现代化产业体系构成结构与建设策略研究

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摘　要：建设现代化产业体系是我国经济高质量发展的核心事项，具有极大的挑战与困难，需要有很大的勇气与智慧，需要采取正确的应对思路与策略。在全球科学技术进步加速、消费需求变化明显、地缘政治格局重构以及全球产业分工体系调整的背景下，我国现行产业体系二元构成结构固化，即传统产业产能过剩且增长困难、新兴高技术产业发展受阻，其中原因复杂，但国内消费需求不足、创新能力较弱确是事实。可以说，建设现代化产业体系的本质就是要在现行产业体系基础上开放创新，实现需求导向下的资源重新配置，其核心是把现行产业体系固化的二元构成结构转换为现代化产业体系的“3+1”构成结构，并使之持续健康发展。为此，需要：1）实施需求导向的建设方针；2）数字化改造加持建设过程；3）科技创新与产业创新关联协同突破；4）进一步改革开放，重构全球科技与产业合作网络。

关键词：现代化产业体系　构成结构　建设策略

JEL 分类号：L16

本文是要分析中国近年来进入中等收入国家之后，现行产业体系的产业结构开始固化，其原因既有外生性因素如地缘政治变化、科技进步加快、产业生态环境等，也有内生性因素如劳动力成本上升，创新能力不足，产业空间布局需要改善等。这些因素的叠加已经对中国进一步的经济增长产生不利影响，有可能导致中国陷入“中低收入陷阱”。因此面对未来增长需要，如何走出如此困境，本文认为中国构建面向未来面向全球有竞争力的现代化产业体系是关键的一步。此外进一步从策略上看我国现行产业体系如何转换为现代化产业体系，就是现代化产业体系建设的核心问题。

一、现行产业体系二元构成结构固化及其原因

现行产业体系是指目前我国正在运行的产业体系，而现代化产业体系则是指融合未来前瞻科技与人类社会发展新需求、建立在新型比较优势基础上的全球领先的新型产业体系。现代化产业体系不是凭空而建，一定是在现行产业体系的基础上演化发展而形成的，现行产业体系的状况就是现代化产业体系建设的现实基础。如果基础扎实牢靠、方向明确、动力充沛，现代化产业体系建设相对

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就容易些，否则就要困难些。

（一）产业体系的二元构成结构及其变化

对所有国家或地区的产业体系中的所有产业进行分类，以便于统计分析和深入研究，最为通行的分类是三次产业分类，即将所有产业按照其生产与自然物品的关系进行分类，于是就有了三次产业结构之说。目前三次产业结构状况已经成为全球判断产业体系发展状况以及经济发展状况的一个重要视角。实际上，现行产业体系还可以从产业依赖的技术密集程度将所有产业分成两类：一类是技术密集度低、劳动密集度高和资本密集度高的产业，称之为传统产业，其中既有传统制造业，也有传统农业与底端服务业；另一类是技术密集度高、知识密集度高和以新兴高技术为核心的产业，既包括航空航天、机器人、智能装备、芯片制造等高端制造业，也包括现代农业与高端服务业。这样分类后的产业体系就呈现为二元构成结构，也就是说现行产业体系由这两个阵列的产业互相关联组成。

改革开放以来我国现行产业体系发展取得了很大的成就，形成了较为完整的生产体系，生产协同配套能力比较强大，许多产品产出量为全球第一，产品的品质也有了极大的提高，深受全球消费者喜爱。但从现行产业体系二元构成来看，传统产业依然是产出贡献最大的阵列，对GDP贡献80%以上；近年来开始启动的新兴高技术产业的投入与发展进程中，涌现出了一批诸如华为这样的科技领军大企业，以及许多优秀的作为产业“隐形冠军”的中小企业，但其对GDP贡献仍不到20%。我国现行产业体系二元构成结构的2:8状况，在面对全球产业分工格局新变化、消费新需求、数字新经济以及人工智能数字技术等现代科学技术进步加快等方面出现了诸多问题，例如传统产业产能过剩、结构失衡、技术进步放慢、全要素生产率提高不快（刘俏，2021），数字化转型困难，新兴高技术产业受到创新能力不足、外部技术封锁等影响，已经开始呈现固化状况。

世界银行曾经观察研究了二战以后工业化的历史进程，发现战后先后有几十个国家进入了工业化阶段，但大部分都是在中等收入阶段就很难继续发展，落入了不同类型的“中等收入陷阱”，只有13个经济体进入了高收入社会。但这13个经济体表现出了一个规律，即在经历了20多年的高速增长以后，当人均GDP达到11000国际元（这里的国际元使用的是麦迪森数据）时，增长速度几乎无一例外地出现了回落，幅度大概在40%—50%，有些降幅甚至超过一半。处于这一阶段的这些国家或经济体既无法在劳动力成本方面与低收入国家竞争，又无法在尖端技术研制方面与富裕国家竞争，这就是所谓“中等收入陷阱”（Gill和Kharas，2007）。究其原因，经济学家们有许多不同的见解。我们的研究发现，主要是因为产业体系的二元构成结构固化，即到了中等收入阶段后，居民收入水平提高导致劳动力成本提高，而工业化的发展导致土地资本价格上升，使得这些国家产业体系中的传统产业的盈利能力下降，全球竞争力减弱，进而导致产能过剩，部分产业不得不开始跨区域转移，本地

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传统产业衰落，产业空洞化现象产生。另一方面，虽然新兴高技术产业的产出在这些中等收入国家或经济体有市场需求，且需求增长速度较快，但这类产业的发展面临两个主要困难：一是缺乏高新技术的持续支持，因为研发创新需要资本与时间，短期内难以实现技术领先；二是新兴高技术产业恰恰是发达国家当前的优势产业，其掌握产业的关键技术，为了继续保持自身优势产业的竞争力，自然要封锁关键技术，打压新兴中等收入国家的新兴高技术产业，阻碍其快速发展。如此，中等收入国家或经济体产业体系的二元构成结构固化，即难以向结构高级化方向演化发展，难以进入高收入国家行列。

突破“中等收入陷阱”，实现从发展中国家到发达国家的转换，其实就是破除其产业体系的二元构成结构固化的过程，即在传统产业不断转型或迁移过程中，新兴高技术产业不断成长壮大，最终以技术先进、高附加价值创造为主的新兴高技术产业作为产业体系核心产业的过程。例如战后日本、韩国等国家能够较快地从发展中国家转换为发达国家，实为他们的产业体系二元构成结构的转化比较顺利。从全球来看，并不是所有的国家产业体系二元构成结构都能够顺利转换，有些发展中国家产业体系二元构成结构演化过程即使一开始很顺利，但发展到某一阶段后也可能停滞下来，甚至再也不能持续演化下去，如阿根廷、巴西、南非、泰国、马来西亚等就是如此而陷入“中等收入陷阱”。破除产业体系二元构成结构的固化是一个艰难的过程，需要时间，更需要市场与政府的双重贡献。

（二）现行产业体系二元构成结构固化显现

统计数据表明，从2016年开始，我国现行产业体系中传统产业和新兴产业的二元构成结构趋于固化，其中传统产业产出过剩、增长下行明显，整个阵列的产业竞争力弱化，产出收益率下降，但目前其对GDP贡献占比依然非常高，达80%以上。新兴高技术产业产出增长速度很快，一些以高新技术为核心的现代产业已经从无到有迅速发展起来，比如高铁的车辆制造、智能手机、5G通信、半导体芯片、智能装备制造等。这些产业都在快速发展，有的已经成为国际上有竞争力的产业，如5G通信、新能源汽车、北斗卫星导航等，成为我国现行产业体系的亮点。但是新兴高技术产业在整个GDP所占比重仍不到20%，尚不足以支撑整个国家经济增长（芮明杰主编，2020）。

我国现行产业体系的二元构成结构状况与以美国为代表的高收入国家的现行产业体系的二元构成结构状况形成明显的反差。在以美国为代表的高收入国家，其现行产业体系中对GDP贡献占比高的是以高新技术为核心的产业，占比低的劳动密集型传统产业大部分已经转移到境外。应该看到，我国产业体系与发达国家产业体系的二元构成结构状况的反差，其背后是双方产业技术的差异，也是双方产业组织效率的差异，更重要的是产业劳动力智力与技能的差异，是整体科学技术水平的差异。不同产业体系的二元产出结构带来的附加价值创造状况是完全不同的，高收入国家其产

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业体系的产出主要是高附加价值产品或服务。出于自身利益的考虑，美国等高收入国家加大了对我国高新技术产业发展所需要的技术、人才、供应链、设备、零部件等的封锁和限制，企图延缓我国新兴高技术产业的发展，表面上说是为了国家安全，实质是要继续保持其产业体系领先的优势，希望能够阻碍我国产业体系二元构成结构顺利转换，进而阻碍我国顺利进入高收入国家行列。

（三）现行产业体系二元构成结构形成逻辑及其固化原因

我国现行产业体系二元构成与运行的基本逻辑如图1所示。1978年改革开放以来，我国根据自身禀赋特性，从传统劳动密集型产业发展入手，通过开放与改革引进外资与技术，加入全球产业分工体系，开展加工贸易培育出口加工产业，生产位于全球产业价值链低端的产品，然后逐步发展其他产业，最终形成比较完整的现行产业体系。之后，随着居民收入水平等的提高、2008年全球金融危机以及人民币逐步升值，导致我国产业发展的资源、环境、劳动力成本逐步上升，使原本建立在劳动密集且以价值链低端生产为主的传统产业竞争力减弱，最终使得原来的正向增强的传统产业运行反馈环无法进行下去，导致我国传统产业的国际竞争力开始下降，产业体系整体开始衰退，加上国内消费不足，我国经济增长速度从2016年开始放慢，出现了与其他中等收入国家类似的经济状况。

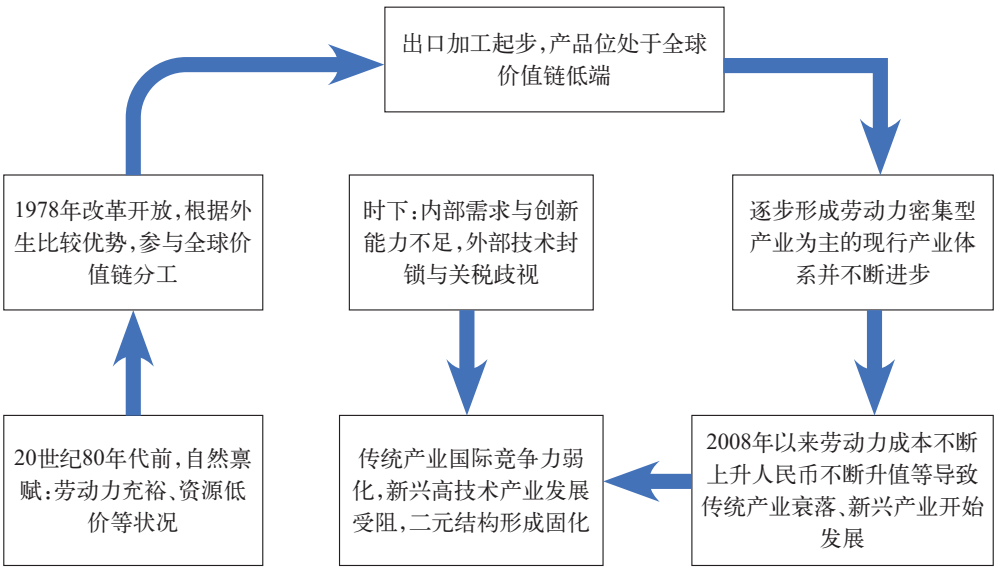

图1：现行产业体系二元结构形成与固化逻辑

为了防止中国经济掉入“中等收入陷阱”，国务院于2015年5月印发《中国制造2025》规划方案，[①]其中明确了9项战略任务和重点，并再次明确了重点突破的十大领域。作为我国实施制造强国

[①] 中华人民共和国中央人民政府：《中国制造2025》https://www.gov.cn/zhengce/content/2015-05/19/content_9784.htm。

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战略第一个十年的行动纲领,《中国制造2025》提出推动我国实现从制造大国向制造强国转变,加速新一代信息技术与制造业的深度融合,促进制造模式、生产组织方式和产业形态的深刻变革,使智能化、服务化成为制造业发展的新趋势。这个规划方案的出台预示着我国现行产业体系的转型升级正式开始,瞄准国际前沿的战略性新兴高技术产业发展正式启动。然而我国瞄准国际前沿战略性新兴高技术产业的发展必然受到发达国家的阻击,因为这些产业正是他们产业体系中的核心优势产业,也是具有国际竞争力的高附加价值产业。在全球经济一体化产业价值链(GVC)全球分工条件下(Gereffi,2009),以美国等高收入国家跨国公司为代表的主导企业为了获得更高的附加价值和利润,一方面通过工序的分解将产业价值链上低附加值的环节转移到劳动力充裕的国家和地区生产以降低成本;另一方面通过技术专利、生产标准、分销网络强化和人才封锁等多种手段来提高设计、研发和营销等高附加值环节的进入壁垒,对发展中国家企业进行产业链、价值链低端锁定。这样就保持了发达国家的高收入,发展中国家则只能一直处在低收入的状况,影响经济社会可持续的发展。如果说过去这样的状况只是企业行为,现在则完全不同,以美国为代表的发达国家以国家安全为名,政府直接干预。一方面,对我国高新技术、高新产业、高技术人才进行封锁与限制,对我国现行产业体系中还处于成长阶段的新兴高技术产业造成极大的影响。另一方面,制定差别性的关税政策,对我国传统产业生产的出口产品收高额关税,而对其他低收入国家传统产业的出口产品收低关税,导致我国传统产业的产品出口竞争力进一步下降,产能过剩,赢利状况恶化。这是我国现行产业体系二元构成结构之所以固化的最大原因,也是现行产业体系两个阵列产业各自面临的关键挑战所在,已经成为现代化产业体系建设的最大障碍。如果无法有效应对这些挑战,我国的经济发展可能会陷入比较优势的“断档”期,陷入所谓的“中等收入陷阱”,可能引发中长期经济衰退。

二、现代化产业体系的“3+1”构成

建设中的现代化产业体系应该是面向未来的,带有中国社会制度文化、自然资源禀赋、人力资源、产业资产存量、知识技术资源、消费倾向、生态环境等特点的,基于新的比较优势基础的、可持续科学发展的、先进的具有国际竞争力的产业体系。这样的产业体系具有资源节约、低碳绿色、智能数字技术复合、产业价值链优化、空间布局合理、自我创新发展、开放先进等特征(芮明杰,2018a)。建设现代化产业体系,不但需要把当前的新兴高技术产业发展壮大,使之逐步成为产业体系中的核心,还需要依赖技术创新对现行的传统产业进行转型升级,使之成为现代化产业体系中不可或缺的组成部分。此外,随着科学技术进步,新技术、新产品、新企业的不断诞生会催生数字化、智能化新型未来产业,需要超前谋划布局。正如《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》中特别提出要前瞻谋划未来产业,“在类脑智能、量子信息、基因技术、未来

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网络、深海空天开发、氢能与储能等前沿科技和产业变革领域，组织实施未来产业孵化与加速计划，谋划布局一批未来产业”。[②]

这样的现代化产业体系，如果依然根据技术密集程度进行结构分类的话，则与现行产业体系的二元构成结构并无不同。建设现代化产业体系表面上只是两类产业对经济与GDP贡献的比例发生了巨大的变化，但从产业体系的组成内容看，现代化产业体系与现行产业体系有较大差别，数字技术、人工智能技术等发展进步已经并还将极大改变现在与未来产业的特性和产出，催生更为前沿、先进、新型的高技术产业，且依赖的基础产业也发生了巨大的变化。因此，从全球产业中长期进步发展看，我国现代化产业体系具体构成内容呈现为三个阵列与一个基础（“3+1”），即现代化产业体系是由数字化转型升级后的部分传统产业、目前正在成长的战略性新兴产业以及正在谋划布局的未来产业这三个阵列组成，一个基础是指数字新基础产业（见图2）。

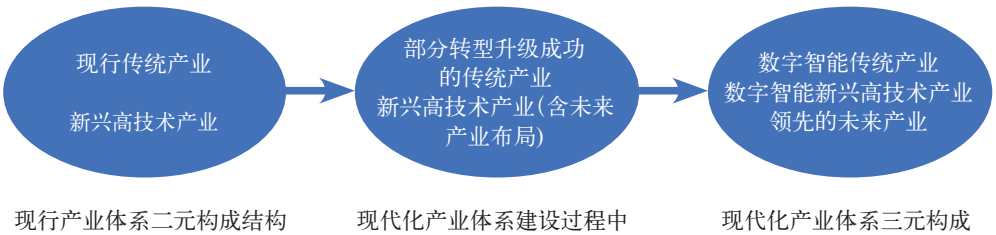

图2：现行产业体系至现代化产业体系的构成结构演化

（一）第一阵列：数字化转型升级后的部分传统产业

从现代化产业体系建设的三个产业阵列来看，现代化产业体系建设的重要构成内容之一是对现行产业体系中占比80%的传统产业进行大规模转型升级。例如现行的纺织服装产业、食品加工业、种植业、建筑业、零售业、交通运输业、能源产业、住房建设、生活服务业等，因为涉及人们的基本生活需求，这些产业在现代化产业体系中依然占有一席之地，但其提供的产品与服务必须适应收入水平提高导致的消费偏好变化后的消费者要求。为此，此类现行传统产业需要经过持续研发投入、加大创新，通过产业技术进步实现转型升级，必须经过数字化智能化改造后才能成为现代化产业体系的重要组成部分。另一方面，并不是当前所有的传统产业都可能转型成为现代化产业体系的一部分，因为消费者需求的重大变化、科学技术进步取得的重大突破都可能导致现行部分传统产业在产业体系演化中被淘汰。可以说，数字化转型升级成功的这部分传统产业，就构成了现代化产业体系中的第一个产业阵列。

[②] 参见《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》，https://www.gov.cn/xinwen/2021-03/13/content_5592681.htm。

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（二）第二阵列：成长中的战略性新兴产业

现代化产业体系中的第二个阵列是现行产业体系中正在发展的新兴高技术产业，该产业的基本特征是技术含量高、产品附加价值高、特别依赖创新能力和高端人才，这些产业关系到国家安全和科技进步，是时下全球产业竞争性分工的关键。我国正在成长的新兴高技术产业中，相当部分是时下发达国家产业体系中有巨大优势的产业，虽然我们已奋起直追，但在技术、产品、创新等方面还有相当大的差距。例如我国新兴高技术产业阵列中正在大力发展的半导体芯片制造业、软件产业、人工智能应用产业、数据分析产业、医疗设备产业、飞机引擎制造、新型材料等产业，从全球来看尚处在成长的“幼稚期”，与欧美发达国家的同类产业相比较还有不少的差距。但这些产业从现在到未来一定是我国现代化产业体系的核心产业。因此，应该充分认识到，在当前全球科学技术进步速度加快、产业技术迭代速度加快的背景下，第二阵列产业面临全球市场竞争激烈、发达国家在技术与人才双重封锁的压力，不仅在先进技术如人工智能、数字技术、新材料技术、基因技术等方面被“卡脖子”，甚至在许多先进制造的制造技术、工艺装备生产等方面都面临断供的状况。可以说，第二阵列产业发展建设的状况直接影响着我国现代化产业体系建设的规模与质量，虽然艰难但必须取得进步。

（三）第三阵列：正在谋划布局的未来产业

未来产业是现代化产业体系建设中的第三阵列。未来产业是指未来相当长时间（15—30年）内形成的新兴产业。未来产业是面向未来人类社会美好需求的，由突破性关键技术驱动的，可能会发展成战略性、前瞻性的新产业。它代表未来科技和产业发展的新方向，对人类经济社会可持续发展具有促进和引领作用。对目前刚刚处在技术萌芽状态，要在若干年后才有可能成熟的前瞻产业进行布局与扶植，争取率先取得全球领先地位，这是现代化产业体系建设中前瞻部分的内容。目前正在谋划布局的未来产业是未来国民经济中的重要组成部分，是我国目前发展的新兴高技术产业阵列之后的面向未来的中长期发展的战略性新兴产业群，严格地说这部分产业也属于产业体系二元构成中的新兴高技术产业阵列。只是从时间上看，我们今天布局的未来产业应该是未来15—20年之后替代今天的新兴高技术产业，成为那个时代的战略性新产业群的产业。彼时，未来产业将引领国民经济、产业体系发展，为当时的消费者提供高质量、高品质的产品与服务，在全球市场上具有强大的竞争力，成为全球产业发展的领先产业。可以预计，未来产业的发展与当前新兴高技术产业发展有较大的不同，这是因为未来产业发展更具有不确定性，需要新的投入机制与发展模式，所以我们特别将其列为现代化产业体系建设的第三阵列。[③]

[③] 芮明杰：《前瞻科学技术是选择未来产业的路径》，《社会科学报》2023年1月12日第2版。

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（四）数字新基础产业

从相当长的时间来看，现代化产业体系的三个阵列中无论是产业的转型升级还是创新发展都应建立在数字新基础产业的高质量发展基础之上。因为从现在到相当长的未来，数据已经成为新型生产要素，[④]数字技术、人工智能技术等快速发展，所有现代化产业与企业的生产运营都与数字智能技术密不可分，可以说现代化产业体系建设绕不开数字经济的发展，离不开数字新基础产业的支持。所谓数字新基础产业是指支持数字经济与社会高质量发展，满足人们美好生活需要，支持传统产业数字化转型升级、新兴高技术产业和数字智能产业发展以及未来产业成长的新型基础产业。数字新基础产业也属于新兴高技术产业阵列，只是由于其具有对其他产业广泛的支持作用，所以特别列出。

数字新基础产业具体可以划分为“硬、软、联”三个方面：一是以5G基站、传感器、数据中心等为代表的所有产业发展的“硬基础”；二是以大数据、人工智能、IT软件、算法等为代表的产业发展的“软基础”；三是以工业互联网、智能物联网等为代表的“互联性基础产业”。在数字基础产业中，“硬、软、联”三大基础产业技术相互融合、互相协同，共同构成了数字基础产业群的核心，支撑数字经济和传统产业数字化应用的进一步发展。[⑤]其中，“硬基础”中的5G基站、传感器等硬件是数字技术的物理支撑要件，也是信息传输、数据存储的最基本单元，由此生产并采集了更多可交互、有价值的数据信息，支撑数据处理功能的实现；“软基础”中的云计算、人工智能算法、数据分析则通过软件和算法进行数据的处理和挖掘，赋予了数据更多的价值；“互联基础”中的工业互联网以及智能物联网等技术则将虚拟世界和物理世界相连接，承载了信息传输主体的作用，提高生产效率、改变传统产业的生产方式。因此，“硬、软、联”三个部分必须相互融合、共同发展，形成现代化产业体系三个阵列建设的新型基础。而数字新基础产业必须先行发展，现代化产业体系三个产业阵列的建设才能顺利展开。

三、现代化产业体系“3+1”构成的主要建设策略

突破现行产业体系中以传统产业为主的二元构成结构固化，建设以前沿新兴高技术产业为核心的“3+1”现代化产业体系，是我国能否成功摆脱“中等收入陷阱”而进入高收入国家行列，以及数字经济条件下我国经济社会高质量发展和人民福祉快速提高的根本。为此需要制定科学的现代化产业体系“3+1”构成的建设策略，助力现代化产业体系早日建成。

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④ 参见《中共中央国务院关于构建更加完善的要素市场化配置体制机制的意见》，https://www.gov.cn/zhengce/2020-04/09/content_5500622.htm。

⑤ 芮明杰：《加快发展数字经济的三大新基础产业》，《解放日报》2020年3月3日第13版。

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（一）实施需求导向的建设方针

现代化产业体系本质上是供给体系，对应的是现行升级了的居民消费需求偏好以及未来居民对美好生活需要的结构与规模。因此，现代化产业体系的建设既需要把握现实消费需求及其变化导向，也需要把握创造新消费需求的可能，这就是现代化产业体系“3+1”构成建设的消费需求导向，也是突破现行产业体系二元构成结构固化的关键。我国是一个拥有14亿人口的大国，收入水平和消费偏好决定了国内市场规模量级，加上全球经济一体化条件下我国产业体系为全球生产的部分，基本决定了现行产业体系的二元构成结构，成为我国现代化产业体系建设与发展的基础。

在改革开放初期，我国的人均收入水平极低，生产的许多商品国内居民消费不起，国内消费对经济增长的贡献比例长期较低，当时经济快速增长主要依赖出口产业的发展，我国的出口依赖度曾经高达50%。近十年以来，随着技术进步与生产效率提高，我国居民的人均收入水平在不断提高，导致我国的市场规模不断扩张，2016年、2019年，我国社会消费品零售总额先后突破30万亿元和40万亿元，2021年达到44万亿元，再创历史新高，是2012年的2.1倍。以新冠疫情状况下的2022年为例，2022年1—12月，我国社会消费品零售总额439733亿元，仅仅同比下降0.2%，其中城镇消费品零售额380448亿元，比上年下降0.3%，乡村消费品零售额59285亿元，与上年基本持平。[⑥]2015年，中国最终消费支出对经济增长的贡献达66.4%，尽管有新冠疫情影响，2021年中国最终消费支出对经济增长的贡献率也达65.4%。目前，44万亿的消费品市场再加上更大的中间产品市场规模，已经基本支撑起现行产业体系发展，但是否可以支持一个正在建设中的现代化产业体系呢？

发展经济学家罗斯托提出了经济起飞模型，即一个国家或经济体的发展主要经历五个发展阶段：1）传统经济阶段，此阶段是以农业为主的经济体，生产效率低下，居民生活贫困；2）起飞前准备阶段，这一阶段主要由政府投资基础设施，开启工业化的准备；3）经济起飞阶段，这个阶段如果是开放的，通过引入海外投资，拉动经济增长，提高制造业生产水平，工业化展开，增长速度很快；4）经济转型阶段，此阶段工业化进入中后期，标志是产业体系从以第二产业贡献为主逐步转型到以第三产业贡献为主的状况，服务产业发展迅速。5）大量消费阶段，这是本模型的最后阶段，这一阶段经济增长的动力主要依赖内需，依赖国内消费，而并不是过度依赖进出口，从而实现居民高福利（罗斯托，2001）。按照罗斯托的理论，我国目前人均GDP已经达到1万美元，进入了中等收入国家行列，GDP总量中第三产业贡献比例已经超过50%，中国经济增长已经进入罗斯托起飞模型的第四个阶段，部分经济发达地区例如上海、北京、广州、深圳、长三角地区等已经进入了第五阶段，因此扩大内需和调整需求结构已成为现行产业体系转换为现代化产业体系的基础条件。

尽管近十年以来，我国的内需市场规模在不断扩张，经济整体上进入中等收入国家行列，但居

[⑥] 参见《2022年社会消费品零售总额简况》，https://www.ndrc.gov.cn/fgsj/tjsj/ssjj/202301/t20230130_1347724_ext.html。

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民的消费需求结构依然偏向于低端产品。居民可支配收入状况以及消费偏好支出结构会影响到现实与未来的消费需求结构，进而影响产业体系内不同产业的成长与发展，最终影响产业体系的产业构成。石明明等（2019）的研究表明，“1998—2017年，中国城乡居民的第I类消费升级（食品等生存性消费占比下降）和第II类消费升级（符号性和服务性消费占比上升）均在持续不断地进行，但乡村居民的第I类消费升级效应小于城镇居民；2013年以后，随着中国宏观经济下行压力增大，第II类消费升级出现一定程度的放缓，居住类支出对其他消费支出形成了较大的挤出效应。消费习惯层面的分析显示，城镇居民和乡村居民、恩格尔系数大于40%和小于40%的居民，其消费行为存在较大的异质性”。城乡居民消费的差异以及消费升级的困难，主要是因为我国14亿人口的收入结构目前存在以下几个问题：1）居民人均可支配收入总体仍比较低，2022年，全国居民人均可支配收入为36883元，虽较2021年的35128元增长了5%，但整体仍然偏低，每月人均可支配收入只有3073元，人均消费支出每月只有2044元。2）地区居民收入差异较大，同样以2022年为例，北京市、上海市2022年的人均可支配收入分别高达77415元和79610元；而经济发展相对落后的中西部省市居民人均可支配收入最低，仅为北京、上海等地区居民人均可支配收入的30%，如甘肃省、贵州省2022年人均可支配收入分别只有23273元和25508元。3）城乡居民人均收入水平差距依然较大，2022年城镇居民人均可支配收入高达49283元，而农村居民人均可支配收入只有20133元，仅为城镇居民的40%。

根据上述数据可以判断：一是如果我国居民收入水平随经济增长而不断增长，则现代化产业体系所需要的市场规模还会不断扩大，这对建设现代化产业体系是十分有利的。二是目前我国居民可支配收入总体较低且存在较大差异的状况在短期内很难改变，因此，其整体消费实力与消费品需求状况并不能完全支持高附加值的高科技产品的消费，这就导致产业体系中的大量传统低价消费品与部分高附加值消费品并存的状况也很难在短期内改变。因此我国现代化产业体系的建设有其自身的特殊性，既需要第一阵列传统产业转型升级产品迭代，有需要新的产品价格不能太高；第二阵列的新兴高技术产业实现技术与产品创新时，要兼顾高收入人群与中低收入人群的需求；第三阵列的未来产业布局除了考虑前瞻科学技术进步趋势之外，还应该考虑未来我国居民可支配收入提高且趋向比较均衡的状况。

（二）数字化改造加持建设过程

决定现代化产业体系“3+1”的建设内容主要有两大因素：一是当前至未来居民收入水平变化以及由此带来的消费需求的变化趋势。因为现代产业体系是生产供给体系，生产的最终目的是为了适应人们未来美好生活的需求，需求变化会影响现代产业体系生产效率、产品种类和品质、绿色低碳生产等，也会影响正在不断进步中的科学技术（芮明杰，2023）。二是数字技术和人工智能技术。可以确定的是，当前所有的科学技术进步中大数据技术、人工智能技术是决定现代产业生产适合消费

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者需求变化的最基础的技术。因为有了数据收集以及数据分析技术，就可以刻画每个消费者的消费特征，把握消费需求变化；而有了人工智能技术，就可能推动智能生产设备、智能生产流水线、智能工厂与智能服务的产生，进而满足大量消费者个性化的消费需求。也正是如此，数字产业化和产业数字化就成为当前和未来相当长时间里我国现代化产业体系建设的重要组成部分，这就要求数字新基础产业发展必须先行。

数字新基础产业的“硬、软、联”协同发展，并结合大数据技术、人工智能技术以及相关产业中的其他技术进步，推动了我国现行产业体系中传统产业的数字化转型升级，使产品与服务不断迭代升级，重塑全球市场竞争力；数字技术、人工智能技术加持我国正在快速成长的新兴高技术产业，助力具有中国特色的未来产业布局、成长以及成就领先态势（见图3）。具体来说，基于数字新基础产业的支持，当前现代化产业体系第一阵列建设即传统产业进行数字化转型，就是要利用数字技术改造原有生产技术与生产过程，实现数据要素在生产经营过程中被不断收集、分析、研究、交换，达到提高资源配置效率、竞争力和收益水平，降低生产成本，优化产品的目的，成功实现数字转型。数字化转型成功后，这部分产业才能算入现代化产业体系中。传统产业转型升级的数字化改造离不开数据要素的应用，这是其与其他传统产业相区分的最关键特点。作为第二阵列的新兴高技术产业是现代化产业体系的核心，目前有三种类型，一是本身生产数据、应用数据要素的产业，如数据分析、5G通信等；二是本身基于数据要素、以数字技术为重要技术支撑实现精准生产、精准营销、精准服务而发展起来的产业，这些产业属于数字经济的范畴，例如移动支付、电子商务等服务型行业；三是高技术产业，但不一定一开始就使用了数字技术，因此也需要数字化转型，例如新能源汽车制造业、仪器仪表制造业和医药制造业等。作为现代化产业体系第二阵列的三种类型产业，由于均要应用数据这一生产要素和数字技术，都是通过数据运用、收集、分析改善生产、经营、服务方式，所以从数字经济角度看，也都是数字经济的核心组成部分，是推动数字经济发展的主要力量。可以预计第三阵列的未来产业发展一定是基于数字基础、数据要素、数字技术和人工智能技术等基础之上的。

（三）科技创新与产业创新关联协同突破

现代化产业体系的建设过程中，无论是传统产业数字化改造、新兴高技术产业快速成长还是未来产业探索布局，都离不开科学技术进步，离不开产业体系自身的创新能力和创新的投入产出效率。现行产业体系的创新能力与创新成果产出依赖于两类创新：一是科技创新与产出，二是产业创新与产出。科技创新很重要，包括科学发现与技术发明。科学发现是发现真理与规律，虽然与产业发展没有直接的关联，但科学发展的成果十分重要，与通用技术的发明和应用有直接的关联性。例如当年的电磁理论就是科学发现，正是这一发现导致发电技术的发明，最终带来电力产业的巨大发展。技术发明是在科学发现基础上进一步应用而展开的创新，就像发电技术的发明才导致电力的广

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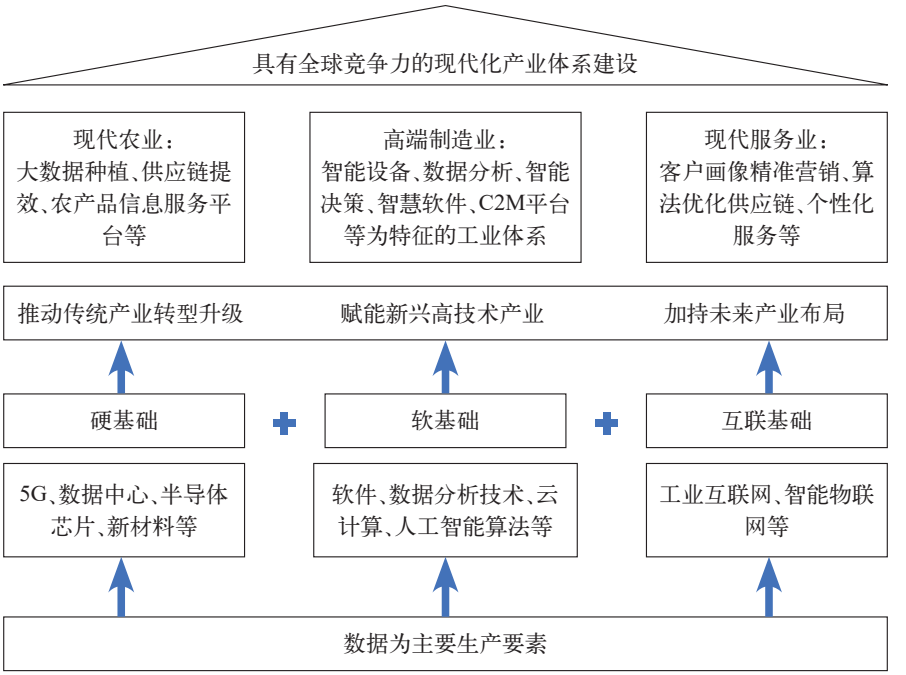

图3：数字化改造助力现代化产业体系建设

泛应用和电力产业的大发展。科技创新的成果可以简单描述为从0到1，具有原创性。然而历史已经证明，并不是所有的科技创新的原创成果都可以形成新产品，即使形成了新产品也不见得可以成功商业化而成为新产业，从新产品到新兴产业要依赖产业创新的成功（Hall和Rosenberg，2010）。

产业创新是过程性创新，是从新产品创新至商业化成功整个过程的创新。产业创新包括以下几个方面的连续性创新：产品创新，然后根据产品特性与需求品质要求进行生产工艺技术创新，即生产设备、生产工艺等方面的创新；之后要对此产品的生产运营实施生产组织创新，如供应链组织、价值链组织等，以便进行商业化生产；再之后是市场创新，即如何使产品更好地被消费者消费与使用，从而真正创造附加值、贡献GDP。产业创新的简单说法就是从1到100、1万、100万或1亿。通过产业创新可以促进新兴高技术产业形成并快速成长，产业创新对现代化产业体系中的新兴高技术产业发展、未来产业成长都十分重要，且更具有商业价值。与科技创新的主体主要是高校、科研机构等不同，产业创新的主体是企业。科技创新与产业创新不仅是现代化产业体系建设成功的两个创新“轮子”，缺一不可，而且两者之间必须关联协同，其中科技创新要先行，尤其是支持科学发现的基础研究应该先行（芮明杰，2018b）。

科技创新与产业创新的双向关联也可以从2022年美国通过的《芯片与科学法案》的内容中领悟。[⑦]该法案表面上是关注芯片等产业发展，其核心则是关注基础研究、能源创新、新材料科学技术

[⑦] H.R.4346 - Chips and Science Act（芯片与科学法案），https://www.congress.gov/bill/117th-congress/house-bill/4346/text。

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发展等议题，谋求科技创新在前，产业发展紧随其后，实现美国再次伟大。美国目前最主要的措施一方面是政府抓住主要基础研究领域加大投入并开始对产业创新进行一定的补贴，另一方面则是在现行技术优势领域对我国进行封锁，使得我国难以获得现有的国际前沿性技术，拖延我国科学技术进步的时间，从而巩固和发展其自身优势。美国在应用研究与开发研究方面的举措原本主要是利用市场来引导企业进行产业创新。过去，他们认为应用研究和开发研究具有市场导向特性而交给市场，由市场上的企业与相应研究机构自行选择，从而形成基础研究主要由政府支持，应用研究与开发研究主要由企业在市场导向下自行开展的合作体系。近年来，美国政府开始运用政府补贴等措施来支持企业在重要产业领域的发展，支持企业产业创新的力度越来越大。美国政府目前策略的变化值得我们思考，建设现代化产业体系不能离开科学技术投入，不能离开基础科学的发展，需要十分重视基础研究及其成果获得。此外，由于产业创新的主体是企业，因此如何调动企业家的创新积极性，取得更多的产业创新成果，推动更多原创新产品成功商业化，是形成新兴高技术产业和未来领先产业的关键。

（四）进一步开放改革，重构全球科技与产业合作网络

我国现行产业体系发展至今取得了巨大的成就，根本原因就是实施了改革开放的基本国策，通过开放改革建立了社会主义市场经济体制，推动产业与企业加入全球产业分工体系，发挥市场机制在资源配置中的基础性作用，使产业发展的主体企业尤其民营企业有了巨大的发展活力，直接推动了现行产业体系的形成与发展。这个经验是十分重要的，尽管当前产业体系二元构成结构固化的突破以及开始建设现代化产业体系的国际环境、技术进步、合作状况都与改革开放初期完全不同，建设的内容也完全不同，建设难度与挑战大大增强，但在建设中，现代化产业体系依然是一个面向全球开放的体系，其无论是在产业技术、产品生产经营、创新研发等方面，还是在产业资本、人才、数据要素市场等方面都应该是开放的。现代化产业体系建设所依赖的主要机制依然是市场机制，即市场的公平竞争、开放与包容。所变化的只是现代化产业体系建设的目标是要建立以内需为主、外需为辅、双向循环开放的产业体系，而不再是以出口导向为主的产业体系。

事实上，在经济全球化不断深入和科技飞速发展的当下，我国现行产业体系二元构成结构固化的突破和现代化产业体系建设的基本路径一定是开放合作，市场机制一定是资源配置的根本性机制。现代化产业体系的建设不能仅仅依靠我国自身的资源，而更需要与全球范围内的产业、企业、科研机构合作，以最大限度地利用全球创新资源，增强产业主体的创新活力。现代化产业体系的建设必须从产业主体企业间的合作扩展到全球产业内外不同主体、不同地域间的网络协同合作，并进一步向全球科技与产业合作网络的形态扩展，可以说，建立全球科技与产业合作网络是推动现代化产业体系的“3+1”产业阵列高质量转型升级、实现跨越式创新发展的需要。我国唯有开放合作，继

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续参与新型全球产业分工生产体系，才能够充分利用合作各方的优势资源，取长补短，突破技术瓶颈，缩短技术原创周期，从而推动传统产业的高质量转型升级，促进新兴高技术产业快速发展，成为现代化产业体系中的核心力量。而正在布局的未来产业也才能够在未来15—30年成为全球领先产业，也唯有开展合作，共享创新成果，才能够加快突破关键核心技术，实现更多0到1的突破才行。

从现行产业体系转变为现代化产业体系本质上是在开放条件下的全球资源重新优化配置的过程，重构全球科技与产业合作网络是资源优化配置的基础。在进一步开放条件下对存量于现行产业体系的资产、人力资源、技术能力、生产能力、品牌声誉等的大规模调整，并结合现在与未来科学技术创新力量、创新成果、先进技术、人才、资本等增量的加入，实现开放条件下高效率的资源配置。这样的开放条件下的资源配置过程应该继续建立在以市场配置资源的基础之上，政府仅仅通过制定法则政策维持市场公平竞争以发挥市场机制作用，实现传统产业内的企业优胜劣汰，促进数字化转型升级快速展开；使新兴高技术产业与科创企业有动力积极投入创新资源加快突破瓶颈而实现快速发展，使之成为现代化产业体系的主要组成部分；实现未来产业的谋划布局和市场选择发展，未来产业的布局不能只看科学技术的进步趋势，还需要判断该产业未来商业化成功的可能，需要对未来全球市场进行预测性判断。

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Composition and Development Strategies of an Industrial System for China's Modernization Drive

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Abstract: *The creation of a modern industrial system is a key priority for China's high-quality economic development. It is fraught with obstacles and challenges, and it necessitates great courage, wisdom, and a suitable approach and strategy. Today's world is defined by rapid technology innovation, shifting consumer demand, geopolitical restructuring, and an evolving global industrial division of labor. In this context, China's current industrial structure is characterized by an increasingly entrenched dual structure. While conventional sectors are afflicted by excess capacity and growth bottlenecks, emerging high-tech industries are hampered in their development. These difficulties can be linked to a variety of factors, including slow domestic consumer demand and insufficient innovation. The creation of a modern industrial system strives primarily to foster inclusive innovation of the existing industrial system in order to reallocate resources in accordance with a demand-driven approach. This paper suggests that the current division between conventional and high-tech sectors should be replaced with a new industrial system that in this study we refer to as "3+1" structure for sound and sustainable development. To that end, we recommend that the government: (i) Adopt a demand-oriented development approach; (ii) support industrial development through the application of digital technologies; (iii) make coordinated progress between technological and industrial innovations; and (iv) continue to reform and open up, as well as reshape global technology and industrial cooperation networks.*

Keywords: *Modern industrial system, composition structure, development strategy*
JEL Classification Code: L16
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The purpose of this paper is to analyze that after China became a middle-income country in recent years, the industrial structure of the current industrial system has begun to be solidified. The causes of this phenomenon encompass both exogenous factors such as geopolitical changes, accelerated technological progress, and changes in the industrial ecological environment, as well as endogenous factors including rising labor costs, insufficient innovation capabilities, and the need for improvement in industrial spatial layout. The superposition of these factors has adversely affected China's further economic growth and may lead China to fall into the "middle-income trap". In light of the imperative for future growth, how to get out of such a dilemma is a topic worth studying. This paper argues that it is a key step for China to build a modern industrial system that is future-oriented and globally competitive. In addition, how to transform our China's current industrial system into a modern industrial system is the core issue of modern industrial system construction.

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1. Structure Entrenchment of Current Industrial System and Causes

In comparison to China's current industrial system, the term "industrial system for the modernization drive"[1] refers to a new industrial system with cutting-edge technology and a new comparative advantage to suit the needs of human society. To succeed, the industrial system for the modernization drive, which evolves from the existing industrial system, requires a firm base, clear direction, and adequate dynamism.

1.1 Dual Structure of China's Industrial System

Industrial sectors can be classified for statistical analysis and research purposes. One typical approach is to categorize industries as primary, secondary, or tertiary based on the relationship between production and natural resources. Such an industrial structure offers an important perspective for assessing the development status of the global industrial system. Also, the current industrial system can be divided into two categories based on the level of technological density. Labor- and capital-intensive sectors with low technological density, often known as conventional industries, include manufacturing, agriculture, and services. The other category includes technology- and knowledge-intensive industries based on emerging technologies, such as aviation and aerospace, robotics, smart equipment, chip manufacturing, as well as modern agricultural and high-end services. The industrial system, according to this classification, has a dual structure comprised of these two arrays of sectors.

After decades of reform and opening up, China has made significant progress in its industrial structure and complete manufacturing system. China leads the world in the manufacturing of numerous products and it has substantially enhanced product quality to win consumers globally. However, based on its dual industrial structure, conventional sectors continue to provide the most to China's industrial output, accounting for more than 80% of China's GDP. China's emerging high-tech industries, whose development in recent years has given rise to prominent tech giants such as Huawei as well as remarkable small and medium-sized enterprises (SMEs) known as "hidden champions", account for less than 20% of China's GDP. This lopsided proportion has resulted in a slew of issues, including excess capacity in conventional industries, structural imbalance, slow technological progress, and tepid growth in total factor productivity (TFP) in the context of a changing global division of labor, new consumer demand, the digital economy, and artificial intelligence (AI) (Liu, 2021). Due to a lack of innovation and the technology embargo, the digital shift has encountered challenges, as have emerging tech sectors.

According to the World Bank, dozens of nations entered the industrial era after World War II, but the majority of them remained in the middle-income stage and fell victim to the "middle-income trap". Only 13 of them have advanced to the high-income society. However, after two decades of robust expansion, those 13 economies saw their GDP per capita decrease abruptly by 40% to 50%, or in some cases, more than half, after reaching the mark of 11,000 international dollars (Maddison, 2003). At this point, the middle-income economies cannot compete in terms of labor costs with low-income countries nor in cutting-edge R&D with high-income countries. This limbo is known as the "middle-income trap" (Gill and Kharas, 2007). The causes of the middle-income trap have been explained from a variety of perspectives by economists. According to our analysis, one of the key reasons is the dual industrial system. Rising labor costs associated with rising household income and rising land prices due to industrial expansion will reduce the profitability and competitiveness of conventional industries in the middle-income stage, creating excess capacity and driving some industries to migrate. The end result is the decline of conventional industries and the hollowing out of the industrial sector. Despite rising demand for high-tech goods and services, emerging high-tech industries in those middle-income

[1] It refers to a new industrial system that drives China's future modernization development.

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economies confront two challenges. First, a lack of continuing support for high-tech products and services; due to the capital-intensive and time-consuming nature of research and innovation, it is difficult for middle-income nations to advance technologically in a short period of time. Second, to maintain their advantage in cutting-edge technology, advanced economies will go to great lengths to prevent emerging middle-income countries from acquiring critical technologies (Rui, 2021). As a result, for those middle-income economies, the dual industrial structure becomes entrenched, inhibiting further structural sophistication.

To escape the middle-income trap and enter the ranks of advanced economies, developing countries must break away from the dual industrial structure. Specifically, developing countries should create an industrial structure dominated by new high-tech industries with advanced technology and high value-added while conventional industries transition and migrate. For instance, countries such as Japan and South Korea advanced from developing to developed status following the World War II, owing primarily to the successful transition of their dual industrial structure. However, not all countries have completed this shift. Despite early progress, some developing countries may face stagnation or discontinuity in the transition to a dual industrial system. Argentina, Brazil, South Africa, Thailand, and Malaysia were all examples of countries that fell into the middle-income trap. Breaking away from the constraints of the dual industrial structure is a difficult and time-consuming task that needs contributions from both the market and the government.

1.2 The Dual Structure in China's Modern Industrial System

Since 2016, China's dual structure of conventional and emerging high-tech sectors has begun to take hold. China's conventional industries became less competitive and productive due to overcapacity and stagnation. Nonetheless, conventional sectors continue to account for more than 80% of China's GDP. Emerging high-tech industries have seen substantial output growth. China has created some high-tech modern industries from scratch, such as high-speed railway rolling stock, smartphones, 5G communications, semiconductor chips, and smart equipment manufacturing. All of these industries have been fast developing, and some - such as 5G communications, new energy vehicles, and BeiDou navigation satellite - have become internationally competitive. Despite the fact that these products are essential components of China's existing industrial system, emerging high-tech sectors account for less than 20% of China's GDP and are insufficient to support the country's overall economic growth (Rui, 2020).

The existing dual structure of China's industrial system contrasts with those of high-income countries led by the United States. Tech industries account for a major portion of GDP in developed countries, while most of their labor-intensive conventional industries have relocated offshore. Behind the contrast between China's industrial dual structure and those of developed nations are disparities in industrial technology, organizational efficiency, and, more importantly, workforce competence and skills, as well as progress in science and technology. The generation of value-added differs greatly among industrial systems having a dual output structure. High-income countries' industrial systems are principally responsible for the production of high-value goods and services. High-income countries, such as the United States, have tightened restrictions on China's access to vital technology, talent, equipment, and parts and components in order to hinder China's development of high-tech emerging industries. The stated rationale of national security belies the real intent of retaining industrial leadership by obstructing China's shift away from the dual industrial structure and blocking China's ascension to high-income status.

1.3 Logic behind the Formation of Dual Structure in China's Current Industrial System

Figure 1 depicts the progression and entrenchment of China's dual industrial structure. China initially developed conventional labor-intensive industries through the importation of foreign capital and technology and participation in the global industrial division of labor system since the implementation of the reform and opening up policy in 1978. These industries specialized in the production of low-

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value goods and processing trade and export. Subsequently, China embarked on initiatives to develop other sectors, ultimately establishing a complete industrial system. The rising household income, the global financial crisis of 2008, and the appreciation of the renminbi all contributed to a rise in the cost of resources, the cost of living, and the cost of labor in China, reducing the competitiveness of conventional industries that rely heavily on cheap labor at the low end of value chains. Consequently, the initial feedback cycle that was mutually reinforcing is unable to endure, leading to a loss in the competitiveness of conventional industries in China. Since 2016, China's economic development has been impeded by industrial growth decline and inadequate domestic consumption, creating an economic quandary comparable to that encountered by other middle-income nations.

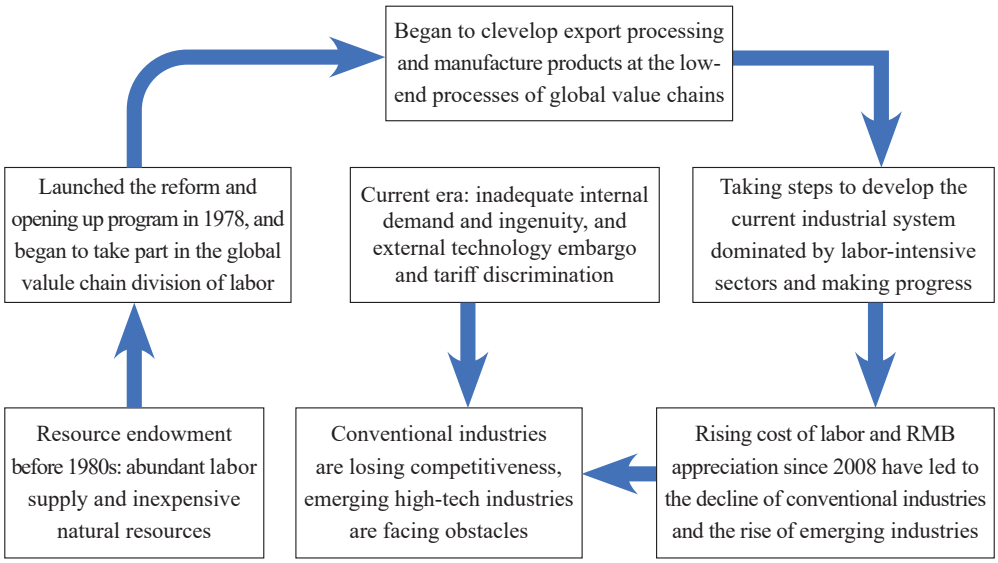

Figure 1: Formation and Entrenchment of China's Current Dual Industrial Structure

To keep the Chinese economy from falling into the middle-income trap, the State Council issued the *Made in China 2025* plan in May 2015[2], which lists nine key missions and priorities, as well as ten development focus areas. This 10-year action plan under the manufacturing revitalization strategy, advocates for China's transition from a large manufacturing nation into a resilient and competitive one; it upholds the incorporation of next-generation information technology into the manufacturing sector and the transformation of manufacturing mode, organizational methods, and industrial reforms to promote intelligent and service-based manufacturing. The implementation of *Made in China 2025* symbolizes the start of the transition and upgrade of China's current industrial system, which will be led by strategic emerging industries. This approach, however, sparked a pushback from developed countries determined to maintain their competitive position in high-value industries. Economic globalization and global value chains (GVCs) have been dominated by multinational corporations from high-income nations such as the United States (Gereffi, 2009). To lower costs and increase profits, these multinational corporations shifted low-value manufacturing activity to countries and regions with abundant labor resources. Furthermore, their technical patents, standards, distribution networks, and intellectual property right (IPR) arrangements have raised the bar to entering high-value processes such as design,

[2] The Central People's Government of the People's Republic of China: *Made in China 2025*, https://www.gov.cn/zhengce/content/2015-05/19/content_9784.htm.

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R&D, and marketing, confining developing-country firms to low-end value chain segments. As a result, rich countries retain their high-income status, whereas emerging economies struggle to raise their income levels. In recent years, governments from developed countries began to intervene in the name of national security, hindering or suppressing free competition. Their restrictions on Chinese technology, industry, and talent have caused significant losses to the country's emerging high-tech industries. Tariff discrimination against China's conventional industries has weakened China's export competitiveness and exacerbated excess capacity and profit declines. The unfavorable external environment has contributed to the entrenchment of China's dual industrial structure, both at the high and low ends. Failure to address external challenges may result in the loss of China's comparative advantage, entangling the country in the middle-income trap and precipitating an economic crisis in the medium and long run.

2. "3+1" Composition of the Modern Industrial System

China has taken a forward-looking strategy in its continuous efforts to modernize its industrial system. This system should be globally competitive, sustainable, and based on the country's newfound comparative advantages, reflecting its social system and cultural customs, natural resource endowment, human resources, industrial asset stock, knowledge and technology resources, consumption tendencies, and ecological environment. Such an industrial system is distinguished by resource efficiency, green and low-carbon performance, intelligent information technology, optimized industrial value chains, reasonable spatial layout, indigenous innovations, openness and sophistication (Rui, 2018a). Emerging high-tech industries should be nurtured to become the backbone of the modern industrial system. Furthermore, innovation should breathe fresh life into conventional industries, making them important components of the modern industrial system. Furthermore, in the midst of scientific and technological progress, policymakers ought to devise strategies to anticipate the emergence of new industries, products, and enterprises. As rightly stated in China's *14th Five-Year Plan for Economic and Social Development and Long-Range Objectives through 2035*, the implementation of future industry incubation and acceleration programs is necessary to foster technology and industrial transformation, including deep-ocean and aerospace development, brain-inspired intelligence, quantum computing, genetic technology, future internet, hydrogen energy, and energy storage[3].

If the industrial system is still characterized by the level of technological density, it will be identical to the current dual structure. On the surface, the modern industrial system implies a significant growth in the GDP contribution of emerging high-tech industries. However, at a deeper level, it entails a considerable shift in industrial composition. Advancements in digital technology and artificial intelligence (AI) have transformed the industrial landscape, paving the way for more innovative high-tech industries of the future. China's modern industrial system consists of three arrays and one foundation, referred to as the "3+1" structure

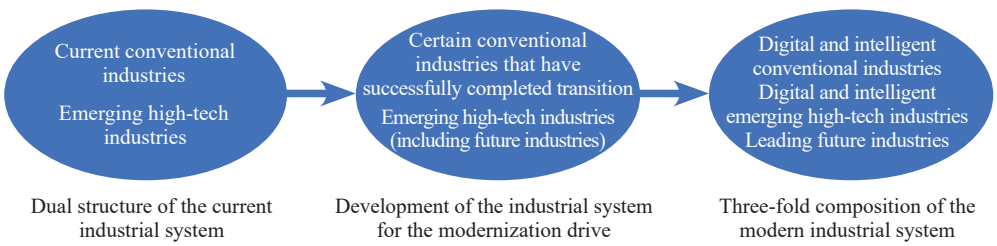

Figure 2: Evolving Structure of China's Industrial System for the Modernization Drive

[3] See *14th Five-Year Plan for Economic and Social Development and Long-range Objectives Through the Year 2035 of the People's Republic of China*, https://www.gov.cn/xinwen/2021-03/13/content_5592681.htm.

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in this study. As shown in Figure 2, the three arrays consist of certain conventional industries that have been transformed by digital technologies, emerging strategic industries, and future industries that are presently being planned; the "one" foundation refers to the digital infrastructure industry.

2.1 First Array: Conventional Industries Transformed by Digitalization

The conventional industries that make up the 80% of China's industrial system need a comprehensive upgrading if the country is to achieve modernization. Certain sectors continue to hold significance in our modern industrial system due to their critical role in fulfilling people's daily necessities. They range from textiles and apparel to food processing, crop farming, building, retail, tra nsportation, energy, housing, and consumer services. However, in order to complete their transition via advances in technology, those conventional industries have to keep raising R&D spending. They must embrace digital and intelligent features in order to become an indispensable part of the modern industrial system. Not all conventional industries may accomplish this transformation; any significant shift in consumer demand or progress in science and technology may lead certain conventional industries to lose ground in the current industrial structure. On the other hand, conventional industries that are effectively adopting digital technologies will form the foundation of the first array of our modern industrial system.

2.2 Second Array: Emerging Strategic Industries

Emerging high-tech industries, which are distinguished by a high level of technology, value-added, reliance on innovation, and high-caliber talent, make up the second array of our modern industrial system. These industries are critical to our national security and technological advancement, as well as the competitive global industrial division of labor. Developed countries are dominant global players for certain emerging high-tech industries. China lags far behind advanced nations in those emerging industries in terms of technology, product, and innovation. In comparison to advanced economies in Europe and North America, China's emerging high-tech industries - such as semi-conductor chip production, software, AI applications, data analytics, medical equipment, aircraft engines, and new materials - are still in their infancy. However, these sectors form the bedrock of our industrial system. Given the rapid advancements in science and technology, it is imperative to acknowledge that the second array of industries is confronted with escalating global market competition and technology embargoes imposed by developed nations. China is reliant on unstable foreign supply of AI solutions, digital applications, new materials, and genetic technologies, as well as advanced manufacturing technology and process equipment. These supplies are regrettably susceptible to disruption as a result of external interventions. Without a doubt, the extent and quality of China's modern industrial system are dependent on the advancement of its second array of industries.

2.3 Third Array: Future Industries

Future industries are the third array of sectors in China's modern industrial system. Future industries are emerging industries that require a long time to develop, foreseeably 15 to 30 years. They have the potential to grow into strategic and forward-looking emerging industries powered by key technologies to meet people's aspirations for a better life. They represent the new directions of future technological and industrial development, as well as the driving force behind long-term social and economic development. As part of China's quest to establish a modern industrial system, it is recommended that the country support and lead the world in forward-looking industries backed by critical future technologies. Future industries, as a major component of the economy, constitute China's strategic emerging industrial cluster for mid- and long-term development, following the ongoing efforts to foster a diverse range of emerging high-tech industries. In a more precise sense, these industries are also included in the array of high-tech strategic industries as part of China's dual industrial structure. From a temporal standpoint, future industries currently under development should be strategic emerging high-tech industries to

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supplant today's emerging high-tech industries in 15 to 20 years. It is expected that by then, China's future industries will be at the forefront of the country's economic and industrial development, offering premium goods and services that can compete on a global scale. Future industrial development is likely to be more uncertain than current emerging high-tech industries, necessitating new investment and development modes; as a result, future industries are identified as the third array in developing the industrial system for the modernization drive.[4]

2.4 New Digital Infrastructure Industry

Over an extended period of time, all the three arrays of China's modern industrial system should be built on the high-quality development of the new digital infrastructure industry. Data has become a new factor of production and will remain so in the foreseeable future[5]. As digital technology and AI advance at a rapid pace, they have become indispensable to the operations of modern industries and businesses. It is safe to say that the modern industrial system cannot flourish without the digital economy and new digital infrastructure. The term "new digital infrastructure industry" refers to a new type of infrastructure industry that promotes high-quality social and economic development, digital transition and upgrade of conventional industries, and the development of emerging high-tech, digital, and future industries to meet people's aspirations for a better life. The new digital infrastructure industries are also part of emerging high-tech sectors, although they are considered separately in this article due to their importance for other industries.

Physical infrastructure such as 5G base stations, sensors, and data centers are part of the new digital infrastructure industry, as are big data, AI, IT software and algorithms, and interconnection infrastructure such as industrial internet and intelligent IoT. The hardware, software, and connectivity infrastructures complement one another and form the foundation of the digital infrastructure industrial cluster, which will promote future development in the digital economy and digitalization of conventional industries.[6] The physical infrastructures, including 5G base stations and sensors, are the fundamental building blocks of digital technology and the conduits through which information is sent and stored. They generate and collect extensive interoperable and valuable data and information to enable data processing. Cloud computing, AI algorithms, and data analytics, as part of the soft infrastructure, enable data processing and mining based on software and algorithms to add value to data. In terms of connectivity infrastructure, industrial internet and intelligent IoT connect the virtual and physical worlds as a means of information transmission to boost productivity and upend conventional business models. Physical, soft, and connectivity infrastructures must be merged to establish a new sort of foundation for developing the three arrays of modern industries. The success of the three arrays depends on the new digital infrastructure industry taking the lead in innovation.

3. Strategies for the Development of the "3+1" Modern Industrial System

China has to establish a "3+1" modern industrial system led by growing high-tech sectors to avoid becoming stuck in a dual industrial structure dominated by conventional industries. That is the key for China to escape the middle-income trap and join the ranks of high-income countries through high-quality of social and economic development in the digital economy to swiftly improve people's welfare. Therefore, a scientifically-based strategy for the creation of a "3+1" modern industrial system is required

[4] Rui Mingjie: "Forward-looking Science and Technology: Path for Identifying Future Industries," *Social Sciences Weekly*, January 12, 2023, Page 2.

[5] See the *Opinions of the CPC Central Committee and the State Council on the Development of More Complete Market-Based Factor Allocation Mechanisms*, https://www.gov.cn/zhengce/2020-04/09/content_5500622.htm.

[6] Rui Mingjie: "Three New Basic Industries for Accelerating the Digital Economy," *Liberation Daily*, March 3, 2020, page 13.

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to facilitate the completion of the modern industrial system.

3.1 Adopting a Demand-Driven Development Strategy

The modern industrial system is primarily a supply-side system, and it corresponds to changing consumer preferences as well as the scale and structure of people's future needs for a better life. In addition to satisfying current consumer demand and following its trend, our industrial system must explore the possibility of creating new consumer demand, which is crucial for the development of the "3+1" modern industrial system and avoiding the entrenchment of the dual industrial structure. The size of the domestic market in China - a large country of 1.4 billion people - is determined by consumer choices and income levels. Domestic demand and industrial exports both contribute to the existing dual industrial structure that serves as the cornerstone of China's modern industrial system in the context of global economic integration.

China's per capita income was extremely low at the initial stages of the reform and opening-up policy in the early 1980s, implying poor consumer affordability. Domestic consumption historically represented only a minor share of economic growth. China's rapid economic growth was mostly driven by exports at the time. Subsequently, China's consumer market expanded further as per capita household incomes increased. In 2016 and 2019 China's aggregate retail sales of consumer goods exceeded 30 and 40 trillion yuan, respectively, before reaching a new high of 44 trillion yuan in 2021, which was 2.1 times the level in 2012. Despite COVID-19 lockdowns, China's retail sales of consumer goods totaled 43.97 trillion yuan in 2022, a 0.2% year-over-year decrease. This figure consisted of 38 trillion yuan in urban retail sales, which were down 0.3% from the previous year, and 5.9 trillion yuan in rural retail sales, which were equivalent to the previous year. China's final consumer spending contributed 66.4% to GDP growth in 2015[7]. Despite the COVID-19 pandemic, final consumer spending in China contributed 65.4% to economic growth in 2021. The current industrial system is supported by China's consumer market at 44 trillion yuan and the broader market for intermediate inputs. The question is, what does it take to construct an industrial system for the modernization drive?

Walt Whitman Rostow, a developmental economist, divided economic modernization into five stages of development in his economic takeoff model: (i) Conventional society: The society is based on agriculture and is characterized by poor productivity and extreme poverty; (ii) preconditions for take-off: The society prepares for industrialization through government investment in infrastructure; (iii) take-off: If the society embraces economic openness at this stage, it will attract foreign investment to fuel growth, enhance manufacturing sophistication, and accelerate industrialization; (iv) drive to maturity: In the mid and late stages of industrialization, the tertiary industry replaces the secondary industry as the dominant contributor to industrial output, and services develop rapidly; (v) mass consumption: In the final stage of the economic take-off model, domestic consumption has become the fundamental stimulus of economic growth, and domestic consumption, rather than an over-reliance on imports and exports, supports a high level of household welfare (Rostow, 2001). Currently, China's GDP per capita has reached $10,000 USD, joining the ranks of middle-income countries, and the tertiary industry accounts for more than half of China's GDP. By Rostow's standard, China's economic growth has entered the fourth stage of the economic take-off model, while some of China's prosperous cities, such as Shanghai, Beijing, Guangzhou, and Shenzhen, have entered the fifth. As a result, domestic consumption growth and demand structure adjustment have become the fundamental prerequisites for China to construct an industrial system for the modernization drive.

China's domestic market has been expanding over the last decade as the country transitions to a middle-income economy. However, low-end consumer goods continue to make for a sizable portion

[7] see *the Brief Update of China's Retail Sales of Consumer Goods in 2022*, https://www.ndrc.gov.cn/fgsj/tjsj/ssjj/202301/t20230130_1347724_ext.html.

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of China's consumer demand. The present and future structure of consumer demand will be affected by household disposable income and consumer preferences, which in turn will have repercussions for industrial development. According to Shi et al. (2019), "Over the period from 1998 to 2017, China's urban and rural households continuously experienced Class I consumption upgrade (as manifested in the decreasing share of food and subsistence consumption) and Class II consumption upgrade (a rising share of symbolic and service consumption), but Class I consumption upgrade of rural households paled in comparison with that of urban households; since 2013, Class II consumption upgrade slowed amid downward pressures on China's macroeconomic performance, and housing spending created a significant crowd-out effect for other types of consumer spending. There is significant heterogeneity in consumer behaviors between urban and rural residents and between those whose Engel's coefficients are above and below 40%". Disparities in urban and rural household consumption and barriers to consumption upgrade can be attributed to the following problems in the income structure of China's 1.4 billion people: (i) Household disposable income per capita was generally low. Despite a 5% increase from 35,128 yuan in 2021, China's per capita household disposable income in 2022 was relatively low at 36,883 yuan. Monthly disposable income per capita was just 3,073 yuan, while monthly consumption spending per capita was 2,044 yuan. (ii) There were considerable regional income disparities among households. In 2022, for example, Beijing and Shanghai had per capita disposable incomes of 77,415 yuan and 79,610 yuan, respectively, whereas household disposable income in less affluent central and western provinces was only 30% that of Beijing and Shanghai. In particular, per capita disposable income in Gansu and Guizhou provinces was only 23,273 yuan and 25,508 yuan, respectively. (iii) Significant discrepancies in per capita income between urban and rural households persisted. In 2022, urban people in China had a per capita disposable income of 49,283 yuan, which was 40% higher than rural households' per capita disposable income of 20,133 yuan.

According to the data shown above, China's consumer market will continue to expand and support the modern industrial system if its household per capita income continues to rise, which is conducive to the development of a modern industrial system. In addition, household disposable income is low and uneven across regions. As a result, the coexistence of conventional low-cost consumer goods and certain high-value consumer goods is difficult to change in the short term. In this sense, China's development of an industrial system for the modernization drive is unique: The first and second industrial arrays must upgrade their products, but the new products must be affordable. The third array of future industries should not only pursue advancements in science and technology that are forward-thinking but should also consider the growth of China's household disposable incomes.

3.2 Digitalization

The scope of China's "3+1" modern industrial system is determined by two factors. The primary influence is current and future changes in household income levels, as well as shifting consumer demand, given that the modern industrial system is geared to produce and supply goods that match people's desires for a better life. Changes in demand will have an impact on the efficiency, product categories and quality, as well as the environmental sustainability of the current industrial system; it will also have an impact on scientific and technological progress (Rui, 2023). Without a question, big data and artificial intelligence (AI) are the most basic technologies for modern industries to respond to changing consumer demand. Data collection and analytics allow for an interpretation of consumer preferences. Intelligent manufacturing equipment, intelligent production lines, intelligent factories, and intelligent services are all part of AI solutions for meeting individualized consumer demand at scale. As a result, digital industrialization and industrial digitalization have become critical to China's industrialization and modernization efforts. This necessitates taking early initiatives to build digital new infrastructure.

Coordination among physical, software, and connectivity infrastructures, as well as advances in big data, AI, and other fields, have accelerated China's digital transformation, resulting in ongoing

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iterations and upgrades of goods and services that redefine its global competitiveness. Technology and AI have turbocharged China's emerging high-tech industries, bolstering China's future industrial layout, growth, and leadership. The development of conventional industries is the first array in the modern industrial system, based on the support of new digital infrastructure, aims to apply digital technology for the transformation of existing technologies and manufacturing processes for the collection, analysis, research, and exchange of data factor during the manufacturing process in order to promote resource allocation efficiency, competitiveness and profitability, reduce production cost, optimize products, and accomplish the digital transition. Only when the digital transition is complete will the first array of industries, i.e. conventional industries, become a component of the modern industrial system. The second array of emerging tech industries, which lie at the heart of the modern industrial system and can be divided into three categories: First, data-generating and data-applying industries, including data analytics and 5G connectivity. Second, precise manufacturing, marketing, and services based on the data factor and digital technology, including mobile payment, e-commerce, and other services as part of digital economy industries. Third, high-tech industries that may not have used digital technology from the start and hence must also go through a digital transition. Among these are new energy vehicles, instruments and apparatus, and pharmaceutical manufacture. In the second array, all three industries must use data and digital technologies to improve manufacturing, business operations, and service modes. These industries are important components and driving forces of the digital economy. As shown in Figure 3, the growth of the third array of future sectors will inevitably be based on the foundation of data, digital technology, and AI.

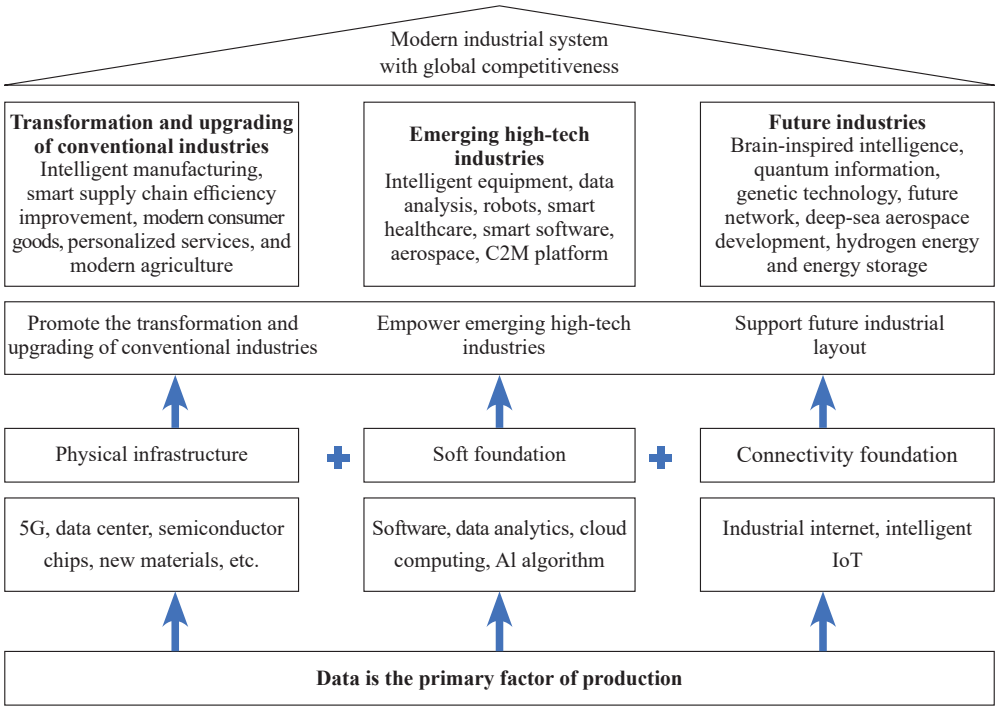

Figure 3: Digitalization Supports Modern Industrial System Development

3.3 Coordination of Technological and Industrial Innovations

The digital transformation of conventional industries, the rapid rise of emerging high-tech

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industries, and the discovery of future industries all necessitate advances in science and technology, ingenuity, and the efficient output of innovation. Our existing industrial system is dependent on two sorts of innovation for ingenuity and innovation outcomes: Technological innovation and output and industrial innovation and output. Technology innovation is essential since it includes scientific discoveries as well as technological breakthroughs. Scientific discoveries are revelations of truth and patterns. Despite the lack of a direct relationship between scientific discoveries and industrial progress, the outcomes of scientific development are crucial to the invention and deployment of generic technologies. For example, electromagnetic theory led to the development of power-generation technologies, which revolutionized people's ways of life. Technology inventions stem from further innovations carried out on the basis of scientific discoveries, such as the widespread use of electricity as a result of the discovery of power-generation technology. Original applications of groundbreaking scientific discoveries are the outcomes of technological innovation and invention. However, as history has shown, not all discoveries made in the realm of science and technology will result in new products, and not all new products can be successfully commercialized and create new industries; rather, it takes successful industrial innovation to complete the transition from new products to emerging industries (Hall and Rosenberg, 2010).

The term "industrial innovation" refers to the entire process of developing new products and bringing them to market. Product innovation is the first phase in industrial innovation, followed by the creation of manufacturing equipment and processes based on product qualities and requirements. The third step is organizational innovation in the supply and value chains to support commercialization. The last step is market innovation, which advertises and delivers products to customers while creating value and contributing to GDP. To put it simply, industrial innovation is the mass commercialization of a groundbreaking invention. Industrial innovation promotes the emergence, commercialization, and rapid development of emerging high-tech industries and future industries. While universities and research institutes drive technological innovation, corporations drive industrial innovation. Technology and industrial innovations are not only the twin engines for the success of the modern industrial system; they must also work in tandem, with technology innovation, particularly basic research that supports scientific discoveries, taking the lead (Rui, 2018b).

The two-way relationship between technology and industrial innovations can also be understood through the *CHIPS and Science Act*, which the United States passed in 2022[8]. This act, ostensibly aimed at the chip industry, is focused on basic research, energy innovation, new materials, and scientific and technological growth in order to pursue leadership in technology innovation. The United States has taken a two-pronged approach. On the one hand, the US government is increasing fundamental research funding and subsidizing industrial innovation. On the other hand, it has implemented an embargo to prevent China from acquiring world-leading technology, so slowing China's advancement in science and technology and strengthening its own position.

Initially, US activities in applied research and development research attempted to promote market-based innovation. US politicians used to think that corporations and private research institutes should be responsible for applied research and development. Meanwhile, it is the government's responsibility to fund basic research. However, in recent years, the US government has begun to subsidize businesses that innovate in important fields. The US government's shift of strategy merits our consideration. Investment in science, technology, and basic research is required for the development of a modern industrial system. Great priority should be given to basic research and the acquisition of research outcomes. Since businesses are the driving force behind industrial innovation, it is crucial to harness entrepreneurial spirit to foster innovation, increase the number of successful innovations, and commercialize new products. That is the key for emerging high-tech industries and future industries to thrive.

[8] H.R.4346, *CHIPS and Science Act*, https://www.congress.gov/bill/117th-congress/house-bill/4346/text

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3.4 Increase Reform and Openness to Rebuild International Systems of Cooperation in Technology and Industry

China's current industrial system has come a long way thanks to reform and opening up as the country's basic national strategy, as well as the creation of a socialist market economy that boosted private enterprise and led to the current industrial system. This is an extremely valuable experience. Significant changes have occurred in the international environment, technological progress, and international cooperation since the 1980s as China seeks to avoid the entrenchment of the dual industrial structure and begin to develop an industrial system for the modernization drive, which is an entirely different and much more difficult endeavor. Despite these changes, China remains dedicated to embracing a modern industrial system that is open and inclusive. The current industrial system is still built on the market mechanism, fair competition, as well as openness and inclusivity. In contrast to the export-oriented industrial system, the only difference is the goal of creating a modern industrial system with two-way circulation in which domestic demand is the primary engine and external demand plays a secondary role.

In the face of deepening economic globalization, China must embrace openness and cooperation, as well as market-based resource allocation, in order to avoid the entrenchment of the dual industrial structure and establish an industrial system to support its modernization drive. Aside from China's domestic resources, the development of a modern industrial system requires international collaboration with industries, corporations, and scientific research institutes to maximize global innovation resources and boost the innovative dynamism of industrial enterprises. The development of a modern industrial system must go beyond cooperation among industrial enterprises and include network-based cooperation among various entities and regions, as well as global technology and industrial cooperation networks, which are essential for the high-quality transition and upgrade of the "3+1" modern industrial system. Only by remaining open and cooperative in the new global industrial division of labor system will China be able to build partnerships that complement each other's strengths and weaknesses, overcome technological bottlenecks, shorten the cycle of innovation, transform conventional industries, and facilitate the growth of emerging high-tech industries to become the key driving forces of the modern industrial system. For China's future industries to lead the world in the next 15 to 30 years, groundbreaking innovations must be developed through collaboration and open innovation.

The transition from the current to the modern industrial system is fundamentally a reallocation of global resources in an open environment. The restructuring of global technology and industrial cooperation networks is required in order to optimize resource allocation. With broader openness, more efficient resource allocation can be achieved by altering existing assets, human resources, technological capabilities, manufacturing capabilities, and brand reputation, as well as incorporating current and future innovations, advanced technologies, human resources, and capital. This resource distribution process should continue to be based on market-based resource allocation under the condition of openness. It is difficult to fully implement market-based processes to achieve the survival of the fittest in conventional industries without the government issuing regulations to ensure fair competition. Emerging industries and start-ups should be encouraged to innovate and achieve breakthroughs in order to accelerate their development and integration into the modern industrial system. When planning for industrial development, policymakers should not only track technological progress trends, but also estimate the likelihood of commercialization success and forecast global market potentials. CE

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