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Production Theory Revisited: Aligning Output Decisions with Evolving Consumer Behaviour in the Digital Age

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Abstract

The digital age has unsettled the epistemological foundations of classical production theory. Traditionally conceived as a deterministic relationship between inputs and outputs, production has long been treated as a technical process governed by efficiency and equilibrium. Yet, the rise of algorithmic consumption, real-time data feedback, and behavioural personalisation has rendered this framework increasingly obsolete. This paper conceptually re-examines production theory through a behavioural and informational lens, proposing the notion of behavioural elasticity - the capacity of producers to interpret, predict, and adapt to evolving consumer behaviour within digital ecosystems. Drawing upon conceptual analysis and interdisciplinary insights from behavioural economics, digital sociology, and agricultural studies, the paper argues that production must be re-theorised as a dynamic, reflexive process of co-creation between producers and consumers. Empirical illustrations from both developed and developing contexts - notably the digital transformation of agriculture in Nigeria and precision farming in the Netherlands - demonstrate how behavioural intelligence now functions as a compounding factor of production. The study advances three core arguments: first, that the production function must integrate behavioural intelligence (B) alongside labour, capital, and technology; second, that adaptive efficiency supersedes static optimisation as the dominant logic of competitiveness; and third, that ethical governance and inclusivity are essential to prevent behavioural responsiveness from devolving into surveillance capitalism. The paper concludes that the future of production theory lies in embracing reflexivity, complexity, and ethical adaptability as central tenets of economic thought in the digital era.

Keywords: Production Theory, Digital Economy, Consumer Behaviour

1. Introduction

Production theory has long served as the backbone for understanding how firms decide on output given their input combinations, technology, and cost constraints (Varian, 2010) [46]. In principle, output decisions are functions of factor availability, marginal productivity, cost minimization (Balk, 2013) [3]. In many models it may also depend on a static and well-behaved demand curves. However, in this age of digital revolution, this model seems to be gradually becoming weaker in explaining complexity of production decisions. The advent of real-time consumer response, online criticism and the rise of influencers and social media marketing (Chu *et al*., 2025) [10], imply that what consumers wants might no longer be based on assumptions of classical production theory. As such, companies are under obligation to make more responsive output decisions which aligns with changes in preferences and to introduce responsiveness into previously inflexible systems of production planning.

In this instance, one question comes to mind, 'how can traditional production theory incorporate these new developments without significant distortion? Some economists argue that fundamental propositions such as diminishing marginal returns, isoquant shapes, opportunity costs still very much hold, that these newer phenomena are simply "shocks" or exogenous

disturbances that firms adjust to via technology or managerial flexibility (Erickson, 2014) [14]. Others contend that the changing nature of demand in digital environments is not merely a disturbance but a structural change requiring new theoretical architecture (Camagni, 2017; Śledziewska & Włoch, 2021) [8, 41]. This suggests that firms must treat demand not as a static curve but as a dynamic process, shaped by consumer behaviour and subject to feedback loops.

For example, in the agricultural sector, these tensions are acute. Consider Nigeria, where agriculture remains central: roughly accounting for about 20% of GDP in recent years and also employing large proportions of the labour force. According to Salahudeen *et al*. 2024), many Nigerian farmers are now exposed to consumer signals via digital marketplaces, social media, and mobile apps. As an example, the use of agronomy advisory tools, Akilimo, and other digital application tools is on the increase (Ogunseye & Adekunle, 2024) [31]. While their yields and profits are much better with these tools; however, a lot of hesitation is still observed due to cost, digital literacy, infrastructure, or distrust. In developed countries, agro-allied firms are trying precision agriculture and smart greenhouses whose production plan are based on consumer data (e.g. preferences towards organic product, climate-friendly production, or local, traceable products) (Kumar, 2025; Yadav *et al*. 2025) [25, 48]. These changes imply a difference in the process of making production decisions - the use of traditional cost-based inputs versus the use of demand signalled and data-driven responsiveness.

Critically, there are contradictory forces in play. On one hand, digital tools and consumer behaviour open up possibilities of aligning output decisions more closely with what consumers want: less waste, greater product differentiation, faster adaptation, and even co-creation of products. On the other hand, there are frictions: imperfect information, asymmetries (consumers' stated preferences may differ from revealed behaviour), algorithmic biases, infrastructure constraints, and the risk that responding excessively to volatile digital signals can itself lead to production instability (over-reaction, oscillations, supply gluts or shortages). Moreover, there is a normative debate: should firms merely chase what consumers express online, or should production theory incorporate stewardship, sustainability, ethical consumption even when consumers are indifferent or misinformed?

This article seeks to revisit production theory with these tensions in mind. It argues that production theory must be conceptually expanded to incorporate dynamic consumer behaviour as a central determinant of output decisions - not merely as external demand curves but as ongoing, data-mediated, and sometimes volatile feedback processes. It aims to develop a conceptual framework - what we term the "Digital-Responsive Production Framework" (DRPF) - that integrates consumer behaviour, digital feedback mechanisms, and production planning under uncertainty. Specific objectives include: (i) to critically evaluate the assumptions of classical production theory in view of evolving digital consumer behaviour; (ii) to identify mechanisms by which consumer signals (via digital platforms, social media, mobile applications) can be processed into production decisions; (iii) to articulate implications for agricultural producers in both developing (e.g. Nigeria) and developed country contexts, paying attention to infrastructural, institutional, and behavioural constraints.

By contributing this conceptual analysis, this paper enters into the scholarly debate about how foundational economic theories must adapt (or risk irrelevance) in an era defined by digital consumer signals. It does so not by collecting new empirical data but by synthesizing existing literature - across production economics, behavioural economics, digital marketing, agricultural studies in order to map out where tensions lie, where contradictions persist, and where new theoretical syntheses are most urgently needed.

2. Literature Review and Critical Discussion

In revisiting production theory in light of evolving consumer behaviour in the digital age, several literatures must be synthesised: (1) classical/neoclassical production economics; (2) behavioural economics; (3) digital consumer behaviour and platform economics; (4) case-evidence from agriculture - especially in developing countries like Nigeria, and in developed settings using precision agriculture and advanced demand signalling. This section critically analyzes these literatures, highlighting tensions, contradictions, and gaps, in order to motivate a refined conceptual framework.

Classical / Neoclassical Production Theory

Classical and neoclassical production theory posit that firms choose output levels by combining inputs so as to maximize profit, given input prices and technology; marginal productivity declines; production functions are well-behaved (smooth, continuous, quasi-concave), and demand is taken as exogenous (koutsoyiannis, 1979; Varian, 2010; Wirkierman, 2024) [24, 46, 47]. These assumptions have proven powerful for generating tractable models and policy predictions (cost curves, scale efficiencies, etc.). However, the following limitations is associated with these postulation in the present digital age.

Static demand curves vs dynamic demand reality: Traditional models assume demand is known or estimable, with preferences stable over time. In digital economies, demand is rapidly affected by online reviews, social networks, and consumer sentiment, which can shift in unpredictable ways (Śledziewska & Włoch, 2021) [41]. Thus, the assumption of exogeneity of demand becomes questionable.

Perfect information & rationality: Typically the production theory assumes that firms and consumers possess sufficient information to act in their best interest (or at least in a manner that is consistent with maximization of utility/profit). However, behavioural economics has demonstrated that consumers (as well as firms) make decisions based on heuristics, are prone to biases, and information are not always symmetrical (Taylor *et al*., 2024) [44].

Adjustment costs and time lags: In agriculture, particularly in the developing world, it is difficult to respond to a change in demand in terms of production decisions. The output decisions, therefore, are not able to adapt as quick as there are shift in demand in digital age.

So, while classical/neoclassical theory remains useful, its assumptions increasingly mis-align with empirical realities under digital consumer influence.

Behavioural Economics and Decision Theory: Alternative Insights

Behavioural economics suggests that human decision-making deviates from the ideal rational agent: bounded rationality, heuristics, biases, temporal inconsistency (Umeaduma, 2024; Taylor *et al*., 2024) [45, 44]. Neoclassical procedures can produce suboptimal output because procedural rationality is limited; achieving "optimality" in input mix and output level is constrained by cognitive and informational factors (Yamamoto, 2024) [49]. Also, research indicate that farmers globally are influenced by non-monetary motivations, risk perceptions, social norms, and loss aversion in decisions about what to plant, what technologies to adopt (Gemtou *et al*., 2024) [19]. These behavioural insights suggest that production theory needs to incorporate not only technological and cost constraints, but also cognitive, social, and perceptual constraints on both consumers and producers.

Digital Consumer Behaviour, Platform Economies, and Feedback Loops

Digital consumer behaviour literature emphasizes reviews, ratings, posts on social media, influencer endorsements and their influence in creating consumer expectations and demand (Śledziewska & Włoch, 2021) [41]. Similarly, in terms of personalization and mass-customization, customers are becoming more demanding in terms of products that are customized according to preference, which can differ among digital platforms. This increases the complexity of production (Yegina *et al*., 2020) [50].

From marketing and management studies, social media marketing and digital marketing significantly influence consumer behaviour: they shape perceived value, brand trust, and hence demand elasticity (Stephen, 2016) [42]. Moreau *et al*. (2018) [28] argues that consumers are no longer passive demanders but also innovators and co-creators, thus production must respond in more interactive ways. These literatures raise the claim that firms' output decisions cannot be made in isolation from consumer(s)' digital signals, or externalities of information spread.

Agriculture Case Evidence: Nigeria and Elsewhere

Empirical and descriptive studies in agriculture in Nigeria provide concrete illustrations of how digital consumer behaviour, technology adoption, and production decisions are already interacting - and with mixed results. The study by Oyekunle (2025) [34] note that the adoption of precision agriculture technologies in Nigeria is increasing, but constrained by high costs, lack of infrastructure, limited digital skills, and limited access to credit. Meanwhile, the study by Ezeaku *et al*. (2024) [15] revealed that a willingness to adopt precision agriculture in Gombe and Bauchi states shows very high willingness (over 90%), but technical know-how, cost, and perceived complexity are negative factors. Studies also show that digital tools like mobile apps, remote sensing, GIS - can help farmers respond to market signals and improve yield/output, but again adoption is patchy and uneven (Bolaji *et al*., 2024) [5].

On the other hand, in developed countries especially in Europe and North America, precision agriculture, IoT, big data, sensors, and machine learning are being used to respond to consumer preferences for organic produce, sustainable practices, traceability, and so forth (Karunathilake *et al*., 2023) [22]. Here, the capacity to adjust production (both quantity and quality) is greater because of more flexible infrastructure, more capital, and better access to information. As an illustration, in areas that consumers seek non-GMO or pesticide-free agriculture, farmers change not only their methods (inputs) but occasionally the timing of production, the type of variety, and branding. These modifications are indicative of the fact that the preferences of consumers are moving closer to spaces of production decisions, rather than downstream demand curves.

Critical Tensions and Contradictions

From the literatures above emerge several contradictions or tensions. First, there is the dilemma between responsiveness and stability of models. Some argue that firms should respond rapidly to digital consumer feedback to remain competitive, other warn that too much responsiveness leads to volatility: over-reaction, supply chain instability, or misallocation of resources when signals are misleading. Secondly, there is the problem of measuring cost of adaptation and potential benefits. In developed countries, adapting production to consumer signals (e.g. custom produce, organic labeling) yields premiums and market differentiation. Meanwhile, in developing countries, adaptation may incur costs that outweigh benefits: technology costs, risk, poor infrastructure, lack of institutional support. Many farmers may prefer "tried-and tested" production methods rather than shifting output frequently. Finally, there is the problem of equity and inclusion. Digital tools lower barriers - information, market links, thus potentially allow smallholders to better align output with market demand. But there is digital divide: smallholders may lack internet, electricity, or funds; age, literacy, gender, and land-tenure issues often dampen capacity to respond. Thus, those most vulnerable may be excluded from the benefits of adaptive production models.

Gaps in Existing Literature

From this critical discussion several gaps emerge. To begin with, there is no single model that connects the production theory and digital consumer behaviour: numerous studies are done either on the demand side (consumer behaviour) or on the supply side (precision agriculture, production technology), however, few combine the two in a theoretical framework including feedback loops, adjustment lags and rationality. Secondly, output adjustment to digital signals (empirical evidence) is not well established in the developing countries. We are only aware of adoption of technologies and less so how producers vary in terms of quantity produced, the mix of products, or the combination of inputs based on the digital feedback (e.g., social media, online markets). Third, there is a lack of research on temporal dynamics and uncertainty: how do producers plan in the face of fast changing consumer demands? What risk management strategies exist when digital demand signals are volatile or conflicting? Finally, Iinstitutional, infrastructural and behavioural constraints are unevenly accounted for: many models assume technology adoption is costless once available; but in Nigeria and similar contexts, costs, knowledge, land tenure, market access, and power dynamics affect how well production theories apply.

Implications for Conceptual Reconstruction

Based on critical discussion above, the implications for revising the production theory abound. Any new conceptual

model cannot assume demand to be exogenous, but as at least partially endogenous through consumer behaviour, digital feedback loops, and social influence. The model should permit limited rationality: consumers and producers have limited information and biases, and risk aversions. They should have clear processes of lag or inertia, to indicate that changes in output or technology in production are expensive and slow, or limited by infrastructure.

The model must include heterogeneity among producers: size, capital, technological capability, market access, geography. The same strategy to use with a major agribusiness in the U.S. might not translate readily onto a small farmer in Northern Nigeria. The moderating variables that will be important in understanding the materiality of feedback loops of consumer behaviour will include institutional support, infrastructure (internet, electricity), digital literacy and trust.

3. Theoretical and Conceptual Foundations

The classical production theory, which is based on neoclassical economics, assumes that a firm aims at maximising production under a number of technological and input constraints, and efficiency is its primary goal (Varian, 2010) [46]. In this perspective, production processes can be described as:

$$Q = f(L,K)$$

This obscures the sociocultural, psychological and digital influences that determine consumer demand. However, this conceptualisation is becoming less satisfactory to explain realities of production in the digital era. Since it has been pointed out by multiple scholars, including Dold and Speck (2021) [12] and Foster (2024) [17], that the balance of classical production theory have been distorted with digitalisation, as there are new types of consumer-producer dependencies.

Critical objections have been made to the fact that the traditional paradigm of production ignores the behavioural and information feedback loops which now constitute markets. Production, in an age of algorithmic personalisation, user-generated data, and real-time feedbacks, is not just a responsive activity; it evolves with it (Yellanki, 2024) [51]. The traditional division between producer and customer is becoming unclear as digital technologies allow what Prahalad and Ramaswamy (2004) [35] call co-creation of value. According to this interactive paradigm, the output decisions should be a bit more attentive to the consumer engagement metrics, the preferences generated by the analysis of the data, and the cultural narratives that can spread in the digital ecosystems.

However, not every scholar holds that production theory should be completely rebuilt. There is an opinion of a modified continuity instead of a radically different rupture. As an example, Gallegati *et al*. (2024) [18] asserts that the very principles of efficiency and marginal analysis have not lost their meaning, but they have to be generalized to include the informational asymmetry and the evolving consumer expectations. Likewise, Śledziewska and Włoch (2021) [41] see that digitalisation has not eliminated the principles of production, rather labour, capital, and technology continue to play a significant role, but it has changed their relative elasticities and substitution patterns.

These discussions highlight the necessity to conceive the reconfiguration of the conceptual framework suggesting the repositioning of production theory in the large ecosystem of information, perception and behaviour changes. Production frontier can no longer be viewed as an exogenous constraint but instead we should view it as dynamically made up, by means of technological mediation and consumer co-creation. Hence, the theoretical challenge lies not in discarding the production function but in reimagining it as behaviourally *elastic* - responsive not only to input constraints but to evolving digital patterns of consumption, identity, and ethics.

Digital Consumer Behaviour and Its Implications for Output Decisions

The digital age has reconfigured not only how consumers access goods but also how they conceptualise value itself. In contrast to the relatively stable demand functions, which are being assumed in classical theory of production, modern consumer behaviour is fluid, data-driven, and often performative. Consumers have become prosumers, producers and consumers of information at once and their tastes change due to the feedback in real time, algorithms that push consumers and social validation (Zwick, 2015) [52]. This shift puts pressure on both firms and agricultural producers to rethink the way production choices are optimized to demand signals which are being mediated more and more by digital ecosystems.

The Dynamics of Digital Consumption

The digital platforms have erased the historical distance between production and consumption. Producers used to predict the demand using past records and consumers were comparatively passive in pre-digital markets. The current social media trends, as well as predictive analytics, have the potential to change the taste of consumers on a whim (Okeleke *et al*., 2024) [32]. Indicatively, in the agricultural sectors of developed economies, online grocery platforms also provide data that producers can quickly respond to changes in the consumer sentiment about sustainability, organic certification, or local sourcing (Mintel, 2025) [26]. The responsiveness has transformed the production planning approach to be more of a pull system, where real-time information is the main factor in determining the volume of output and the type of product (Rosak-Szyrocka *et al*. 2024) [36].

In contrast, developing economies such as Nigeria reveal a more fragmented digital consumption landscape. While urban middle-class consumers increasingly engage in online food purchasing, rural production systems remain largely traditional. However, digital intermediaries - like *Thrive Agric* and *AFEX Commodities Exchange* - are bridging this divide by collecting consumer trend data and transmitting it upstream to farmers (Balana *et al*., 2023) [2]. As a result, farmers in Nigeria are starting to organize their crop choice and planting scheduling in line with market analytics as opposed to their customs or subsistence demands (Sanusi *et al*., 2025) [39].

Behavioural Complexity and Production Response

From a conceptual standpoint, digital consumer behaviour introduces a paradox: while data analytics offer unprecedented precision, they also amplify volatility. Preferences shaped by social media trends are inherently transient, leading to what Schneider *et al*. (2022) [40] terms the surveillance paradox - the illusion of predictive control

in an inherently unpredictable landscape. To producers, this implies that output choices have to take into consideration temporal volatility, ethical issues associated with the use of data and the potential of consumer backlash against over-commercialised or environmentally insensitive production methods.

More importantly, researchers are divided regarding whether digital data contributes to the allocative efficiency in fact. Its advocates believe that digital demand modelling eliminates waste, and its output is more focused on consumer utility (Chase, 2021) [9]. On the other hand, sceptics emphasise that algorithmic recommendation systems may manipulate genuine demand with the help of echo chambers of preference reinforcement (Stray *et al*., 2024) [43]. It is especially clear in Agri-food industries where sustainability discourses are overlapped with digital marketing. As an example, the increasing demand in plant-based products in Europe has caused a sudden change in the agricultural investment, but research indicates that these demand peaks usually do not continue to grow as consumers lose novelty (Batool *et al*., 2025) [4].

Towards Adaptive Production Systems

To overcome these complexities, the production systems need to develop beyond the deterministic optimisation model to a flexible ecosystem that is able to learn in real-time. The shift will necessitate incorporation of behavioural analytics, digital traces and feedback into the production theory. In farming, it may imply the use of AI to predict a change in consumer preference of local, organic, or ethical food, and adjust production to curb economic efficiency as well as social and environmental validity (FAO, 2023) [16]. Adaptive production, in manufacturing and service sectors, may involve digital consumer-agile production such as on-demand production, or modular production systems (Kaur, 2025) [23].

Therefore, convergence of production and digital consumer behaviour is far beyond technological adjustment, it is a paradigmatic transformation in economic rationality. Companies will cease to focus only on output but also on relevance, resonance and reputation in a digital moral economy. Such a development requires an evolution of the re-calibration of production theory as not a passive act of transformation but a dialogue between data, culture, and consumption.

4. Reconciling Classical Efficiency with Digital Responsiveness: A Conceptual Reorientation of Production Theory

The modern economic environment is an epistemic dilemma between the classical goal of production efficacy and the new necessity of digital responsiveness. Classical theory of production is based on cost minimisation and output maximisation, which presumes that customers will stay the same and the market will remain unaffected (Ruhshona, 2025) [37]. Conversely, the digital economy is typified by fluid behaviour, fast tastes changing, and data asymmetry. The resolution of these conflicting logics is a theoretical and practical problem to the firms, policymakers and producers.

The Efficiency - Responsiveness Paradox

This paradox is based, in its simplest form, on the trade-off between behavioural adaptability and allocative efficiency. Conventional production designs are based on the optimum of inputs to a demand function and digital responsiveness necessitates flexibility and redundancy, which is usually viewed as inefficiency in neoclassical terms. As Mirshafiee *et al*. (2024) [27] observe, the rise of digital production systems has transformed efficiency from a static endpoint into a dynamic process, where the value of adaptability often outweighs the cost of excess capacity. It means that productive efficiency is replaced by adaptive efficiency whereby companies can remain competitive through the constant recalibration to streams of consumer data.

This tension is very noticeable in agricultural settings. Smallholder agriculture in Nigeria is economically rationalized to achieve cost-efficiency, i.e. maximum output with the minimum utilization of inputs but the digital market is providing more and more incentives to producers to change to meet the evolving needs of the consumers who are demanding traceability, sustainability, and other ethically sourced products (Cutinha & Mokshagundam, 2024) [11]. Conversely, within the developed economies, such as the United States or the Netherlands, the technology of precision agriculture allows manufacturers to balance efficiency and responsiveness to offer real-time information about the soil, the weather, and the market demand (OECD, 2022) [29]. Thus convergence between these two paradigms is easy with the help of technology, although institutional and infrastructural asymmetry continues to divide regions.

Towards a Behaviourally Elastic Production Function

To conceptually integrate these dynamics, this paper proposes a reconfiguration of the production function as *behaviourally elastic*. In this framework, output (Q) is not merely a function of physical inputs labour (L), capital (K), and technology (T), but also of *behavioural intelligence* (B) - the firm's capacity to interpret, predict, and adapt to evolving consumer preferences:

$$Q = f(L,K,T,B)$$

Here, 'B' captures the informational and cognitive dimensions of production — including data analytics, consumer sentiment tracking, and responsiveness to socio-digital trends. Unlike traditional factors of production, 'B' does not diminish with use but compounds through iterative feedback and learning. The introduction of 'B' reflects a paradigm shift where production efficiency depends not solely on tangible resource allocation but on the elasticity of the producer's behavioural insight.

Implications for Agricultural and Industrial Policy

Practically, the restructuring of the production theory in terms of behavioural elasticity requires the creation of new policy and institutional structures. Investment of digital literacy, market data infrastructure and broadband access becomes critical to the developing economies such as Nigeria in order to realise behavioural intelligence at the producer level. Likewise, agricultural cooperatives may act as intermediaries in the data, having the insights of consumers aggregated to inform the diversification of crops and the timing of markets. Developed economies, in their turn, might have to address data monopoly to avoid the manifestation of informational asymmetry by distorting the actual demand trends (OECD, 2023) [30]. Therefore, efficiency and responsiveness should be institutionally

balanced so as to maintain equitable and sustainable production systems.

5. Critical Reflections: Contradictions, Challenges, and Future Directions

The intellectual stimulation of the conceptual shift of the production theory to the behavioural elasticity is full of contradictions and unresolved tensions. Not just a matter of an academic discussion of the sufficiency of economic modeling, but a more fundamental ontological question, what is the production in a world of value that is more and more co-produced and mediated digitally? The problem is thus how to balance the economic rationality of output maximisation with the sociocultural complexity of the modern consumer behaviour.

Theoretical Contradictions

Determinism and indeterminacy is one of the main contradictions (Burton, 2017) [7]. Classical production theory is a positivist economic theory that assumes that there is a deterministic relationship between inputs and outputs which is mediated by constant technological and market conditions (Koutsoyiannis, 1979; Varian, 2010) [24, 46]. The digital economy, in its turn, brings radical indeterminacy as the consumers change their preferences depending on the algorithmic cues, social trends, and world narratives. This uncertainty compromises the predictive stability that the conventional functions of production rely on.

Nevertheless, to go all the way to the end of determinism is to strike a fatal setback to production theory. In this way, researchers like Brynjolfsson and McAfee (2017) [6] support a hybrid model, one that is more structurally rigourous but still has adaptive behavioural mechanisms implemented in it. This hybridisation is reminiscent of the complexity theory that considers economic systems to be non-line, adaptive, and self-organising. The difficulty lies in methodology: in what ways can adaptive behaviour be formalised in a production system and still remain something other than mere coincidence?

Conceptual and Practical Uncertainties

The other significant dilemma is the epistemological basis of new production paradigm. Even the very concept of behavioural intelligence as an element of production raises eyebrows. The critics believe that behavioural responsiveness does not necessarily produce the best results because consumers themselves are irrational and unpredictable (Earl, 2023) [13]. Digital consumer-driven production strategies are therefore dangerous because it is likely to pursue volatility instead of generating value. Moreover, algorithmic decision-making is prone to bias, reinforcing the dominant culture at the expense of minorities (Gerdon *et al*., 2022) [20].

Digital platforms can also put the cash crops which have high demand in the urban areas ahead of the local food security and biodiversity in the agricultural industry. Similarly, the augmentation of consumer-centric production could entrench short-termism, with firms focusing on transient trends rather than sustainable productivity. Hence, while behavioural elasticity enhances adaptability, it may also erode long-term resilience - a dilemma that classical efficiency models, with their focus on stability, at least partially mitigated.

Towards a Reflexive Production Paradigm

Moving forward, the production theory needs to be reflexive - to be able to scrutinize its assumptions on rationality, efficiency, and value. This involves the incorporation of behavioural economics, digital sociology and ecological economics. Reflexivity suggests the recognition of production as neither a technical nor economical process but a socio-digital formation, determined by narratives, identity, and power relations. Such reflexivity has concrete implications. For developed economies, it calls for rebalancing efficiency with ethical governance of data-driven production. In the case of developing countries such as Nigeria, it requires policies that should democratize access to digital tools, making responsiveness to strengthen inclusiveness. At the worldwide level, it challenges a re-specification of productivity, not as the maximisation of production, but as the optimisation of agility, sustainability and fairness.

6. Conclusion and Theoretical Implications

This paper has revisited the foundations of production theory in light of the profound transformations ushered in by digitalisation and evolving consumer behaviour. The classical notion of production as a deterministic, input–output process, though elegant in its simplicity, no longer suffices to explain the volatile, data-driven, and reflexive dynamics of the digital economy. In its place, this article has advanced a conceptual reorientation that situates production within a broader behavioural and informational ecosystem - one in which consumer preferences, cultural narratives, and algorithmic mediation actively shape output decisions.

Synthesis of Key Arguments

The discussion has unfolded across several interlinked debates. First, it established that digitalisation dissolves the temporal and informational boundaries separating production and consumption. Through platforms, feedback systems, and predictive analytics, consumers now co-determine production processes in real time. Second, the paper proposed the notion of *behavioural elasticity* - a conceptual innovation that recognises behavioural intelligence (B) as a distinct and compounding factor of production. Third, it critically analyzed the role of digital responsiveness as it promotes adaptive capacity and at the same time destabilizes traditional efficiency indicators provoking ethical, epistemological, and distributive issues.

Examples of disproportionate diffusion of digital responsiveness were highlighted by empirical examples of agriculture in Nigeria and the developed economies. Although the application of behavioural intelligence in production through methods such as precision agriculture and real-time consumer analytics in developed economies is present, infrastructural and institutional limitations in the developing context testify to a chronic asymmetry in adaptive capacity. This drives the necessity of theory and policy that is context sensitive - production systems cannot be digitalised out of context, without social, infrastructural, and regulatory contexts in which they are situated.

Theoretical Implications

From a theoretical standpoint, this reconceptualisation demands that production theory move beyond its positivist origins and embrace complexity, uncertainty, and

reflexivity. The inclusion of behavioural intelligence as a production factor suggests that knowledge, adaptability, and interpretation are now as critical to productivity as physical capital or labour. This challenges conventional production models that treat consumer preferences as exogenous and stable. Instead, consumers must be theorised as *endogenous agents* within the production function - co-producers of economic meaning and value. Moreover, the proposed behavioural elasticity framework invites a pluralistic methodological agenda. It does not require the use of only econometric formulations but interdisciplinary approaches that combine the knowledge of data science, behavioural economics, and cultural studies. This is consistent with the new look of digital political economy (Goldfarb and Tucker, 2019) [21] and complex adaptive economics (Arthur, 2021) [1], which views markets as a system of learning, instead of a mechanism of equilibrium.

Policy and Practical Implications

To practitioners in policy formulation, the results imply that it is quite urgent to promote digital inclusiveness and ethical data management. This in Nigeria and other developing settings would imply making an investment in digital infrastructure, training of farmers, and open data platforms to make behavioural insights democratic. In developed economies, the idea should be switched to focus on controlling algorithmic bias, guaranteeing the transparency of data-driven production decisions, and consumer autonomy protection. On the international scale, organisations like FAO, OECD, and WTO have to realise that technological innovation alone is not the key determinant of the future competitiveness of production but also behavioural congruence and moral flexibility.

Final Reflections

Finally, the need to go back to production theory in the digital age is not a question of gradual adaptation but of conceptual transition. Further, the production process is not restricted to the factories, farms, or assembly lines anymore; it goes further into the digital spheres where the attention, sentiment, and identity are created and transmitted. With the closing of the gaps between producer and consumer, the question moves off from how effectively can we produce to how smart and responsible can we be?

The new epistemology of production described hereby proposes the need of a new epistemology of production that is dynamic, ethically sensitive and also responds to the rhythms of human behaviour in a digitally interconnected world. Only by embracing this reflexive, behavioural paradigm can production theory remain analytically relevant and normatively grounded in the twenty-first century.

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