
Agricultural Value Chain Extension: A Comprehensive Strategy beyond Production and Market Access

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ABSTRACT

Agriculture is undergoing rapid changes due to globalization, climate change, changing consumer preferences, food safety requirements and need for market linkages. These changes have shifted the focus of agriculture from merely increasing production towards improving profitability, competitiveness and sustainability. Farmers are now required to maintain quality standards, reduce post-harvest losses, undertake value addition and respond to changing market demand. However, majority of the small and marginal farmers have limited access to resources, infrastructure, and information and possess poor bargaining power to participate effectively in modern markets. This creates a need to move agricultural extension beyond a production-centred approach towards a value chain-based approach. A value chain involves different actors and activities from input supply and production to processing, marketing and consumption, where each activity influences the quality, cost, safety, marketability and final value of the product. Therefore, agricultural extension is evolving to support farmers and other actors throughout the value chain by facilitating technical guidance, institutional linkages, entrepreneurship development, value addition and market linkages. The approach is comprehensive and requires better coordination among farmers, FPOs, processors, warehouse operators, financial institutions, research organisations, extension agencies and private organisations. In such a system, the extension professional has a broader role as a value-chain facilitator rather

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than only a technology-transfer agent. FPOs, digital technologies, post-harvest infrastructure, market linkages, capacity building and public-private partnerships can further support farmers' participation in agricultural value chains. Thus, a value chain-based extension approach can help in improving coordination among different stakeholders, reducing transaction costs, increasing value addition and market access leading to improved farmers income and livelihoods.

Key words: Agricultural extension, agricultural value chain extension approach, its components, institutional arrangements, market led extension

Introduction

The contemporary agricultural landscape is undergoing rapid transformation due to globalization, climate change, technological innovations, changing consumer preferences, food safety regulations and strengthening integration of domestic and global markets. These developments have shifted the focus of high value agriculture from merely increasing production to improving profitability, competitiveness and sustainability. Farmers today must comply with quality standards, adopt value addition practices, reduce post-harvest losses, respond to market demand and integrate with increasingly complex and profitable supply chains. Consequently, agricultural development strategies have evolved from production-oriented approaches to market-led extension, with emphasis on market information, price intelligence, consumer demand and marketing skills (Christoplos, 2010 and Kumar et al., 2012).

Agricultural extension has been recognised as a means to facilitate this transformation if revived to make services demand driven which implies making extension more responsive and accountable to the need of all the farmers (Birner and Anderson, 2007). The shift from production-centric to demand driven-extension is expected to improve orientation of farmers towards market and consumer needs. Though, in the changed agricultural landscape with lot many challenges and opportunities, there is a need for interventions to go beyond production and marketing to ensure enhanced farmers' income.

The extension system in developing / underdeveloped countries is production orientated with inadequate attention on processing, value addition and marketing, though there is need for a balanced approach for introducing competitiveness in value chain activities (Manteaw et al., 2020). Thus, the traditional production centric approach in agricultural extension may not be sufficient for income enhancement and necessitates a shift to a value chain extension approach which focuses on facilitation at various stages of value chain to enhance profitability (Shukla et al., 2026). The extension should move beyond production centric advisory services to market orientation, leadership,

digital literacy, collective action and business competencies to enable farmers organisations to avail value chain opportunities (Praphavathi et al., 2023). The participation of farmers in organised retail supply chains is influenced by factors like assured price, quality, access to market information and finance, highlighting the role of extension as an integrator and facilitator that link farmers with other value chain actors (Nandi et al., 2017). Farmers need support throughout agricultural value chain, from input supply and production to post-harvest management, processing, value addition, quality assurance, logistics, finance, and market linkages.

Against this backdrop, the present paper attempts to improve the understanding on the need for a shift in focus of agricultural extension from production-central Centric to value chain based approach to support the transformation which Indian agriculture is undergoing. The paper focuses on the concept of value chain based agricultural extension and its key components and different value chain actors. The paper also speaks about the policy suggestions to strengthen the existing agricultural extension system which is efficient, inclusive and resilient with ability to enhance farmers' income and agricultural competitiveness.

Need for paradigm shift towards value chain extension

The majority of Indian farmers operate on small and marginal landholdings and few challenges are there regarding the scale, resources, infrastructure and information required to participate effectively in modern markets (Sharma et al., 2021). Farmers can no longer depend solely on increasing production to improve their incomes but need to understand the way their produce is harvested, handled, graded, stored, processed, transported, branded and marketed and also the means to reduce the cost of production and manage risk associated with production. Value chain extension can help overcome these constraints by promoting collective action, strengthening FPOs, facilitating business partnerships and providing knowledge about value-addition opportunities. It can also help farmers move away from supply push production towards planning production according to identified market demand, quality requirements and consumer preferences.

A value chain is a set of activities carried out by actors (input dealers, producers, processors, transporters, wholesalers, retailers, and consumers) to deliver a product or service from conception to end use. Value Chain Development (VCD) has emerged as a comprehensive framework for analyzing and improving agricultural systems (Singh et al., 2025). A value chain perspective emphasizes the interconnectedness of multiple actors. Instead of focusing solely on on-farm productivity, value chain development seeks to enhance efficiency and equity across the entire chain (Prasanna et al., 2025). A value chain is not merely a linear

movement of produce from the farmer to the market. It is an interconnected process in which each activity influences the quality, cost, safety, marketability and final value of the product. Decisions concerning seed selection, production practices and harvesting influence the quality of produce available for grading, storage and processing. Similarly, packaging, branding, market promotion and consumer satisfaction determine demand and influence future production decisions.

Value chain approach to agricultural extension

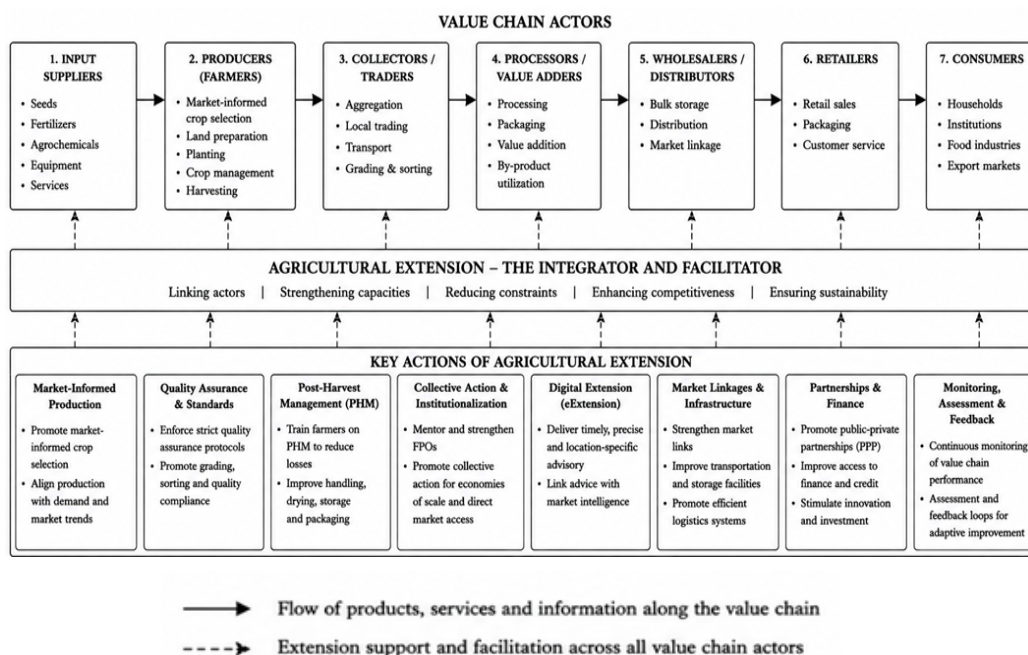
In the process of evolution of the agricultural extension from production to market linkage to organising farmers and empowering them to develop into micro – enterprises to conservation of resources, the FARMERS have been central to the theory and practices of the concept. However, the value chain development is going to be central to the concept of agricultural transformation so as to bring focus on actors other than farmers as well. It is value chain approach that will facilitate integration of various actors of the chain with the concept of agricultural extension and reposition itself to advice various actors of the chain, other than the farmers. This emphasises on the need of a multi – actor agricultural extension system which is capable of addressing the challenges faced by different actors of the agricultural value chain leading to optimal value realisation by each player including farmers (Ammani and Abdullahi, 2015). An example of potato value chain in India speaks about the comprehensive support offered by the firm to the farmers covering, technical extension, monitoring, assured market and prices, access to credit and inputs and insurance. The arrangement is facilitated by the vendors and people (identified by the firm) to establish coordination between farmers and the firm.

The agricultural value chain begins with the provision of quality inputs such as seeds, fertilizers, machinery and credit. It then progresses through production, harvesting, post-harvest handling, grading, storage, transportation, processing, packaging and branding and marketing before the product reaches the consumer. Every stage provides opportunities for reducing losses, improving quality, adding value and increasing farmers' incomes. Therefore, agricultural extension should no longer be confined to production enhancement and strategies to market the surplus efficiently but should facilitate technical guidance, institutional linkages, entrepreneurship development, value addition and market integration throughout the value chain.

Value chain approach extends the conventional role of agricultural extension beyond technology dissemination and market facilitation by promoting collaboration among farmers, Farmer Producer Organizations (FPOs), input suppliers, processors, traders, financial institutions, private enterprises and

consumers. It also focuses on developing farmers' entrepreneurial capacity, strengthening farmer producer organizations, facilitating value addition, improving access to finance and digital technologies, promoting quality standards, traceability, developing efficient market and business linkages (Figure-1). By addressing constraints across the entire value chain rather than only the ones experienced at the production or marketing stage, value chain extension contributes to better planning, higher productivity, reduced transaction costs, enhanced competitiveness and improved profits leading to sustainable livelihood improvement.

Figure 1. General value chain approach in agricultural extension



Source: Manteaw et al. (2020); and Shukla et al. (2026) and Ammani & Abdullahi, 2015 and references therein, like Aderibigbe, et al. (2007), Akpokodje et al. (2001), Erenstein et al. (2003), UNEP (2005 and USAID (2009)

In this context, value chain based extension approach represents a strategic shift beyond production-support and market-led extension by positioning extension services as facilitators for development of inclusive value chain rather than merely providers of production technologies or market information to its stakeholders (Ferroni & Zhou, 2012 and FAO, 2014).

Component of value chain extension approach

1. **Input Supply and Production:** The value chain begins with timely access to quality seeds, fertilisers, crop-protection inputs, machinery, credit and technical information.
2. **Harvesting and Post-Harvest Handling:** Harvesting at the appropriate stage of maturity is essential for maintaining product quality and reducing losses. Post-harvest activities include cleaning, drying, grading and sorting.
3. **Storage and Transportation:** Scientific storage protects produce from moisture, pests, contamination and deterioration. Efficient transportation reduces transit losses and ensures that products reach processors and markets on time. Extension agencies can connect farmers and FPOs with warehouses, cold-storage units, pack houses, refrigerated transportation and other logistical services. Farmers and other players need to be oriented about the changes like electronic negotiable warehouse receipt (e-NWR) system.
4. **Processing:** Processing transforms agricultural produce into products with greater utility, shelf life and market value. Examples include converting cereals into flour, oilseeds into edible oil, fruits into juice or pulp, milk into processed dairy products and spices into cleaned and packaged products. Extension personnel can facilitate training on the importance of processing and processing technologies, enterprise development, food-safety compliance and access to government schemes.
5. **Packaging and Branding:** Suitable packaging protects the product and improves convenience, appearance and shelf life. Branding and labelling help create product identity and communicate information concerning origin, quality and certification. Extension organisations can assist farmers and FPOs with market assessment, packaging selection and digital promotion
6. **Consumer Feedback and Production Planning:** Consumer preferences regarding quality, price, taste, convenience, safety and sustainability influence demand. Extension systems should facilitate the collection and sharing this information with farmers and FPO.

Agricultural Extension in India

The agricultural development efforts in India after the independence were supported through a series of programs such as Grow More Food Campaign (GMFC, 1947), Community Development Programme (CDP, 1952), National Extension Service (NES, 1953), Intensive Agricultural District Programme

(IADP, 1961) and Intensive Agricultural Area Programme (IAAP, 1964-65). The agricultural extension support was extended through initiatives like National Demonstrations (1965), Farmers Training Centres (FTC, 1966), Small and Marginal Farmers Development Agencies (SFDA, 1971), Krishi Vigyan Kendra (KVK, 1974), and Lab-to-Land Programme (1979) during green revolution period (DFI, 2017). Training and Visit (T&V) extension system was observed to be effective in potential irrigated areas leading to good effect impact on productivity and income among farmers. Subsequently, decentralised system was experimented with to address issues related to lack of integration of programs among different departments, weak research-extension linkages and various other constraints faced by the system (Glendenning & Babu, 2011 and Singh, 2006).

The 'Agricultural Technology Management Agency (ATMA)' represents a shift in agricultural extension from a top-down approach towards a decentralised, demand-driven and participatory system. The component was launched in 2005-06 under the Centrally Sponsored Scheme, 'Support to State Extension Programmes for Extension Reforms'. Inherent issues of capacity and culture of public sector agriculture extension in India; limits the ability of the concept to fulfil its objectives (Glendenning & Babu, 2011). The scheme supports the efforts of state governments to provide farmers with access to improved agricultural technologies and good agricultural practices in agriculture and allied sectors. Its activities include farmer training, demonstrations, exposure visits, Kisan Melas, Farmer-Scientist Integration and farm schools. ATMA also facilitates the formation and strengthening of 'Farmer Interest Groups' and 'Farmer Producer Organisations' and supports entrepreneurship development and market-oriented training. It can therefore serve as an important institutional platform for implementing value chain extension at the district level by facilitating coordination among different public and private organisations. ATMA model is considered a key concept for decentralising decision making to the local level. Owing to its structure, it promotes coordination both among the government agencies and among the public, private and development organisations (Birner & Anderson, 2007).

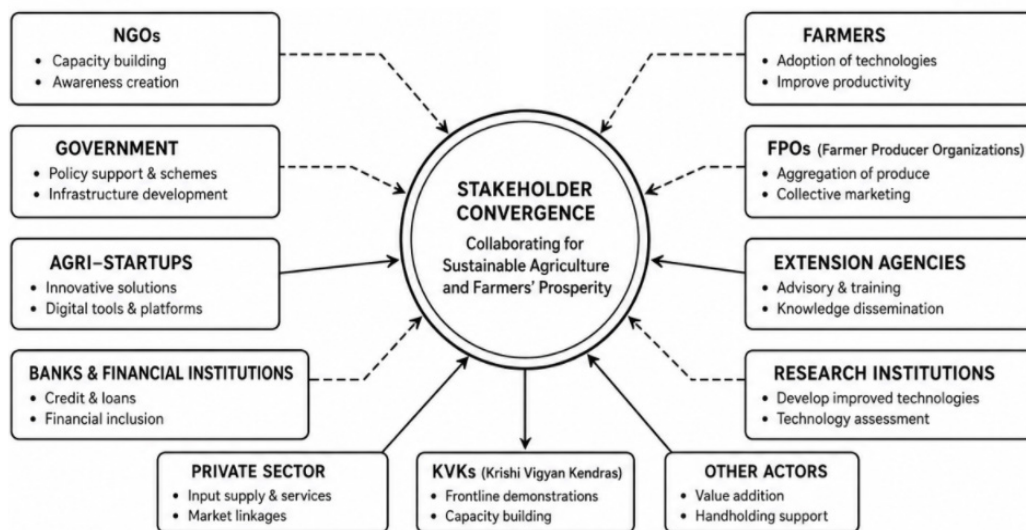
Institutional Arrangements

Agricultural value chain development requires coordination from input suppliers, farmers, FPOs, processors, transporters, warehouse operators, wholesalers, retailers, exporters, financial institutions, research organisations, extension agencies and consumers. Each performs a specialised function, but the efficiency of the overall chain depends on the strength of the relationships among them calling for the need for them to work in tandem. The government

extension agencies provide technical guidance, training, policy support and access to development schemes. Para-extension workers and lead farmers provide locally accessible advisory services and promote farmer-to-farmer learning. FPOs aggregate produce, improve bargaining power and facilitate collective purchase, grading, storage, processing and marketing. Non-governmental organisations support community mobilisation and institutional development, while private-sector organisations provide inputs, technologies, processing facilities, logistics and market linkages. Financial institutions facilitate access to credit, and research organisations generate technologies and quality-management practices.

In this ecosystem, the extension professional serves as a value-chain facilitator rather than only as a farm-level technology-transfer agent and therefore, need to have a complete understanding of the complete entire ecosystem in terms of stakeholders and institutional arrangement available to for realising the maximum profits from the chain (Figure-2). The extension role extends from helping farmers obtain appropriate inputs to facilitating production planning, collective action, value addition, business development, quality compliance, market linkage and consumer feedback. Effective coordination among these stakeholders can improve productivity, reduce transaction costs, expand market access and support sustainable and inclusive agricultural development.

Figure 2. Emerging institutional arrangement for agricultural extension in India



Source: Partly drawn from Mall et al., 2025

Different approaches for value chain orientation of extension

This section deals with some of the approaches which can be used to provide value chain orientation to the agricultural extension system existing in India.

Farmer Producer Organization (FPO)

Small and marginal farmers need extra support because of low marketable surplus, limited bargaining power, input costs and mechanical challenges. Farmer Producer Organisations provide an institutional mechanism through which such farmers can undertake different activities collectively. FPOs can reduce transaction costs, improve economies of scale and strengthen farmers' negotiating position in input and output markets. The role of an FPO can extend across the entire agricultural value chain from the input stage to the post-harvest stage. After harvesting, it can facilitate collective cleaning, drying, sorting, grading, storage and transportation. FPOs may also establish processing units, develop packaged and branded products, obtain quality certification and supply products to bulk and organised buyers and establish linkage with digital marketplaces. Agricultural extension organisations play an important role in mobilising farmers, facilitating FPO formation and strengthening their technical, organisational and entrepreneurial capacities. FPOs can function as intermediaries between individual farmers and other value-chain actors. Thus, FPOs provide an important platform for integrating smallholders into organised and higher-value agricultural markets. At present, more than 40,000 farmers' organisations are working in India under different arrangements. Some of these organisations have specialised in specific commodities and established direct linkage with bulk buyers and processors by avoiding intermediaries.

Technology Interventions in Crop Value Chains

Technologies are influencing how a commodity is produced, handled, stored, transported and marketed. There are different initiatives employing blockchain and IoT to manage the supply chain of perishables. Likewise, various mobile apps under private and public set-up are available to facilitate marketing of agricultural produce. Market intelligence systems provide timely information on prices, demand, weather, and consumer preferences, enabling farmers to make market-oriented production and marketing decisions. Digital platforms such as e-NAM improve market access, price discovery, and transparency. Drones and remote support assessment of crop quality and expected yields and facilitate traders and agro-industries in planning their procurement more efficiently. However, the usefulness of tools depends on accessibility, affordability, local relevance and interaction with farmers and FPOs with respect to various technologies available such as AI, IoT, blockchain, and traceability, drone,

remote sensing, e-NAM, digital payments and incorporating the information into production and marketing decisions.

Industrial Linkage

Industrial linkages play an important role in transforming agricultural produce into higher-value products and expanding market opportunities for farmers. Linkages with mills, food-processing units, dairy plants, cold-chain enterprises, exporters, retailers and agri-MSMEs can help farmers move beyond the sale of raw produce and participate in more profitable markets. Micro food-processing enterprises, self-help groups, cooperatives and FPOs can promote local-level value addition, rural employment and entrepreneurship. Programmes such as the Micro Food Processing Enterprises Scheme can support technology upgradation, product-quality improvement, branding and enterprise formalisation. Extension personnel can facilitate linkages among farmers to assist with enterprise selection, business-plan preparation, financial linkage, technology assessment and the establishment of suitable primary processing facilities, and integrating the same with industry.

Improvement of Post-Harvest Infrastructure

Post-harvest infrastructure may include village-level collection centres, drying yards, mechanical drying units, pack houses, grading and sorting lines, scientific warehouses, silos, cold-storage facilities, ripening chambers, refrigerated vehicles, primary processing centres, testing laboratories and packaging units. The type of infrastructure required depends on the commodity. The availability of infrastructure alone does not ensure its effective utilisation. Farmers and FPOs require technical knowledge regarding maturity assessment, harvesting methods, drying, moisture management, grading, storage conditions, cold-chain handling and inventory management. Accordingly, extension agencies should train farmers, organise regular capacity-building programmes for farmers, FPOs and rural entrepreneurs on post-harvest management, scientific storage, warehouse management, quality standards and value-addition practices.

Building Capacity of Farmers and Extension Personnel

Entrepreneurship and skill development are essential for fostering innovation and competitiveness in agricultural value chains. Agri-start-ups, food processing enterprises, women-led self-help groups, and rural micro, small, and medium enterprises (MSMEs) encourages for value addition and employment. Capacity-building programmes should therefore, extend beyond production technologies to post-harvest management, food safety standards, packaging technologies, digital marketing, and business management. Farmers require knowledge and skills related to quality-oriented production, appropriate harvesting,

post-harvest handling, grading, scientific storage, market information, digital platforms and financial decision-making.

Improving Market Linkages

Efficient market linkages are essential for ensuring that value-added products reach consumers at competitive prices while maximizing returns to producers. Strengthening linkages through contract farming, direct marketing, retail partnerships, institutional procurement, e-commerce platforms, export promotion, and digital agricultural markets reduces dependence on intermediaries and improves price realization. Consumer-oriented production, branding, and quality assurance further enhance market competitiveness and support the development of integrated agricultural value chains.

Policy and Institutional Support

The Government of India is very actively creating a platform for supportive policies and institutional frameworks for developing post-harvest infrastructure, processing enterprises, producer organisations, digital systems and market linkages. There are various initiatives of the Government such as Agriculture Infrastructure Fund (AIF), Pradhan Mantri Kisan Sampada Yojana (PMKSY), KCC Card Scheme, Digital Agriculture, Pulse and Oilseeds Mission, Mission for Integrated Development of Horticulture (MIDH), and schemes for promoting Farmer Producer Organizations provide financial assistance, infrastructure support, and capacity-building support to different value chain actors. These schemes are leading to effective value-chain development. Farmers and FPOs may face difficulties in understanding eligibility conditions, preparing project reports, completing documentation, arranging matching finance and managing sanctioned infrastructure. Extension organisations are providing institutional handholding by creating awareness, supporting proposal preparation, facilitating convergence among departments and connecting beneficiaries with technical and financial agencies.

Public to Public-Private Partnership (PPP)

Public private partnership is an arrangement between public institutions and private sector organisations, generally established to combine their respective expertise, resources and capacities for delivering services or infrastructure (Hodge and Greve, 2007). In agriculture value chains, public-private partnerships have great potential for their ability to connect farmers with input companies, processors, exporters, retailers, warehousing agencies, logistics providers, financial institutions and digital agricultural start-ups. Public extension agencies can provide technical guidance, mobilisation and institutional support, while private organisations may contribute specialised technologies, processing

facilities, market information and procurement arrangements. Extension personnel have an important role in ensuring that such partnerships remain transparent, farmer-oriented and beneficial to small and marginal producers. Public-private partnerships, access to affordable credit, investment incentives, and regulatory reforms further encourage private sector participation and accelerate value chain modernization.

Conclusion

Agricultural extension has an important role in empowering farmers and other players to realise full potential of farming. Considering the need for reorienting extension services from production-centric to value chain-centric approaches, the focus is shifting beyond production to encompass the entire agricultural value chain, covering input supply, quality assurance, post-harvest management, value addition, processing, branding, transportation, storage and market linkage. Towards this, the Government is now developing Farmer Producer Organizations (FPOs) into value chain facilitators for their ability to achieve scale, reduce transaction cost, establish infrastructure to support processing and storage, negotiate with buyers and integrate quality production with organised domestic and internal market. Agriculture has become multi-dimensional and technology is going to be an effective support. In order to support farmers and other players all along the supply chain, the extension system is now encouraging adoption of digital technology such as Artificial Intelligence (AI), the Internet of Things (IoT) and blockchain leading to various digital agricultural initiatives like Bharat Vistaar, AgriStack and Farmer IDs, eNAM and various mobile Apps. One of the most important focus area is building capacity of the extension professionals on different components of agriculture value chain to improve their ability to support farmers on aspects like access to inputs, production-technology, post-harvest infrastructure, government schemes, credit and public-private partnerships to support sustainable value chain development. Agriculture is changing, the environment in which it is practiced is changing, which calls for refocusing and redefining the concept of agricultural extension to go beyond the farmer and production, to include different actors and the components/activities supported by them all along the agricultural value chain (Ahmad & Slathia, 2011).

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