现代化创新体系的构建，应以创新生态的动态平衡为核心目标，着力打造开放协同、灵活适应的创新生态系统。创新生态的动态平衡不仅是创新体系高效运行的基础，也是应对全球科技竞争、产业变革以及社会需求变化的关键保障。在后熊彼特创新范式的视域下，创新生态的网络化和动态化特征尤为突出，要求创新主体之间的协作从静态线性向动态交互转变，通过知识流动、资源共享与协同创新构建开放式的网络生态。这一生态系统的核心在于，通过多主体参与和相互作用，为创新活动提供一个灵活、有机的运行环境，使创新体系能够在复杂多变的内外部环境中实现自我调整与持续进化。

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中国特色现代化创新体系通过新型举国体制的协同机制，为创新生态的动态平衡提供了重要支撑。通过整合战略科技力量、国家级创新平台和用户企业，形成覆盖创新链全周期的协作网络，既能够在宏观层面实现资源的高效配置，又能够在微观层面释放多元主体的创新活力（陈劲、吴丰，2024）。此外，政府在创新生态中的元治理角色尤为关键，其通过政策引导、资源调配和风险应对等手段，确保创新生态在面对内外部冲击时具备较强的适应能力（吴丰等，2024）。这种动态平衡的创新生态，不仅能够促进创新效率和效能的提升，还能为高质量发展和高水平安全提供系统性保障（陈劲等，2025）。

（三）科技与人文的融合共生

中国特色现代化创新体系的建设，应以科技与人文的深度融合为重要方向，使创新活动不仅停留于技术与经济的维度，更能够承载社会价值、文化意义与生态责任。现代化不仅是技术进步的过程，更是人类文明形态的跃迁，科技创新理应与人类社会的整体发展目标相契合（谢立中，2018）。在这一背景下，中国特色现代化创新体系需要超越传统的工具理性导向，将创新活动与人民福祉、生态可持续发展以及文化传承紧密结合，推动科技与人文在更高层次上的融合共生。

以人民为中心的发展思想是中国特色现代化创新体系的重要价值底色。习近平总书记指出，坚持以人民为中心的发展思想，是马克思主义政治经济学的根本立场，要求科技创新问需于民、问计于民，尊重人民群众的首创精神，将科技成果转化为人民的福祉（陈劲、李根祎，2024）。在医疗健康、公共安全、绿色能源等领域，科技创新应优先服务于提升人民生活质量和满足社会公共需求。创新的意义不应仅体现在技术突破和市场收益上，更应通过回应社会问题、促进社会公平和提升公共福祉来实现。这种以人民为中心的创新理念，不仅拓展了科技创新的价值内涵，也为中国特色现代化创新体系注入了深厚的文化底蕴。

科技与人文的融合共生还体现在生态效益的持续显现上。中国特色现代化创新体系肩负着推动绿色发展和生态文明建设的重任，应通过绿色技术的研发与应用，探索出一条兼顾经济增长与生态保护的可持续发展路径（陈劲等，2024）。通过发展新能源、优化储能技术、推广环保技术等方式，中国特色现代化创新体系能够助力“双碳”目标的实现，为全球生态环境保护贡献中国智慧。在这一过程中，创新活动不再仅仅是技术上的进步，而是与社会价值、文化传承和生态责任的深度结合，展现出科技与人文相互滋养的独特魅力。

四、构建中国特色现代化创新体系的关键着力点

中国特色现代化创新体系的构建是实现科技强国战略目标的重要抓手，也是推动高质量发展和全面现代化的核心路径。在当前全球科技竞争加剧、产业变革加速以及社会需求日益多元

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化的背景下，中国特色现代化创新体系的构建不仅需要理论上的系统探索，更需要实践中的深度应用与动态优化。要全面提升中国特色现代化创新体系的整体效能，必须从战略目标、资源配置、运行机制和价值实现等关键方面着手，确保创新活动在全链条、全过程中实现高效协同和动态平衡。

（一）以新质生产力发展为目标，引领创新体系高效运转

中国特色现代化创新体系的构建，应以新质生产力的发展为核心导向，探索创新体系运行的理论基础与实践路径。新质生产力作为现代化经济体系的重要引擎，强调生产力形态从传统的物质驱动向知识驱动、技术驱动的全面跃升，要求创新体系在要素整合、资源配置与功能协同上实现质的突破。一方面，应从理论层面重新定义生产力的内涵与外延，超越传统物质生产的视角，将知识、数据、技术与生态要素纳入生产力结构框架，将其作为推动经济发展和社会进步的核心动力源。另一方面，应注重创新要素的动态交互与结构优化，通过提升科技资源的流动性与匹配度，强化创新体系的内部效能。在新质生产力的发展过程中，应大力推动技术与产业的深度融合，将前沿科技成果转化为具有市场价值和社会效益的生产能力。同时，应以新型基础设施为抓手，通过构建涵盖数据、算力、算法等数字要素的基础设施网络，释放创新要素的集聚效应与倍增效应。

此外，新质生产力的发展还应以体系思维（system of system，SoS）为指导（陈倩等，2023），注重现代化创新体系的整体联动性与协同性。一方面，应推动创新主体之间的深度协作，形成以企业、高校、科研院所为核心的多元创新主体联合体，充分发挥产学研用一体化的优势。另一方面，应通过优化创新政策与制度设计，强化政府在资源配置、规则制定与风险管理中的引导作用，完善市场化的资源流通机制，构建政府与市场相辅相成的协同创新格局。从管理学视角来看，推动新质生产力的发展不仅是技术突破和资源整合的过程，更是文化塑造与价值观重构的过程。通过塑造以创新为核心的价值导向，营造尊重知识、鼓励创造的社会氛围，可为中国特色现代化创新体系的高效运转提供坚实的文化支撑与制度保障。

（二）以科技创新和产业创新深度融合为核心，优化创新资源配置

在充分发展新质生产力的同时，中国特色现代化创新体系的完善还应以科技创新与产业创新的深度融合为核心，推动创新资源的优化配置与高效利用。科技创新是知识体系的外在表达，产业创新则是科技成果向经济价值转化的实践路径，两者的深度融合是现代化创新体系建设的重要抓手。一方面，科技创新为产业创新提供前沿技术、知识储备与理论支持，是产业创新的驱动力；另一方面，产业创新则为科技创新提供应用场景、市场反馈与可持续发展的动力来源，是科技创新的实践延伸。因此，构建中国特色现代化创新体系，需要在科技创新与产业创新的交汇点上

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实现资源配置的动态平衡与结构优化。

实践中，应以需求为导向，强化科技创新对产业升级的支撑作用。在构建创新体系时，需明确科技创新在产业链、价值链中的关键环节，通过前瞻性布局基础研究和前沿技术，解决关键领域的“卡脖子”问题，为产业发展提供战略性支撑。同时，应注重技术成果的转化效率，通过构建统一、高效的科技成果转化机制，打通从实验室到产业化的“最后一公里”，实现科技创新对产业创新的赋能。此外，产业创新也应为科技创新提供动态反馈，通过市场需求的牵引作用，推动技术研发目标的精准化、实用化。此外，需要构建区域协同创新体系，依托区域资源禀赋与产业特色，形成“科技创新—产业创新”双轮驱动的区域创新格局。

从资源配置的角度来看，科技创新与产业创新的深度融合还需依赖于多元主体的协同参与和资源共享。企业应作为创新主体，在技术研发、成果转化与市场推广中发挥主导作用；高校与科研院所则应聚焦基础研究与前沿探索，为产业创新提供理论与技术储备；政府则需通过政策引导、资源调配与制度设计，为科技与产业的协同创新提供良好的生态环境与制度保障。

（三）以需求和场景为驱动，培育数字化赋能的创新生态

中国特色现代化创新体系的建设，还应以需求和场景为驱动，着力培育以数字化赋能为核心特征的创新生态。在数字经济快速发展的背景下，创新活动的逻辑由技术驱动逐步向场景驱动转变，数字技术的广泛应用为创新生态的构建提供了新的可能性与实践范式（尹西明等，2024）。场景驱动的创新模式强调以应用需求为出发点，通过构建多样化的创新场景，打破技术与应用之间的壁垒，实现技术价值的快速转化与规模化推广。因此，中国特色现代化创新体系应紧密围绕社会需求与市场需求，在数字经济的赋能下构建开放、动态、网络化的创新生态系统。

数字化赋能的创新生态需要以数据为核心要素，通过数据的采集、分析与应用，充分释放场景驱动的创新潜力。一方面，应通过构建数据共享平台与数字基础设施，强化数据在多元主体之间的流动性与互操作性，为创新活动提供精准的需求洞察与决策支持。另一方面，应以数字技术为工具，推动创新场景的多样化发展。例如，在智慧城市、智能制造、医疗健康等领域，可以通过构建基于物联网、人工智能与大数据的创新场景，实现技术与社会需求的深度对接。此外，应注重探索场景创新的动态机制，通过开放式创新平台与跨主体协作网络，推动创新场景的快速迭代与高效扩展，为中国特色现代化创新体系的持续优化提供动力。

在场景驱动的创新生态中，政府的作用尤为重要。政府应通过政策引导与资源支持，推动数字技术在公共领域的广泛应用，为创新场景的培育与推广提供制度保障。同时，应注重营造开放、公平、包容的创新环境，通过完善知识产权保护制度与市场竞争规则，激发多元主体的创新动力与活力。通过构建以需求和场景为驱动的创新生态，不仅能够提升创新活动的效率与效益，还

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能够推动科技创新与社会发展的深度融合，为实现中国式现代化提供强有力的技术支撑与生态保障。

（四）以体制机制创新为依托，提升创新治理能力

中国特色现代化创新体系的构建，应以体制机制创新为依托，着力提升创新治理能力，从而为创新活动提供更加科学高效的组织保障。体制机制创新是现代化创新体系建设的重要前提与关键环节，其核心在于通过优化制度设计与治理结构，解决传统创新体系中资源配置低效、主体协同不足与政策执行力弱化等问题，为创新活动的高效开展创造良好的制度环境。

从治理结构的角度来看，应以新型举国体制为基础，构建政府与市场协同作用的创新治理体系。政府应通过完善政策设计、优化资源配置与强化执行监督，发挥“有为政府”的引导作用，为创新活动提供强有力的制度支持。市场则应通过激发企业的主体作用，推动技术研发与成果转化的市场化运作，实现“有效市场”与“有为政府”的有机统一。此外，应注重多元主体的协同治理，通过构建跨部门、跨行业的协作机制，提升创新体系的整体联动性与协调性。

实践中，应以治理机制创新为着力点，完善创新活动的全过程管理与动态调控能力。例如，应通过完善科技项目管理机制，强化对创新资源的精准投放与高效利用；通过优化科研评价机制，提升对基础研究与前沿探索的支持力度；通过健全风险防控机制，增强创新体系在面对不确定性时的适应能力与韧性。此外，应注重创新政策的持续优化与动态调整，通过加强政策实施效果的评估与反馈机制，确保创新政策在实践中的科学性与针对性。

（五）以优化科技成果转化机制为抓手，促进创新价值实现

科技成果转化是现代化创新体系建设的重要环节，其核心在于通过构建高效的转化机制，推动技术从实验室走向市场与社会，最终实现创新价值的全面释放。中国特色现代化创新体系的建设，应以优化科技成果转化机制为抓手，着力解决技术转化的“最后一公里”问题，提升科技创新对经济社会发展的服务能力。

从理论层面来看，科技成果转化的本质在于知识价值链的构建与延伸。优化转化机制需要从供需两端入手：一方面强化技术供给端的市场适应性，通过市场需求的精准牵引，推动科技研发目标的应用化与实践化；另一方面强化需求端对技术的吸收能力，通过完善企业技术引进机制与人才培养体系，提升企业在技术转化中的主体地位与创新能力。此外，应通过在不同主体间构建具备“创新公地”属性的科技成果转化平台，打破技术供需双方之间的信息壁垒，推动技术、资本与市场的高效对接。

在政策层面，应以完善激励机制为重点，推动科技成果转化的制度化与规范化。例如，应通过

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优化知识产权保护制度，为科技成果的转化与推广提供法律保障；构建以市场为导向的收益分配机制，激励创新主体参与技术转化的积极性；完善科技金融服务体系，发展耐心资本，为技术转化活动提供充足的资金支持。通过优化科技成果转化机制，不仅有助于提升创新活动的经济效益与社会效益，还能够为中国特色现代化创新体系的可持续发展提供源源不断的动力。

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Innovation System for Chinese Modernization: Connotations and Strategic Priorities

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Abstract: *The modern innovation system with Chinese characteristics serves as a critical foundation for achieving China's strategic goal of becoming a global leader in science and technology, promoting high-quality development, and advancing comprehensive modernization. This paper offers a systematic theoretical exploration of the system's connotations and key areas of focus. It begins by tracing the conceptual origins of innovation systems and their development in China, analyzing the evolution of the national innovation system and the theoretical basis for improving its overall effectiveness. Building on this, the authors examine the evolving characteristics of China's innovation system, including the shift from technology introduction and imitation to independent innovation, the emergence of a post-Schumpeterian innovation paradigm, the refinement of localized innovation theories, and a comparative assessment of Chinese and international innovation models. This paper explains the core characteristics of the innovation system with Chinese characteristic. Finally, it identifies five key strategic priorities: Guiding the modern innovation system's efficient operation through the pursuit of new quality productive forces; enhancing resource allocation by deeply integrating scientific, technological, and industrial innovation; fostering a demand- and scenario-driven, digitally empowered innovation ecosystem; improving innovation governance through institutional and policy reforms; and strengthening the transformation mechanism for scientific and technological achievements to maximize innovation value.*

Keywords: *Modern innovation system with Chinese characteristics; Post-Schumpeterian innovation paradigm; Connotation analysis; Strategic focus areas*

JEL Classification Codes: O31；L52；P48

DOI: 10.19602/j.chinaeconomist.2025.11.02

The modern innovation system with Chinese characteristics is a vital pillar for the rejuvenation of the Chinese nation. Additionally, it is an essential platform for promoting global development cooperation and contributing China's unique wisdom to the world. On June 24, 2024, President Xi Jinping, in his speech at Speech at the Nationwide S&T Conference, National Science and Technology Awards Conference, and the Conference of Academicians of the Chinese Academy of Sciences (CAS) and the Chinese Academy of Engineering (CAE), announced the goal of making China a sci-tech powerhouse by 2035 and emphasized that, "We must have the firm determination and tenacious will that

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Acknowledgement: This research was supported by the Major Project of the National Social Science Fund of China "Research on the Goals, Main Directions, and Strategies for Winning the Battle of Key Core Technologies" (Grant No. 23ZDA062).

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'sharpens the sword for ten years,' seizes the day, and works hard, in order to turn this strategic objective into reality step by step." The construction of a modern innovation system serves as both a strategic cornerstone for achieving scientific and technological self-reliance and strength, and a powerful engine driving industrial innovation and high-quality economic development. The *Report to the 20th National Congress of the Communist Party of China* places scientific and technological innovation at the core of the country's overall development, explicitly proposing to "improve the scientific and technological innovation system". The Third Plenary Session of the 20th CPC Central Committee further proposes "building institutions and mechanisms that support comprehensive innovation" and emphasizes that "education, science and technology, and talent constitute the foundational and strategic supports for Chinese modernization". In light of this, this paper aims to systematically elaborate on the conceptual connotations of the modern innovation system with Chinese characteristics and to identify its key strategic focus areas, thereby enriching China's innovation theory and facilitating deeper integration among scientific, technological, and industrial innovation.

1. Conceptual Origins and Chinese Practice of the Innovation System

1.1 Conceptual Origins of the Innovation System

The concept of the innovation system originated from the national innovation system (NIS), first proposed by British economist Christopher Freeman in 1987. Freeman defined this as "the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify, and diffuse new technologies" (Freeman, 1987; Chen & Li, 2024). Building upon this foundation, scholars have strengthened the analysis of NIS from a systemic perspective. In doing so, they characterize it as a dynamic network that emphasizes the synergy of diverse actors and the efficient allocation of resources (Lundvall, 1992; Chen & Li, 2024). As this concept has evolved, the innovation system has become a broader theoretical framework encompassing multilevel innovation networks at national, regional, and sectoral levels.

The Organization for Economic Co-operation and Development (OECD) defines the National Innovation System (NIS) as a network of public and private entities—including governments, enterprises, universities, research institutions, and intermediary organizations—that influences technological innovation through the division of labor and collaboration. Notably, this emphasizes the system's structure, functions, and interactions among the factors of production (OECD, 1997; Chen & Li, 2024). Moreover, this analytical framework has been widely accepted in academic circles (Chen & Li, 2024; Du & Li, 2024). As a lens for examining the role of innovation in economic growth and national competitiveness, Chinese scholars have conducted in-depth studies of the NIS. In doing so, they emphasize that its core lies in establishing an open and dynamic innovation network through the synergy between government and market forces, thereby promoting the deep integration of science and technology with economic and social development (Chen & Li, 2024; Du & Li, 2024). The system encompasses innovation actors, factors of production, activities, and supporting policies, aiming to enhance overall innovation efficiency through optimized resource allocation. In the Chinese context, the NIS emphasizes the integration of industry, academia, research, and application, as well as the role of the "new whole-nation system", which mobilizes collective efforts to address key technological bottlenecks. As such, they form a uniquely Chinese model for building an innovation system (Chen & Li, 2024; He et al., 2023).

The effectiveness of the NIS, as a key indicator of operational efficiency and value realization, has attracted growing attention in recent years. At its core, effectiveness is driven by the coordinated interaction among innovation actors, institutional mechanisms, and the broader innovation environment, enabling the efficient allocation of innovation resources (Chen & Li, 2024; Meng et al., 2024). Both

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international organizations and Chinese scholars have performed in-depth research on mechanisms to enhance system effectiveness. For example, drawing on perspectives on system structure, function, and the interactions among factors of production, the OECD proposed the concept of "innovation ecosystem synergy" as a pathway to improving the effectiveness of innovation systems. Building on this, Chinese scholars have further explored how integrating resources and institutional innovation—within the framework of the "new whole-nation system"—can enhance the overall performance of the NIS (Chen et al., 2024; Chen & Li, 2024). Based on this body of research, this paper proposes "organized innovation" as a novel strategic paradigm for improving the effectiveness of the NIS, providing theoretical support for China's development of an innovation system in the new era.

1.2 Development Practice of China's Innovation System

Before reform and opening-up in 1978, China's NIS underwent several distinct developmental stages. In the early years following the founding of the People's Republic of China in 1949, the CPC oversaw the rapid establishment of a talent cultivation system, the construction of an industrial base through 156 key projects, and the consolidation of the Chinese Academy of Sciences (CAS). In 1956, the CPC Central Committee issued the call to "march toward science", initiating long-term plans for science and technology development and establishing the "five forces for progress in science and technology". Subsequently, under the planned economy system, China adopted a research and development model focused on pooling national resources to accomplish major scientific and technological tasks, achieving remarkable results in strategic areas such as the "Two Bombs, One Satellite" program (i.e., the development of the atomic bomb, hydrogen bomb, and artificial satellite). This government-led phase laid a crucial foundation for the subsequent evolution of the NIS.

In the early stages of reform and opening-up in 1978, China initiated reforms to its science and technology (S&T) system to dismantle outdated institutional constraints and unleash the innovative potential of scientific personnel. In 1985, the CPC Central Committee issued the *Resolution on the Reform of the Science and Technology Management System*, promoting integration of science and technology with the economy and accelerating the transformation of scientific achievements into a fundamental productive force. Subsequently, a series of policies aimed at strengthening S&T innovation was rolled out, including the establishment of the National Natural Science Foundation of China (NSFC), providing crucial funding for basic research. In the 1990s, as the socialist market economy gradually took shape, China deepened its S&T system reforms by launching major national initiatives, such as the "863 Program" and the "Torch Program", to boost high-tech industries and cultivate innovative enterprises. In 1995, the CPC Central Committee and the State Council issued the *Resolution on Accelerating Scientific and Technological Progress*, which for the first time introduced the national strategy of "invigorating the nation through science and education", emphasizing the central role of science, technology, and education in driving economic and social development. In 2005, the State Council released the *National Medium- and Long-Term Program for Science and Technology Development (2006–2020)*. For the first time, this defined the NIS from a policy perspective as "a government-led social system that gives full play to the fundamental role of the market in resource allocation, while promoting close collaboration and effective interaction among various S&T innovation actors". Thus, advancing and refining this NIS was established as a core goal of continued S&T system reform.

China's blueprint for developing its national innovation system has evolved progressively through the 18th, 19th, and 20th CPC National Congresses, each adding new layers of priority. The 18th CPC National Congress in 2012 introduced the innovation-driven development strategy, recognizing S&T as the strategic foundation for national strength. Notably, it called for placing innovation at the center

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of development and for an enterprise-led, market-driven innovation system that integrated industry, academia, and research. Thus, reforming the S&T management system was seen as key to unlocking innovation. The 19th CPC National Congress in 2017 went further, calling for accelerating the construction of an innovation-oriented nation. Moreover, it emphasized strengthening basic research, enhancing the national innovation system, and expanding strategic S&T capacity. It also reaffirmed the enterprise-led, market-driven, and deeply integrated innovation model, while promoting an innovation-friendly culture and stronger intellectual property protection and use. The 20th CPC National Congress in 2022 underscored that S&T are the primary productive force, that talent is the foremost resource, and that innovation is the core driving force. It called for strengthening the NIS by refining the "new whole-nation system", focusing on serving strategic needs, advancing self-reliance in science and technology, improving talent development, and fostering a fertile environment that encourages and embraces innovation. The Third Plenary Session of the 20th CPC Central Committee, held in 2024, further emphasized the need to build a robust innovation-supporting framework through integrated reform of education, S&T, and talent systems. Key measures include reinforcing national strategic S&T capacity, enhancing program management, positioning enterprises at the heart of innovation, improving central funding mechanisms, and deepening the institutional reform of the mechanism for transforming scientific and technological achievements.

2. Evolving Connotation of China's Innovation System

2.1 Shifting the Innovation Path: From Import and Imitation to Indigenous Creation

Amid intensifying global competition, China's scientific and technological innovation is undergoing a critical transition from being a significant scientific power to becoming a worldwide science and technology leader. Since the launch of reform and opening-up in 1978, the nation has pursued a strategy of "introduction, digestion, absorption, and re-innovation", and then progressed to integrated innovation. These approaches laid a solid technological foundation, propelled industrial upgrading, and significantly narrowed the gap with global leaders. However, the current international landscape has intensified challenges in achieving technological progress through imitation and catch-up strategies, particularly in critical core technologies where China faces severe "bottleneck" constraints. Simultaneously, a new wave of technological revolution and industrial transformation is accelerating, intensifying global competition for leadership in frontier technologies. Against this backdrop, China's innovation path has undergone a significant transformation—shifting decisively toward independent innovation. Landmark achievements such as the successful launch of *Mozi*, the world's first quantum science satellite, and the fully self-developed CR400 Fuxing Hao high-speed trains exemplify breakthroughs in original innovation. These advances not only signal progress in cutting-edge fields but also provide strong support for industrial upgrading and sustained economic growth (Chen & Li, 2024; Liu et al., 2019; Pei, 2024).

Original innovation, characterized by fundamental breakthroughs in science, technology, and engineering, is the most essential and intellectually intensive form of innovation. It serves as the wellspring of scientific and technological progress. Typically emerging from significant advances in basic research, original innovation can open up entirely new disciplines, research frontiers, or technological pathways. Additionally, it lays the foundation for subsequent technological development and industrial transformation and plays a critical, strategic role within a nation's independent innovation system (Chen et al., 2023; Chen & Li, 2024). Recently, China has achieved notable breakthroughs in original innovation, particularly in quantum communication and high-temperature superconductivity. These breakthroughs have

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significantly advanced scientific theory and granted China an early advantage in the development of related industries, thereby enhancing its position in global science and technology competition. However, substantial challenges remain. These include relatively insufficient investment in basic research, an imperfect research evaluation system, and suboptimal talent cultivation and incentive mechanisms.

Disruptive innovation focuses on creating transformative impacts on existing markets and industrial landscapes through novel technologies, products, or business models, offering late entrants opportunities to surpass established leaders (Chen & Li, 2024; Qu et al., 2023). In the current digital economy, the role of disruptive innovation has become increasingly prominent. Emerging technologies—such as the internet, artificial intelligence, and big data—are continually giving rise to new industries and business models, including the sharing economy and intelligent manufacturing, that are profoundly reshaping how people work and live. Furthermore, disruptive innovation can break away from existing technological trajectories, alter the course of economic development, and foster the emergence of new quality productive forces. China has demonstrated strong capabilities in some regions of disruptive innovation—for example, mobile payments and short-video platforms have achieved global leadership. However, to better compete on the international stage, it remains essential for China further to strengthen the integration of technological R&D with market applications and enhance its ability to identify, cultivate, and scale disruptive technologies.

2.2 Rise of the Post-Schumpeterian Innovation Paradigm

The post-Schumpeterian innovation paradigm has emerged in response to the knowledge era and the digital age. Characterized by diversified actors, open governance, societal objectives, and a networked ecosystem, this paradigm aligns closely with the development path of China's modern innovation system. It highlights the pivotal role of non-traditional innovators—such as ordinary users and makers—which echoes China's recent "mass entrepreneurship and mass innovation" initiative. The diversification of innovation actors ensures that innovation outcomes are more attuned to societal needs. Additionally, the paradigm promotes an inclusive vision of technological innovation, emphasizing that innovation should advance economic growth, social welfare, and sustainable development—an idea deeply aligned with China's people-centered development philosophy. Furthermore, China's new whole-nation system, through policy coordination and resource integration, provides institutional support for implementing this paradigm, fostering collaborative innovation and the emergence of a networked innovation ecosystem (Chen & Li, 2024).

From the perspective of innovation actors, the post-Schumpeterian innovation paradigm emphasizes the pivotal role of non-producers—such as ordinary people and makers—in the innovation process, recognizing their irreplaceable contributions to technological R&D and the diffusion of innovation (Chen & Li, 2024; Chen & Li, 2022). This paradigm significantly broadens the definition of innovation actors within China's national innovation system, expanding it beyond traditional enterprises and research institutions to include end users, maker communities, and innovation networks. Notably, by bringing innovation activities closer to societal needs, it promotes more inclusive knowledge sharing and collaborative innovation. Thus, integrating non-producers into the national innovation framework has markedly improved the efficiency of innovation resource utilization.

From the perspective of innovation goals, the post-Schumpeterian innovation paradigm shifts the focus from a purely economic orientation toward broader social value and the public interest, highlighting the public nature and societal functions of technological innovation. It views innovation as a driver of economic growth and as a crucial tool for addressing social challenges, promoting equity, and enhancing public well-being. This paradigm calls for China's NIS to incorporate social needs, ecological

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sustainability, and human welfare into its innovation agenda. Through targeted policy guidance and strategic resource allocation, it aims to ensure that innovation activities are more responsive to societal realities and public demands, thereby fostering a deeper integration of technological progress and social development.

From the perspective of innovation governance, the post-Schumpeterian innovation paradigm marks a shift from closed, single-entity management to multi-actor collaborative governance. Traditional models dominated by either government or enterprises alone struggle to meet the complex and diverse demands of contemporary innovation. In contrast, the post-Schumpeterian innovation paradigm advocates creating open platforms that reconcile diverse interests and facilitate the efficient flow of innovation resources among stakeholders. This model of governance requires innovation systems to emphasize multi-actor coordination in policy design—by establishing shared rules, promoting knowledge exchange, and incentivizing collaborative innovation. In this way, open governance becomes a key mechanism for fostering a robust innovation ecosystem.

From the perspective of the innovation ecosystem, the post-Schumpeterian innovation paradigm emphasizes its networked, dynamic nature, calling for a shift from a linear, single-track model to a complex, interconnected system. Collaboration among innovation actors is no longer unidirectional or static; it now takes place within an open, evolving network driven by the dynamic flow of knowledge and the sharing of resources. In building its innovation system for the new era, China is actively cultivating an open and interactive innovation ecosystem through regional collaborative innovation, cross-industry knowledge integration, and global partnerships. This transformation not only enhances the efficiency of resource allocation but also provides crucial support for strengthening China's strategic position in international science and technology competition (Chen & Li, 2024; Chen & Li, 2022).

In summary, the post-Schumpeterian innovation paradigm integrates forward-looking demand-pull with effective problem-solving across the innovation process, positioning the broader populace as the ultimate users. This approach adeptly addresses the issues of innovation generation and diffusion, providing a coherent framework for the entire process.

2.3 Evolution of Indigenous Innovation Theories

In October 2015, the Fifth Plenary Session of the 18th CPC Central Committee underscored the need to uphold a people-centered development philosophy, prioritizing the enhancement of public well-being and comprehensive human development as the core objectives of progress. On November 23, 2015, during the 28th collective study session of the Political Bureau of the 18th CPC Central Committee, President Xi Jinping emphasized that this philosophy reflects the foundational stance of Marxist political economy. This approach demands that S&T innovation draw on the needs and insights of the people, honor their pioneering spirit, harness public participation to advance innovation, convert S&T achievements into tangible benefits for society, and evaluate innovation's impact through practical outcomes. Recently, drawing on China's innovation practices and focusing on its ultimate societal value, scholars have developed distinctive indigenous innovation theories, forging a pathway for S&T innovation to "originate from the masses and serve the masses."

First, people-centered innovation: an approach that puts people's needs at its core and aims to enhance their overall well-being. It regards the public as the primary agents and the ultimate beneficiaries of innovation. As such, it emphasized that innovation should serve not only economic growth but also social progress and the holistic development of individuals. Rooted in the Marxist principle of a people-centered stance, this concept advocates for "innovation for the people, by the people, and shared with the people". Through mechanisms of multi-actor collaboration, it seeks to mobilize the innovative potential of the entire population and transform innovation outcomes into social value. This approach also

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integrates traditional Chinese cultural values, such as the holistic worldview embodied in the concept of the "unity of man and nature", emphasizing cultural continuity and ecological balance. Through such integration, the innovation paradigm shifts from one narrowly focused on economic metrics to one that prioritizes social welfare and sustainable development. As a concrete manifestation and further development of the post-Schumpeterian innovation paradigm within China's socialist system, it extends the role of innovation to encompass broader societal objectives. On one hand, it highlights the diversity and inclusivity of innovation actors, contributing to the more efficient and socially embedded allocation of innovation resources. On the other hand, it emphasizes the universal sharing of innovation benefits, promoting equitable access and distribution. Moreover, it drives a transition from a "production-driven" to a "society-driven" innovation system—guided by the multifaceted needs of the people—and integrates economic, technological, cultural, and ecological dimensions in a coordinated manner. This people-centered innovation framework provides crucial support for advancing China's strategic goals of becoming a science and technology leader and achieving shared prosperity (Chen & Li, 2024).

Second, meaningful innovation. Meaningful innovation is an emerging paradigm in the new era that places "meaning" at the core of corporate innovation. It emphasizes the strategic recombination of innovation elements to fully articulate both the intrinsic value of innovation outcomes—such as meeting user needs and fostering emotional resonance—and their extrinsic value, such as advancing social welfare, supporting national strategic goals, and promoting sustainable human development. Conceptually, meaningful innovation treats meaning as a central variable, balancing short-term instrumental benefits with long-term strategic value. The goal is to foster innovation practices that carry economic, social, strategic, and future-oriented significance (Qu et al., 2020). Notably, this paradigm goes beyond traditional technology- and market-driven models by reintegrating humanistic and philosophical considerations into innovation, encouraging enterprises to break free from short-term profit constraints and focus on medium- and long-term returns and broader societal benefits. Furthermore, it promotes groundbreaking innovation practices that drive social progress and human development (Chen et al., 2019). By introducing the dimension of "meaning", meaningful innovation reshapes both the theoretical framework and practical trajectory of China's innovation system. Significantly, it expands the scope of innovation beyond purely technological or market-driven approaches to encompass broader social needs and national strategies—providing theoretical support for the strategic upgrading of China's innovation system (Qu et al., 2021). Therefore, encouraging firms to integrate social value and national priorities into their innovation activities enhances their capacity to respond to external demands, facilitating China's transition from imitative to leading innovation. Furthermore, by emphasizing the dynamic processes of "meaning discovery" and "meaning transformation", it guides enterprises in building cognitive and decision-making frameworks grounded in meaning management. This approach aligns efficiency-driven logic with meaning-oriented goals, enabling more efficient allocation of innovation resources and enhancing synergy and sustainability within China's innovation ecosystem. In the face of intensifying global competition and accelerating technological change, meaningful innovation lays a foundation for China to develop a more inclusive, forward-looking, and systemic innovation model.

2.4 Characteristics of Innovation Systems: An International Comparison

Innovation systems in other countries are predominantly market-driven, with government policies primarily aimed at incentivizing R&D investment and facilitating technology transfer. Their innovation goals tend to focus on economic growth and enhancing national competitiveness. These systems often operate within relatively closed ecosystems and governance structures, where stakeholder collaboration

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is fragmented. Mainly rooted in the Schumpeterian paradigm, innovation activities in these contexts are typically driven by technological breakthroughs, with limited emphasis on social welfare or ecological sustainability. In contrast, China's innovation system emphasizes the synergy between an *enabling government* and an *efficient market*, building a new whole-nation innovation system that positions enterprises at its core. Additionally, it promotes a shift from technology importation and imitation to independent innovation, strengthening strategic scientific and technological capabilities through the integration of industry, academia, research, and application. Notably, this model highlights both original and disruptive innovation while balancing economic development with social value and ecological sustainability. Moreover, China places a strong focus on collaborative, multi-actor governance and an open, adaptive innovation ecosystem. By leveraging regional coordination and international cooperation, it improves the efficiency of innovation resource allocation. Over time, this has contributed to the emergence of a people-centered value orientation and a distinctive culture of innovation. A comparative overview of China's national innovation system and those of other countries is presented in the table below.

Table 1: Comparison of Innovation Systems Between China and Other Countries

Comparison dimension	China's distinctive innovation system	Innovation systems from other countries (based on major OECD economies)
Innovation entities	Prioritizes enterprises as leading actors, promotes integration of industry, academia, research, and application, with participation from users and makers; features diverse innovation actors	Center on enterprises, universities, and research institutes, with a clear division of roles among actors; limited participation from ordinary users and non-producers
Innovation goals	Balances economic growth, social well-being, ecological sustainability, and national strategic needs, with a strong focus on social value	Primarily focus on economic growth and national competitiveness, with limited attention to social issues and ecological sustainability
Innovation paths	Shifts from "introduction, digestion, absorption, and re-innovation" to independent originality, focusing on original and disruptive innovation to address bottlenecks in critical technologies	Primarily incremental innovation, relying on technological accumulation and market mechanisms, with a focus on optimization and improvement
Innovation governance	Stresses government-market coordination through the new whole-nation system, aligning diverse actors to promote resource flow and benefit sharing	Market-led, with government incentivizing innovation through policy; governance is decentralized with weak coordination mechanisms
Innovation ecosystem	Builds an open, dynamic, and networked ecosystem that promotes regional coordination and global cooperation with high resource-allocation efficiency	The innovation ecosystem is relatively closed, with limited collaboration between entities, relying more on market mechanisms, and displaying a static or linear model
Innovation paradigm	Leans toward the post-Schumpeterian innovation paradigm, with diversified innovation entities that focus on social goals and collaborative network ecosystems	The innovation model, based on the Schumpeterian paradigm, emphasizes corporate competition and technological breakthroughs. It is oriented toward economic benefits and follows a relatively closed, unidirectional approach
Policy support	The government promotes the deep integration of technology with the economy and society through policy guidance, resource integration, and institutional innovation, strengthening the role of enterprises as innovation entities	Policies mainly incentivize R&D investment and technology transfer, focusing on economic growth, with less emphasis on social and cultural innovation environments
International cooperation	Enhances international collaboration through open innovation, focuses on independent innovation of key technologies, and promotes connectivity of global innovation resources	Rely on multinational companies and tech alliances to enable international technology flow, with more market-oriented and economically-driven collaboration

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3. Core Manifestations of the Modern Innovation System with Chinese Characteristics

Modernization typically refers to the developmental trajectory of a society, nation, or organization, encompassing technological progress, economic restructuring, social evolution, and lifestyle transformations (Xie, 2018). It is a dynamic historical process that extends beyond material and technological advancements to include a profound shift in human civilization, centering on the modernization of people. Chinese modernization highlights that this process involves technological catch-up and a redefinition of civilizational progress. The modern innovation system with Chinese characteristics can be analyzed through three dimensions: the S&T innovation system, the industrial innovation system, and the management innovation system. Its modern essence manifests in three key aspects: the paradigm restructuring of knowledge production, the dynamic equilibrium of the innovation ecosystem, and the integrated symbiosis of science and humanities. The paradigm restructuring of knowledge production serves as the theoretical foundation, the dynamic equilibrium of the innovation ecosystem ensures operational efficacy, and the integrated symbiosis of science and humanities defines its value orientation. Amid intensifying global S&T competition, rapid industrial transformation, and growing social demands, the modern innovation system with Chinese characteristics must leverage the "new whole-nation system" to foster an open, dynamic, and inclusive innovation ecosystem. As such, this requires coordinated resource allocation, collaboration among diverse actors, and enhanced institutional design, providing robust S&T support and theoretical grounding for advancing Chinese modernization (Figure 1).

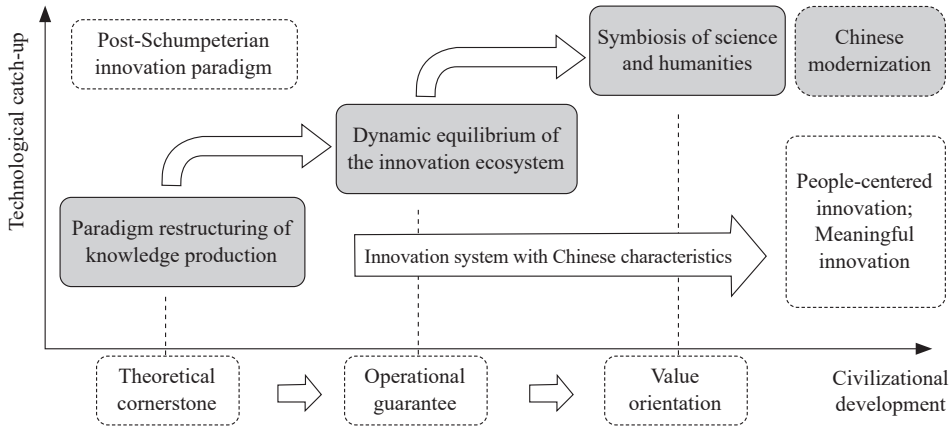

Figure 1: Core Components of China's Modernization Innovation System

The core components of the modern innovation system with Chinese characteristics are defined through a synthesis of theoretical inquiry and the practical evolution of China's innovation landscape, as follows:

Theoretical Foundations: This framework draws upon the post-Schumpeterian innovation paradigm, innovation ecosystem theory, and systems science. The post-Schumpeterian innovation paradigm emphasizes the diversification of knowledge production, the networked nature of innovation ecosystems, and the socialization of innovation goals—offering a theoretical foundation for both the "restructuring of knowledge production paradigms" and the "dynamic balance of innovation ecosystems" (Chen & Li, 2022). The innovation ecosystem theory advocates for building a dynamically balanced system through

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multi-actor collaboration and the efficient flow of resources, resulting in an open, networked innovation system (Lundvall, 1992; Chen et al., 2024). At the same time, the "people-centered" tenet of Chinese modernization underscores the deep integration of science and the humanities, making the "integrated symbiosis of science and humanities" a critical component (Xie, 2018).

Practical Foundations: This division is aligned with *Report to the 20th CPC National Congress*, which emphasized that "science and technology are the primary productive forces, talent is the primary resource, and innovation is the primary driving force"—clearly identifying the core mission of the innovation system. In addition, the *National Medium- and Long-Term Program for Science and Technology Development (2006-2020)* identified "comprehensively advancing the establishment of a national innovation system with Chinese characteristics" as a key task in reforming the science and technology management system for the present and years to come, and specified the priorities for developing such a system in five aspects. *The Outline of the 14th Five-Year Plan (2021-2025) for National Economic and Social Development and the Long-Range Objectives Through the Year 2035* outlines a series of arrangements for further reforming the science and technology management system, improving the national science and technology governance system, and optimizing the management and operational mechanisms of national science and technology programs. Thus, these strategic policy documents provide a strong practical foundation for identifying the core components of the modern innovation system with Chinese characteristics.

3.1 Paradigm Restructuring of Knowledge Production

The construction of a modern innovation system with Chinese characteristics must be grounded in a fundamental restructuring of the knowledge production paradigm. This transformation entails a shift from a traditional, linear, and closed model to an open, dynamic, and networked approach that emphasizes multi-actor collaboration, deep interaction among innovators, and the efficient circulation of knowledge resources (Chen & Li, 2022). The emergence of the post-Schumpeterian innovation paradigm offers strong theoretical support for this shift by advocating the active participation of non-traditional producers—such as users and makers—which expands the boundaries of innovation actors. This approach liberates knowledge creation from the monopoly of professional institutions, making socialized collaboration a key feature of contemporary knowledge production. It calls for knowledge activities to align more closely with societal needs, leveraging synergy among diverse actors to fully unleash the creative and transformative power of knowledge.

The modernization of China's innovation system should also incorporate the strengths of the "new whole-nation system" to optimize the organizational model of knowledge production. This system addresses critical "chokepoint" issues by concentrating superior resources, enhancing original innovation in basic research, and strategically advancing the development of frontier technologies. Such a systematic approach to knowledge production promotes deep accumulation and breakthroughs in key areas (Chen et al., 2023). It also mobilizes the innovative potential of diverse actors—governments, enterprises, universities, research institutes, and end users—fostering efficient collaboration across the entire knowledge chain, from generation and dissemination to application. Through this process, knowledge production extends beyond traditional technological R&D to become a multidimensional endeavor that integrates technological, institutional, and cultural innovation. This provides a solid theoretical and practical foundation for building a modern innovation system.

3.2 Dynamic Equilibrium of the Innovation Ecosystem

The modern innovation system with Chinese characteristics should place the pursuit of dynamic

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equilibrium within its innovation ecosystem at the core of its development strategy. This entails cultivating an open, collaborative, and adaptive environment that actively supports and sustains innovation. Notably, dynamic equilibrium serves as both the foundation for the system's efficient operation and a vital mechanism for responding to global technological competition, industrial transformation, and shifting societal demands. Drawing on the post-Schumpeterian innovation paradigm, the innovation ecosystem is characterized by its networked, dynamic nature—necessitating a shift from static, linear models of collaboration to dynamic, interactive partnerships among innovation actors. The circulation of knowledge drives this transformation, the sharing of resources, and collaborative innovation, ultimately shaping an open and interconnected ecosystem. At its core, such an ecosystem fosters a flexible and organic environment for innovation through the active engagement and interaction of diverse stakeholders. It enables the system to self-regulate, adapt, and evolve continuously in response to complex and changing internal and external conditions.

The modern innovation system with Chinese characteristics also bolsters the dynamic equilibrium of the innovation ecosystem through the collaborative framework of the "new whole-nation system". By uniting strategic scientific and technological forces, national innovation platforms, and user enterprises, it creates a cohesive network spanning the entire innovation chain. This structure also facilitates efficient macro-level resource allocation while unlocking the innovative potential of diverse actors at the micro level (Chen & Wu, 2024). The government's meta-governance role is equally vital, leveraging policy guidance, resource distribution, and risk management to ensure the ecosystem's resilience against internal and external disruptions (Wu et al., 2024). Therefore, this dynamically balanced ecosystem not only enhances innovation efficiency and effectiveness but also provides robust systemic support for high-quality development and high-standard security (Chen et al., 2025).

3.3 Integrated and Synergistic Development of Science, Technology, and the Humanities

The construction of the Chinese-style modernization innovation system should prioritize the deep integration of science and technology with humanistic values as a critical direction. Importantly, innovation should not be confined to the technological and economic domains, but should also embody social value, cultural meaning, and ecological responsibility. Modernization represents technological advancement and a profound transformation of human civilization. Scientific and technological innovation, therefore, must align with the broader goals of societal development (Xie, 2018). In this context, the innovation system must transcend traditional instrumental rationality and forge strong connections between innovation, human well-being, ecological sustainability, and cultural inheritance. This will promote a more advanced and synergistic integration of science and technology with the humanities.

The people-centered development philosophy serves as a fundamental value underpinning the modern innovation system with Chinese characteristics. President Xi Jinping has emphasized that this philosophy embodies the core stance of Marxist political economy, calling for scientific and technological innovation to respond to the needs of the people, draw upon their insights, and respect their pioneering spirit—ultimately transforming innovation outcomes into tangible improvements in public well-being (Chen & Li, 2024). In fields such as healthcare, public safety, and green energy, technological innovation should prioritize enhancing quality of life and meeting public needs. The significance of innovation lies not only in technological breakthroughs and economic returns but also in its ability to address social issues, promote equity, and improve public welfare. This people-centered innovation paradigm expands the value dimension of science and technology, infusing the modern innovation

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system with profound cultural connotations.

The seamless integration of science and technology with the humanities highlights the ongoing emergence of ecological benefits. The innovation system in China plays a vital role in promoting green development and establishing an ecological civilization. Through the research and application of green technologies, it aims to chart a sustainable development path that balances economic growth with ecological preservation (Chen et al., 2024). By promoting new energy sources, optimizing energy storage technologies, and advancing environmentally friendly innovations, this system also contributes to achieving China's "dual carbon" goals—namely, reaching peak carbon emissions before 2030 and achieving carbon neutrality by 2060. Additionally, it also offers Chinese insights for global environmental protection. In this process, innovation transcends technological advancement alone, becoming deeply intertwined with social values, cultural heritage, and ecological responsibility—demonstrating the unique synergy between science and technology, and the humanities, each enriching and reinforcing the other in meaningful ways.

4. Priorities in Building a Modernized Innovation System with Chinese Characteristics

Building a modern innovation system with Chinese characteristics is a crucial lever for achieving the strategic goal of becoming a global leader in science and technology, as well as a central pathway to promoting high-quality development and comprehensive modernization. In the context of intensifying global technological competition, accelerating industrial transformation, and increasingly diverse societal demands, this system requires systematic theoretical inquiry, deep practical application, and continuous adaptation. To enhance the overall effectiveness of China's innovation system, focus must be directed toward key areas such as strategic goal-setting, resource allocation, operational mechanisms, and value realization. This approach ensures efficient coordination and dynamic equilibrium throughout the entire innovation process—from conception to implementation.

4.1 Driving the Efficient Operation of the Innovation System through the Development of New Quality Productive Forces

The construction of a modern innovation system with Chinese characteristics should prioritize the development of new quality productive forces as the core guiding principle, as it serves both as the theoretical foundation and the practical pathway for ensuring the system's effective operation. As a core engine of the modern economic system, new quality productive forces represent a fundamental transformation, like productivity, from traditional material-driven models to those powered by knowledge, technology, and innovation. This transformation calls for qualitative breakthroughs in integrating factors, allocating resources, and fostering functional synergy within the innovation system. On a theoretical level, it is essential to redefine the connotation and extension of productivity itself, moving beyond a narrow focus on material production to incorporate knowledge, data, technology, and ecological elements as key components. These elements must be recognized as central drivers of economic development and social progress. On the practical level, greater emphasis should be placed on the dynamic interaction and structural optimization of innovation factors. By enhancing the fluidity and alignment of scientific and technological resources, the internal efficiency of the innovation system can be significantly improved. In advancing new quality productive forces, priority should be given to the deep integration of technology and industry, transforming cutting-edge scientific achievements into productive capacities that generate both market value and social benefits. At the same time, the

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development of new infrastructure—encompassing digital elements such as data, computing power, and algorithms—should serve as a key enabler, unleashing the agglomeration and multiplier effects of innovation factors to maximize systemic impact.

Moreover, the development of new quality productive forces should adopt a System of Systems (SoS) approach (Chen et al., 2023), prioritizing interconnectedness and synergy within the modern innovation system. This approach entails fostering deep collaboration among diverse innovation entities—enterprises, universities, and research institutions—forming a dynamic consortium that maximizes the strengths of industry-academia-research-application integration. Simultaneously, by refining innovation policies and institutional frameworks, the government's role in steering resource allocation, establishing regulations, and managing risks should be enhanced. Notably, this should be paired with market-driven mechanisms for resource circulation, creating a complementary partnership between government and market forces to drive collaborative innovation. From a management standpoint, advancing new quality productive forces goes beyond technological progress and resource integration; it is also a process of cultural evolution and value redefinition. By nurturing an innovation-centric value system and fostering a societal culture that values knowledge and creativity, a robust cultural foundation and institutional support can be established. This ensures the efficient and sustainable operation of the modern innovation system with Chinese characteristics.

4.2 Focusing on the Deep Integration of Scientific and Technological Innovation with Industrial Innovation to Optimize Resource Allocation

While advancing new quality productive forces, the modern innovation system with Chinese characteristics should also center on the deep integration of scientific and technological innovation with industrial innovation to optimize the allocation and efficient use of innovation resources. Scientific and technological innovation is the outward expression of the knowledge system, whereas industrial innovation is the pathway through which scientific achievements are transformed into economic value. The integration of these two dimensions is a key driver of a robust, adaptive modern innovation system. Scientific and technological innovation provides industrial innovation with cutting-edge technologies, a reservoir of knowledge, and theoretical support, serving as its primary driving force. In contrast, industrial innovation offers application scenarios, market feedback, and the impetus for sustainable advancement, acting as a practical extension of scientific innovation. Therefore, constructing a modern innovation system with Chinese characteristics requires achieving a dynamic balance and structural optimization of resource allocation at the intersection of these two innovation domains.

In practice, a demand-driven approach should be adopted to strengthen the role of scientific and technological innovation in supporting industrial upgrading. When building the innovation system, it is essential to identify the critical links where science and technology intersect with the industrial and value chains. This includes strategically advancing basic research and frontier technologies to address "bottleneck" issues in key areas, thereby providing strategic support for industrial development. Equally important is improving the efficiency of technology transfer and commercialization. A unified, streamlined mechanism must be established to facilitate the translation of scientific achievements into practical applications, effectively bridging the "last mile" from the laboratory to industrial deployment. This ensures that scientific and technological innovation can fully empower industrial progress. Conversely, industrial innovation should also provide dynamic feedback to scientific research. Market demand should guide R&D, driving greater precision and applicability in technological development. Furthermore, it is vital to build a regionally coordinated innovation ecosystem that leverages local resource endowments and industrial strengths. Such a system can foster a dual-engine innovation

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model—driven by both scientific advancement and industrial innovation—thereby enhancing regional synergy and development impact.

From a resource-allocation perspective, the deep integration of scientific and technological innovation with industrial innovation relies on the collaborative participation and resource-sharing of multiple stakeholders. Enterprises should act as the principal drivers of innovation, taking the lead in technology development, the commercialization of research outcomes, and market deployment. Universities and research institutions should focus on basic research and frontier exploration, providing the theoretical insight and technological foundation needed to fuel industrial innovation. Meanwhile, the government should play a guiding and enabling role—shaping a supportive innovation ecosystem through policy direction, resource coordination, and institutional design—thereby ensuring effective synergy between scientific, technological, and industrial development.

4.3 Fostering a Digitally Empowered Innovation Ecosystem Driven by Demand and Usage Scenarios

The development of a modern innovation system with Chinese characteristics should be propelled by demand and real-world scenarios, with a focus on nurturing an innovation ecosystem defined by digital empowerment. Amid the rapid rise of the digital economy, the innovation paradigm is shifting from a technology-centric approach to one driven by practical use cases. The pervasive adoption of digital technologies offers fresh opportunities and actionable models for building this ecosystem (Yin et al., 2024). A scenario-driven innovation approach prioritizes application needs as its foundation, dismantling barriers between technology and its practical use by creating diverse innovation contexts. This facilitates the swift transformation and widespread deployment of technological value. To achieve this, the modern innovation system with Chinese characteristics must align closely with societal and market demands, cultivating an open, dynamic, and interconnected innovation ecosystem powered by the digital economy.

A digitally empowered innovation ecosystem hinges on data as its foundational element, unlocking the potential for scenario-driven innovation through robust data collection, analysis, and application. This requires enhancing data fluidity and interoperability among diverse stakeholders by establishing data-sharing platforms and advanced digital infrastructure that deliver precise demand insights and support decision-making for innovation activities. Simultaneously, digital technologies should serve as catalysts for diversifying innovation scenarios. Scenarios that leverage the Internet of Things, artificial intelligence, and big data can be designed to seamlessly integrate technology with societal needs. These applications are especially relevant in domains such as smart cities, intelligent manufacturing, and healthcare. Moreover, emphasis should be placed on understanding the dynamic mechanisms of scenario innovation. By fostering open innovation platforms and cross-stakeholder collaboration networks, rapid iteration and scalable expansion of innovation scenarios can be achieved, ensuring a steady stream of momentum for the continuous enhancement of the modern innovation system with Chinese characteristics.

In a scenario-driven innovation ecosystem, the government's role is particularly crucial. Through strategic policy guidance and targeted resource allocation, the government should promote the widespread application of digital technologies in the public sector, while establishing institutional frameworks that support the cultivation and expansion of innovation scenarios. At the same time, it is essential to foster an open, fair, and inclusive innovation environment by strengthening intellectual property protection and refining market competition rules, thereby stimulating the innovation drive and vitality of diverse stakeholders. By building an innovation ecosystem driven by demand and real-world scenarios, this approach not only enhances the efficiency and effectiveness of innovation

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activities but also promotes the deep integration of scientific and technological progress with broader social development. In doing so, it provides strong technical support and an enabling environment for innovation to advance Chinese modernization.

4.4 Leveraging Institutional and Mechanism Innovation to Strengthen Innovation Governance Capacity

Development of a Chinese-style modern innovation system should rely on institutional and mechanism innovation to enhance innovation governance capacity and provide more scientific and efficient organizational support for innovation activities. Such innovation in institutions and mechanisms is both a critical foundation and a linchpin for building this system. The essence of this innovation lies in addressing challenges such as inefficient resource allocation, poor coordination among stakeholders, and inconsistent policy implementation inherent to traditional innovation frameworks. By refining institutional designs and governance structures, such efforts aim to establish an enabling environment that enhances the effectiveness and agility of innovation endeavors.

From a governance perspective, an innovation governance system should be built on a new whole-nation system that promotes synergy between government and market forces. The government should act as an "enabling force" by improving policy design, optimizing resource allocation, and strengthening oversight of implementation to provide strong institutional support for innovation. At the same time, the market should play a leading role by empowering enterprises to drive market-oriented development and technology commercialization, thereby achieving an organic integration of an "efficient market" and an "enabling government". Furthermore, emphasis should be placed on collaborative governance involving multiple stakeholders. This includes establishing cross-departmental and cross-industry coordination mechanisms to enhance the overall connectivity and coherence of the innovation ecosystem.

Efforts should aim to innovate governance mechanisms that improve comprehensive management and dynamic regulation throughout the entire innovation process. This includes refining the management of S&T projects to ensure the precise allocation and efficient use of innovation resources. Additionally, it is essential to optimize research evaluation systems to strengthen support for basic research and frontier exploration. Furthermore, enhancing risk prevention and control mechanisms will help increase the adaptability and resilience of the innovation system in the face of uncertainty. Additionally, continuous improvement and adaptive adjustment of innovation policies should be emphasized, with a strong focus on establishing robust evaluation and feedback mechanisms to ensure their scientific soundness and practical effectiveness.

4.5 Optimizing Sci-tech Commercialization Mechanism to Unlock Innovation Value

The commercialization of scientific and technological achievements is a crucial link in the construction of a modern innovation system. At its core, it involves establishing an efficient mechanism that enables the transition of technologies from laboratory research to market and societal application, thereby fully realizing the value of innovation. In developing a modern innovation system with Chinese characteristics, a key focus should be the optimization of the mechanism for transforming scientific and technological achievements. This entails addressing the "last mile" challenge in technology transfer and enhancing the capacity of scientific and technological innovation to support economic and social development.

From a theoretical standpoint, the transformation of scientific and technological achievements lies in the construction and extension of the knowledge value chain. Optimizing this transformation

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mechanism requires a dual focus on both the supply and demand sides. On the supply side, it is essential to enhance the market adaptability of technological outputs by aligning R&D objectives more closely with market demands, thereby promoting the practical orientation and application of scientific research. On the demand side, efforts should focus on strengthening enterprises' capacity to absorb and apply new technologies by improving mechanisms for technology acquisition and advancing talent development systems. This will reinforce their leading role and their capacity for innovation in the transformation process. Furthermore, it is recommended to establish sci-tech commercialization platforms that act as collaborative "innovation commons" for a wide range of stakeholders. Such platforms can break down information barriers between the supply and demand sides, facilitating more efficient integration of technology, capital, and market forces.

At the policy level, efforts should focus on improving incentive mechanisms to promote the institutionalization and standardization of the transformation of scientific and technological achievements. This includes enhancing the intellectual property protection system to provide a solid legal foundation for the application and commercialization of such accomplishments. Additionally, a market-oriented profit-sharing mechanism should be established to motivate innovation stakeholders to participate in technology transfer actively. Developing a robust S&T financial service system to foster patient capital and ensure sufficient funding for transformation activities. By optimizing the mechanisms for technology transfer, we can enhance the economic and social returns of innovation and provide a continuous driving force for the sustainable development of a modern innovation system with Chinese characteristics.

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