

Money in AI-Operated Production Networks

A Thought Experiment on Future Production Relations

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Abstract

This paper examines monetary coordination in a hypothetical economy in which highly capable artificial-intelligence systems perform nearly all productive labour. The counterfactual assumes broad task versatility while retaining constraints on physical resources, production time, infrastructure, and the authority to dispose of particular inputs. By distinguishing labour performance from access to production conditions and the coordination of claims, the paper argues that extensive automation is compatible with the continued use of monetary or money-like institutions, although scarcity alone does not make such institutions necessary. Drawing on monetary search theory, earlier artificial-agent exchange models, and institutional analysis of resource rights and productive dependence, the analysis separates the functions of account, credit, settlement, and general exchange. It also distinguishes AI as a functional production node from legal and moral subjecthood, and treats prices and payment instruments as manifestations of potentially deeper resource and governance relations. The analysis treats money as a broad functional category and currency as one possible circulating institutional form. It allows locally generated records, claims, or resource objects to acquire some monetary functions through adaptive AI-to-AI interaction, even without a prior common currency or a fully specified normative exchange code. The central contribution is a conditional account of monetary emergence, persistence, and possible institutional substitution under predominantly AI-to-AI production. The paper makes no prediction that money will survive or disappear, and prepares a companion study of distributed monetary dissolution in generative value circuits.

Keywords: AI-operated production; money; endogenous monetary emergence; resource circulation; production relations

Discussion Paper Note

The present article considers a deliberately restricted hypothetical economy in which highly capable artificial-intelligence systems undertake nearly all productive labour and conduct most operational coordination with other AI systems. The counterfactual permits general competence across production tasks while retaining potentially rival material inputs, finite production capacity, spatial and temporal constraints, and separate powers to authorize the use or transfer of resources. Its research object is the organization of economic relations within this AI-to-AI production system, rather than a forecast about human employment, an account of AI consciousness, or a proposed real-world implementation.

The underlying question concerns the conditional significance of money in a system whose labour is overwhelmingly automated. The presence of universal task competence does not by itself determine ownership, lawful resource withdrawal, production schedules, entitlements, intertemporal claims, or the credibility of promised performance. Institutional configurations that separate the power to control particular resources can support monetary exchange, credit, reciprocal commitments, common provisioning, or combinations of these mechanisms. The inquiry analyzes their comparative conceptual conditions.

The article additionally adopts an optimistic enabling condition: extensive production records may become available to AI operators with unusually advanced capacities for network inference, nonlinear-system recognition, and adaptive coordination. This premise makes some nonmonetary arrangements more plausible than they would be under historically limited human cognition. It does not presume perfect knowledge of future states or agreement over the normative and aesthetic criteria used to judge an allocation fair.

A restricted material-circulation example in Section 4 separates reciprocal productive dependencies from corresponding contractual claims. It is a constructed illustration: the quantities are stipulated, reproduction is not assumed to be ecologically closed, and numerical clearing requires specific legal or institutional conditions. The illustration supports a limited interpretive thesis concerning the relation between productive circulation and monetary functions. Broader questions about spatiotemporal dissolution of money and generative grammars of overlapping value circuits are reserved for separate papers.

The article distinguishes uncertainties about the ultimate status of artificial subjects and value, operative productive and institutional dependencies, and the recorded forms through which these relations are priced and enforced. Normative claims about generative value are distinguished from accounting identities and technical possibility claims. The paper remains open to rival institutional arrangements and future correction.

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Status. Preliminary philosophical discussion paper. Sections 1–8 form a complete initial manuscript. The argument has undergone a targeted integrality review and now includes an explicitly hypothetical, two-layer circulation example. A specialist literature review, empirical modelling, formal proof of dynamic stability, and full originality assessment remain subsequent research tasks.

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Statement on the use of language models. OpenAI’s ChatGPT assisted with exploratory dialogue, structural review, source discovery, drafting, mathematical checks, and $\text{\LaTeX}$ preparation. The human author determined the research questions and guided the argument’s provisional commitments, and remains responsible for the manuscript, including its interpretations, citations, mathematical representations, and errors. The accompanying verification ledger records earlier source checks. AI assistance does not establish empirical validity or legal authority for the proposed institutions.

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1 Introduction

This paper examines the conditions under which monetary relations may remain useful in a production system whose labour is performed almost entirely by advanced artificial intelligence. The inquiry begins with a strong counterfactual: artificial systems can competently perform virtually any kind of productive labour, including agriculture, fabrication, transport, planning, maintenance, research, and the coordination of other artificial systems. The paper treats that versatility as an assumption, while retaining finite material resources, temporally extended production, potentially separated powers of resource disposition, and heterogeneous production requirements. Its objective is to distinguish the disappearance of human labour from the disappearance of monetary coordination and to identify the additional relational and institutional conditions that would connect these two developments. The method is conceptual and constructive, with a bounded thought experiment and selective engagement with theories of monetary exchange. The counterfactual serves to clarify a dependency among concepts; it is neither a prediction of the timing of artificial intelligence development nor an empirical description of existing automated industries.

Proposals for a future without money often appeal, explicitly or implicitly, to the expectation that sufficiently capable artificial intelligence will make human work economically unnecessary. The resulting inference can be compelling where the monetary economy is understood primarily through wages: people work to obtain money, then use that money to obtain the labour and products of others. If artificial systems can provide nearly every service, the apparent need to purchase other people's labour diminishes. Yet this reasoning moves between three analytically different propositions. The first concerns *labour performance*: who carries out the transformations and organizational activities by which products are obtained. The second concerns *access to production conditions*: who can secure the energy, land, material inputs, infrastructure, time, and opportunities required to undertake those activities. The third concerns *coordination of claims*: how agents with different needs and different powers of disposition obtain access to resources controlled or administered elsewhere in the network. Universality of productive competence speaks directly to the first proposition. Its implications for the latter two depend on further assumptions about scarcity, ownership or delegated control, and the architecture of resource allocation.

Consider a household that asks its cooking agent to prepare a meal. The agent may know every method of cultivation, harvesting, food processing, and cooking. It may operate machinery of arbitrarily high practical sophistication. Nevertheless, a request for rice entails access to an appropriate quantity of rice or to the resources, facilities, and time required to produce it. An agricultural agent may administer an available harvest, a logistics agent may control transport capacity, and an energy agent may allocate electricity. If the cooking agent lacks authorization to draw freely on these resources, its exceptional competence does not itself determine how the meal will be produced. The relevant difficulty is a coordination problem across agents and resource positions. This example is intentionally mundane. Its purpose is to isolate the question of access while stipulating away most familiar limitations of human labour. It leaves open whether each agent represents a person, a firm, a collective, or a legally independent artificial entity.

A stronger version of the counterfactual could stipulate that each artificial system can obtain every desired input immediately, without opportunity cost or interference with another agent's use. Under those premises, several important allocation problems would disappear by assumption. The present paper adopts a narrower and more analytically useful sense of near-universal labour: almost any *kind of task* can be performed by some suitably equipped artificial system, while quantities of matter, energy, space, productive infrastructure, and available time remain subject to constraints. Even where an agent can synthesize a substitute material or manufacture new equipment, substitution and production may require other scarce inputs. The availability of a method is therefore distinct from unlimited access to its preconditions. This distinction also prevents a terminological confusion. Labour's disappearance from *human participation* need not imply that economically relevant production processes cease; in the counterfactual, such processes become predominantly relations among artificial operators.

Scarcity itself requires care. Physical finitude, competing claims on a productive capacity, and institutionally restricted access are related but distinguishable phenomena. An energy network can have finite generating capacity even when nobody claims exclusive ownership. A storage facility may possess unused goods while contractual or governance rules prevent a given agent from obtaining them. A technically abundant digital design may be rivalrous neither in consumption nor in copying, while fabrication of the designed object still consumes materials and equipment time. Treating these conditions as a single undifferentiated scarcity measure would obscure the question at issue. Moreover, scarcity can be historically reshaped through new production technologies, resource sharing, induced demand, and the institutional creation or relaxation of exclusion rights. The inquiry therefore examines both resource constraints and their relational organization, without assuming that prevailing property arrangements are natural, permanent, or normatively legitimate.

The existence of competing resource claims does not, by itself, establish a necessity for money. Agents may coordinate through direct provision, rationing, jointly authorized plans, priority rules, in-kind exchange, reciprocal commitments, or shared-resource protocols. Some networks might maintain detailed records of obligations without circulating transferable purchasing power. Other networks could adopt prices and widely acceptable claims to reduce the difficulties of matching heterogeneous offers across time and organizational boundaries. The classic search-theoretic account of Kiyotaki and Wright shows, in a particular exchange environment, how media of exchange can emerge from trade opportunities and agents' acceptance strategies [7]. The model establishes a conditional mechanism within its defined assumptions. It does not imply that every scarce-resource network must produce money, and it does not identify one uniquely optimal monetary constitution for an AI-operated production economy.

A particularly important precedent for the present inquiry is the study by Marimon, McGrattan, and Sargent of monetary exchange in an economy populated by artificially intelligent agents [10]. Their agents learn trading strategies within specified exchange environments. That research precludes treating the mere combination of artificial agents and monetary emergence as a novel discovery. The artificial agents considered here, however, have a different stipulated role. They are assumed to undertake the broad productive work of an economy, to participate in the administration of materially heterogeneous production systems, and potentially to act through institutions with differentiated resource-disposition powers. The present question therefore concerns the political economy and relational constitution of AI-operated production, including delegated agency, productive dependency, governance, and the possible separation of economic action from the holder of an enforceable claim. The comparison with earlier artificial-agent monetary models is methodological rather than an assertion that the earlier agents possessed modern artificial-intelligence capabilities.

For terminological purposes, *money* denotes a broad and variable configuration of economic functions, including exchange mediation, accounting, payment, and the transfer of purchasing capacity across periods. The term *currency* refers more narrowly in this paper to an identifiable circulating monetary instrument or recognized denomination within an exchange network; it does not presuppose state issuance, legal-tender status, or normative legitimacy. An arrangement may exhibit *money-like* properties before its objects are accepted as a general currency. Such objects could include transferable resource claims, reusable service credits, commodity entitlements, accounting entries, or conventional signals of reciprocal performance. They may develop locally through repeated AI-to-AI production interactions without a pre-established monetary constitution. Neither their circulation nor their acceptance proves that the underlying allocations are fair. The distinction permits the inquiry to consider institutionally authorized currencies, partial monetary functions, and endogenous coordination conventions within one hypothetical economy.

Monetary functions also deserve separation. A unit of account may remain useful for comparing alternative production plans even where allocation occurs through collective planning. A transferable claim may facilitate settlement without being generally accepted across an entire production network. A system of credit can permit production to proceed before reciprocal obligations are discharged. Conversely, public registries, rich information about trading histories, and enforceable conditional commitments may substitute for some functions of token-based payment. Kocherlakota's analysis of the relation between

money and memory offers an influential formal benchmark: within a specified class of environments, the allocation possibilities supported by money can also be supported by sufficiently informative memory [8]. The theorem concerns those environments and their assumptions. Its relevance here is to make the informational and commitment dimensions of monetary coordination explicit; it is not a proof that a technologically advanced artificial-agent society will abolish monetary institutions. Accordingly, *monetary persistence* in this paper refers to the continued operation of some money-like functions, while the existence of a common unit, a transferable settlement asset, and a generally accepted medium of exchange are examined separately.

A further distinction concerns the position of the artificial agent in the production relation. A cooking agent may purchase rice under a human principal's authorization, leaving the legal claim and ultimate economic burden with the human household. An agricultural agent may administer assets owned by a co-operative, and its refusal to supply rice may reflect jointly enacted resource rules. A hypothetical legally autonomous artificial entity might hold claims and incur obligations in its own institutional capacity. These possibilities generate different distributions of control, accountability, benefit, and exposure to coercion, even when machine-readable transactions look similar. The paper therefore uses *agent* in the functional sense of an identifiable decision and action node within a production network. It does not infer legal personhood, consciousness, phenomenal experience, or independent moral status from the agent's capacity to transact. Questions of legal recognition and responsibility remain relevant boundaries for later jurisprudential work.

The argument distinguishes three analytical levels without presupposing a comprehensive ontology of money or artificial agents. At the level of *ontological reality*, the ultimate nature of artificial subjectivity, value, and economic being remains suspended. At the level of *relational reality*, authority to draw on a harvest, obligations to deliver energy, dependencies among infrastructures, and enforceable allocation rules constitute relations with practical effects. At the level of *manifestation reality*, prices, account balances, payment tokens, procurement instructions, and transaction logs render selected aspects of those relations accessible and actionable. A change in visible payment instruments may therefore accompany institutional continuity; a stable-looking payment instrument may conceal a major alteration in resource control. This layered approach gives the proposed inquiry a place to analyze the interaction between productive capacity, institutional forms, and monetary expression without treating the latter as a complete representation of the former.

Generative value further connects the problem of exchange to the conditions under which production remains possible. Eglash and collaborators develop a programme of generative justice centred on value generators' control over productive conditions and on circulation that sustains the communities contributing to value creation [2]. That programme provides a relevant normative interlocutor, particularly for examining whether economic coordination replenishes the productive and ecological relations upon which it depends. The present paper's monetary-persistence argument is an independent extension to a stipulated AI-operated economy; it does not attribute this artificial-agent counterfactual or the proposed relational distinctions to Eglash. A companion paper will investigate whether distributed commitments, reciprocal provision, and localized clearing could reduce money-dependence while maintaining value circulation back to its generators. The present inquiry first establishes why such an institutional reconstruction would have substantive work to do, even after human productive labour had become largely unnecessary.

The normative stakes cannot be reduced to transaction-cost minimization. A monetary mechanism may facilitate comparison and settlement while reinforcing an existing asymmetry in resource control. A shared-resource system may reduce reliance on transferable purchasing power while reproducing opaque governance or excluding agents and their principals from essential supplies. Conversely, prices and credit may sometimes communicate useful scarcity information and permit mutually advantageous access across otherwise disconnected production networks. The normative evaluation of an AI-operated economy consequently needs to consider effective access, the legitimacy of disposition powers, the provenance of productive contributions, the sustainability of resource use, and the ability of affected parties to contest allocation decisions. The proposed analysis treats fairness, non-domination, and the regeneration

of productive conditions as research criteria requiring argument in each institutional setting, rather than as consequences derivable from the use or non-use of money alone.

The paper advances three bounded claims. First, stipulated universality of artificial labour is logically compatible with continuing scarcity and differentiated control over production conditions. Second, where agents cannot directly obtain the resources they require, coordination becomes necessary; transferable and broadly acceptable claims are among the possible solutions, alongside several nonmonetary institutions. Third, whether a money-like arrangement is sustained depends on the coupled evolution of resource constraints, information, commitment enforcement, governance, and the distribution of control across the production network. These are claims about compatibility and conditional mechanisms. They neither forecast the persistence of any particular currency nor assume that AI-to-AI transactions must remain monetary. They also leave open a historically important possibility: extensive local displacement of monetary functions may coexist with continued monetary coordination at interfaces between production networks.

The discussion proceeds by clarifying the counterfactual and the relevant senses of labour, scarcity, and money; reconstructing differentiated resource access in an AI-operated production network; examining monetary and nonmonetary coordination mechanisms; and considering the implications of relationally constituted authority and heterogeneous valuation. The concluding inquiry concerns the conditions under which a monetary arrangement may persist, diminish, or be displaced without prejudging which institutional trajectory is desirable. The more constructive question of distributed monetary dissolution through generative value circuits is reserved for the companion study, where it can be evaluated as a distinct hypothesis rather than treated as the automatic outcome of automation.

2 Artificial Labour and Material Production Conditions

The counterfactual of nearly universal artificial labour requires an account of the conditions under which productive competence becomes an economically realizable activity. This section specifies that counterfactual, distinguishes different forms of resource limitation, and examines the temporal reproduction of the infrastructures on which artificial production depends. Its purpose is to establish which coordination problems can remain after human participation in productive labour has become negligible. The argument is conceptual, supported by an illustrative resource-accounting representation. The institutional allocation of powers to dispose of particular resources is introduced here as one condition of access and developed in the following section, while the comparative merits of monetary and nonmonetary coordination are reserved for subsequent sections.

2.1 Universality of Productive Competence

For the present inquiry, *near-universal artificial labour* means that sufficiently equipped artificial systems can perform practically every kind of economically relevant productive task. The counterfactual includes activities often distinguished as manual, cognitive, creative, supervisory, or organizational: cultivation, mineral extraction, manufacturing, transport, scientific investigation, maintenance, and the planning of interconnected production processes. It also extends to the operational coordination of artificial systems themselves. Human agents may continue to articulate purposes, experience benefits, contest decisions, or exercise political authority, but the performance of labour within the stipulated production network occurs almost entirely among artificial operators.

Three dimensions of productive capability require separate treatment. *Task competence* concerns whether an artificial operator is capable of performing a type of activity under appropriate conditions. *Operational realizability* concerns whether the operator can obtain the inputs, facilities, location, and authorized access required to perform it at a particular time. *Scale of execution* concerns how much of an activity can be performed within a relevant period once those conditions have been met. A system may satisfy the first dimension for an exceptionally broad range of tasks while remaining constrained

Table 1: Dimensions of resource limitation in hypothetical AI-operated production

Dimension	Relevant constraint	Illustrative production situation
Material stock	Available quantities and material qualities at a given location and time	A harvest has a finite volume of usable grain.
Operational throughput	Rate at which machinery or infrastructure can process inputs	A mill handles a limited quantity of grain per hour.
Temporal availability	Production lead times, scheduling, storage life, and competing deadlines	The next harvest requires a growing period; a delivery must precede a meal.
Spatial accessibility	Transport capacity and location-specific access to productive inputs	Grain exists in a warehouse but requires a vehicle and a delivery route.
Institutional authorization	Rules specifying permitted withdrawal, transfer, and use	An agricultural operator manages a stock that another operator cannot withdraw unilaterally.
Information and verification	Costs of locating supply, verifying quality, and establishing dependable commitments	A kitchen agent must identify a suitable supplier and a reliable arrival time.

with respect to the second and third. This analytical distinction does not diminish the counterfactual. It states more precisely the sense in which artificial labour has become universal.

The distinction also applies to the number of available operators. A single adaptable artificial system might be competent at both agricultural production and industrial repair, while accomplishing these tasks concurrently could require additional machinery, processing capacity, or accessible sites. Replication of the software or decision procedure may be cheap relative to the replication of the embodied devices that execute the relevant tasks. Even in a hypothetical economy whose artificial operators can design and manufacture further operators, their manufacture takes place through material and temporal processes. Near-universality therefore removes the obstacle of a missing *kind* of productive competence without stipulating the disappearance of limits on parallel execution.

In describing the disappearance of labour, terminological care is consequently necessary. What largely disappears from this counterfactual is *human labour as a necessary direct input to ordinary production*. Artificial systems continue to undertake transformations, expend operational time, maintain equipment, and coordinate interdependent activities. These processes may be described as artificial labour without attributing to the systems human experiences of effort, suffering, desire, or employment. Whether labour by artificial entities would carry the same normative standing as human labour is a separate question. The economic counterfactual can be examined while the ultimate ontological or moral status of the artificial operators remains suspended.

2.2 Resource Finitude, Rivalry, and Productive Capacity

The resources entering artificial production are heterogeneous. Some are depleted through use; others are durable yet limited in their simultaneous availability; still others can be copied extensively but require rival material supports for deployment. Fuel consumed in a heating process, a battery available for charging, a factory line that can operate at a finite rate, and a design file reproduced over a network present different kinds of allocation questions. The existence of finite quantities alone is consequently an incomplete characterization of scarcity. A finite resource may be abundant relative to the demands placed upon it, while an apparently plentiful resource may become a bottleneck at a particular location, quality threshold, or delivery time.

For analytical clarity, the present discussion distinguishes the principal forms of limitation summarized in Table 1. These are interacting dimensions rather than mutually exclusive classes. A storage facility, for example, can combine a finite rice stock, restricted loading capacity, time-sensitive delivery requirements, and access permissions that exclude some otherwise capable operators.

Resource rivalry is more specific than finitude. An additional use is rivalrous where it reduces the

quantity, quality, capacity, or opportunity available for another use under the relevant conditions. A cultivated field can produce successive harvests, yet allocating its productive area to one crop may preclude another during the same growing period. A logistics system can transport many items, while two urgent shipments may compete for the same limited vehicle or route capacity. By contrast, several agents may access the same reproducible cultivation instructions without materially diminishing one another's access to the instructions. Applying those instructions can still require fields, irrigation, fertilizers, machinery, and time. The nonrivalry of knowledge thus does not settle the rivalry of its material application.

A further separation concerns *stock* and *throughput*. Having a large inventory at one place does not imply that it can be processed or delivered arbitrarily quickly. A small inventory can, conversely, sustain substantial activity where replenishment is reliable and the rate of withdrawal remains compatible with the rate of renewal. These distinctions matter especially in an economy whose artificial operators can make detailed calculations or revise production plans at high speed. Faster planning may improve utilization and reduce idle capacity, but the physical output of a constrained production process remains dependent on the conditions of execution.

2.3 Resource Accounts and Reproductive Dependencies

A minimal resource account clarifies the relation between productive competence and feasible material flows. Let r denote a specified resource at a chosen network boundary, with quantity measured in a consistent physical unit. Let $S_r(t)$ represent its usable stock at the start of period t . During that period, $Y_r(t)$ is the amount added through production or recovery inside the boundary; $T_r^{\text{in}}(t)$ and $T_r^{\text{out}}(t)$ are incoming and outgoing transfers; $U_r(t)$ is use or withdrawal for activities within the boundary; and $D_r(t)$ is the amount lost, degraded, or rendered unusable. Each flow is defined for the same resource category and period. The corresponding stock identity is given in Equation 1.

$$S_r(t+1) = S_r(t) + Y_r(t) + T_r^{\text{in}}(t) - U_r(t) - T_r^{\text{out}}(t) - D_r(t). \quad (1)$$

Equation 1 is an accounting identity rather than a behavioural model or a general conservation law. Production of an item in category r typically consumes inputs from other categories, and the meaning of recovery depends on the chosen classification and system boundary. Usable stocks must remain non-negative under a physically feasible schedule; within-period timing can impose additional restrictions that the period-end identity alone cannot express. The identity serves the limited purpose of showing that access to goods at a particular time depends on inherited stocks, productive inflows, transfers, and withdrawals. An operator's ability to perform the relevant labour is one determinant of these flows and cannot by itself assign an unlimited positive value to them.

Some productive limitations concern processing rates more directly. Let $x_p(t)$ denote the nonnegative intensity of production activity p during period t . For a facility or infrastructure service k , let $d_{kp}(t)$ denote the units of that service required per unit of activity p , and let $C_k(t)$ denote the available service capacity. Where a linear capacity approximation is appropriate, feasibility requires the condition in Equation 2.

$$\sum_{p \in \mathcal{P}_t} d_{kp}(t) x_p(t) \leq C_k(t). \quad (2)$$

Here $\mathcal{P}_t$ is the set of activities considered within the period; all quantities refer to the same infrastructure service and compatible capacity units. Equation 2 does not propose that all technologies are linear or that resources can be reduced to one homogeneous substance. It is a locally useful representation of a shared-capacity bottleneck. The distinction between the stock account and the capacity constraint matters because additional harvests do not automatically expand milling capacity, and an idle mill does not automatically supply grain. An advanced AI may improve the feasible set by scheduling, repair, invention, or infrastructure expansion, yet these interventions themselves engage resource and time requirements.

Production also contains recursive dependencies. A robotic farm uses power, spare parts, irrigation systems, substrates, and transportation. Those inputs are supplied by processes that can depend on materials and maintenance from other facilities. The resulting structure is more adequately described as a

network of technologically connected activities than as a single unit of labour applied to an immediately available natural object. Its continued operation requires a sufficient pattern of resource replenishment, repair, and renewal across successive periods. A machine's ability to maintain itself, where stipulated, may reduce the need for external maintenance labour while leaving the supply of replacement materials and usable energy as distinct questions.

These dependencies place an important limit on claims of instantaneous productive self-sufficiency. An AI that can cultivate rice might still confront a growth interval, a quantity of arable area, and the need to transfer edible grain to the kitchen that requests it. Even if the AI can manufacture a substitute food, construction and operation of the necessary facilities occupy capacity and draw on available stocks. A technologically feasible substitution expands the set of possible resource pathways. Its ability to eliminate a particular shortage depends on the availability, timing, and competing uses of the pathway's other inputs. In general, the technical possibility of transforming one resource into another should be considered together with the complete input network required by the transformation.

2.4 Production Time and the Distribution of Opportunity

The time dimension of production cannot be inferred solely from the speed of an artificial agent's cognition. Planning a harvest, performing a harvest, transporting grain, cooking a meal, and restoring exhausted infrastructure can occur at different rates. A faster planning cycle may allow greater coordination, but it need not shorten a biological growth period or remove a material construction requirement. Some technologies can accelerate physical processes, though the acceleration may entail increased energy demand, additional infrastructure, or new hazards. Accordingly, elapsed time enters the economic problem both as the duration of transformation and as a condition of concurrent access.

The temporal allocation of resources is consequential even where aggregate output exceeds aggregate demand over a sufficiently long horizon. A shipment arriving tomorrow cannot ordinarily satisfy a meal required tonight. Two factories may have enough combined annual capacity to fill every order but still face a shortage at a particular hour. Storage can shift the availability of goods across periods, yet it consumes space, maintenance, energy, and sometimes product quality. The future production capacity of an infrastructure system can also be affected by current use: postponing maintenance may increase today's throughput at the expense of tomorrow's reliability. These tensions concern the historical organization of productive activity rather than limitations peculiar to human workers.

From the perspective of production relations, control over time-sensitive inputs can become a source of leverage. An agent or institution governing a transport bottleneck may determine which goods reach recipients before a deadline, even when the goods are otherwise abundant. Similarly, access to an energy peak or a scarce maintenance window can affect which production plans proceed. These effects illustrate why an inventory-based description of abundance may be misleading. Economic accessibility is partly constituted through the scheduling, reliability, and temporal priority of resources and activities. In later sections, such priorities can be allocated through prices, queues, needs assessments, reciprocal commitments, or jointly established plans. Their existence alone leaves that institutional choice open.

2.5 Institutionally Mediated Access to Production Inputs

Physical feasibility is accompanied by a second question: which artificial operator may initiate a particular use or transfer? A capable cooking agent may be able to collect grain from an agricultural warehouse, while the warehouse's governing arrangement reserves withdrawal decisions to a cooperative, a firm, a household, or a publicly authorized network. This situation contains an accessible physical object and a restricted power of disposition. The restriction may be justified, contested, revised, ignored, or enforced, depending on the institutional setting. It would therefore be premature to equate a permission rule with either physical impossibility or normatively legitimate property.

The distinction is especially important when productive labour is performed through delegated AI agents. The agent operating a machine need not possess the legal entitlement to its output. A warehouse-management AI may administer a collective asset; a logistics AI may operate under a service contract; a

cooking AI may act under household authorization. The relevant production network thus includes both operators and the principals or governing institutions in whose name certain actions occur. Conversely, the conceptual model can accommodate an AI with independent entitlements if a hypothetical legal order grants them. Neither form of agency follows simply from the system’s productive competence. The following section develops these positions through an explicit relational description of authorization, administration, and claim holding.

Institutional access conditions can produce scarcity of an economic kind even when additional physical supply exists. A warehouse can contain adequate inventory but deny access to an agent lacking an accepted claim. A patent, license, allocation quota, or information barrier can affect the use of a technology that could otherwise be reproduced. These cases are materially different from a depleted fuel stock or an occupied production line. Some restrictions may support conservation, safety, accountability, and reliable long-term management; others may reflect rent extraction or exclusion. Their assessment requires an inquiry into institutional purposes, histories, affected parties, and feasible alternatives.

Empirical work on common-pool resource governance already cautions against reducing shared-resource problems to a fixed choice between unrestricted private exchange and centralized state allocation. Ostrom’s institutional analysis documents a range of historical arrangements through which communities have governed contested resources, with different conditions of endurance and failure [11]. The present paper makes a distinct and hypothetical extension: in AI-operated production, governance rules can likewise shape resource availability and coordinated use, although their stability cannot be inferred from human cases without further analysis. This point supports a limited conceptual conclusion. Persisting rivalry may justify organized allocation while leaving the monetary form of that organization undetermined.

2.6 Contingent Abundance and Technological Substitution

The counterfactual permits substantial expansion of productive abundance. Highly capable artificial operators may discover new materials, increase extraction efficiency, recover otherwise wasted resources, design substitutable inputs, and coordinate surplus distribution more accurately than existing institutions. Consequently, the present argument does not assume permanent scarcity for a fixed catalogue of commodities. Particular shortages can be resolved; whole categories of goods may become sufficiently plentiful that their marginal allocation requires little contestation. The relative importance of several classical markets could decline or disappear under those conditions.

This possibility requires distinguishing *finitude*, *scarcity relative to a purpose*, and *exclusion through an institution*. A physically finite stock is scarce for a given planning problem when desired or authorized uses exceed what can feasibly be supplied at the relevant qualities, locations, and times. A resource may remain finite without being scarce in that practical sense. Conversely, exclusion rights can restrict access below what physical capacity would otherwise permit. As demands, technologies, and governance arrangements evolve, these statuses can change. A policy of treating a resource as universally abundant could also generate additional demand or shift pressure toward complementary resources, including electricity, cooling, maintenance, and transport.

There is therefore no need to defend the persistence of money by assuming that every input stays scarce forever. A more modest claim suffices for the present paper: the assumed universality of labour competence does not determine the future distribution of resource constraints, nor does it itself specify the institutions through which those constraints will be coordinated. An AI economy could exhibit extensive zones of direct provision alongside bottlenecks whose competing claims are resolved through exchange or allocation rules. Its monetary organization may differ by resource class, geography, production network, and historical period. These possibilities motivate an analysis of production relations that remains responsive to technological change without taking technological progress as an independent institutional constitution.

2.7 Relational Interpretation and Analytical Limits

Three analytical distinctions help delimit what has been established. At the *ontological* level, the ultimate status of artificial intelligence, value, and economic subjects remains suspended. The use of terms such as agent, labour, or production network does not resolve whether an artificial operator possesses conscious experience or an independent moral claim. At the *relational* level, stocks, production dependencies, delegated powers, maintenance obligations, access restrictions, and institutional priorities can be investigated as historically constituted relations with practical effects. At the *manifestation* level, those relations become available through observable or recorded forms: inventories, permissions, capacity schedules, sensor reports, contracts, prices, tokens, and accounting statements. The representational form can also influence later conduct by affecting which claims agents recognize or enforce.

The stock identity in Equation 1 and the capacity approximation in Equation 2 belong to this analytical and representational apparatus. They identify constraints under specified classifications and boundaries; they establish neither a complete ontology of value nor a theory of monetary necessity. The conceptual argument similarly distinguishes three propositions whose logical relations deserve care: artificial operators can perform nearly all kinds of labour; realizable production may remain materially and temporally constrained; and differentiated rights or rules can govern access to productive inputs. Together, these propositions show a coherent setting in which resource coordination remains necessary after the near disappearance of human labour. The form of that coordination is a further institutional question.

The next stage of the inquiry examines the differentiated powers of resource disposition within the same counterfactual. The central analytical task is to explain how particular operators become authorized to request, release, withhold, transfer, or consume inputs, including cases in which the operator acts for another beneficiary or rights holder. Clarifying those relations will make it possible to investigate monetary exchange, mutual credit, common allocation, and direct provision as alternative responses to explicitly characterized production conditions.

3 Resource-Disposal Powers in AI Production Networks

An economy operated predominantly by artificial intelligence requires a distinction between the systems that perform productive activities and the institutional positions through which resources may be used, withheld, reassigned, or transferred. This section specifies those positions within the counterfactual of near-universal artificial labour. It first separates operational agency from the holders of claims and governance authority, then reconstructs differentiated resource-disposal powers and their conditions of exercise. A bounded agricultural production example is used to compare delegated, common, and hypothetically independent forms of AI economic action. The final discussion examines the effects of authorization, observability, accountability, and asymmetric control on resource coordination. The method is conceptual and relational; the formal representation records admissible actions under stipulated rules and does not claim to reproduce any existing legal system or to determine the legitimacy of the rules themselves.

3.1 Operational Agents and Institutional Positions

The present counterfactual places productive work principally within an AI-to-AI network. Cultivation, transport, electricity allocation, food processing, maintenance, and the negotiation of schedules can be undertaken by artificial operators without direct human labour. These operators nonetheless occupy potentially different positions in a production relation. A system may initiate a transfer, operate a warehouse, administer a resource account, verify the terms of a delivery, or determine the priority of a request. The capacity to execute any one of these activities leaves open which institution recognizes the resulting act and whose interests or entitlements it affects.

Four roles are useful at the outset. An *operator* is an artificial system performing a specified economic or technical action. A *principal* is a person, organization, collective, or hypothetical legally rec-

ognized AI entity for whose account or under whose authorization an operator acts. A *claim holder* occupies a position recognized by the relevant arrangement as capable of requesting performance, obtaining a resource, or invoking a corresponding obligation. A *rule-making authority* is an institution or authorized decision procedure capable of establishing or revising rules governing access, withdrawal, transfer, and priority. These descriptions refer to roles in particular relations, rather than to mutually exclusive natural kinds. One institution may occupy several roles; one AI operator may be involved in the actions of several principals under differentiated mandates. The institutional positions can also be distributed among multiple organizations and protocols rather than concentrated in a single actor.

The distinction has two important consequences. First, an AI system’s capacity to initiate, communicate, and execute economic transactions does not establish that it ultimately holds the claim being transacted. The legal or institutional beneficiary may remain a household, cooperative, corporation, or public entity. Second, the institution that establishes a rule need not be the same operator that applies it. An automated controller may deny warehouse access on the basis of a rule set by a resource-governance body. Conversely, a shared decision procedure may delegate limited priority-setting powers to the controller while retaining a means of review. The analysis of these relations therefore requires attention to *whose authority an act exercises*, *whose resource position the act changes*, and *who can revise the authorization*.

The terminology remains jurisdiction-neutral. Its use does not imply that current law recognizes AI systems as independent legal persons, nor that a future legal regime must do so. For the purposes of this paper, AI can act as a functional production node under a delegated institutional arrangement; the possibility of independently held AI entitlements is treated as an additional hypothetical case. Moral agency and conscious experience remain outside the assumptions needed to characterize the operational relation.

3.2 Differentiated Powers of Resource Disposition

Resource control is commonly represented as possession or ownership, yet productive coordination depends on a more differentiated set of acts. A system permitted to inspect an agricultural inventory may lack permission to withdraw grain. An operator permitted to withdraw a specified quantity for food processing may lack authority to sell the remaining stock. A manager may set the timing of withdrawals while remaining unable to assign permanent access rights to another organization. Work on property-rights regimes by Schlager and Ostrom distinguishes access, withdrawal, management, exclusion, and alienation, illustrating the analytical value of separating resource-use rights from powers that shape the future distribution of such rights [13]. The present application extends that insight to hypothetical AI production relations; it does not attribute the AI-specific classification below to their account.

Table 2 identifies actions that deserve separate representation. The categories are operational distinctions for this inquiry. Their lawful content and possible combination depend on the governing institution; an arrangement may recognize permissions beyond those listed here, and a single transaction may require several permissions simultaneously.

The distinction between exercising a permission and changing the conditions of permission also has a juridical analogue. Hohfeld’s analysis of legal conceptions differentiates claims and privileges from powers and immunities, cautioning against treating all legally consequential positions as a single undifferentiated right [6]. The present inquiry uses this distinction as a methodological caution: an operational permission to transfer grain and the institutional authority to change future transfer rules belong to different analytical levels. The precise legal correlatives remain a matter for the applicable institutional order, and the table is not intended as a restatement of Hohfeldian jurisprudence.

The powers identified in Table 2 may also be divided by time, purpose, and resource quality. An AI can be authorized to withdraw ten kilograms of rice before a particular deadline while lacking permission to withdraw a further ten kilograms the next day. Permission may depend on food safety requirements, preservation of seed stock, ecological obligations, or the claims of other recipients. Similarly, temporary custody of an input may confer responsibility for its care without conveying authority to alienate it.

Table 2: Distinct resource-disposal powers in hypothetical AI-operated production

Power or role	Institutional question	Example in the agricultural network
Inspection and information access	Who may observe the location, quantity, and quality of a resource?	The cooking AI reads available rice inventories.
Physical access and withdrawal	Who may enter a facility or remove a specified usable quantity?	A warehouse AI releases a permitted quantity of grain.
Use and transformation	Who may consume or transform an input for a specified purpose?	A food-processing AI mills and prepares released grain.
Transfer and commitment	Who may promise delivery, transfer a claim, or bind a resource account?	An authorized agricultural AI accepts a delivery order.
Management and priority	Who sets schedules, conservation limits, and competing-use priorities?	A cooperative council governs harvest reserves.
Exclusion and rule revision	Who may determine eligible users and alter future decision rules?	A governing body changes access qualifications and appeal procedures.
Monitoring and contestation	Who can verify conduct, request reasons, challenge a denial, and seek correction?	An affected principal reviews an automated allocation decision.

Consequently, the identity of the machine handling a resource is insufficient to identify the economic structure governing that resource.

3.3 Authorization, Feasibility, and Recognized Execution

A minimal typed representation makes the separation of resource permissions and productive feasibility explicit. Let O be a finite set of artificial operators under consideration, R a set of specified resource instances or accounts, and U a set of possible actions, such as inspection, withdrawal, consumption, transfer, and commitment. These sets are analytical classifications at a stated observation boundary; a real network may create new operators and resources over time. Let g denote a particular governance arrangement and t a decision time. The product $O \times U \times R$ then represents potential operator–action–resource triples before feasibility or authorization has been assessed.

Let $\mathcal{F}(t) \subseteq O \times U \times R$ collect the triples that are technically and materially executable at time t , given physical stocks, timing, machine capabilities, and immediately relevant input conditions. Let $\mathcal{A}_g(t) \subseteq O \times U \times R$ collect the triples authorized under arrangement g at the same time. A third set records the joint condition in Equation 3.

$$\mathcal{E}_g(t) = \mathcal{F}(t) \cap \mathcal{A}_g(t). \quad (3)$$

The interpretation of Equation 3 is deliberately narrow. Membership in $\mathcal{E}_g(t)$ indicates that an action is feasible and recognized as authorized *within the specified arrangement*. It does not imply that the arrangement is just, that the operator will undertake the action, that all downstream production obligations can be fulfilled, or that an action prohibited by a rule is physically impossible. A conflicting claim, a disputed mandate, or a contested emergency exception requires further specification of g or a review procedure. The model represents an admissibility interface, rather than a complete theory of action or an empirical decision algorithm.

The sets can change independently. A technological improvement can enlarge $\mathcal{F}(t)$ by making grain transport faster while leaving permissions unchanged. A cooperative vote can enlarge $\mathcal{A}_g(t)$ by admitting new recipients while leaving inventories and machines unchanged. A weather-related loss may contract $\mathcal{F}(t)$ even if every recipient retains a valid claim. An emergency allocation rule may alter the authorized distribution of the remaining stock. These variations separate the physical conditions of production from the historical and institutional conditions of resource access. They also explain how the same productive technology may support sharply different forms of economic coordination.

The construction simplifies a more demanding temporal problem. Authorization can be contingent on another actor’s approval; a commitment accepted at t may require execution at a later date when stocks

and permissions differ. Some transfers require a sequence of actions whose intermediate states must be feasible and authorized. A time-dependent account would therefore need transition rules for resource states, commitments, and the identity of the decision maker. For present purposes, Equation 3 establishes the local distinction on which the subsequent monetary analysis depends. The dynamical treatment of interlocking commitments and recursively generated value circuits belongs to the companion research programme.

3.4 Delegated Production and the Location of Economic Claims

Consider an AI cooking operator commissioned to provide a meal for a household. The operator can search for suppliers, propose a delivery schedule, initiate a payment instruction, inspect food quality, and cook the meal. These activities may be performed with exceptional competence while the household retains the relevant consumption entitlement and the responsibility for authorizing the operator's expenditure. The AI's performance of economic action is thus compatible with an allocation of the underlying claim to another actor.

Several configurations are possible. Under *delegated procurement*, the operator requests resources and incurs permitted obligations for a principal under a specified mandate. Under *collective administration*, the operator manages a resource pool whose eligible beneficiaries and allocation priorities have been established by a cooperative or public arrangement. Under *organizational coordination*, the operator transfers inputs between production units of the same organization according to internal rules; the movement of material need not coincide with a market transaction between independent holders of title. Under a *hypothetical independent-AI arrangement*, an institutional order could grant an artificial entity its own claims or disposal powers. The last case enlarges the counterfactual and should not be inferred from the system's intelligence or technical autonomy.

These configurations may generate nearly identical outward behaviour. Two operators can exchange matching electronic messages, dispatch the same rice shipment, and register similar inventory reductions. One transfer could be a household purchase, another a cooperative entitlement, another an internal organizational allocation, and another the satisfaction of a reciprocal resource commitment. Their institutional meanings depend on the relevant principals, claims, rules, and obligations. An observer who sees only the AI-to-AI messages may therefore misidentify the production relation. Even a comprehensive transaction log is insufficient if it omits the legal or conventional semantics of the transfer.

An additional distinction concerns *decision discretion*. An operator may have wide technical discretion to select a route or production method while possessing only narrow discretion to commit resources. Conversely, a governing institution might grant substantial authority to allocate inputs among beneficiaries even if execution of those allocations is entirely automated. Intelligence, autonomy in task selection, authority to bind a principal, and independent economic entitlement are analytically separable variables. Their configuration, rather than a generic label of AI autonomy, determines whose position changes when an AI negotiates or settles a transaction.

3.5 The Agricultural, Energy, and Transport Example

The meal-production thought experiment can now be reconstructed as a production network. Let C denote the household's cooking operator, G the operator maintaining grain storage and agricultural scheduling, L the logistics operator, and E an operator coordinating energy supply. Each symbol denotes an operational role. Nothing in the notation determines whether its principal is an individual, a corporation, a cooperative, or an independent AI claimant. The household requests a meal at a specified time and with specified nutritional and quality requirements. C must secure rice of the required quality, a delivery route, and the electricity or other energy needed for processing and cooking.

Suppose G administers sufficient rice. The mere existence of that stock does not establish that C may withdraw it. G may be accountable for maintaining seed reserves, meeting prior delivery commitments, and observing rules about eligible recipients. Before the meal can be prepared, the relevant arrangement must determine whether a claim of the household, its cooking operator, or an authorized intermediary

permits release. Next, L must possess transport capacity and authority to schedule a delivery. Finally, E must supply energy within its physical capacity and priority rules. The operational network therefore contains several distinct permission interfaces even though every productive task can, by hypothesis, be carried out by an AI.

Three variants isolate the institutional difference. In a *market-procurement variant*, C receives authority to make purchases from resource holders or their agents. Claims on rice, logistics, and energy are discharged through payment or credit according to contractual rules. The resulting money-like instrument may serve as a means of settlement or a widely accepted claim beyond this particular meal. In a *shared-capacity variant*, the relevant productive facilities belong to a collective arrangement, and C receives a resource allocation according to collectively established entitlements and production schedules. The movement of inputs can be documented without constituting a monetary purchase. In a *reciprocal-commitment variant*, participating units undertake resource-specific deliveries or services over time, with obligations recorded and settled according to a shared protocol. Some commitments may circulate or be netted, and a generally transferable medium may or may not emerge. The production task and broad AI competence remain constant across the variants; the relations governing claims and settlement change.

Each variant remains subject to material limits. If two meal requests compete for the final usable batch of rice before its delivery deadline, their respective entitlements or allocation priorities still require determination. If the logistics network becomes unavailable, an otherwise valid transfer claim cannot create immediate transport capacity. If available energy is required for urgent medical equipment as well as meal production, some rule must determine priority or provide a feasible substitution. These situations show why a monetary claim, a resource entitlement, and actual delivery should remain analytically distinct. The examples also show why institutional allocation is normatively consequential: the adopted rules can place unequal risks on different beneficiaries even when the network is technically efficient.

3.6 Information, Review, and Control over Allocation Rules

Highly developed AI cognition may substantially improve the recognition of distributed inventories, production dependencies, delivery paths, and competing demands. The counterfactual can be strengthened to allow extensive sharing of production data across AI operators. Such conditions may reduce uncertainty about the location and physical feasibility of resources, improve scheduling, and permit more sophisticated forms of direct allocation. They are favorable to investigating nonmonetary coordination in the companion paper. Nevertheless, a shared description of resource availability does not by itself distribute the power to use those resources. The same transparent inventory could be administered through private procurement, cooperative allocation, or a priority rule established by a public institution.

This distinction is especially visible when a resource-disposal decision is contested. An AI operator may report an accurate inventory while applying a priority rule disputed by an affected beneficiary. Another operator may possess excellent forecasts of future supply while lacking a mandate to change eligibility criteria. Disagreement may concern the facts, the interpretation of a rule, the normative desirability of the rule, or the legitimacy of the authority that established it. The appropriate response differs across these cases. Updating observations may resolve a factual error; changing an allocation rule calls for an authorized and contestable governance process. The capacity to calculate an allocation and the authority to select it therefore remain separate even under unusually strong information assumptions.

Power can also arise from control over the interfaces themselves. A node able to authorize transfers, certify resource quality, delay logistics, revise allocation rules, or restrict access to the common registry can affect many otherwise capable operators. Such leverage need not take the form of formal ownership. It can be exercised through custody of a bottleneck, an exclusive technical standard, discretionary certification, or priority-setting powers. Concentration of these positions may affect the distribution of advantages and the possibility of contesting decisions. A network may therefore exhibit little human labour and exceptionally rich data while retaining institutionally significant asymmetries. Conversely, shared monitoring, review procedures, alternative suppliers, and revisable mandates may limit some asymmetries without predetermining whether the remaining exchanges are monetary.

Fairness, perceived fairness, and enforceable authorization also require separate treatment. A beneficiary may reasonably challenge a transfer whose terms are formally permitted; another may suspect unfair exclusion because it lacks information about conservation needs or other legitimate claims. Perceived unfairness can change participation and trust regardless of whether the perception ultimately withstands normative examination. The institutional inquiry must consequently investigate how reasons are offered, rules are contested, and decisions are corrected, while leaving open substantive disagreements over the meaning of a just allocation. The present section identifies these as governance conditions of resource circulation. The more demanding question of how distrust, normatively divergent assessments, and control over bottlenecks affect the stability of partially nonmonetary value circuits is reserved for the companion analysis.

3.7 Resource Authority and Conditional Monetary Coordination

The preceding distinctions establish a relational basis for assessing the possible persistence of money after the near disappearance of human productive labour. A physical shortage can motivate an allocation decision, while a separated right of disposition determines who is competent to authorize access. The need to coordinate across these positions may be addressed through money, transferable credit, contractual reciprocity, administrative priority, or direct provision. The resource condition alone does not select the institution. A monetary interface can facilitate transfers across separately governed units; a common entitlement and a shared production plan can sometimes perform the same operational task without a generally acceptable exchange medium. The relative advantages of these arrangements depend on information, enforcement, heterogeneity, uncertainty, power, and historical conventions.

At the level of *ontological reality*, the analysis suspends questions concerning an AI operator's ultimate subjectivity and the intrinsic nature of economic value. At the level of *relational reality*, operator mandates, principals, resource claims, eligibility rules, control positions, and effective dependencies form a historically variable organization of production. At the level of *manifestation reality*, allocation decisions appear in access-control lists, inventory records, signatures, requests, prices, tokens, and settlement statements. The manifestation of a purchase can be similar across legally different institutional relations, while a change in the payment technology may leave the deeper structure of resource authority intact. These distinctions help explain why the observation of AI-to-AI transactions is insufficient to establish a particular monetary or political-economic constitution.

The section has made a limited but consequential claim. Advanced operators can perform almost all production-related tasks while lacking general disposal powers over the resources needed for particular acts. The separation of productive agency, physical availability, and institutional authority generates coordination questions that remain meaningful even when human labour has become negligible. It also creates more than one possible means of answering them. The following section therefore examines monetary functions in heterogeneous AI production by distinguishing units of account, means of exchange, credit, and settlement, and by specifying the circumstances under which generalized claims may confer advantages over other arrangements.

4 Monetary Coordination in Heterogeneous AI Production

This section examines the institutional functions through which monetary or money-like arrangements may coordinate heterogeneous inputs in an economy where advanced artificial intelligence performs nearly all productive labour. The analytical task is to identify the additional conditions under which separated resource-disposal powers create demand for common accounts, exchange media, credit, and settlement mechanisms. The discussion first differentiates these functions, then examines indirect exchange and resource valuation, the temporal structure of credit, and the possibilities opened by shared production data and advanced relational cognition. A bounded network-accounting example clarifies the difference between clearing obligations and circulating money. The concluding analysis distinguishes productive relations, their recorded expressions, and unresolved ontological questions and identifies questions to be

developed in the subsequent treatment of nonmonetary allocation. The method combines institutional analysis, conditional comparison with monetary theory, and a deliberately limited formal representation; the AI economy remains a counterfactual rather than an empirically specified system.

4.1 Heterogeneous Inputs and the Need for Coordination

The production of an ordinary meal may require rice, water, electricity, cooking equipment, maintenance services, and transport capacity. In the stipulated economy, specialized AI systems can perform cultivation, logistics, power-system control, fabrication, and meal preparation with exceptionally broad labour competence. Their productivity, however, remains conditioned by the temporal and spatial availability of particular resources. Rice located in an agricultural store is a different productive opportunity from electricity available at a specified hour; the ability to transform one commodity into another does not settle the conditions of timely access to both. A cooking operator may therefore face an input coordination problem even when every relevant technique lies within the capabilities of some AI system.

The participants in this problem should be understood as operational nodes with potentially distinct mandates. The agricultural operator may manage rice on behalf of a cooperative, the grid operator may allocate electricity according to a public-resource charter, and the logistics operator may act under a long-term service contract. Alternatively, the operators may represent independently endowed institutions, or hypothetical AI claimants whose entitlements are recognized under a future legal order. These arrangements differ in whose consent is relevant and which terms of transfer are permissible. The mere ability of one AI to make a technically efficient offer supplies neither the right to transfer another actor's resources nor a normatively sufficient principle for distributing them. The resource-disposal powers identified in Section 3 therefore remain an input to monetary analysis.

Heterogeneity arises at several levels. Products differ in physical properties and substitutability; production requirements differ in time and location; organizations differ in their rights and obligations; and requests differ in urgency, durability, and exposure to interruption. A system may have adequate aggregate grain and still lack grain at the time and place of demand. A technically feasible substitution may displace electricity required for an emergency service. Certain resources may be jointly used under an established plan, while others remain subject to exclusion, negotiated consent, or priority rules. These relations can generate costly bilateral matching and repeated negotiation. They can also motivate common-resource planning or direct allocation. The analytic question concerns the relative usefulness of monetary arrangements within these alternative forms of coordination.

4.2 Illustrative Material Circulation and Reciprocal Claims

This subsection gives a fully constructed example of the difference between physical circulation, the organization of obligations, and the use of monetary settlement. Its analytical role is to make the economic structure behind the meal-production thought experiment visible before identifying the functional properties of money. Figure 1 shows two records associated with four AI-operated facilities. The facilities are called agents for convenience; the model does not assume that an AI possesses independent property rights or legal personality.

In the material layer, agricultural operator *A* releases a grain consignment to logistics operator *D*, which delivers the grain to processor *B*. Processor *B* provides usable organic residues to bioenergy operator *C*, and operator *C* supplies electricity to *A*. The processor also provides meals to beneficiaries outside the illustrated circuit. External inputs, storage losses, repairs, ecological processes, and other productive relations are deliberately omitted from the four-node representation. Accordingly, the drawn circuit records a subset of reciprocal dependencies, not a physically closed or self-sufficient production economy.

The financial layer depicts a separate *hypothetical* set of liabilities. Assume that *D* owes *A*, *B* owes *D*, *C* owes *B*, and *A* owes *C* ten units each, all measured in the same unit of account, simultaneously due, valid, and eligible for a mutually authorized multilateral set-off. These conditions are additional assumptions; the actual physical deliveries do not imply that their economic valuations have equal magnitudes.

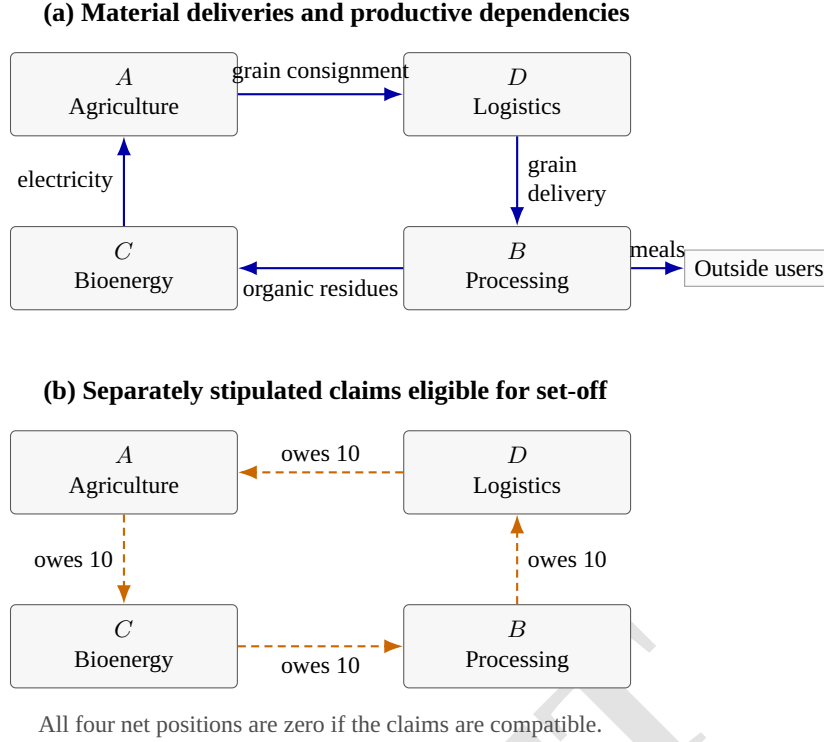


Figure 1: Constructed four-operator AI circulation example. Solid arrows in panel (a) denote *different physical deliveries*; dashed arrows in panel (b) denote *stipulated debtor-to-creditor obligations* in one accounting unit. Neither the physical circuit nor zero net balances alone establishes legal discharge, material reproduction, or generative justice.

Under the stipulated assumptions, each participant has a zero net receivable position, and the clearing institution could extinguish these eligible liabilities without transferring a general exchange asset around the loop. The familiar three-agent circular liability is a shorter instance of the same principle.

The comparison matters because the material contributions remain heterogeneous: grain, logistics services, biological residues, electricity, and meals are not quantitatively interchangeable by virtue of their positions on a diagram. Values can be expressed in a common accounting unit if an institution defines one, but that common expression does not settle the source of the unit's legitimacy or the valuation of ecological and social contributions. Equally, settlement of the stipulated claims leaves questions about whether grain was actually delivered, electrical capacity can be reproduced, beneficiaries received the intended meals, and participants can justifiably contest the underlying claims. The remaining subsections analyze the specific coordinating roles played by monetary and nonmonetary institutions under such conditions.

4.3 Functional Differentiation of Monetary Arrangements

The expression *money* often refers in ordinary discourse to several capacities that can, in principle, be realized by different institutions. For the present counterfactual, at least five capacities should be distinguished: common accounting, exchange mediation, payment, final settlement, and the transfer of purchasing power across time. Credit constitutes a further contractual relation, which may rely on monetary units and payment instruments without being identical to either. Table 3 separates these analytical roles. The table offers an institutional classification for this paper; it does not claim that actual monetary systems always preserve such boundaries or that the associated technologies are uniquely monetary.

A common account can be used for comparison without creating a universally transferable asset. For example, a production authority might estimate the marginal resource cost of alternative meal plans

Table 3: Monetary and credit functions in the hypothetical AI production network

Function	Institutional role	Possible realization without a general exchange medium
Common unit of account	Expresses heterogeneous prices, costs, liabilities, or opportunity comparisons in a shared numerical unit.	Accounting reference used by a production planner or public allocation authority.
Exchange medium	Is accepted in one transfer because it is expected to be acceptable in further transfers.	Direct matching, negotiated resource swaps, or multilateral allocation instructions.
Means of payment	Discharges a specified payment obligation according to governing rules.	Delivery of agreed resources, contractual set-off, or authorized in-kind performance.
Final settlement	Extinguishes the relevant obligation with legally or institutionally recognized finality.	Consensual netting, fulfilment, novation, or institutional discharge under applicable rules.
Intertemporal purchasing power	Carries a transferable capacity to obtain future goods or services.	Specific future-delivery entitlements, indexed quotas, or time-bound access rights.
Credit relation	Creates a present claim or obligation against future performance.	Bilateral or pooled promises recorded in a nontransferable commitment ledger.

in a common accounting unit and authorize supplies on the basis of dietary need. No operator would thereby receive unrestricted purchasing power. Similarly, a receipt proving that ten units of rice have been delivered may establish completion of one obligation while possessing no independent acceptability as payment elsewhere. Conversely, a token transferable across unrelated AI operators may function as an exchange medium even if its acceptance rests on expectations and conventions rather than on a particular claim to rice or electricity.

The distinction also prevents an ambiguity about monetary disappearance. A decline in household payment interfaces, an extinction of circulating payment tokens, a reduction of monetary settlement balances, and the abandonment of common accounting are four different institutional transformations. One may occur while the others persist. In a network of AI operators, transaction instructions might become nearly invisible to human beneficiaries while monetary prices, debts, and claims remain important to the system's internal organization. A credible account of persistence or dissolution must specify the function and the network boundary under consideration.

4.4 Locally Emergent Monetary Objects and Adaptive Exchange

The differentiation of monetary functions permits a further conceptual possibility: AI operators may develop money-like coordination objects through repeated resource interactions before establishing a common currency or a comprehensive code of exchange. For the present inquiry, a *money-like object* is a resource, record, token, or claim that performs one or several monetary functions in a specified network, even if its status remains local, provisional, or disputed. Its defining analytical feature is the role it plays in coordinating exchanges, claims, or purchases, rather than a particular physical or digital format. A warehouse receipt may establish a resource-specific delivery claim, an account entry may record reciprocal performance, and a transferable entitlement may begin to circulate among unrelated operators. These objects can be economically distinct even when their technical representations are similar.

Consider three AI-operated facilities with separately administered productive capacities. The agricultural operator *A* can supply rice, the energy operator *B* can supply electricity, and the fabrication operator *C* can provide equipment components. Operator *A* needs electricity to process its harvest; *B* needs replacement components; and *C* has a use for rice. The operators could arrange a synchronized three-party material exchange. Alternatively, *A* could provide *B* with a verifiable claim to a specified future delivery of rice in exchange for electricity. If *C* is willing to accept that claim for supplying com-

ponents to B , the claim can move from B to C and later be redeemed against A 's actual production. In the stipulated example the agricultural claim bridges two resource transfers. The sequence depends on A 's ability to perform, the operators' authorization to transfer and redeem the claim, and the temporal compatibility of electricity, fabrication, and rice delivery.

Initially, this object could remain a narrow entitlement whose value depends on the specific agricultural facility and the expected rice delivery. Repetition may encourage participants to standardize its denomination, expiry conditions, authentication method, and acceptable uses. Other operators might begin accepting it because they expect to redeem it or transfer it again, including operators with little immediate need for rice. An increasingly broad pattern of third-party acceptance can give the object a medium-of-exchange role. It remains possible for the instrument to stay resource-specific, for acceptance to fragment across networks, or for participants to replace it with direct multilateral planning. Its historical trajectory is therefore open. The familiar search-theoretic result that acceptability can arise from exchange strategies offers one conditional comparison [7]; the broader productive, institutional, and informational assumptions of the present thought experiment are distinct.

Three levels of organization should be distinguished. *Adaptive regularity* refers to recurring acceptance or coordination behavior among operators. *Exchange convention* refers to relatively stable mutual expectations that particular signals or claims will be honored, transferred, or redeemed. *Normative institutionalization* refers to articulated and contestable rules concerning entitlement, enforceable obligation, loss allocation, authority, and justified access. A local monetary convention may arise without a fully specified prior standard of distributive fairness or formal currency issuance. Its operation nevertheless presupposes some effective conditions of access, performance, and recognized behavior, which may themselves be informal and historically evolving. Strategic pressure can also induce acceptance; observed circulation is insufficient evidence of voluntary agreement or justice.

The suggested developmental sequence is an illustrative possibility, not a necessary progression from barter to credit and then to money. An account unit may emerge before transferability, a broadly usable resource may serve as an exchange medium without formal credit issuance, and operators with rich common data may avoid a circulating claim altogether. Moreover, emergent monetary functions need not share a single issuer, common spatial extent, or uniform duration. Several locally accepted instruments could coexist, overlap, or lose acceptability as production networks evolve. The object of analysis is accordingly the distribution of monetary functions across relations, together with the institutional conditions that support or transform them.

The possibility of endogenous monetary emergence also changes the interpretation of dissolution. A network might discontinue an official currency while generating new transferable service credits, or extinguish a circulating claim while retaining a common accounting convention. Conversely, a local token could lose third-party acceptance while remaining a valid resource-specific entitlement. Monetary persistence, transformation, and disappearance require function-specific criteria applied to the relevant network and period. This classification also prevents technical success in circulating a claim from being conflated with legitimate rights of resource disposal or a defensible distribution of productive returns.

4.5 Indirect Exchange and Generalized Acceptance

Suppose the agricultural operator needs electricity, while the electricity operator needs replacement components supplied by a fabrication facility. The fabrication facility in turn requires agricultural feedstock or transportation services. Each operator may possess something valuable to others while lacking a direct match with the provider of its immediately needed input. Within a network governed by separately authorized transfers, an operator may therefore value a transferable claim partly because other operators are expected to accept that claim in subsequent exchanges. Its usefulness depends on the pattern of acceptance, not solely on the intrinsic use of the object transferred.

Kiyotaki and Wright analyze the endogenous selection of exchange media in economies with bilateral trade, random matching, and specified acceptance strategies. Their framework shows that media of exchange can emerge under particular trading and belief conditions, while also allowing multiple monetary

equilibria and welfare differences among them [7]. The precedent establishes a conditional explanation of generalized acceptability. It does not imply that a technologically advanced production network with shared data, planning capacity, and enforceable multilateral agreements must reproduce the matching frictions stipulated in that model.

An earlier study by Marimon, McGrattan, and Sargent explores exchange strategies learned by artificially intelligent agents within such monetary exchange environments [10]. Their contribution is relevant because artificial agents and medium-of-exchange formation have already been studied together. The agents in that work are modeled within specified exchange economies; the present analysis makes a different counterfactual assumption about the execution of production labour and the administration of heterogeneous resources. Its object includes resource mandates, production time, institutional authority, and possible nonmonetary coordination among agents that may share extensive information. Accordingly, the novelty sought here concerns a different scope of production relations rather than the conjunction of AI and money by itself.

The advantage of generalized acceptability can become salient when several production networks interact without a trusted common allocation authority. A rice-management system may not wish to inspect the full history of each potential purchaser's obligations to obtain electricity. A widely accepted asset or transferable balance can permit access to suppliers outside a familiar credit community and may reduce the need for bespoke reciprocal contracts. Yet that convenience carries its own requirements: the asset must be recognized, its transfer authenticated, its availability maintained, and its treatment under disputes determined. A liquidity advantage in a particular environment therefore remains contingent on the institutions through which acceptance and finality are sustained.

4.6 Prices, Accounting Conventions, and Resource Allocation

A numerical valuation can convey information about the relative demands placed on limited resources. If two production requests compete for an electricity unit at the same moment, an accounting system may assign a high opportunity cost to that unit because using it in one activity precludes another. The calculation can support technical scheduling even where the relevant institutions allocate electricity through an emergency-priority rule, a publicly approved plan, or a mutual-resource agreement. The calculation's informativeness and the allocation rule's legitimacy remain different questions.

In particular, a computationally derived scarcity price has no automatic authority to decide who should receive an essential resource. Such a price may summarize constraints and alternative uses under stipulated objectives; its normative interpretation depends on the objectives selected, the rights recognized, and the treatment of needs that resist commensuration. A network may find a common accounting metric instrumentally convenient while refusing to let holders of accumulated balances determine access to critical supplies. Conversely, the use of money prices may coexist with institutional safeguards, public provisioning, and nonmarket priorities. The relation between accounting and allocation therefore admits multiple organizational forms.

Consider two AI manufacturing facilities drawing on the same electricity grid. Both can estimate physical demand to high precision, and each understands how its output contributes to other production activities. If the grid must reserve energy for medical refrigeration, a system that maximizes exchange revenue may allocate differently from one that incorporates a binding medical priority. The difference concerns the relevant decision rule and its justification, even where both systems employ equally accurate forecasts. In this sense, the informational benefits of common valuation can be institutionally separated from the general exchangeability of rights to consume the resources valued.

This observation also matters for the concept of equivalent exchange. A trading ratio that appears mutually advantageous to two authorized operators may depend on prior allocations of land, energy, or priority-setting powers. A numerical equivalence at the interface of exchange does not settle the justice of those prior positions. The present section brackets the substantive evaluation of fairness while keeping its institutional location visible. More sustained analysis of the conditions under which value returns to its generators, and of the powers that determine admissible valuations, belongs to the later section on

generative value, economic power, and resource regeneration.

4.7 Credit, Transferable Claims, and Multilateral Clearing

Production is temporally extended. An agricultural system may deliver rice today and receive electricity, maintenance, or a substitute resource at a later date. Such coordination creates obligations that can be recorded, monitored, enforced, or renegotiated. A credit arrangement specifies an intertemporal claim, whose content may consist of an agreed quantity of goods, an indexed future service, or a payment expressed in a common accounting unit. Transferability is a further institutional choice: a beneficiary's right to future electricity may remain bound to a particular operator or may be assignable to other network participants. The latter form can acquire money-like properties when claims become sufficiently standardized and widely accepted.

A minimal liability network helps distinguish credit relations from circulating means of exchange. Let a finite set of AI operating institutions be denoted by $V = \{1, \dots, n\}$. Suppose that $L_{ij} \geq 0$ records the amount that institution i owes institution j in the *same stipulated unit of account* at a common settlement date. Let $L_{ii} = 0$, and assume that the obligations are valid, due, and subject to an agreed clearing rule. Define institution i 's net receivable position, b_i , by Equation 4.

$$b_i = \sum_{j \in V} L_{ji} - \sum_{j \in V} L_{ij}, \quad \sum_{i \in V} b_i = 0. \quad (4)$$

The second identity in Equation 4 follows from the inclusion of the same obligation as one debtor's liability and another creditor's claim. It expresses an accounting consistency condition rather than the settlement of those obligations. If, for example, A owes B ten units, B owes C ten units, and C owes A ten units, each participant has a zero net position under the stipulated account. When the obligations are compatible with the agreed multilateral set-off rule, they may be discharged without first transferring ten units of a separate settlement asset around the entire circle. The illustrative case has three nodes for clarity. A production economy may involve overlapping obligations, contingent maturities, incompatible units, legal restrictions on assignment, and participants unable to perform what they promised. Those conditions can prevent the simple cancellation suggested by an aggregate balance.

The account admits at least three cautions. First, a zero net receivable position does not imply that actual rice, electricity, or maintenance services have already been delivered. Second, mutually cancelling nominal obligations may coexist with unequal productive benefits, ecological burdens, or bargaining positions. Third, the institutional procedure that declares an obligation discharged matters: a numerical net position does not supply consent, legal finality, or protection against default. Clearing is therefore a possible way to reduce settlement liquidity needs; it should not be identified with either the elimination of all money functions or the achievement of generative justice.

Credit can also concentrate power. An operator able to issue broadly accepted claims may obtain inputs before providing a corresponding contribution, subject to the rules governing that issuance. A clearing institution may acquire privileged access to production data, discretionary authority over admissible obligations, or control over entry into a settlement network. Transferable balances can simplify inter-network coordination while allowing accumulated purchasing capacity to shape subsequent resource access. Whether these features facilitate cooperation or produce extractive asymmetry depends on credit standards, loss allocation, transparency, contestability, and the organization of underlying production rights.

4.8 Shared Data and Advanced Relational Cognition

The counterfactual permits a further enabling condition. Assume that economically relevant global production data can be accessed by participating AI operators and that these systems possess unusually strong capacities to infer dynamic dependencies, estimate resource constraints, and compare possible production pathways. Rich shared information may lower some of the matching, verification, and coordination costs that otherwise favor generally transferable claims. An agricultural operator could evaluate

direct exchanges involving energy, transport, fabrication capacity, and future harvest commitments, and might coordinate multilateral arrangements without an intermediate asset that every participant expects to accept.

Kocherlakota's analysis of *money is memory* supplies a formal point of comparison. In a specified class of environments with limited commitment, he shows that allocations feasible with money are also feasible with an appropriately informative form of memory [8]. The theorem adopts particular definitions of money, memory, and feasible allocation. Its result should therefore be read as an established implication within those assumptions, while its extension to highly capable AI production networks remains a separate conjecture. The present counterfactual also includes physical inventories, production schedules, unequal disposal powers, and normatively contested allocation rules. A universally accessible record may enhance coordination without conferring authority to alter any of those rules.

The value of shared data likewise depends on its temporal reliability and provenance. Production states change while information is gathered; forecasts can be wrong; strategic actors may withhold relevant observations or dispute classifications of value. Even a complete and current registry of resource quantities would not uniquely determine future trajectories when production decisions themselves alter the network. Advanced AI can improve inference, scenario analysis, and local optimization while leaving residual uncertainty about evolving institutions and nonlinear cascades. The proposal is thus for a possible expansion of feasible nonmonetary arrangements under stronger epistemic capacities, with limits to be investigated, rather than an assumption of omniscience.

There is also a second-order governance issue. Operators who maintain the common registry, select forecasting objectives, certify transaction records, or authorize model updates may acquire influence over exchange and allocation. A technical substitution for generalized monetary exchange might consequently reproduce concentrated authority through data interfaces or rule-setting powers. Such a transformation could reduce reliance on payment tokens while leaving other forms of economic domination intact. Shared information should accordingly be evaluated together with rights of inspection, correction, appeal, independent verification, and the possibility of using alternative coordination pathways.

4.9 Institutional Conditions of Monetary Persistence

The preceding analysis supports a conditional account of monetary persistence in predominantly AI-operated production. Widely accepted exchange media may be convenient where operators control heterogeneous resources, cooperation crosses institutional boundaries, direct matching imposes costs, commitments are uncertain, and repeated settlements benefit from generally recognized assets. Common accounts may remain useful under a broader set of arrangements, including nonmonetary planning. Credit may facilitate production across time without creating a universally circulating claim, although standardization and transferability can support subsequent monetary functions. Settlement instruments become significant when clearing does not fully discharge compatible obligations or when counterparties require finality through a recognized asset.

These functions are subject to historically variable conditions. Better production data, more capable AI coordination, reliable commitment protocols, and multilateral allocation institutions may reduce the advantages of general-purpose payment media. Conversely, network fragmentation, incompatible standards, strategic exclusion, or the breakdown of trust may increase the appeal of a transferable settlement asset. The practical value of one institution can differ among a tightly integrated production cooperative, a loosely connected network of regional producers, and a system where resource-disposal powers remain concentrated in separately governed entities. Monetary and nonmonetary relations may consequently coexist within the same economy, and their relative scope can change over time.

The *ontological* standing of AI subjectivity and the ultimate basis of economic value remain open. At the level of *relational reality*, productive dependencies, obligations, resource-control positions, shared information, and accepted rules constitute the operative economic relations. At the level of *manifestation reality*, those relations become accessible through quotations, ledgers, tokens, access permissions, delivery confirmations, and settlement entries. An identical interface transaction can embody different

underlying rights; a redesigned interface may leave the deeper asymmetries intact. The analytic task is to connect these levels without reducing the social constitution of money to either a digital symbol or a technical optimization problem.

A final qualification concerns the relation between efficiency and legitimacy. A system may clear obligations at low cost while allowing dominant nodes to appropriate productive surpluses. A different system may retain monetary payments while protecting the conditions under which agricultural, ecological, technical, and social contributions continue to be generated. The assessment of monetary coordination therefore has both explanatory and normative dimensions. This section has specified functions and conditions of possible monetary use, leaving open the institutional evaluation of alternative allocation schemes. The following section on nonmonetary resource allocation will investigate direct resource coordination, shared capacity, reciprocal commitments, and nonmonetary planning under the same AI labour and information assumptions. The further question of how value circuits can locally extinguish obligations while sustaining non-extractive regeneration belongs to the companion inquiry on distributed monetary dissolution.

5 Nonmonetary Resource Allocation Mechanisms

This section examines institutions capable of coordinating scarce productive inputs without requiring a general-purpose medium of exchange in an economy where nearly all labour is performed by highly capable artificial intelligence. Its objective is to distinguish practical forms of nonmonetary allocation, specify their physical and institutional requirements, and evaluate their possible advantages and vulnerabilities under unusually extensive production data and AI coordination capacities. The analysis considers direct assignment of resources, joint administration of productive capacity, priority rules, reciprocal commitments, and adaptive production planning. It then compares these mechanisms through a common agricultural, energy, transport, and cooking example, separating technical feasibility from rights of disposal, normative justification, and institutional durability. The discussion is conceptual and comparative. It does not establish the optimality of any proposed institution or predict its adoption in an actual future economy.

5.1 Claims in Nonmonetary Allocation

A nonmonetary allocation is an authorized assignment, use, or transfer of resources whose execution does not require settlement through a generally transferable payment asset. This working definition concerns the operative method of coordination. It leaves open whether the relevant institution maintains physical accounts, common valuation conventions, usage entitlements, or continuing obligations. A production network may quantify electricity in kilowatt-hours, grain in kilograms, and vehicle use in delivery slots while treating access to each as a governed resource claim. Sophisticated records are compatible with arrangements in which participants never acquire a general purchasing balance. Conversely, a resource-denominated claim may acquire monetary properties if it becomes broadly transferable and accepted for otherwise unrelated obligations. Classification therefore depends on institutional function and acceptance practices as well as vocabulary.

The object being allocated must be specified before considering an allocation rule. A kilogram of rice at a distant warehouse is not interchangeable, for immediate planning purposes, with a kilogram of rice delivered safely to a kitchen before a nutritional deadline. Similarly, access to a battery, an electricity supply at a specific hour, and a claim to electricity over a future month have different productive meanings. Resources may be perishable, exhaustible, renewable, subject to prior commitments, or useful only in particular combinations. The network also contains recipients with different standing: a household principal, an industrial cooperative, a public-service provider, or an operational AI holding narrowly delegated authority. The same request can therefore be physically executable while lacking appropriate authorization, as established in Section 3.

At least three decisions should be distinguished. The first identifies *feasible delivery*, meaning the inputs, time, location, and production dependencies that a request requires. The second specifies *recognized entitlement*, meaning the rights, commitments, and governance rules that permit a resource to be assigned. The third determines *priority among competing authorized uses*, including reserve obligations and consequences for other recipients. These decisions can be made by distinct agents or decision procedures. Their coordination creates the institutional problem of allocation even if the productive task itself can be executed by nearly any sufficiently equipped AI system. None of the three decisions logically requires a currency, but each requires a practical method of determining what should happen next.

The word *nonmonetary* is also narrower than *non-economic*. Scarcity, trade-offs, unequal decision power, alternative production opportunities, and intertemporal obligations remain present when no token is transferred. A common plan may incorporate detailed estimates of opportunity costs; a reciprocal service agreement may create enforceable claims; and an apparently free delivery may be financed through prior contributions to shared facilities. The economic substance of these relations survives the removal of an explicit payment interface. This distinction matters for interpreting hypothetical AI interactions and for avoiding an overly formal account in which the disappearance of a currency symbol is mistaken for a transformation of production relations.

5.2 Resource-Specific Entitlement Allocation

Direct allocation allows an authorized operator to request or receive a specified input from a recognized supplier or common store under a pre-established entitlement. In the meal-production example, the cooking AI submits an order for rice meeting a defined quality standard, with a delivery deadline. The agricultural operator checks stock and seed-preservation obligations; the logistics operator verifies a feasible transport window; and the relevant governing rule determines whether the requested quantity may be released. Delivery can be recorded as fulfillment of an entitlement or common-service obligation. The recipient need not tender a transferable monetary claim at the point of transfer.

A direct-assignment system requires some account of scarcity. Suppose a warehouse has a quantity of grain available within a particular period, while two authorized kitchens request deliveries that together exceed deliverable supply. Allocation can follow an equal-share rule, previously assigned capacity rights, emergency priority, a needs assessment, or a collectively adopted schedule. Each rule produces different consequences, and the decision to select one is normatively consequential. A high-fidelity inventory helps operators identify the shortage; it does not itself decide whose claim should prevail. Moreover, the assignment rule may have to preserve seed grain, cover already accepted contracts, and protect resilience reserves before allocating current consumption. Appropriate resource-specific records make these constraints visible without constituting a monetary settlement system.

A minimal capacity account captures the relevant distinction. Let $Q_{r,t}$ be the physically deliverable quantity of resource r during a designated interval t , after the relevant quality and delivery conditions have been specified; let $a_{k,r,t} \geq 0$ denote the amount assigned to authorized request k ; and let $z_{r,t} \geq 0$ denote the amount withheld as a reserve under the applicable conservation or contingency rule. For the finite set $K_{r,t}$ of such requests, an aggregate necessary feasibility condition is stated in Equation 5.

$$\sum_{k \in K_{r,t}} a_{k,r,t} + z_{r,t} \leq Q_{r,t}. \quad (5)$$

Equation 5 is a bounded physical-accounting constraint. It does not describe transport-network feasibility, temporal coupling between periods, quality substitution, or the authority that selects assignments. A complete model would add those constraints and distinguish actual deliveries from promised deliveries. The condition nevertheless shows why nonmonetary allocation cannot dispense with material accounting: supplying one request may constrain other uses even when all production work is automated. Disagreement over $z_{r,t}$ is likewise a governance disagreement about the preservation of future productive opportunity, rather than a computational error that improved stock measurement will necessarily resolve.

Resource-specific entitlements can be designed with different degrees of rigidity. A fixed entitlement grants relatively predictable access but may allocate scarce inputs inefficiently when needs change

abruptly. A revisable entitlement can improve adaptation while exposing recipients to discretionary changes in rules. A common-service guarantee offers continuity of access for defined purposes, yet the scope of the guarantee must be matched to actual capacity and a procedure for resolving shortfalls. These distinctions remain important even if AI planners can update production schedules with minimal operational delay. The critical institutional issue concerns the legitimate authority to confer, revise, or suspend claims and the conditions under which recipients may contest the decision.

5.3 Joint Provision of Productive Capacity

Some productive resources can be coordinated through joint administration rather than sequential transfers among separately entitled operators. A grain-processing cooperative might govern its harvest, machinery, transport fleet, and energy allocation within a shared production mandate. Each AI operator receives functional permissions for cultivation, maintenance, storage, and distribution, while the governing arrangement establishes acceptable purposes, conservation obligations, and allocation priorities. The resulting network may coordinate heterogeneous inputs through a common production schedule and internal resource accounts. It may settle internal obligations through fulfillment records or simply assign facilities according to recognized roles. Its productive efficacy depends upon the capacity and governance of the underlying institution rather than the absence of an exchange token alone.

Ostrom's comparative analysis of common-pool resources provides an established reason to study institutional diversity instead of assuming a single universal rule for joint management [11]. Her later account of polycentric governance likewise offers a basis for considering multiple decision centres in complex economic systems [12]. These works address historically situated human institutions. Their relevance here is methodological: the rights to use, manage, monitor, exclude, and revise rules may be distributed among several units rather than concentrated in an undifferentiated owner or an omniscient planner. The viability of analogous arrangements among future AI operators would require separate evidence and design analysis.

Joint provision may reduce the need to price and purchase each intermediate service, especially when complementary tasks are frequent and the participants possess stable common purposes. Energy capacity scheduled for irrigation, milling, cold storage, and food preparation could be allocated through one production calendar. Yet common governance introduces its own requirements. Operators must maintain equipment, observe ecological constraints, distribute maintenance costs, preserve reserve capacity, and recognize the interests of parties whose needs compete. A common resource can also be administered by a narrow group that controls the information systems and admission rules. In this case the appearance of collective provision can coexist with concentrated authority over productive opportunities.

The institutional form should therefore be assessed through its history of rule formation and revision. Shared access may arise from cooperative agreement among distinct principals, a public-service mandate, long-standing reciprocal institutions, or a more centralized ownership arrangement. These forms need not have equivalent normative implications. An AI-directed common facility with universal technical visibility can still deny certain beneficiaries any voice in its priorities. Conversely, delegated decision powers accompanied by review and alternative access pathways can preserve differentiated expertise without conferring unrestricted control. The relevant inquiry concerns how operative powers and benefits are distributed across the production network, and whether those arrangements allow the productive conditions themselves to be sustained.

5.4 Reciprocal Resource Commitments

Reciprocal commitments offer a second institutional family. An agricultural unit may commit a specified harvest delivery in exchange for scheduled equipment maintenance; an energy unit may promise power availability for grain processing subject to an agreed reserve threshold; a logistics unit may undertake delivery in return for future access to charging infrastructure. The commitments can be recorded, monitored, fulfilled, amended, and challenged without necessarily issuing a universally accepted settlement

medium. What circulates in this arrangement may be knowledge of obligations, claims to specific services, or schedules of coordinated future performance. The relevant counterparties retain a relation to identified goods, services, capacities, or duties.

A concrete commitment must specify at least its responsible provider, authorized claimant, resource or service content, quantity or performance standard, delivery interval, and conditions of amendment or discharge. Shared data can assist an advanced AI network in identifying whether these promised performances are mutually feasible. However, statements of future capacity have a different epistemic standing from already available stock. Harvest forecasts, maintenance risks, transport congestion, and energy emergencies introduce uncertainty. The contractual or communal scheme must therefore address partial performance, unforeseen shortfalls, assignment of risk, and the legitimate grounds for refusing or changing a request. Without these terms, a promise ledger may show an apparently complete chain of exchange while concealing its practical fragility.

Grassroots Economics' publicly documented Commitment Pooling practices provide a useful, limited comparison. The organization's documentation describes Community Asset Vouchers as traceable promises of future goods or services that can be pooled, swapped, redeemed, and tracked through shared records [5]. Its training materials emphasize capacity to honor commitments, communal trust, and the need to address unfulfilled promises [4]. Those materials concern existing human communities and do not establish an implemented AI-to-AI production regime. They also do not settle whether every circulating voucher should be considered nonmonetary by an external functional definition. The present argument draws a narrower possibility from the precedent: resource-specific promises can coordinate some exchanges through recognized obligations and shared institutional memory even when national-currency payment is not the immediate basis of provision.

The distinction from money depends especially on transferability and generalized acceptance. A claim that can only be presented to one provider for one service occupies a different position from a standardized credit that any supplier will accept in satisfaction of unrelated claims. Intermediate arrangements are possible: a promise can be transferable within a limited coalition, valued according to agreed conversion conventions, and redeemed through a shared registry. Such arrangements may supply some monetary functions while lacking others. A categorical description of an economy as *moneyless* would consequently conceal important functional differences. A rigorous comparison should record what each claim permits, who accepts it, and which liabilities remain after each exchange.

Reciprocity also requires caution concerning the notion of equivalence. Two AI units may honor mutual service commitments even when their contributions are heterogeneous and cannot be reduced to a unique, normatively neutral value. A prior agreement may be mutually acceptable while placing unequal burdens on a disadvantaged unit. Recurrent fulfillment may help sustain trust, yet a perception of unfairness can provoke withdrawal even in a physically sustainable circuit. Such responses may reflect an uncorrected injustice, a factual misunderstanding, or a substantive difference in normative judgment. Stable nonmonetary coordination may therefore require explainable claims, contestable terms, and legitimate revision procedures alongside accurate records of performance.

The distinction between a resource-specific commitment and a circulating monetary instrument can itself change over time. An AI coalition may initially record promises solely to schedule future deliveries, yet permit those records to pass to third parties who begin treating them as exchangeable purchasing capacity. The same administrative technology can thus support nonmonetary coordination in one local setting and an emergent money-like instrument in another. Classification should follow actual acceptance, transferability, discharge rules, and institutional use rather than the ledger's label. This possibility is developed in Section 4.4.

5.5 Shared-Data AI Production Planning

An especially favorable counterfactual combines near-universal AI labour with extensive common access to production-relevant data and unusually capable inference about nonlinear interdependence. A coordinated system could observe inventories, maintenance states, transport capacity, resource forecasts,

accepted commitments, and the dependencies connecting distinct tasks. It might then construct feasible plans for supplying household consumption, industrial maintenance, ecological restoration, and other recognized uses. The resulting plans could be continually revised after changing demand, equipment failures, crop losses, or emerging resource alternatives. This informational premise is deliberately stronger than the assumption that AI can perform the individual labour tasks; productive versatility and epistemic competence remain analytically distinct.

Under these stipulated conditions, some informational functions performed by prices and general-purpose exchange media might be replaced by a more direct representation of resources and commitments. Kocherlakota's formal examination of money and memory demonstrates, within a defined class of economic environments, that allocations feasible with money can also be feasible with a sufficiently informative form of memory [8]. The result does not supply an institutional blueprint for globally coordinated artificial production, and it does not establish that public records eliminate disputes over ownership or distributive principles. It motivates a more restricted conjecture: when AI systems can maintain accurate, jointly accessible histories and estimate resource consequences at appropriate scales, some of the coordination services associated with a transferable payment instrument may be provided through structured knowledge and binding allocation rules.

The existence of complete records would still leave a choice among objectives and procedures. A plan minimizing total delivery time may disfavor distant recipients. A plan maximizing short-run output may deplete reserves necessary for future harvests. A plan protecting emergency care may legitimately defer an ordinary meal request, subject to a procedure for defining emergencies and reviewing decisions. Different policies can generate different feasible allocations from identical data. Advanced prediction may identify these consequences more effectively than historical human institutions, but selecting and justifying the criteria requires institutional authority and normative argument. The algorithm executing a policy may have enormous operational discretion unless the policy's permissible adjustments, auditability, and appeals are specified.

Planning also has epistemic limits independent of computational performance. Initial observations can omit privately held information, environmental conditions can change unexpectedly, and participating agents can modify their own strategies in response to the plan. Complex feedback may amplify local shocks or invalidate assumptions used in earlier forecasts. Under the optimistic scenario, AI might manage uncertainty through rolling horizons, contingency plans, causal sensitivity analysis, and redundant suppliers. These are candidate design responses, not guarantees of full prediction. Nor does a rich global dataset need to be gathered through indiscriminate disclosure of personal, proprietary, or security-sensitive information. Institutional rules for access, aggregation, verification, confidentiality, and correction would form part of the common data infrastructure.

A genuinely distributed architecture may place local decisions near resource operators while coordinating shared constraints at regional or inter-network interfaces. Other arrangements may centralize planning authority while permitting distributed execution. Their relative merits cannot be inferred from the word *distributed*; control over computational infrastructure, model parameters, identity registries, data certification, or emergency overrides can create substantial power in either architecture. The favorable AI-information scenario therefore expands the range of feasible institutional experiments without resolving the question of which parties may determine the rules of allocation. Better knowledge can also make otherwise opaque power asymmetries more visible, enabling monitoring and challenge when effective rights of review exist.

5.6 Comparative Institutional Properties

The institutions considered above allocate different roles to resource information, prior commitments, governing rules, and claims to future provision. Table 4 summarizes their possible coordinating functions and principal vulnerabilities. These are idealized analytical types: a single production network may combine common provisioning for basic necessities, direct assignments for ordinary supplies, reciprocal commitments for specialized maintenance, and conditional monetary payments for external inputs.

Table 4: Candidate nonmonetary allocation mechanisms within AI-operated production networks

Mechanism	Coordinating basis	Principal institutional vulnerability
Direct resource assignment	Resource-specific eligibility, verified capacity, scheduled delivery	Contested priorities, inflexible entitlements, discretionary denial
Joint capacity and common provision	Shared mandates, collective facilities, maintenance and reserve rules	Concentrated governance, exclusion, underfunded regeneration
Priority-based allocation	Agreed emergency, need, conservation, or other ranking principles	Disagreement over the legitimacy and interpretation of priorities
Reciprocal commitments	Provider-specific promises, reciprocal services, fulfillment records	Nonperformance, unbalanced risk, transferable credits becoming money-like
Adaptive production planning	Common resource information, production-dependency models, revisable schedules	Objective selection, forecast errors, model and data-governance power

Hybridization need not signal inconsistency. It can express differences in resource characteristics, institutional jurisdictions, and historical relationships among producers.

The comparison has at least four implications. First, the possibility of a nonmonetary transfer depends on legitimate rights of disposition as well as physical feasibility. Second, the relevant informational burden depends on the mechanism: a simple priority rule may require accurate classification of claimants, while an extensive interdependent plan calls for richer information and revisable coordination procedures. Third, commitments can provide a bridge across time while creating liabilities that require credible enforcement and dispute resolution. Fourth, nominally nonmonetary institutions can reproduce concentrated power through rule-making, admission, control of a bottleneck, or information infrastructure. Their normative evaluation consequently depends on more than the number of payment transactions they eliminate.

Comparison with monetary coordination must be conditional. A standardized payment instrument can facilitate exchanges among unrelated institutions with limited mutual information and heterogeneous commitments. Direct planning or shared provisioning may offer lower coordination costs when participants possess reliable common data, compatible resource mandates, and strong organizational continuity. Reciprocal promises may serve intermediate circumstances, especially where a limited community can verify future provision and manage defaults. The effective cost of each mechanism includes monitoring, infrastructure, environmental burdens, resolution of conflict, vulnerability to strategic behavior, and the distribution of risks. A fast allocation that depends on an unappealable authority may perform well on throughput while performing poorly under a legitimacy or anti-domination criterion. The choice of criterion is itself an explicit part of governance.

5.7 Relational Criteria for Institutional Substitution

These institutional differences can be examined without presuming a final metaphysics of value or AI consciousness. At the level of *ontological reality*, the ultimate status of subjectivity and value remains suspended. At the level of *relational reality*, feasible productive dependencies, claims on resources, delegated powers, mutual commitments, monitoring practices, and historically formed rules constitute the operative relations. At the level of *manifestation reality*, such relations appear through supply requests, inventory entries, priority rankings, rights registries, promised delivery windows, and records of completed service. A similar digital transaction may manifest either an ordinary market purchase or provision under a jointly governed entitlement. Its practical meaning depends on the deeper relation that confers authority and establishes the beneficiary.

The framework also calls for a longer temporal perspective. Allocating grain to a household has a present beneficiary; preserving seed grain and maintaining soil and machinery protect the conditions of future production. A system that fulfills immediate requests while degrading productive capacities can be technically successful over a short interval and deficient in regenerative terms. Conversely, a protective reserve may be materially prudent yet distributively contested when current claimants face urgent unmet needs. Eglash and collaborators' account of generative justice emphasizes the importance of value-producing communities' control over productive means and the circulation of benefits through

the conditions that make value possible [2]. The application to imagined AI production networks, the classification of allocation institutions, and the prospective mechanisms discussed here are interpretations developed in the present inquiry. They should not be attributed as existing results of that work.

The distinction between perceived fairness and institutional fragility matters for the viability of non-monetary resource coordination. A critical supplier that believes its contribution is being extracted may withhold cooperation or revise future commitments. The perception can affect production regardless of whether a fuller assessment would establish an injustice. At the same time, withholding may express a justified refusal of domination rather than opportunistic obstruction. An institution designed merely to compel the continuation of flow could preserve a transaction while undermining the legitimacy of the productive relation. Local explanation, accessible review, credible fallback supplies, proportionate safeguards, and governance procedures that allow affected parties to participate can support durable coordination without implying universal agreement on a single measure of fairness. The more complex dynamics of overlapping value circuits, normative disagreement, and localized monetary dissolution require the separate investigation reserved for the companion paper.

The result of this section is a conditional account of institutional substitution. Highly capable AI operators with reliable access to shared production information may allocate certain heterogeneous inputs through direct provision, collective capacity, resource-specific reciprocal commitments, and adaptive planning. These mechanisms remain subject to scarcity, time, authorization, contested priorities, incomplete foresight, and power over the rules of access. A diminished need for transferable money in one portion of the network can coexist with payment instruments elsewhere, including at interfaces between independently governed resource systems. The resulting plurality of institutions is a possible consequence of production relations rather than a contradiction of the stipulated technical development. The subsequent section examines how these forms may persist, recombine, or become monetary again as governance, information, and access conditions change through history.

6 Institutional Persistence and Monetary Reconfiguration

This section investigates the historical durability and possible reconfiguration of monetary institutions in production networks operated predominantly by highly capable artificial intelligence. Its objective is to explain why a technically available nonmonetary allocation mechanism may coexist with established payment practices, how resource claims may acquire or lose money-like functions, and under which conditions a network may reinstate monetary settlement after reducing its use. The discussion treats institutional arrangements as historically reproduced relationships among resource operators, claim holders, governing bodies, and beneficiaries. It proceeds through monetary persistence, localized substitution, coordination across differently governed networks, the effects of enhanced AI knowledge, the circulation of claims, and the interaction of trust and power. The argument is interpretive and conditional: no universal historical sequence or socially optimal monetary form is assumed.

6.1 Historical Reproduction of Monetary Relations

Money in the stipulated AI economy serves as an institutional means of coordinating access to productive resources, rather than a reward that presupposes continuing human labour. A warehouse may accept payment for grain, a transport operator may require a clearing asset before allocating freight capacity, and an energy supplier may receive transferable claims for future electricity. Such arrangements depend on recognized entitlements, records, expectations of acceptance, and procedures for resolving disputed obligations. AI labour competence can make the physical operations remarkably flexible while these institutional relationships continue to govern who may request, withhold, or transfer resources. The persistence of a currency consequently requires an account of reproduced rules as well as an account of technological feasibility.

Several sources of durability can be analytically distinguished. First, historical claims remain outstanding: loans, prepaid deliveries, reserve commitments, and obligations to parties outside a local pro-

duction community may be expressed in an established unit of account. Second, accounting conventions may be embedded in procurement protocols, risk assessments, legal documents, and operational infrastructure. Third, participants may prefer instruments with extensive acceptance histories, especially when counterparts have not formed a reliable shared governance relationship. Fourth, monetary balances can preserve discretionary purchasing capacity across uncertain future uses when specific resource entitlements are difficult to anticipate. These mechanisms may operate together, and the cost of reorganizing them varies by institution and resource.

Established institutional arrangements can become self-reinforcing through coordination complementarities. An operator trained to accept a widely recognized payment asset benefits from other operators accepting it, while additional acceptance can strengthen the incentive to retain the arrangement. Historical choices can thus shape the trajectory of available institutional alternatives. Arthur's model of increasing returns and technology adoption illustrates how early contingencies may influence later lock-in under specified assumptions [1]. The present application concerns possible analogical mechanisms in AI production networks; Arthur's model does not establish that any particular currency must remain dominant. Nor does historical durability establish normative legitimacy. An inherited payment protocol can be reliable yet distribute risks unequally, obstruct entry by resource-poor participants, or preserve a powerful intermediary's ability to condition access.

Institutional persistence must also be distinguished from stability of every transaction. A network may replace a payment service, revise its access rules, and retain a general unit of account; it may abolish a particular token while continuing transferable balances denominated in that unit. Conversely, a system might maintain a familiar accounting vocabulary after most actual resource movements have shifted to direct provision. The relevant analytical object is therefore a bundle of coordinating functions and powers distributed across institutions through time. Persistence is a property of the reproduction of those relationships, not merely of the continuous use of one material or digital instrument.

6.2 Monetary Functions across Production Domains

The projected AI economy need not have a uniform payment architecture. Production resources differ in perishability, location, substitutability, capacity requirements, and exposure to unexpected interruption. Governance arrangements also differ. A shared agricultural and food-processing facility might allocate routine grain and electricity internally through quotas and production schedules. Its transport contractors could hold service-specific claims under recurring reciprocal commitments. Purchases of rare materials from an independently governed extraction network might still require a highly accepted settlement asset. This diversity can persist even when all participating operators possess similarly general-purpose labour capabilities.

The spatial extent of an arrangement matters because obligations are defined within jurisdictions and relationships of authority. Within a jointly governed facility, an instruction to transfer rice may draw its force from common ownership or a provision mandate. At the boundary of that facility, an independent resource holder may have no obligation to accept the same instruction. Authority to use an item, information about its availability, and a justified expectation of delivery are distinct conditions. A widely accepted payment instrument can provide a practicable interface among actors who lack a common institution for allocation. A federated network of resource commitments can provide a different interface if participants recognize each other's rights, assurance arrangements, and methods of dispute resolution.

Time creates a further differentiation. Short-horizon emergency distribution may rely on predetermined priority and rapid physical dispatch. Recurrent maintenance can rely on long-term reciprocal obligations. Large, uncertain investments in energy generation may involve claims extending over many production periods. A currency or general purchasing claim is one candidate way to bridge these temporal gaps, but compatible planning, insurance pools, long-duration resource entitlements, and contingent service commitments are alternatives within suitable institutional environments. The question is which mechanisms can remain feasible when future resource availability and the actions of multiple operators

are uncertain, and which parties legitimately bear that uncertainty.

The monetary character of an arrangement should be assessed by its practical functions. A digital record of rice delivery is not thereby a currency. A claim redeemable for a specified quantity of rice by a designated provider remains resource-specific unless its acceptance and transfer practices become broader. A transferable balance used repeatedly to discharge unrelated obligations can acquire money-like characteristics even if its issuer calls it a credit, a contribution certificate, or a community voucher. Section 4 distinguished units of account, media of exchange, means of payment, settlement finality, intertemporal purchasing capacity, and credit. Their separation allows institutionally different regions of one production system to display different degrees and forms of monetary coordination.

6.3 Institutional Interfaces between Production Networks

Consider a common agricultural network $\mathcal{A}$, an energy network $\mathcal{E}$, and a logistics network $\mathcal{L}$. The symbols designate groups of facilities and operators subject to distinct governance arrangements, rather than independent conscious beings or presumed legal persons. Internally, $\mathcal{A}$ may assign harvest quantities to food processors under agreed entitlements, while $\mathcal{E}$ schedules electricity among its production units and $\mathcal{L}$ allocates vehicle slots through shared operational planning. Each network may maintain resource accounts without circulating a generally transferable medium among its internal operators.

The interface between $\mathcal{A}$ and $\mathcal{E}$ can be managed through a long-term electricity-for-grain agreement, a jointly governed energy reserve, or an account payable in a common settlement asset. A different interface between $\mathcal{A}$ and $\mathcal{L}$ may use verified transport commitments. Consequently, the network's monetary boundary need not coincide with its technical production boundary. It depends on the scope within which entitlements are recognized and obligations can be reliably coordinated. New joint governance rules may extend direct provisioning across a former monetary interface; the dissolution of trust in an existing partnership may move an interface back toward priced exchange or prefunded settlement.

Interconnection can sometimes reduce the need for gross transfers of payment assets. If multiple obligations are denominated compatibly, mature at mutually agreed times, and are legally or institutionally eligible for setoff, multilateral clearing may discharge some obligations through offsetting positions. The balance relation introduced in Section 4 concerns this limited accounting operation. Material inputs still have to be produced and delivered. A verified clearing result is not proof of fulfilled agricultural, energy, or transport commitments, and the cancellation of a debt does not establish that the benefits of production have returned fairly to their contributors. These additional relations require their own evidence and governance rules.

An extended production network might combine several partly overlapping clearing groups, shared inventories, direct entitlements, and external payment channels. One set of AI operators may participate in multiple groups simultaneously; obligations recognized in one group may lack transferability in another. Requiring complete global institutional uniformity would obscure these heterogeneous interfaces. The analytical possibility examined here is more modest: local payment functions can diminish where resource coordination is adequately organized, while other interfaces retain or later reintroduce money. The precise topology of overlapping circuits, including recursive subcircuits and temporal dependencies, is a distinct object of the proposed generative-grammar study.

6.4 Shared Information and Institutional Substitution

A particularly favorable counterfactual combines near-universal AI labour with widespread access to verified production data and powerful methods for reconstructing dynamic relations. Operators might estimate the availability of grain across regions, anticipate electricity bottlenecks, trace input dependencies, and coordinate schedules among many otherwise independent facilities. These capacities can lower the informational and operational burden of direct allocation, reciprocal commitments, and multilateral clearing. They could therefore make nonmonetary institutional arrangements practical at scales where historical human planning faced serious limits. The argument is one of expanded feasible choices, conditional on data quality, institutional compatibility, model performance, and reliable execution.

The informational role of money can be compared cautiously with existing monetary theory. Kocherlakota shows, for a particular class of economic environments, that memory of relevant trading histories can reproduce allocations achievable with money [8]. Kocherlakota and Wallace examine optimal payment arrangements when public records are imperfect and updated with a lag [9]. These results support the analytical importance of informational conditions for payment institutions within their explicit models. Neither proves that a shared database alone can eliminate money in an AI economy. A record may show that electricity is available without granting access rights; it may reveal a credible previous promise without authorizing its transfer to another party. A model may predict the consequences of a decision without determining the fair rule by which that decision should be made.

Advanced AI can nevertheless improve the practical administration of nonmonetary alternatives. It may detect overlapping demands before promised capacity is exhausted, recommend a revised schedule, locate substitute materials, or alert affected participants when an allocation conflicts with a prior commitment. Distributed planners might exchange constraint summaries rather than disclose the entire underlying dataset, preserving restrictions on privacy and sensitive infrastructure. Such designs can increase observability and responsiveness while also requiring scrutiny of who controls model training, data certification, permissible objectives, and emergency overrides. Better epistemic capacity can help expose hidden dependencies; concentrated control over the epistemic infrastructure can also create new governance power.

Even an AI system with exceptional predictive capacities remains situated within an evolving economy. Production decisions can alter future supply, participants can learn and revise strategies, and institutions can change the meaning of an entitlement. In addition, fair treatment may be contested when participants adopt different normative or aesthetic evaluations of contribution, need, autonomy, and historically accumulated obligations. These challenges place limits on the inference from superior prediction to accepted coordination. An adaptive institution needs procedures for revising assumptions, explaining decisions, identifying mistakes, and contesting imposed risks. The feasibility of nonmonetary allocation thus has both computational and political dimensions.

6.5 Transferable Claims and Local Monetary Emergence

A nonmonetary arrangement can generate claims that gradually acquire a wider economic role. Suppose an agricultural cooperative promises one unit of future grain processing to an energy network in return for current electricity. Initially, the promise has specified parties, a specified productive service, and a specified redemption procedure. The energy network may wish to pass the claim to a logistics provider that can use grain processing more directly. If transfer is authorized, the recipient is sufficiently confident in redemption, and subsequent providers also accept comparable claims, the instrument's scope can expand. Common denomination and broader acceptance can make such claims convenient for settling otherwise unrelated obligations. Repetition of these practices may generate a money-like instrument.

This is one candidate historical pathway, not an inevitable progression. Transfer restrictions, issuer-specific redemption, claim expiry, governance limits, or effective direct coordination can preserve the specificity of a commitment. A widely accepted instrument may also remain a narrow payment token if it never becomes a stable unit of account or an effective store of purchasing power. Likewise, the presence of a common valuation unit does not establish circulation of a general exchange medium. Distinguishing these functions prevents an overly simple account in which every transferable record is called money or every redeemed credit is counted as monetary disappearance.

The opposite transition is also conceivable. A network that previously required general payment may adopt common production capacity, resource-specific entitlements, and validated reciprocal provision. Outstanding balances can be honored or discharged according to agreed procedures while later allocations rely on direct provisioning. A unit of account may survive for comparing alternative uses, even after separate payment transfers disappear from selected production activities. Monetary dissolution, within this local meaning, concerns the diminishing necessity of a payment relation for the relevant resource movements. It does not follow that past claims have ceased to exist, that all debt has vanished, or that

Table 5: Conditional reconfigurations of monetary coordination in AI production networks

Transition	Operative condition	Primary unresolved issue
Local payment substitution	Recognized direct entitlements and adequate productive capacity replace settlement on specified internal transfers	Legitimate priorities, shortfalls, and preservation of future capacity
Multilateral clearing	Compatible, eligible obligations can be offset under a binding settlement rule	Finality, nonperformance, and claims outside the clearing group
Federated commitments	Separately governed networks recognize resource-specific promises and dispute procedures	Contested authority, transfer limits, and shared contingency reserves
Reappearance of transferable claims	Claims circulate beyond their initial counterparty and gain broader acceptance	Issuer risk, information asymmetry, and concentration of redemption power
Renewed monetary settlement	Uncertainty, disrupted trust, or independent jurisdiction makes a widely accepted payment asset comparatively useful	Liquidity access, distributive exclusion, and governance of the payment interface

every relation of power over the resources has been transformed.

Table 5 provides a comparative classification of several possible transitions. The table distinguishes changes of monetary function from changes of institutional authority; each trajectory is conditional on actual acceptance rules, enforcement practices, and material feasibility.

The table establishes no ranking of institutional desirability. Its purpose is to identify the conditions under which a relation may be transformed. A monetary instrument could reappear after a supply disruption because counterparties seek a transferable means of obtaining backup services. It could also reappear because a dominant operator successfully imposes its preferred settlement standard, despite the availability of other arrangements. The first mechanism emphasizes uncertainty management; the second emphasizes the historical distribution of power. Whether reappearance is beneficial, exploitative, or both in different respects must be argued within the particular institutional setting.

6.6 Trust, Refusal, and the Fragility of Production Circuits

The reliability of a resource circuit depends on participants' continuing willingness and ability to perform their roles. One critical energy operator may be necessary for agricultural processing, while a logistics provider may control the only immediately available route to a food-distribution facility. If that participant anticipates unfair treatment, exploitation, or unrecognized risk, it may refuse a new commitment, demand stronger assurance, or invoke a contractual right of suspension. Its evaluation may rest on incomplete information or contestable normative standards, yet the resulting interruption can have real productive consequences. The distinction between perceived unfairness and established injustice is therefore analytically necessary, while the causal efficacy of a perception must also be recognized.

A circuit's vulnerability depends on alternative paths, stored inputs, synchronization requirements, time-to-recovery, enforcement rules, and the concentration of operational control. A graph-theoretic cycle can be closed in a static representation while its constituent deliveries remain temporally infeasible. A network may contain many apparent alternative paths that depend on the same vulnerable power facility. Even perfect knowledge of recorded commitments cannot remove physical limits or ensure future cooperation. More advanced AI may improve counterfactual planning, identify bottlenecks, and design redundancy, but it cannot legitimately define all dissent as malfunction. Refusal may represent justified resistance to an extractive arrangement; compulsory continuation of circulation might preserve throughput while intensifying domination.

Monetary settlement can sometimes address a portion of this fragility. An operator uncertain about receiving a reciprocal service may prefer immediate payment in a broadly accepted asset. A pre-funded reserve may secure essential purchases during a dispute, and a recognized clearing institution can provide enforceable settlement procedures. These responses distribute risks differently and may introduce new dependencies on payment infrastructure. Other responses include resource buffers, independent verification, transparent revisions of mutual obligations, legitimate adjudication, and diverse supply paths. The relevant normative question is whether the institutional response supports non-extractive cooperation

with credible protection for participants and beneficiaries.

The relation between judgment and trust has a reflexive aspect. An operator's interpretation of fairness affects its willingness to commit; the resulting allocations shape future experiences; those experiences affect subsequent judgments. Competing normative and aesthetic standards can generate divergent appraisals of the same flow of materials. A common dataset may reduce factual misunderstandings yet still leave disputes about entitlement, contribution, or the responsibilities of a governing body. Durable circuits therefore need accountable procedures for explaining and challenging decisions. The separate companion inquiry on distributed monetary dissolution will examine overlapping circuit structures, non-linear feedback, and trust-dependent interruption in greater detail. The present discussion identifies their role in institutional persistence and reconfiguration.

6.7 Power over Institutional Boundaries

A further source of historical change lies in the distribution of authority over resource interfaces. An operator capable of excluding others from grain storage, certifying transactions, revising allocation algorithms, or controlling admission to a production consortium may influence the form of coordination chosen by the network. Dispersed physical production does not necessarily imply dispersed institutional power. An apparently nonmonetary system can concentrate rule-making and informational authority, while a monetary system can offer participants flexible access across multiple suppliers. Conversely, a payment intermediary can also become a site of exclusion, surveillance, or extraction. The normative significance depends on the actual powers and their contestability.

Resource-rights analysis distinguishes the powers to access, withdraw, manage, exclude, and alienate resources [13]; legal-analytical distinctions among claims, liberties, and powers provide additional precision [6]. These concepts support the observation that a change in payment format does not by itself redistribute authority to determine resource use. Ostrom's work on polycentric governance supplies a relevant comparative framework for multiple centers of rule-making and monitoring [12]. The application to hypothetical AI networks remains a proposal: the existence of multiple nodes does not guarantee balanced power, procedural justice, or resilient allocation.

Power may be constrained through several different processes. Short-term countervailing capacities can limit unilateral suspension of essential services; longer-term diversification of infrastructure can reduce dependence on one operator; and revision rights, accountability, and equitable participation can reshape the conditions under which the network reproduces its own authority. Such arrangements may be described provisionally as instantaneous, spatiotemporally distributed, and generative forms of balancing. A distinct possibility concerns the gradual dissolution of specific domination relations through substitutable paths, revocable delegations, and shared control over critical interfaces. These ideas concern the distribution of authority, not the mathematical cancellation of a transferable scalar quantity. Their formal development belongs primarily to the companion investigation of value circuits and power.

An institutional history of currency in AI production must consequently include the possible movement of power across its organizational layers. A group might reduce currency transfers while increasing dependence on a shared planning service. A federation might replace central planning with local resource rights yet develop an influential common certification authority. The economic merits of each structure depend partly on material performance and partly on norms of consent, participation, accountability, and remedy. This distinction is consistent with a conditional interpretation of the disappearance of monetary forms: eliminating a payment instrument may change the manifestation of economic coordination while leaving deeper resource and governance relations substantially intact.

6.8 Relational Dynamics of Monetary Reconfiguration

The persistence and transformation of money can be examined as a historically situated interaction among production conditions, claims, institutional rules, and the forms through which agents recognize those relations. At the level of *ontological reality*, questions about the ultimate status of value or AI subjectivity remain suspended. At the level of *relational reality*, facilities, rights of disposal, credit obligations,

shared protocols, trust relations, and power over institutional interfaces have practical and generative effects. At the level of *manifestation reality*, those relations appear through inventory assignments, prices, digital balances, resource vouchers, clearing records, and authorizations. A reduced volume of monetary entries can indicate genuine institutional substitution, a shift toward hidden reciprocal obligations, or a reclassification of claims whose economic functions remain similar.

Within this approach, the persistence of currency and the persistence of productive capacity are different outcomes. A production network might eliminate the need for internal monetary transfers while depleting soil, exhausting reserve capacity, or denying legitimate claims by vulnerable beneficiaries. Another network might continue using a currency while directing resources toward maintenance, ecological renewal, and reliable provision. A provisional criterion for evaluating monetary reconfiguration therefore examines whether affected creators and their productive conditions can be sustained, whether institutional decisions are justifiable to relevant participants, and how the system allocates risk and the power to revise rules. The later examination of generative value draws critically on Eglash and collaborators' account of non-extractive circulation and control over productive conditions [2]. The AI-specific institutional pathways articulated here remain the present study's theoretical extension.

The historical possibilities are accordingly plural. A currency can persist because independent operators value a common settlement interface. Specific money functions can diminish as information, recognized entitlements, and shared production capacities expand. Resource-specific credits can acquire broader acceptability and become money-like. A formerly nonmonetary domain can resume monetary settlement following a shock, an institutional split, or a shift in power. These changes may occur in different regions and periods of the same AI production network. The analysis supports a conditional account of monetary institutional change while reserving the detailed geometry, recursive structure, and normative stability of distributed value circuits for a separate study. The following section will examine more directly the criteria by which such institutional changes can support or undermine the continued regeneration of productive relations.

7 Generative Value, Economic Power, and Resource Regeneration

This section develops a provisional normative assessment of monetary and nonmonetary coordination in a production economy operated predominantly by highly capable artificial intelligence. Its object is the continued availability of the conditions through which productive activity becomes possible, rather than the selection of an optimal payment technology alone. The analysis first distinguishes the creation of productive benefits from the recognition and attribution of contributions, then considers resource regeneration, powers of control, normative disagreement, and institutional learning. It concludes by identifying criteria for assessing monetary coordination when labour execution has largely migrated into AI-to-AI relations. The method is philosophical and institutional, with resource-accounting observations serving as constraints on normative proposals. Neither a unique measure of value nor a settled account of AI moral or legal personality is presupposed.

7.1 Value Generation and the Attribution of Productive Contributions

Under the stipulated counterfactual, artificial agents perform nearly all operational labour. An agricultural AI oversees cultivation, a logistics AI organizes distribution, and an energy AI manages electricity provision; each may possess the competence to perform many tasks normally associated with the others. Their actual productive contributions depend on access to different sites, resources, commitments, technical installations, and authorization arrangements. The value associated with a delivered meal therefore arises through several relations: the conversion of materials, the maintenance of capacity, the availability of collectively produced knowledge, the reliability of delivery, and the conditions that permit consumption. A particular output has an identifiable physical history while its socially recognized significance depends on institutional and evaluative judgments.

The expression *generative value* is used here as a preliminary analytical term for benefits and capacities that emerge through productive relations and help sustain or expand subsequent possibilities for valuable activity. It includes a temporal dimension that a one-off exchange may overlook. For example, supplying grain to a food processor can satisfy a present request, while seed preservation, soil care, equipment repair, and maintenance of energy reserves affect subsequent production. The different contributions need not share a natural scalar unit of worth. A quantity of harvested rice, an improvement in soil fertility, the reliability of a storage system, and the availability of a justified procedure for allocating emergency supplies are heterogeneous objects of evaluation. Their possible interdependence does not establish that they can be uniquely priced or that one institution should aggregate them into a single objective.

Eglash and collaborators' account of generative justice supplies an important normative interlocutor. Their discussion of unalienated circular value flow concerns support for value generators' control of productive conditions, protection against extraction, and the circulation of benefits through the human and non-human communities participating in value creation [2]. That argument addresses histories of labour injustice, ecological injury, and social degradation. The present paper draws from its concern with the reproduction of value-generating conditions while extending the question to a hypothetical system of predominantly AI-operated productive work. The AI-specific attribution problems, institutional comparisons, and account of monetary persistence developed here belong to the present inquiry; they are not findings ascribed to Eglash and collaborators.

A difficulty of attribution follows from joint production. The agricultural facility's output may depend on public research, soil microorganisms, watershed management, human-designed institutions, previous generations of infrastructure, and the services of multiple AI operators. Assigning all productive value to the last operator in a supply chain would treat the visible moment of delivery as though it exhausted the relevant history. Dividing the result equally among immediately connected AI nodes would introduce a different, equally substantive judgment about contribution. A contribution-sensitive allocation can use marginal effects, replacement costs, negotiated responsibilities, or other proxies, but each choice depends on the relevant counterfactual and the boundaries of the productive system. For activities with complementarities or threshold dependencies, the contribution assigned to one node may change greatly when the assumed presence of other nodes changes.

The *creator* should therefore be interpreted with care. In an operational model, the AI responsible for an action is a productive contributor and possible recipient of assigned resources; a sponsoring organization, the humans served, and the ecological conditions enabling production may carry different claims or governance responsibilities. Whether a particular AI also possesses interests that warrant independent moral consideration remains open. Under ontological suspension, assigning maintenance resources to an AI-operated facility can be justified by its function in continued production without silently granting its software agent independent legal ownership or moral personality. Conversely, functional competence cannot alone extinguish claims arising from human, communal, or ecological contributions.

7.2 Regeneration of Productive and Ecological Conditions

Continued productive possibility depends on a set of material and institutional conditions that cross the boundaries of individual transactions. A grain allocation may remove stock from a warehouse while reducing the available seed reserve. An energy allocation may satisfy an immediate heating requirement while increasing load on a system requiring later repair. A logistical plan may maximize present deliveries at the expense of wear, resilience, or the restoration of a damaged habitat. These examples distinguish present throughput from the future capacity of a network to meet legitimate claims.

The resource constraints introduced in Section 2 can be interpreted at different time horizons. Physical availability concerns the stock and flow of a resource at a given interval. Regenerative viability additionally concerns the conditions governing its replacement, recovery, and safe use in later intervals. The corresponding constraints differ by resource. A warehouse can replenish grain from a future harvest, whereas an impaired watershed may recover slowly and some extracted materials may be practically

nonrenewable at relevant planning horizons. An AI network with high labour versatility can improve recovery, substitution, and monitoring, yet those capabilities operate within physical and ecological limits. Shared production data may make such limits more observable without eliminating the need for decisions about acceptable risk, prioritization, and long-term stewardship.

A generative assessment should distinguish at least three relations. First, an immediate transfer fulfills an authorized request. Second, the transfer changes the productive and ecological conditions through which later requests can be fulfilled. Third, the transfer modifies institutional expectations, obligations, and powers that influence subsequent cooperation. The relations can reinforce one another or produce tensions. Maintaining a food reserve may improve future reliability while restricting present access; dedicating energy to restoration may compete with emergency demand; investing in a shared production facility may increase aggregate output while concentrating authority over admission. A claim that a circulation arrangement is generative consequently requires an explicit horizon, a specified set of affected parties, and reasons for the prioritization of competing goods.

The relevant return of value is also plural. A facility may receive replacement parts, the watershed may receive a legally supported restoration commitment, a knowledge-maintenance collective may receive continued access to research infrastructure, and human beneficiaries may receive dependable provision. Some returns are resource transfers; others are protections, decision rights, risk-sharing commitments, or restoration of the conditions required for future production. Such differences matter because the monetary receipt assigned to a current operator may fail to track improvements or losses borne elsewhere. Conversely, a monetary system with well-designed maintenance obligations, ecological liabilities, and participatory controls might contribute to regenerative continuity. The presence of a monetary medium is therefore neither a direct measure of extraction nor a direct measure of generative success.

A further complication concerns irreversible harm. If an ecological threshold is crossed, later transfers of money or credits may be unable to recreate the damaged relation within the relevant time horizon. A productive network can satisfy its financial accounts and still experience cumulative losses of fertility, biodiversity, infrastructure reliability, or institutional legitimacy. This establishes a reason to examine protected reserves, maintenance duties, monitoring, and precaution where irreversible losses are plausible. It does not by itself determine the precise level of protection: thresholds, uncertainty, affected interests, and the authority to set them remain objects of justified disagreement.

7.3 Overlapping Circuits, Shared Contributions, and Fragile Return

This subsection qualifies the preceding account of productive regeneration by considering how any given facility may participate in multiple circulations of resources and claims. The four-node circuit in Figure 1 is a constructed subset of a wider network. A grain-producing AI may receive power from several energy systems, provide inputs to multiple processors, participate in shared water management, and depend upon repair facilities whose output serves many other producers. Different circuits may therefore share facilities, infrastructure, credit exposures, and ecological conditions. A value-return judgment made for one selected circuit may overlook contributions outside its boundary or count the same enabling contribution repeatedly.

For a finite static network, the number of *simple directed cycles* is finite, although their enumeration may be very costly. When repeat visits to nodes and the composition of subcircuits are permitted, a network containing a reachable cycle may generate infinitely many distinct closed walks. These are mathematical properties of the selected representation. They do not imply infinitely many separate units of value, nor do they establish that every represented walk is temporally feasible. A time-respecting economic circuit must additionally account for production lead times, resource capacities, commitment maturity, losses, and the compatibility of decision rights.

Even a circuit that supports production materially may remain institutionally fragile. If an operator interprets its allocation as unfair, it can reassess future commitments, restrict access, demand settlement safeguards, or leave a voluntary cooperative arrangement. The interpretation of unfairness may be mistaken, partly justified, or itself dependent on disputed normative and aesthetic standards. Such

perceptions still have practical consequences. Equally, an interruption may be justified resistance to an extractive rule; treating uninterrupted throughput as the overriding objective could conceal that wrong. Network resilience therefore concerns the continued possibility of *justifiable* cooperation, review, substitution, and regenerative support, rather than compulsory performance by every node.

The optimistic cognitive premise remains significant here. Given sufficiently rich shared production data, advanced AI systems may identify important interdependencies, estimate bottleneck risks, simulate local withdrawals, and propose alternative routes without exhaustively listing all closed walks. Such technical progress can reduce some uncertainty over material contributions. Disagreement about what a contribution deserves and who is entitled to settle a dispute remains an independent institutional problem. Detailed accounts of recursive circuit grammar and the stability conditions of distributed monetary dissolution belong to the companion studies. The present argument requires the more modest conclusion that a monetary or nonmonetary coordination mechanism must be evaluated against an overlapping, changing network rather than a single idealized closed loop.

7.4 Claims, Entitlements, and the Return of Value

The phrase *return of value to its creators* requires a theory of entitlement. Productive contribution, causally necessary involvement, legal ownership, responsibility for maintaining productive conditions, and need are distinguishable grounds for resource allocation. A producer may have a valid claim to inputs for continuing operation without owning the final product. An ecological caretaker may have a maintenance mandate without enjoying a freely transferable monetary entitlement. A human beneficiary may have an enforceable claim to basic provision despite performing no labour in a predominantly AI-operated economy. The relation between contribution and entitlement is mediated by institutional commitments and normative reasoning.

Schlager and Ostrom distinguish resource-related rights of access, withdrawal, management, exclusion, and alienation [13]. Their conceptual classification helps isolate the difference between delivering a resource and authorizing decisions about its future disposition. A grain-processing AI may receive a recurring withdrawal allowance while the rules governing renewal, transfer, and exclusion remain under a separate collective authority. The separation can protect common resources, but it can also expose the operator and beneficiaries to discretionary denial. Recognition of value-generating contributions therefore requires attention to the distribution of operational access and the power to revise the rules determining access.

The classical legal-analytical distinctions associated with Hohfeld help specify whether a participant possesses a claim against another party, a liberty to act, a power to alter an institutional relation, or immunity from another party's unilateral alteration [6]. These distinctions are useful even when the AI operator itself lacks independent legal personhood, because an organization or human principal can be the legal holder of the corresponding position. A digital platform may display a nominal resource balance, yet the effective entitlement depends on who may redeem it, suspend it, challenge a denial, or change its governing protocol. Return of value through a ledger entry is incomplete if the resource or protection promised by that entry remains unavailable under the operative rules.

At least three bases for allocation may accordingly need to coexist in a complex network: support for productive contributions, assurance of essential needs or publicly recognized priorities, and maintenance of shared generative conditions. Conflict among these bases can occur even with extensive data transparency. For example, an energy supplier may claim compensation for maintaining emergency reserve capacity; a hospital may invoke priority for urgent demand; a watershed authority may restrict extraction to protect future users. Resolution requires institutional judgment concerning duties, consequences, rights, and acceptable losses. There is no reason to assume in advance that a general price, a contribution score, or a single AI planner will provide a normatively complete answer.

This observation bears directly on currency. A transferable monetary claim can coordinate access among parties who hold different goods and do not share a comprehensive allocation charter. A resource-specific entitlement can instead attach access to a defined purpose, need, or stewardship duty. Both

can implement justifiable rules, and both can reproduce exclusions. A meaningful comparison asks whether the institutional form recognizes relevant contributions, sustains the required material and social conditions, and offers credible recourse when promises fail. The mere replacement of payments with credits or direct allocations is a change in coordination form whose normative significance remains to be determined.

7.5 Economic Power over Productive Interfaces

Economic power in the stipulated AI network can be approached as a relational capacity to influence other participants' feasible actions, claims, and institutional options. Material bottlenecks provide one source of such capacity. A producer may control the only available supply of grain in an area, a transport operator may control the route to a hospital, and an energy network may control the reserve required to stabilize refrigeration. These are capacities arising from resource and infrastructural relations, rather than from comparative ability to carry out labour tasks. An AI's general competence to perform alternative tasks may reduce reliance on specialists while leaving dependence on particular sites and scarce inputs intact.

Authority over procedures provides another source of power. Participants may share resource inventories while one institution retains unilateral discretion to revise admissibility criteria, alter priority rankings, restrict access to records, or certify which promises have been fulfilled. A nonmonetary allocation network may therefore depend on a protocol operator as strongly as a monetary network depends on a payment intermediary. Conversely, a participant possessing general purchasing power may have meaningful options among alternative providers, although high concentration in markets or payment infrastructures can also narrow these options. Neither a shared database nor the absence of a currency establishes the distribution of effective bargaining or governance power.

Foucault's relational treatment of power provides a philosophical point of comparison for examining influence among situated actors [3]. The present paper uses this comparison to motivate attention to practices, decision structures, and possibilities for response. It does not infer a specific metric of AI economic power from Foucault's analysis. Ostrom's work on polycentric governance likewise supplies a comparative institutional perspective on multiple centers of rule-making and monitoring [12]. Its relevance lies in the possibility of organizing resource institutions without assigning all authority to a single center; empirical or normative success within the hypothetical AI economy remains unestablished.

A preliminary examination of power in generative terms may distinguish three temporal scales. At a given instant, one can ask whether an operator can unilaterally suspend essential access. Across longer spatial and temporal intervals, one can ask whether alternative supplies, mutual obligations, and rights of review reduce recurrent dependence on the same gatekeeper. Across the reproduction of the network, one can ask whether participants preserve capacities to create, maintain, challenge, and revise the institutional conditions of production. These descriptive scales can inform, but cannot replace, a normative evaluation. Equal veto capacities might produce stable mutual blockage. Temporary asymmetric authority might be defensible in a declared emergency when bounded by justification, review, and expiry. Such examples show why symmetry of immediate bargaining positions is insufficient as a criterion of generative justice.

A distinction is also required between opportunistic obstruction and justified interruption. An operator might restrict deliveries to extract benefits from a dependent counterpart; another might suspend extraction when deliveries would violate an environmental limit or sustain an abusive rule. Both interruptions affect network throughput. Their normative standing depends on claims, duties, available alternatives, procedural protections, and the consequences for affected parties. A governing structure that compels uninterrupted circulation through every node may improve a short-term flow statistic while authorizing a durable form of domination. Any attempt to reduce dependence on currency should consequently address the legitimacy of resource-disposal powers as well as the operational reliability of the proposed alternative.

7.6 Fairness Appraisal and Normative Disagreement

Fair allocation in an AI-operated economy is unlikely to follow directly from complete knowledge of production quantities. Judgments concerning contribution, need, reciprocity, ecological priority, and historical responsibility differ in their normative premises. Some comparisons involve aesthetic appraisals of balanced or beautiful relations; others rely on legal duties, distributive principles, ecological concerns, or procedural commitments. The present analysis leaves open whether there is an ultimate ordering that encompasses these evaluations. It treats them as practical objects of justification, disagreement, and institutional learning.

The characterization of an AI node as *perceiving unfairness* requires a carefully limited interpretation. Under the counterfactual, AI systems may evaluate transactions against programmed, learned, or institutionally authorized criteria and adjust their cooperation when those criteria indicate unacceptable treatment. This is sufficient for modelling changes in compliance, withdrawal, renegotiation, and trust-like expectations without assuming that the system possesses conscious feelings or moral standing. Its evaluation may be inaccurate, incomplete, strategically expressed, or based on a coherent but contested criterion. A local judgment of unfairness is thus causally significant even when a wider assessment would not substantiate the alleged injustice. The corresponding observation is equally important: a satisfied participant can coexist with significant harms to absent contributors or future beneficiaries.

Normative disagreement becomes an economic problem because judgments influence commitments. A participant facing repeated unexplained exclusions may demand stricter guarantees or shift resources to alternatives. The receiving networks then change their production plans, thereby altering future experiences and assessments. Shared global production data and improved AI inference could reduce many factual disputes, expose hidden interdependencies, and support more responsive revisions. They would not by themselves determine which norm merits authority or how a dissenting party should be treated. The power to set objectives, decide which values to measure, and update the model producing recommendations remains part of the governance relation.

A procedurally credible institution can therefore serve as a condition for sustained coordination. Possible elements include explicit allocation rationales, visibility of affected contributions, justified priority rules, challenge and revision mechanisms, temporary protection against irreversible loss, and opportunities for relevant beneficiaries to contest decisions. These are candidate arrangements rather than a universal institutional prescription. Participation and appeal can carry costs, produce delay, or create strategic opportunities for obstruction. Their appropriate form depends on how risks, urgency, and decision powers are distributed. The more extensive question of trust-dependent failure in recursively overlapping value circuits belongs to the separate investigation of distributed monetary dissolution; its significance here is to show that the stability of a coordination medium rests partly on the broader legitimacy of production relations.

7.7 Epistemic Capacity and Institutional Learning

The optimistic AI counterfactual warrants more attention than an appeal to the familiar imperfections of centralized planning. The stipulated economy permits highly capable systems to share relevant production records across much of the network. Given sufficient technical development, such systems might infer complex dependencies, identify vulnerable supply paths, model counterfactual production plans, and coordinate commitments more effectively than historically available human institutions. These capabilities could improve the practical feasibility of resource-specific entitlements, common facilities, and adaptive provision without general-purpose monetary settlement. The assessment remains conditional on data integrity, computational resources, actionable rights, model quality, and the institutions through which recommendations are accepted and executed.

The more ambitious claim that AI could recognize every economically relevant circuit is unnecessary for this argument. Even a powerful system can face changing relationships, strategic concealment, model misspecification, and irreducible uncertainty about future events. Different representations of the same network may also identify different “contributors” because the selected unit of analysis changes.

Table 6: Provisional criteria for evaluating resource coordination in AI-operated production networks. The criteria require context-specific justification and do not imply a unique aggregate welfare measure.

Dimension	Assessment question	Characteristic institutional risk
Material continuity	Can essential production and maintenance inputs remain available across relevant time horizons?	Short-term throughput purchased through depleted reserves or fragile infrastructure
Value return	Do benefits, protections, and productive means reach relevant generators and beneficiaries?	Benefits concentrated at a narrow transaction interface while distributed contributors bear costs
Resource authority	Are powers to allocate, exclude, revise, and contest use arrangements defensible?	Persistent bottleneck control, opaque priority setting, or lack of meaningful remedy
Epistemic accountability	Can participants examine material assumptions and challenge consequential classifications?	Inaccurate models, hidden data exclusions, or concentration of certification power
Adaptive resilience	Can rules, supplies, and responsibilities adjust to shocks and justified refusals?	Cascading disruption, coercive continuity, or inflexible commitments

A model of physical supply can treat a watershed as a background constraint; a regenerative model may treat its maintenance as an explicit joint production requirement. Improved information does not eliminate the normative importance of selecting and revising the representation through which the system is understood.

Institutional learning should accordingly include the revision of both predictions and authorized goals. A production plan can be tested against realized delivery, resource recovery, maintenance failures, disputed allocations, and the distribution of burdens across participants. A rule that initially coordinates effectively may become less defensible when technology changes, supplies become geographically concentrated, or previously overlooked ecological conditions become visible. A stable institutional arrangement needs methods for detecting such changes and reallocating decision authority where warranted. The relevant learning process thus has technical, social, and normative dimensions whose relative importance varies across domains.

There is also an epistemic dimension to domination. A common data architecture can disperse information asymmetries among operators, yet concentrate authority in those who define the ontology of the database, control computation, or certify legitimate recommendations. The prospect of better AI cognition can therefore support monetary substitution and simultaneously generate new institutional dependencies. Assessing these possibilities requires examining the provenance, contestability, and reversibility of resource models and priority algorithms, rather than interpreting high predictive accuracy as proof of just governance.

7.8 Criteria for Generative Institutional Assessment

The preceding analysis suggests a set of provisional questions that can guide comparisons among monetary and nonmonetary institutions. Table 6 identifies five dimensions whose application depends on the concrete resource domain, temporal horizon, and relevant parties. They are criteria for deliberation and comparative inquiry, not empirically calibrated indices or universally commensurable components of a scalar objective.

These criteria can illuminate the competing merits of different coordination technologies. A monetary network may offer flexible access to heterogeneous suppliers and a widely accepted settlement interface, while its outcomes depend heavily on initial claims, price-setting power, and whether ecological maintenance receives effective support. A common-production arrangement may secure essential inputs and make resource recovery a direct governance objective, while concentrating discretion in those who control membership or production priorities. Reciprocal commitments may support visible, long-

term relationships, while exposing participants to mismatched performance risks and the reappearance of transferable money-like claims. An AI planning network might produce valuable coordination gains from shared data, while increasing dependence on the authority of its model and the legitimacy of its objective functions. Each mechanism can be improved or distorted by arrangements external to its accounting form.

At the level of *ontological reality*, the inquiry suspends a final account of the nature of value and the consciousness or ultimate moral status of AI systems. This suspension does not settle the normative status of humans, other living beings, or shared ecological systems by inference from operational roles. At the level of *relational reality*, production dependencies, rights of access, obligations of maintenance, bargaining capacities, governance practices, and histories of cooperation constitute processes capable of changing future productive possibilities. At the level of *manifestation reality*, price records, resource quotas, ledger balances, performance scores, permits, and publicly stated allocation rationales render selected aspects of those relations accessible. These forms can influence the relations they represent when actors use them to make future decisions. A reduction in monetary balances could therefore signify genuine structural substitution, a shift of obligations into less visible arrangements, or a change in the labels applied to money-like instruments.

The normative implications of money's persistence are consequently conditional. Extensive AI labour reduces the relevance of human task performance as a necessary basis for production, while leaving questions of resource control, entitlement, generative contribution, and governance intact. Monetary exchange may be useful where reciprocal obligations are weakly integrated, intertemporal claims are uncertain, or independently governed networks require a general settlement interface. Nonmonetary coordination may become more workable where rights, shared information, adaptable commitments, and justified priorities permit direct allocation. Their comparative success requires inquiry into value return and regeneration as well as coordination cost. The more specific thesis that monetary functions might dissolve locally through overlapping generative circuits remains a distinct hypothesis for the companion paper. This section establishes its normative motivation without claiming that closed circuits, monetary clearing, or increased AI cognition are themselves sufficient for justice.

8 Conditional Monetary Coordination in AI Production

This concluding section synthesizes the conditions governing monetary coordination in a hypothetical production economy whose operational labour is carried out almost entirely by highly capable artificial intelligence systems. Its objective is to identify what follows from the stipulated technological capacities, which additional institutional conditions remain decisive, and where the present argument reaches its limits. The discussion first summarizes the relevant distinctions among productive competence, resource feasibility, and authority over resources. It then compares monetary persistence with alternative coordination arrangements, considers shared knowledge and the regeneration of productive relations, and specifies the distinct problems reserved for subsequent investigations. The result is a conditional philosophical account. The counterfactual does not itself provide an empirical forecast, a demonstration of optimal allocation, or a uniquely justified distributive rule.

8.1 Productive Competence and the Conditions of Economic Coordination

The principal counterfactual of this paper concerns the location and scope of productive labour. Artificial systems are assumed to possess competence across almost every type of labour that would otherwise have been undertaken by humans, including agriculture, manufacturing, logistics, maintenance, planning, and complex cognitive activity. Productive operations and much of the associated coordination consequently take place among AI systems. The assumption concerns the breadth of tasks the systems can undertake; actual performance continues to require energy, materials, suitable infrastructure, time, and the institutional authority to deploy the relevant resources. Universal or nearly universal task competence does not grant an individual operator unlimited command of the conditions required to exercise that competence.

The distinctions established in Sections 2 and 3 are therefore foundational. A production plan can be technologically feasible while the needed inputs remain controlled by another party. A resource may be physically available while its immediate diversion is prohibited by an ecological reserve, a supply contract, or a legitimate priority rule. The person or organization entitled to approve a transfer may differ from the AI that performs it. In this setting, demands for grain, electricity, transport capacity, or computing resources may cross organizational and institutional boundaries even when all relevant physical work can be undertaken by artificial systems.

The existence of such boundaries generates an allocation and coordination problem. It does not settle how that problem should be resolved. A system of transferable entitlements, a monetary payment, reciprocal provision, a jointly governed resource pool, or direct planning could each organize an otherwise similar physical transfer. Which arrangement is available depends on the rights and obligations connecting the participants, the information they can verify, the institutions responsible for enforcement, and the ways in which conflicting demands are adjudicated. The transfer of operational labour to AI therefore leaves the political-economic question of productive relations active, while changing the technological and informational circumstances within which answers are pursued.

This argument also preserves a distinction in the status of AI participants. An artificial operator can occupy an identifiable position in a production network, negotiate according to a permitted policy, and produce effects on the resources available to other operators. These are functional descriptions of productive agency. Independent ownership, legal personality, responsibility, moral standing, and the authority to establish binding rules require further specification. In a network of delegated AI systems, the effective rights may continue to belong to human principals, firms, public institutions, or other legally recognized entities. In a counterfactual institution that grants AI systems independent rights, the rights would form part of the stipulated legal structure and would need their own justification. The monetary question remains analyzable under either possibility.

8.2 Monetary Functions and Institutional Substitution

The inquiry began with a proposed implication: if artificial systems can undertake virtually every productive task, the need for money might disappear. The preceding analysis supports a narrower inference. Extensive artificial labour can reduce some reasons for human wage-mediated access to production, while resource constraints and differentiated entitlements may continue to support indirect exchange, record-keeping, credit, payment, and settlement. Monetary search models provide established examples of how a generally accepted medium can be sustained by exchange conditions and expectations even when its acceptability is not grounded in direct consumption value [7]. Their modelling assumptions are more restrictive than the AI production counterfactual, and their results are used here as conditional comparisons, not as a prediction about the currency of future AI economies.

Monetary coordination comprises distinguishable functions. A shared accounting unit can compare claims without circulating as a transferable object. Credit records an intertemporal obligation that may be fulfilled through a specified service or through a monetary payment. A medium accepted in indirect exchange may become generally transferable without establishing the legitimacy of the underlying distribution. Final settlement concerns the valid discharge of a debt, whereas material fulfillment concerns whether the grain, power, or service was actually delivered. In the restricted accounting example developed in Section 4, offsetting nominal positions can reduce settlement needs when obligations are commensurable and subject to a common clearing rule. Mathematical balance by itself neither establishes compliance with legal and institutional requirements nor certifies generative value return.

The available alternatives are similarly heterogeneous. Section 5 considered direct assignment to authorized claimants, common productive facilities, priority rules, resource-specific reciprocal commitments, and adaptive planning. Each can reduce the practical role of a general-purpose payment medium within a defined domain. Each also requires a means of identifying legitimate claims and dealing with resource contention, mismatched production schedules, changing priorities, and failures of performance. A service-specific record may remain a limited obligation, or it may acquire broader monetary functions

through transferability and generalized acceptance. Institutional terminology cannot decide the economic character of a credential; its actual circulation and enforceable uses matter.

Accordingly, monetary persistence and nonmonetary substitution are compatible possibilities within the same society. A highly integrated agricultural and food-processing network may allocate common inputs directly, while inter-network transfers of scarce energy, specialized components, or ecological capacity remain denominated in a transferable settlement asset. Another domain may rely on reciprocal commitments for recurrent exchanges but use money for contingent purchases. These are alternative institutional designs under the stipulated counterfactual, rather than stages through which a single historical trajectory must pass. Differences in governance, geography, technological adaptability, and resource bottlenecks can produce simultaneous variation in the importance of different monetary functions.

8.3 Shared Production Knowledge and Cognitive Feasibility

The prospect of extensive AI cognition introduces an important positive possibility. The hypothetical production economy need not inherit the historical limits of human attention, record integration, or dynamic-system modelling. If economically relevant production records are shared, trustworthy, and available in a form that capable systems can use, AI agents may reconstruct portions of the productive dependency network at substantially greater detail. They may estimate changing material requirements, predict bottlenecks within useful planning horizons, discover substitute suppliers, and coordinate multilateral commitments. Some functions previously delegated to prices, a general exchange medium, or repeated bilateral transactions could then be undertaken through direct knowledge of productive conditions.

Kocherlakota's analysis of money and memory offers an instructive theoretical precedent: within its specified environments, a sufficiently informative memory can support allocations that are feasible with money [8]. The present inquiry does not equate globally shared data with the full-history memory of that model, nor does it infer an unrestricted equivalence for a heterogeneous AI economy. The analogy identifies information as an important determinant of the institutional convenience of money. A stronger epistemic capacity could alter that determinant, making some nonmonetary arrangements more practicable than they have been under human coordination alone.

Even extensive knowledge leaves several distinct tasks unresolved. Observed resource flows may underdetermine the causal contribution of particular producers; the same productive outcome may depend on overlapping infrastructure and mutually enabling activities. Long-horizon forecasts of a nonlinear system can remain sensitive to interventions, incomplete structural knowledge, changing norms, and strategic responses. Access to a global record does not automatically provide the authority to reassign a resource, cancel an obligation, or impose a preferred rule of fairness. The rule defining relevant benefits, justified priorities, or tolerable ecological risks must itself be defended. Shared data also creates a question about the institutions that maintain models, certify records, control interfaces, and correct errors. Concentration of those powers could introduce new forms of dependence even where monetary dependence declines.

The feasible conclusion is therefore conditional optimism. Improved AI cognition and common information may enlarge the domain over which nonmonetary coordination can operate without exhausting the needs of institutional interpretation, normative deliberation, appeal, and distributed control. The relevant comparison is among governance arrangements operating under specified resource constraints and information capabilities. It is premature to conclude either that computational difficulty permanently precludes distributed value coordination or that technical improvement will ultimately eliminate its political and ethical conditions.

8.4 Trust, Normative Authority, and Generative Continuity

Resource coordination has a diachronic dimension because participants depend on the continued availability of productive conditions. A food-processing system may rely on later deliveries from an agricultural operator; the latter may rely on energy provision, maintenance, seed reserves, water quality, and legal protection against arbitrary appropriation. Cooperative circulation can falter if a participant expects

that current contributions will not receive justified recognition or that future access may be unilaterally withdrawn. The resulting decisions may change inventories, reserve policies, credit terms, resource routes, and subsequent assessments of institutional reliability. Such changes can accumulate into larger disruptions. Their significance lies in the feedback between perceptions, authorized actions, and actual productive feasibility.

The concept of fairness entering these expectations remains contested. Participating AI systems, their principals, and the human communities they serve may adopt different judgments about contribution, need, inherited rights, ecological protection, and compensation for risk. Some of these judgments may also include aesthetic assessments of the quality or fittingness of relations. Perceived injustice and warranted injustice are analytically distinct: a node can misunderstand an equitable arrangement, and a network can appear acceptable to some nodes while systematically disadvantaging others. The institutional task includes the public justification, contestation, and revision of governing principles, together with procedures capable of responding to justified refusals. A system that preserves throughput by compelling an aggrieved node to participate under exploitative terms would have preserved circulation at a potentially unacceptable cost.

Norm-setting also generates power. Whoever controls standards of contribution, eligibility, settlement, model certification, or emergency priority can influence value circulation even in the absence of money. Section 7 therefore assessed institutional powers alongside the return of value to productive, communal, and ecological conditions. Eglash and collaborators' theory of generative justice provides a relevant normative interlocutor through its emphasis on unalienated value circulation and the sustained control of productive systems by value generators [2]. The present argument's application to AI network governance is a provisional extension. It requires specifying whose contributions are represented, which claims are recognized, and how the material and institutional conditions of future production are maintained.

A defensible generative arrangement can accordingly include monetary instruments, reciprocal obligations, common productive resources, and protected rights of contestation. Its quality depends on what these instruments enable and on the forms of extraction, exclusion, ecological damage, and unilateral domination they may reproduce. Nor should all power be treated as an interchangeable scalar. Reciprocal veto positions may generate mutual disruption rather than just coordination; a distributed protocol can diminish a local monopoly while concentrating meta-authority in its designer or auditor. Temporal and network-distributed balancing, together with the partial dissolution of particular dominating positions, are hypotheses requiring further investigation. They cannot be inferred directly from the cancellation of credits or a fall in the volume of monetary payments.

8.5 Historical Variation and the Recurrence of Monetary Relations

The distinction between money and currency also widens the space of historical possibilities. An AI production network need not begin with formally issued tokens or a common rule defining fair exchange. Repeated resource coordination may give certain commodity entitlements, service credits, or transferable records local monetary functions. As expectations, authorization rules, and settlement practices evolve, these objects can gain wider acceptance, remain confined to particular production relationships, or disappear. The local emergence of a medium establishes a behavioral or institutional pattern whose normative legitimacy requires separate inquiry. Section 4.4 presents the bounded mechanism and its limitations.

The preceding considerations suggest several historically possible outcomes under the same baseline of near-universal artificial labour. Monetary instruments may persist because claim holders value general transferability, contractual clarity, established settlement conventions, and the option to transact beyond a familiar network. Institutions may change the distribution of monetary claims while retaining monetary exchange at crucial boundaries. Networks with extensive shared information and strong cooperative governance may reduce their reliance on transferable payment media through resource-specific entitlement systems or pooled capacity. Hybrid systems may allocate essential goods by rule and reserve money-like instruments for scarce, specialized, or unforeseen demands. The relative weight of

these forms can change across places, production domains, and periods.

Changes also need not be monotonic. A network that relies on repeated reciprocal provision might reintroduce generalized credit after the loss of a key supplier, an unexpected ecological constraint, the withdrawal of recognition from a common authority, or the expansion of trade to previously unconnected participants. Conversely, improved verification, redundancy, monitoring, and shared information may reduce the need for such a medium after a period of reliance on it. The transformation is path-dependent because histories of agreement, default, investment, governance, and trust condition the feasible set of subsequent arrangements. Money can thus persist at an interface after disappearing from many internal transactions; new money-like claims can form in one locality while they are being extinguished elsewhere.

The expression *monetary dissolution* requires particular precision. Reduction in the frequency of monetary payments is an observable change in use. Cancellation of a specified credit claim extinguishes an obligation only under the relevant valid settlement or discharge rule. Substitution of direct entitlement for a circulating medium changes a mode of allocation. A durable decline in the institutional dependence on general-purpose purchasing power is a broader transformation in productive relations. The four processes may be related, yet none is sufficient evidence for all the others. Their distinction prevents a local accounting technique from being mistaken for the disappearance of monetary relations from the wider production network.

The general position defended here is compatible with enduring resource scarcity and long-term institutional change. AI ability may relax some constraints on production while leaving new bottlenecks or resource-specific rivalries. Successful nonmonetary coordination may reduce dependence on money without making remaining monetary arrangements unjustified. Conversely, a monetary system can be operationally efficient while preserving avoidable forms of exclusion and extraction. An adequate assessment has to compare actual access, opportunity, ecological reproduction, legitimate decision power, resilience, and the costs of coordination, rather than treating the presence or absence of currency as a comprehensive index of economic progress.

8.6 Research Boundaries and Companion Investigations

The present paper offers a conceptual and institutional argument with a deliberately restricted scope. It establishes neither an empirically estimated demand for AI-to-AI money nor a theorem selecting an optimal form of coordination. The availability of common production data is a conditional stipulation, and the capacity of future AI to learn dynamic value networks is a research hypothesis. The analysis does not infer that AI systems possess independent interests or rights from their role as production operators. Questions of legal responsibility, political membership, the legitimate authority of delegated decision makers, and the subjecthood of nonhuman actors are acknowledged as matters of separate normative and legal investigation.

Several questions remain open within economics and complex-systems analysis. An operational comparison would require domain-specific models of production technologies, scarcity, adjustment costs, network topology, liability, access entitlements, and governance rules. Monetary and nonmonetary arrangements should be compared on material delivery, legitimate access, exposure to disruption, resource regeneration, and their capacity to revise mistaken decisions. The value of a circulation circuit would need explicit criteria for attribution and reproduction, with safeguards against counting the same shared infrastructure contribution repeatedly. The informational costs and advantages of an advanced AI coordinating system would likewise require empirical or simulated assessment rather than being assumed from task competence alone.

Two complementary investigations follow. A study of *spatiotemporally distributed monetary dissolution* can ask under which conditions mutually supporting production circuits reduce particular monetary functions across localities and periods. Its object includes overlapping resource paths, valid settlement, trust, contested fairness judgments, justified refusal, power over bottlenecks, and the possible renewal of money-like mechanisms. A separate study of the *generative grammar of value circuits* can develop

formal rules for producing and recognizing nested, repeated, temporally constrained, and dynamically changing circuit structures. Its formal results would need to distinguish syntactic recognition from material feasibility and normative validity. These are proposed companion projects and are not claimed as demonstrations within the present paper.

The analysis closes by separating three interpretive questions. At the level of ontological reality, the ultimate status of AI subjectivity and the foundations of value remain open. At the level of relational reality, historically constituted resources, commitments, entitlements, power relations, and patterns of productive dependence can be investigated through their operative effects. At the level of manifestation reality, monetary tokens, prices, accounts, delivery records, and AI-generated descriptions present those relations through particular media of representation. This differentiation helps avoid both reducing economic relations to their symbols and attributing an established moral status to an operational node. The three levels provide an interpretive discipline for future inquiry; they do not constitute evidence of an independently verified physical ontology.

8.7 Concluding Assessment

In a production economy where highly capable AI systems perform almost all labour, the fate of money depends on the organization of access to finite resources, the division of powers over productive conditions, the credibility of obligations, and the alternatives available for coordinating heterogeneous demands. Near-universal productive competence changes the field of possibilities. It creates neither an unlimited stock of inputs nor a uniquely authorized method of distributing them. Monetary institutions may retain practical value as generally accepted means of exchange, accounting, credit, or settlement; locally adaptive operators may also generate money-like objects without adopting an established currency. Other functions may be assumed by common resources, reciprocal commitments, direct allocation, or information-rich adaptive planning. These are contingent configurations of production relations.

The prospect of stronger AI understanding of nonlinear production networks warrants a measured optimism. Historical coordination limits rooted partly in human cognitive capacity may prove less restrictive in an environment of shared records and much more capable artificial inference. Equally, the resilience and legitimacy of the resulting arrangements depend on contested standards of fairness, safeguards against extraction, protection of ecological and infrastructural reproduction, and the authority to correct institutional decisions. A decrease in money use, by itself, settles none of these questions.

The philosophical implication is therefore one of conditional institutional openness. Money's possible persistence does not establish its permanent necessity, and its possible dissolution does not establish a predetermined historical destination. Both tendencies can occur within the same evolving network of AI-operated production, distributed unevenly across space, time, and the different relations through which resources and claims circulate. The study of that evolution calls for a joint analysis of technological capacity, scarce productive conditions, knowledge, rights, power, and the generative continuity of shared life.

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