

Supporting Inclusive Innovation: Developing Improved Analytical Methods and STI Policy Instruments to Operationalise Inclusive Innovation

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Abstract—In this paper we consider the “inclusive innovation” concept and the growing interest among academics and practitioners in the role of innovation in socio-economic development. ‘Inclusive innovation’ – i.e. the development of new products, services, processes and business models aimed at resource-poor individuals or groups – is considered to present a positive contribution to better life conditions and upward mobility among low-income or resource-poor communities.

The gap that was identified in the literature is that there remains a lack of analytical methods to analyse inclusive innovation opportunities from a system perspective. We argue that there is a need for developing a systems and network approach to understand systems that perpetuate inequalities and poverty based on the terms and conditions of inclusion and exclusion. To this end, the contribution made in this paper is to create a framework on which basis the innovation systems approach may be contrasted and compared with approaches of pro-poor value chain development. The aim here is to explore how the value chain approach may be used or integrated in the analysis of inclusive innovation systems.

The methodological approach taken in this paper has its roots in the congruence analysis approach. Through this approach, we consider the explicit development of inclusive practices in innovation systems and value chains. We draw a number of general propositions towards conceptualizing and operationalizing inclusive innovation within the Innovation System (IS) and (Global) Value Chain (VC) frameworks. This is followed up with some proposals of how the IS and GVC approaches could be used in unison to the development of an analytical framework for operationalizing inclusive innovation.

I. INTRODUCTION AND PROBLEM STATEMENT

The pitfalls of unfettered capitalism are well documented and trends such as the concentration of capital within such system and resulting perpetuation of inequalities, is captured in a statement by Oxfam stressing the risks of an unfair system and increasing inequality: *“This massive concentration of economic resources in the hands of fewer people presents a real threat to inclusive political and economic systems, and compounds other”* *“Left unchecked, political institutions are undermined and governments overwhelmingly serve the interests of economic elites – to the detriment of ordinary people”* [1].

“Inclusive innovation” has been proposed as a promising approach towards which new growth paths may be created and where the poor/underserved may also benefit from the fruits of innovation. Inclusive innovation is the means by which new goods and services are developed for and/or by a

broad range of actors including those living on lower incomes. Conceptualisations of inclusion in the innovation process may include [2]–[5]:

- The problem statement: The extent to which the problems being addressed are relevant to poor people;
- The process of innovation: The extent to which the poor are involved in the development of innovations be that goods or services;
- The adoption or absorption of innovation: The extent to which the poor are able to use innovation or have access to these innovations, and;
- Economic inclusion: The extent to which the poor may economically benefit from innovations.

The South African environment with its relatively sophisticated economy, large percentage of unemployment and characterized by huge inequalities places the country in a unique position for a “Grand Societal Experiment”. Such an experiment may allow for exploring new ways of learning, new forms of collaborative problems solving and new growth paths that will promote inclusion of the poor (Rip, 2015).

In terms of the creation of an analytical framework we refer to Kuhlman and Rip’s [6] analysis of the requirements of a Grand Societal Experiment. Firstly, such a system requires a way to engage and support a “new constellation of actors” where a wider range of diversity is required not only in the presence of actors but also the options that are generated through these interactions between these actors. Secondly, a new range of institutions is required and a “reinvention of the commons” such as new forms of dealing with Intellectual Property which will have far reaching implications for the process of knowledge execution and circulation. Thirdly, a real requirement for social innovation exists where goals may be stated for social and economic systems – which has implications for how this constellation of actors choose to approach society’s greatest challenges. Fourthly, in order for these interactions to take place and for actors to engage in new ways – spaces and places need to be created where this may happen often through intermediaries, innovation platforms or through some traditional actors taking on new roles and approaches to engage. In the fifth instance, such a system will require new capabilities which has implications for the type and form of learning that needs to take place – the form and focus of these learning activities will drive an improved understanding of issues also various

perspectives and transformations toward constructive and productive interactions.

We propose that in order to be able to design such systems, analytical approach to guide and understand the development of inclusive development is required. We further aim to create a framework on which basis the innovation systems approach may be contrasted and compared with approaches of pro-poor value chain development towards designing and developing useful policy interventions.

We argue that such a framework will be useful as it will address the following:

Firstly, acknowledge the process of inclusion and exclusion as a systemic process that needs to be addressed on various levels and at various stages of development of such a system. Much of the literature on especially inclusive innovation systems provide insight on the micro-level [7] and defines various changes in the system but fails to provide insight on the dynamic processes involved – specifically the inclusion and exclusion process [8];

Secondly, to overcome the short comings of the systems of innovation approach that mostly is focused on components and functions and could be argued to neglect issues such as value chains and supply chain structures [9]. To this end this study provides a practical means towards analysing the system in terms of more structured approaches by including the value chain framework and to allow for systematically mapping and understanding possibilities for opportunities for inclusive innovation in a structured manner, and;

Thirdly, a framework may be utilised as a planning tool where we can consider normative approaches towards developing opportunities for inclusive innovation i.e. how to design the system and develop structures in order the create opportunities for inclusive development. This means that by mapping a stage model we have a means to assist in developing a transition and capacity development pathway. Here the transitioning of the system may entail a process of removing the old and building the new with an incremental process of strengthening an inclusive innovation system and therefore a framework within which the “Grand Societal Experiment” may take place [6].

II. METHODS

Sinkler [10] argues that as the usefulness of case studies to test general theories is limited and a contested area much debate has followed regarding methodological choices and approaches. Sinkler continues that such debates often fall short as it is based on a narrow definition of science and its goals to merely test general theories and to prove causal inferences. The goal of explaining an individual outcome (in

the form of a case study) is also a legitimate goal for scientific studies and entails a range of different standards than for “large-N” studies. Sinkler uses the analogy of a doctor that needs to explain the cause of death of a patient – the goal here is not to define a general theory of death but rather to explain the causes of death based on the doctor’s knowledge to explain this event. They propose congruence analysis which is based on the logic of retrodution as a useful method. This is not only used in autopsies but also natural sciences such as geology. In summary, the aim here is to consider how a range of factors and theories may explain an outcome.

The congruence approach has a very strong case study focus for comparing frameworks or theories. Traditionally this has been applied within the case study context where opposing or complementary theories are used to analyse case studies on which basis the real world relevance of such theories are determined. We adapt this approach to apply this to develop a scheme for comparison of two frameworks [11].

“Practitioners of congruence analysis indicate that empirical findings are strongly influenced by the theoretical lenses employed. Therefore, congruence analysis has a clear affinity for relativist epistemologies, which results in the conviction that empirical research cannot be used to verify or falsify theories but just to provide evidence for the relative strength of a theory by providing understandings and explanations. The reason for developing this range of lenses or theories is to apply a plurality of theoretical lenses in studying empirical cases. This plurality of theoretical lenses will provide a more comprehensive understanding and/or explanation of a specific case.” [12]:210

We propose that this discussion now be taken forward to develop a case study-based congruence analysis study to develop a more practical framework for uncovering inclusive innovation opportunities. Such a framework may uncover novel ways through which GVC and IS approaches may be integrated to inter alia, considering inclusion and exclusion as a process, uncover opportunities due to changes in manufacturing practices, the dynamics of the informal economy and how systemic processes may be engaged with to strengthen innovation systems to empower the marginalised. The ultimate aim is to therefore develop a typology of the explanatory usefulness and practical appeal of a synthesis of the approaches.

In order for us to be able to compare the descriptive and explanatory merits of each of the approaches we need to move through a number of steps that will aid a deductive analysis of the descriptive inference and impact hypotheses to be developed from such a study. We propose the following steps be integrated in the study where the same case will be analysed from a IS and GVC perspective (see Table 1).

TABLE 1: METHODOLOGICAL STEPS FOR OUR LITERATURE REVIEW

Step	Summary goal of step	Description of the step	Section addressed in this paper
Step 1: Data generation	Discussion of each of the frameworks, their relevance to inclusive innovation	<ul style="list-style-type: none"> • How do the frameworks allow for developing practical strategies and actions? • Develop an analysis of the descriptive and explanatory merits of each of the approaches 	Two framework namely the inclusive innovation systems (IIS) and pro-poor value chains (PPVC) approaches are discussed; The analytical components and methods are unpacked and briefly discussed
Step 2: Comparative analysis – objective 1	Contrast and compare the analytical approaches with each other	<ul style="list-style-type: none"> • Compare the descriptive and explanatory merits of each of the approaches • Dimensions and building blocks of the analytical approaches methods are contrasted and compared to each other regarding conceptual contributions 	In the section entitled “Comparative analysis” we contrast and compare the IS and GVC approaches; We unpack the key elements that each approach include in the analysis
Step 3: Comparative analysis – objective 2	The conceptual contribution of these approaches	<ul style="list-style-type: none"> • The real world relevance of the frameworks i.e. how they contribute to practical strategies and actions • An analysis of how the frameworks can complement each other in order to create a more comprehensive framework. 	In the section entitled “Comparative analysis” we compare the real world relevance of the frameworks and how they may contribute to practical strategies and actions
Step 4: Proposals for framework integration	General conclusions regarding integrating these frameworks in analysis	<ul style="list-style-type: none"> • An analysis of how the frameworks can complement each other in order to create a more comprehensive framework. 	General propositions are made regarding conceptualising and operationalising inclusive innovation within the IS and VC frameworks; Proposals of how the innovation system and global value chains approaches could be integrated and complementary are made

III. DATA GENERATION – A REVIEW AND DISCUSSION OF THE IS AND GVC FRAMEWORKS

Referring back to Table 1 in the methods section, this section provides a brief discussion of both of the frameworks namely Inclusive Innovation Systems (IIS) and Pro-Poor Value Chains (PPVC). We here explore their relevance to inclusive innovation analysis on a system level. Here as stated in the table we aim to answer the two following questions:

- How do the frameworks allow for developing practical strategies and actions?
- Develop an analysis of the descriptive and explanatory merits of each of the approaches

A. The process of inclusion and exclusion

Before a discussion is entered into around analytical approaches to inclusive innovation or pro-poor value chains, we frame the debate by introducing some basic aspects from the literature on “exclusion” or “inclusion” as a systems process.

Du Toit [13] criticises an approach for problematizing exclusion and highlights the role of the system dynamics of inequality, impoverishment and conflict within institutions, systems and networks [14]. It is widely recognized that poverty and underemployment may result from closer integration in systems i.e. the terms of inclusion as the distribution of wealth is becoming increasingly skewed [15],

[16]. This means that inequality and poverty may be the result of the terms and conditions of inclusion rather than exclusion [14]. Gupta [17] confirms and explain the views of the above authors, as “A relational view, then, understands poverty as the effect of social relations, understood not narrowly in terms of connectivity or networks, but in terms of inequalities of power”.

Processes and institutions are viewed as mechanisms through which marginalised people should be integrated into the circuits and networks of ‘developed’ society in ways that do not marginalize them and undermine their ability to control and impact the systems into which they are locked [13]. Therefore, when analysing exclusion, attention has to be paid both to the vertical links, the commodity chains and supply chain systems that link local livelihoods ‘upstream’ and ‘downstream’ to distant and complex networks of economic production and exchange [13], [18]. Equal attention should be paid to the horizontal linkages, the ways in which the impact and nature of integration and inclusion into globalized systems are locally mediated [13], [19].

Social exclusion provides a useful framework, conceptualising human deprivation and establishing mechanisms and understanding broader, structural factors that produce and reproduce it. This emphasises the linkages between the well-being and broader conditions and factors that affect different dimensions of well-being, as well as the description of the ‘outcomes of deprivation’ and ‘processes of

deprivation'. It focuses on societal structures leading to poverty rather than personal failings [20].

An accessible and practical contribution in the form of the "ladder of inclusive innovation" provides insight into various steps towards the implementation of inclusivity in the innovation process. What is of utmost significance here is the acknowledgement that as with scaling the steps of a ladder, the process of creating an inclusive innovation system occurred through a gradual deepening or broadening of inclusive practices. Generally a set of stages need to be moved through. We adapt these stages into the following [21], [22]:

- **Intention:** This is not based on action, but mainly the idea behind the innovation with the target group of excluded people in mind. This is the stepping stone for inclusive innovations to come.
- **Use of products:** An innovation can only be seen as inclusive if the specific innovation is adopted in such a way that the use of the product or service suits the requirements of the specified group. This will also include the aspect that the innovation should be affordable and accessible by the excluded group.
- **Developing and creating products and processes:** In this step it is impossible to include the entire group, but an innovation is seen as inclusive if at least certain members of the group are involved. In this category the involvement should be broken down into the different stages of innovation namely: invention, design, development, production and distribution. Here again the level of involvement should be determined in each of these steps and again different levels of involvement should exist such as: being informed, being consulted, collaborating, being empowered and controlling.
- **The structure and post structure of the system develops a transformed system where inclusive innovation is mainstreamed:** The actors and institutional set-up all of these include and draw on poor individuals not only as customers but also as developers. Here it may be required to adapt current innovation systems to become inclusive or create an alternative inclusive innovation system. Thus only if key actors involved allow inclusion for the excluded, can an innovation truly be called inclusive.
- **Impact:** An innovation can only be seen as inclusive if it has a positive impact on the daily lives of the excluded group. This can be in different perspectives. In an economic setting this can refer to greater productivity and welfare. On the other hand it can be seen as the impact in terms of well-being, livelihood and the capabilities of the excluded group.

Although a topic of increasing interest, the area of inclusive innovation has been relatively under-researched and under-conceptualized to date [21]. Although data is lacking and limited understanding exists regarding the inclusive

innovation perspective, a few fundamental characteristics have been observed regarding innovation in informal settings [23][24]:

1. Innovations in informal settings are frequently supported through the strong demand from users to obtain better-quality of life and welfare;
2. A large proportion of the skills in informal settings are acquired outside formal education/training systems;
3. The interaction among informal settings and formal settings is very limited, and the authors argue that formal networks may benefit from improving the diffusion of knowledge and scaling up knowledge creation in informal settings [25];
4. Howells [26] identified intermediary organisations/actors to play an important role in facilitating knowledge diffusion in informal settings. However, limited knowledge is available on how these intermediaries are formed and how they operate in an informal setting;
5. Although exceptions do exist, innovation in informal settings are characterised by incremental and organizational innovation as non-technological innovations dominate the innovation front [56][25] and;
6. Policies improving the welfare of marginalised populations in informal settings are a very new concept. Further research is required with regard to the local and specific context of knowledge flow and design and implementation of policies [28][25].

The major benefit of this relational approach to understanding social exclusion is that it places emphasis on the drivers of inequality rather than the conditions experienced by particular 'deep-rooted excluded' groups [29]. Exclusion has economic, social and political dimensions, not often explicitly stated. The exclusion process may form a very useful tool to analyse innovation system function processes in terms of the conditions and terms of inclusion. It is related to systems and value chains as exclusion processes look through the lens of networks, the interrelatedness among these networks and the actors participating within. From this it flows that the exclusion process will assist in the evaluation of inclusive innovation systems, in order to address root-cause processes for exclusion or inclusion on unfair terms.

This also has implications for the definition of inclusive innovation – where we see this as various stages to be moved through with various specific actors that need to be considered. People are therefore excluded from the formal market due to a lack of governance focusing on the social well-being of the poor as well as the lack of upgrading within a system or value chain to incorporate the poor. Every innovation function as well as the "ladder of inclusive innovation" requires attention to ensure the identification of target groups and that the specific requirements of the group are reached through the terms and conditions of inclusion.

These activities should also ensure that the method of inclusion unite communities and does not broaden the divide.

We can conclude from this section that poverty and exclusion may be seen as closely related subjects. There are however many instances where exclusion exist in the absence of poverty and vice versa [30]. For the purpose of this paper our attention will be directed towards the overlap of exclusion and poverty, and by the means of focusing on people who are excluded from participation in formal innovation systems and value chains. The process of social exclusion is seen as an addition to other poverty approaches, describing various contextualised social causes and/or consequences of poverty, with an extra emphasis on coercion and discrimination than is usually made in the more liberal strands of the poverty studies literature.

B. Inclusive Innovation systems

“Systems of innovation are shown to be an appropriate frame for conceptualisation of inclusive innovation. However, the conventional content of this framework must be modified to allow for particular features of inclusive innovation, including the nature of innovations and aim required, the actors involved and their interrelations, the type of learning they undertake and understanding knowledge flow, and the institutional environment in which they operate. Four system domains must be effective if inclusive innovation is to succeed: the product, its retailing and support, the micro-enterprises that provide these demand-side services, and the wider context” [21], [24].

The innovation systems approach is under increasing scrutiny as new challenges are emerging with the aim to ‘solve non-market problems’ in less-understood and under researched settings (informal, global, traditional, community of practice). A number of major overhauls of the concept is required as the goal of inclusive development may imply a shift away from the traditional goal statement for innovation systems being “the development and diffusion of innovations” to include an additional systems goal of the “creating opportunities for a better quality of life for the underserved/poor community”. Building on these systems goals this may have implications for the development of appropriate policies related to mechanisms that are either blocking or facilitating desirable system goals.

The components based approach and the functional approaches are the two main analytical approaches towards innovation systems analysis. The components-based approach (or structural approach) devotes its attention mainly to the various institutional actors and interactions between them [31]. The function-based approach focuses on system dynamics [32]. For the innovation system to perform well, it’s underpinning dynamic processes or functions are important. These functions include entrepreneurial activities, knowledge development, knowledge diffusion, guidance of the search, market formation, mobilisation of resources and

the creation of legitimacy [9], [33]. Wieczorek & Herkkert [34] argue that this perspective is complementary, as functions are dependent on actors and interactions. The analytical rationale is to identify the absence or weaknesses in functions. These perspectives may contribute to developing suggestions for systemic instruments through which the operation of the system as a whole can be modified and improved.

An inclusive innovation system can be defined as a multi-stakeholder social learning process that generates new knowledge, puts it to use, and expands the capabilities and opportunities of the poor [35]. As was discussed in the previous section, the “ladder of inclusive innovation” stresses that inclusion may entail a range of steps and dimensions of the innovation process and the benefits of such inclusion. The “ladder of inclusive innovation” stresses that inclusion may entail a range of steps and dimensions of the innovation process and the benefits of such inclusion, as discussed in the previous section. The components and functions-based approaches are combined to develop analytical building blocks to support systemic innovation policy instruments, which may include managing interfaces, providing platforms for learning and experimenting, developing strategies and visions, and stimulating the articulation of demand.

The usefulness of the components based approach for our purposes are a better understanding of opportunities for inclusive innovation systems as far as actors, learning, networks and linkages, infrastructure and institution are concerned [32]. This specifically entails the inclusion of non-conventional actors in knowledge networks and different contextual environments and conditions for interactions [36]. This “new constellation of actors” has implications for a new set of STI policies [37]. These actors must align their activities towards inclusive practices in order to create inclusive innovation systems.

The capabilities of actors to generate diffuse and utilize technologies that have economic value in an innovation system is an important consideration of an inclusive innovation system [33], [38]. The central process of knowledge creation and collaborative learning that needs to exist between the various actors in the system is an important function and enabler of inclusive innovation [39]. It also raises the issues of how and when to establish suitable linkages to develop and access knowledge and learning [40].

This is where policies will play an important role towards the way actors interact and how they align the interactions towards developing inclusive innovation systems. Within this perspective the top-down approaches of traditional STI policy also increasingly come into question with a renewed focus on bottom-up processes and the self-organization of users in communities.

The structural components of the innovation system need to be identified, which includes the various actors involved in Table 2 [32].

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TABLE 2: STRUCTURAL COMPONENTS AND INCLUSIVE INNOVATION SYSTEMS

Structural components	Key factors that this approach considers
Actors	Type of partners, competences and competence profiles, and capabilities of actors
Interaction	Type of processes and mechanisms, level and nature of engagement, networks and partnerships
Knowledge and learning	Education and education policies; knowledge areas of relative advantage; type of ideas and skills, type of (co-) creation processes and knowledge use, absorptive capacity
Innovation	Type of innovation, business models, sustainability and scaling-up, synergies and conflicting interests, between education, research, community engagement and commercialisation
Institutions	University policies, government-subsidy systems and support systems, tax system; intellectual property rights, laws and regulations
Infrastructure	Physical, knowledge and financial; development and improvement of infrastructure

TABLE 3: THE FUNCTIONS BASED APPROACH TOWARDS ANALYSING INNOVATION SYSTEMS ([9], [42])

Function	Description of functions	Inclusive innovation instrument goals	Examples of mechanisms	Development stage	Growth stage
F1: Entrepreneurial activity	Functions through which the region could create opportunities for businesses to exploit ideas - possibly through business-level or sector-level interventions	Involvement with BoP ¹ , BoP entry, Business planning, Business models for inclusive innovation	Processes, platforms and mechanisms through which technology providers or technology users could create opportunities for commercial exploitation	Experimentation with different designs Competition between alternative designs High entry/growth in number of entrepreneurs	Specialization Shake out
F2: Knowledge development and learning	This function describes the processes of knowledge development and learning through formal R&D or informal knowledge production activities	Sources of knowledge, focus of knowledge development, research capacity, research collaborations, IP protection	Processes, platforms and mechanisms of knowledge development and learning through formal R&D or informal knowledge production activities or co-production of knowledge	Learning by searching Product innovation	Learning by doing Process innovation
F3: Knowledge dissemination / diffusion	The role to support the diffusion of ideas and of innovations - possibly through supply-side and demand-side support mechanisms	Focus of dissemination, capacity for dissemination, absorptive capacity, dissemination methods	The diffusion of ideas, skills and/or technologies through supply-side and demand-side support mechanisms	Exchange through personal networks Exchange at academic conferences Science – entrepreneur interaction	User producer interaction
F4: Guidance of Search	Guidance on the appropriate investment in technology or projects	Focus of considering opportunities e.g. inclusion of development concern in policies, recognition of constraints in planning, support for strategic knowledge development	Guidance on the appropriate (monetary or non-monetary) investments in technologies or technology-based services	Hype cycle expectation dynamics Expression of general positive expectations Appearance of foresight studies and government plans	Expression of more realistic and specific expectations Technology Standards
F5: Market Formation	Mechanism through which the region can create a space in which innovations can be developed and also introduced to markets – e.g. access to markets,	How is government supporting the creation of spaces for innovations to become market-ready, gaining access to markets	The role and contribution of technologies, or technology-based services, to create ‘technological innovations’ for competitive (local) user markets and/or commercial market economies	Limited demand articulation Small non-commercial market for experimenting	Creation of niche markets Establishment of mass markets
F6: Mobilization of resources	Support to access to Human and financial resources available for innovation	Access to capital, access and development of human resources and appropriate financing and business models for inclusive innovation	Human and financial resources available for creation or development of innovation	Availability of (Public) R&D funds	Availability of capital from profit oriented actors
F7: Creation of legitimacy	What support is in place to legitimise resources and commitment from government and the private sector to support innovation?	Commitment, engagement with community – legitimacy and sustainability of relationships	Support facilities and mechanisms to legitimize resources and commitment from actors and stakeholders (universities, government, private sector) in order to support technological innovation	Alignment with general societal concerns Alignment with positive expectations	Lobbying by dedicated lobby groups, branches organizations and NGO’s

¹ Base of the Pyramid

The usefulness of the functional approach on the other hand provides insights into the functional patterns of the system. These functions map out a range of processes largely as normative features of the innovation system. Accounts in the literature exist where the functions based approach considers a range of typological components which provides insight into the range of attributes to shape these functions to support inclusive practices [7], [32], [41].

There are considerable differences of how the various functions of an innovation system is performed not only between systems but also the various stages of the development of such systems [42]. As the functional pattern is likely to differ from one system to the next, as well as over time, care should be taken in doing this analysis and also to consider the evolution of the system [32].

One way of developing a scheme along which one can attempt to consider the creation of opportunities for the poor to be included in systems is then to link the findings from the analysis to systemic instrument goals aimed at improving the operation of the system [34]. Here the systems failure rationale for selecting and developing policies is important. [32]. In actual practice, 'systemic instruments' take the form of specific interventions that in one way or another need to address relevant system imperfections and failures [40]

Alkemade & Hekkert [42] built on the functions based view and develop a scheme against which one may map the specific types of functions and also the various focus areas for them during a "development stage", growth stage and maturity stage of an innovation system. This is interesting as the industry life-cycles of specific industries may also be brought into the picture.

C. Industry or Global value chains for inclusive development

As argued by Kaplinsky & Morris[18], the value chain (VC) has mostly been applied as a heuristic device but has also generated some utility as an analytical structure. Value chains may be viewed as a framework against which to analyse sources of rent and allows for the recognition that these rents are dynamic, changes over time and become eroded through the forces of competition. Through VC analysis the determinants of competitiveness can be unpacked with a specific focus on the range and structure of interconnected firms rather than of the individual firm.

Kaplinsky & Morris [18] provide valuable insights to why value chain analysis may strengthen such systems. Referring to Adam Smith, they explain that with the division of labour and mechanization of labour and the resultant optimization and optimal efficiency of production processes makes system thinking very important. The intra-plant processes have spread also to intra-firm level. Here it has been shown that should a firm aim to become more competitive, the various tiers of suppliers need to ensure similar processes such as Just-in-Time or total-quality-management and continuous improvement. Through an improved understanding regarding the nature of returns and the linkages throughout the value chain, policy makers may be better positioned to address the question of appropriate value chain upgrading.

The framework acknowledges power between the rural poor and lead firms that set the "rules of the game", and allow for access to opportunities. It acknowledges that trade is about economic power and the ability to extract value from the value chain [43]–[45].

The value chain places economic viability and suitability at the core. Here it allows a dimension to enterprise development that acknowledges the need to be compatible with market-based approaches to development [44], [45]. It provides a diagnostic tool to identify blockages and target groups in order to design robust and effective policies. It is not only a practical framework for a normative approach but also serves to diagnose issues for formulating interventions.

Value chain interventions in the sense of inclusion may mean the overhaul of current processes in order to align activities to include informal sector in formal value chains. The analysis is evidence based and action oriented and can be focused on the firm level that show what specific firms need to do and is not overly reliant on issues such as "competitive advantage factors" that may be difficult to act on and provide few clues on developing strategic interventions.

Frederick [46] transformed the building blocks named earlier into steps used to carry out a value chain research approach and analysis. These steps along with the framework approaches of Henderson et al. [47] and Unido [48] has been combined to give an overview of possible strategies and framework approaches.

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TABLE 4; VALUE CHAIN RESEARCH APPROACHES AND ANALYSIS

Category [48]	Description [48]	Factors considered [48]
Physical mapping	Physical mapping of value chains to consider the structure and flows	Output values, physical flows of inter alia services, consultants, skills. The employment in the chain, and also flows on a geographic level such as import and exports on a geographic level.
Dimension 1: Sourcing of Inputs and Supplies	The mapping and analysis of sources of products and services, the relationship and structure of chains through identifying partners and suppliers or customers, providers of primary materials and inputs in the industrial process.	<ul style="list-style-type: none"> • Product • Value chain actors and their functions • Flow of product and end-markets • Business interactions • Service provision
Dimension 2: Production Capacity and Technology	Analyse and understand capacities of firms to manufacture and transform goods. Here we consider various factors such as the means of production, human capital and knowledge and technologies applied	<p>Often indicators of technical productivity, cost-efficiency and profit margins are used to describe and compare productive capabilities.</p> <ul style="list-style-type: none"> • Production capacity • Technology • Knowledge use • Costs and margins • Innovation
Dimension 3: End-markets and Trade	Analyse and understand the markets and their product quality requirements. This includes considering the capacity of the value chains to meet demands, the role of traders, buyers and customer segments sometimes requiring standards and licensing.	<ul style="list-style-type: none"> • End-product characteristics • Consumer demand • End-buyer perspectives • Marketing and trade capacities • Standards
Dimension 4: Governance of Value Chains	Governance analysis will provide a view on the rules that determine the functioning of the value chain. Here power relations and the dominance of certain players, barriers to entry play a role. The focus is here on the institutional environment as well that may include contractual arrangements and the factors that affect the relationships between actors	<p>The form an focus of governance affects the relationship through which the business operate, diffuse and absorb knowledge technology and competences</p> <ul style="list-style-type: none"> • Actor domination • Participation in and distribution of value addition • Cluster concentration • Type of governance
Dimension 5: Sustainable Production and Energy Use	Sustainability considerations may also be included in value chain analysis. Here consideration needs to be given to complying with standards, environmental regulations and apply cleaner production and energy efficient technologies	<ul style="list-style-type: none"> • Use of materials • Energy use • Use of water • Effects on bio-diversity • Emissions • Waste management
Dimension 6: Value Chain Finance	An analysis of value chain finance provides insight into how activities are financed. Here we consider the appropriateness of finance delivery mechanisms and the accessibility of finance by value chain actors	<ul style="list-style-type: none"> • Financial attractiveness • Financial risks • Norms and practices • Availability of financing • Financing gaps
Dimension 7: Business Environment and Socio-political Context	Generally the business environment may facilitate or constrain activities in the value chain. Here the role of public institutions is considered as well as the trade regime and trade regulations, support services to industry, business culture etc.	<ul style="list-style-type: none"> • Business environment • Product and trade regulations • Public and private service provision • Social and cultural context

IV. COMPARATIVE ANALYSIS OF THE IIS AND VC APPROACHES

The Global Value Chain (GVC) literature and innovation systems approaches have developed in parallel and there exist increased awareness of the benefit of combining these approaches to strengthen development planning and analysis, however very little work is done to achieve this. It has been acknowledged that there is great potential in integrating the GVC and innovation system approaches towards a more comprehensive framework for analysing opportunities for inclusive innovation [49]–[51]. The traditional innovations systems approach augment specific stages of a value chain by focusing on knowledge creation and the use of it, while the traditional value chain approach focus more on value creation and market opportunities and linkages across a chain [18], [49], [50], [52], [53].

This section now sets out to achieve the objectives as were stated for steps 2 and 3 in the methodology section (Table 1). We briefly revisit the objectives as:

In order to fulfil the objective of step 2 (see Table 5) we contrast and compare the analytical approaches of the IIS and GVC with each other and compare the descriptive and explanatory merits of each of the approaches. The purpose of this is to uncover the dimensions and building blocks of the analytical approaches

Also, in order to fulfil the objective of step 2 (see Table 5) we contrasts and compare the conceptual contribution of the IIS and GVC and explored the real world relevance of the frameworks i.e. how they contribute to practical strategies and actions. Here the purpose of the analysis is to focus on how the frameworks can complement each other in order to create a more comprehensive framework.

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TABLE 5: COMPARATIVE ANALYSIS OF SYSTEMS OF INNOVATIONS AND GLOBAL VALUE CHAINS FRAMEWORKS

Key areas of analysis	Systems of Innovation	Global value chains
The conceptual contribution of these approaches	<ul style="list-style-type: none"> • Inclusive innovation systems in early stages of development, the application on inclusive innovation systems mostly on the micro-level at this stage; • The core of this approach centers on the systems failure rationale for government intervention and means a shift from neo-classical approaches of solving the problem of efficient allocation of resources or improving productivity to creating opportunities for innovation; • We propose that this systems perspective to inclusive innovation may have implications for treating the issue of creating inclusive innovation systems and policies and mechanisms to affect change as a matter of institutional design; 	<ul style="list-style-type: none"> • The area of pro-poor value chains have been well established especially in the agricultural sector and has been used a lot by international development agencies; • The value chain approach has a key strength that it allows for addressing the nature and determinants of competitiveness and expand from individual form to groups of interconnected firms; • Consideration of all links on the chain allows for identification of increasing returns and decreasing returns – allowing for policy development and appropriate choices; • Consideration of the mode of connectedness and also integration into global value chains; • Allows for understanding inter country income distribution and drivers of integration; • Globalisation and governance key factors in considering value chains;
Dimensions	<ul style="list-style-type: none"> • Supporting bottom-up processes and self-organization has implications for policy design; • The inclusion of non-traditional actors and new methods for learning and interaction – also has implications for STI policies through “new constellations of actors”; • Multiple dimensions of knowledge and definition of types of knowledge as well as the diffusion of such knowledge; • Component-based approaches allows for structural analysis: Actors, Infrastructure, Learning, Knowledge, Linkages and networks; • Functions based approaches consider systems functions and various dynamics that need to be stimulated in the system; • System failure approaches to identify focus for creating opportunities for innovation and systemic instruments to overcome weaknesses; • Learning traditionally a core focus of IS and focuses a lot on a range of capabilities that need to be developed in systems actors namely: selective or strategic ability, organizational ability, technical ability, learning or adaptive ability; 	<ul style="list-style-type: none"> • The GVC framework is divided into four building blocks that can be used to describe the structure, dynamics and relationships among stakeholders in global value chains: <ul style="list-style-type: none"> ○ Supply chain segments (inputs, components, final products, distribution/sales), ○ Value-adding activities (research, design, marketing and support services); ○ End markets; ○ External supporting environment (business, information, and technology services, education, testing, and training, government services, infrastructure and finance, NGOs and standards, and trade and professional organizations); • GVCs are acknowledged to be embedded within economic, social and environmental institutional dynamics; • The mechanisms through which the value chain’s structural factors interact and is organized is also acknowledged to be determined by geographic scope: activities in the input-output structure is often carried out in different parts of the world thereby acknowledging the geographic nature of the value chains; • Institutional context: identifies how local, national and international conditions and policies shape the globalization of each stage of the value chain; • Upgrading: Involves a learning process through which firms or countries aim to maintain or improve their position in the global value chain; various types if upgrading acknowledged in value chain literature which also may link up with different types of learning. Importantly, the VC literature also sees upgrading and development as a process driven by mostly the private sector with small role for government; • Governance, i.e. the mechanisms of exerting and distributing power throughout the chain; Acknowledges the role of power-relations and hierarchy included through governance mechanisms;
The real world relevance of the frameworks i.e. how they contribute to practical strategies and actions	<ul style="list-style-type: none"> • Assists in the comparison of innovation system performance with other institutional set-ups; • Provides a systematic method of mapping determinants of innovation and thus increasing the analytical power of innovation system; and • Deliver a clear set of policy targets and instruments that meet these targets. • Allows for the analysis of components in the system, their role and quality of these components • Allows for a functional analysis to identify the range of functions that an effective innovation system supports towards its goal of developing and diffusing innovations • Allows for various functions an actors to take on a different shape during various stages of development of an innovation system • System failure approach allows for redefinition to define processes of exclusion or inclusion on unfair terms as “systems failures” and therefore basis for intervention • The design of systemic instruments through which system goals could be achieved 	<ul style="list-style-type: none"> • Access to opportunities: Allows for a mechanisms through which one may have a structured approach to identify opportunities how poor people can engage in regional or international trade • The value chain places competitiveness, economic viability and suitability at the core and has mostly a market-based focus in the range of mechanisms introduced to strengthen chains; • Provides a diagnostic tool to identify blockages and target groups the design robust and effective policies it is basically a practical framework for a normative approach but also to diagnose issues for formulating interventions (Mitchell); • Useful to identify core rents and barriers to entry – specifically allowing for how one may support the poor to participate considering key mechanisms for upgrading namely: the need to improve system efficiency; product quality; product differentiation; social and environmental standards; and the business environment. (Mitchell); • It is scalable and can be applied to clusters of firms but also nations and regions. It is therefore evidence based and action oriented – it also can be focused on the firm level and show what specific firms need to do and is not overly reliant on issues such as “competitive advantage factors” that may be difficult to act on and provide few clues on developing strategic interventions; • The aim is to locate the biggest and most costly value chain weaknesses, dysfunctional links and most costly inputs. This means it is a means for analysis and understanding systems weaknesses and failures: cost drivers, risk, opportunities, sustainability, resilience, competitive advantage, localisation issues, strength of the supply base, routes to market; • The impact of globalisation on the dynamics in the value chain can effectively be included as these are part of the mapping process; Extra-regional issues and their impact on the value chain; • The role that institutions play in structuring business relationships and industrial location is useful

V. PROPOSALS FOR FRAMEWORK INTEGRATION

In order to fulfil step 4 as outline in the methodology section in Table 1 we make some proposals for framework integration. We also draw general conclusions regarding integrating these frameworks in analysis. This entails an analysis of how the frameworks can complement each other in order to create a more comprehensive framework. And to make some general propositions regarding conceptualising and operationalising inclusive innovation within the IS and VC frameworks. We also attempt to make some proposals of how the innovation system and global value chains approaches could be integrated and complementary are made.

Innovation can be an appropriate mechanism to develop local economies on a regional level. As the informal market vastly differs from the formal markets, new and innovative solutions are required to bridge these differences. An opportunity but also challenge awaits for engaging in a “Great Societal Experiment”. This will entail coordinated action across a broad range of actors from the national to regional and local level to work towards better understanding and equipping themselves to solve local problems. Countries like South Africa is uniquely positioned to take a lead role in this process as it has strong links into global value chains, good IT and financial services sectors, innovative capabilities and a mature innovation system. Apart from these positives South Africa also faces local problems such as huge inequalities, poor government service delivery, low educational attainment, endemic poverty - similar to many other developing countries [6].

Should one embark on a “Great Societal Experiment” it may entail developing proof of concept innovation projects and programmes that may involve “new constellations of actors” that also includes non-traditional actors. These actors will have to engage in new forms of collaborative learning and knowledge production which will require novel approaches to Science, Technology and Innovation (STI) policy where traditional top-down approaches will have to be augmented with considering how bottom-up processes could be supported. An important factor to be considered is that an important role needs to be reserved for the private sector in stepping into this space where market-based solutions need to be sought for sustainably involving, engaging and benefitting the poor and presently underserved [6].

The bottom-up processes that needs to be stimulated requires a whole new range of instruments and mechanisms to drive behaviour from the bottom-up. This has major implications for the role of local and regional government. The range of mechanisms under control of regional government such as enterprise development, cluster support, trade facilitation, are possible effective platforms for supporting experimental projects.

An experimental approach towards supporting inclusive innovation projects may provide an ideal learning

environment for public sector but also private sector and community organisations about what works for whom.

We propose in this section that in order to develop a new order of innovation systems as described above, it will require the identification and development of growth points and new development pathways. In the following sections we therefore proceed to make the following suggestions:

- We draw a number of general propositions towards conceptualising and operationalising inclusive innovation within the IS and VC frameworks;
- This is followed up with some proposals of how the innovation system and global value chains approaches could contribute to develop an analytical framework for operationalising inclusive innovation.

A. General propositions for inclusive innovation

A relational and systems approach places emphasis on drivers of inequality and has social, economic and political dimensions. Social structures are acknowledged as the key mechanisms through which exclusion is affected rather than personal failings – this is an incredibly important aspect of considering how exclusion related issues may be mediated.

Social and economic exclusion should be approached as a systems process and the key drivers of this i.e. place and connectivity to networks and power asymmetries should be recognised. Considering the inclusion or exclusion as a systems process means that the root cause of inequalities need to be addressed. Through such analysis vertical linkages (that consider upstream and downstream) and also horizontal linkages (how VCs are integrated into global systems and how they are locally mediated) should be considered. Here one may argue the VC and IS frameworks may be useful to understand such phenomena.

Within the South African context, as an immature inclusive innovation system may be characterised by ad hoc projects and also by engagement through relationship that may be tenuous. Such a systems approach need to ensure that the levels of skill, knowledge and depth of relationships are developed in such a way that they become more valuable and enduring over time.

Within an inclusive innovation systems perspective the above implies that the systems goal should be expanded from “the development and diffusion of innovations” that may also be expanded to inclusion related goals as outlined in the ladder. Such a shift in systems goals will require some transition not only in the nature of the components of the system but also the systems functions. Here one may argue that considerations will need to be given to transactional vs transformational interventions. These in turn may be useful to consider appropriate systemic instruments through which transformation could take place.

B. Analytical propositions – IS and VC approaches

The inclusive innovation systems perspective is a useful conceptual method to consider the inclusion of marginalised groups in formal systems through innovation. The innovation systems approach has a very strong systematic method for mapping the determinants of innovations, hence providing a strong analytical power. The components and functional approaches are at the core and allow analysing innovation systems on the basis of the exclusion process / inclusion on unfair terms.

One may therefore argue whether within an inclusive innovation system framework one may include the failure of the system to create opportunities for including the marginalised in various aspects of innovation and predominantly to benefit from progress as a systems failure. This then may also be argued to form the basis for a new set of policy mechanisms and instruments and an additional rationale for government intervention. This then becomes a question for institutional design that allows for inclusion and also to sustainably develop value chains for industries that can support inclusive development. Many pitfalls may be conceptualised here in that there certainly is potential that an anti-business or sub-optimal intervention scheme may result where traditional business and value chains may become uncompetitive.

Here some guidance from the value chain perspective will be highly instructive as this helps us to consider competitiveness, rents, and sources of rent, the supply chain and input-output processes and also to include sustainability and innovation integration in the process. Furthermore, the value chain approach places much emphasis on developing market-based approaches to pro-poor development which arguably may be a core consideration should one want to ensure sustainable and business friendly mechanisms for inclusive development. It allows for acknowledging the globalised nature of value chains, the realities of competing and surviving in value chains through the governance mechanism and may provide a basis for benchmarking.

Although value chains as an analytical construct has been critiqued due to the lack of empirical work on the process of exclusion and inclusion and the phenomenon of upgrading in value chains, it does provide an additional dimension to the innovation systems approach by bringing a globalised perspective and some focus on the governance and upgrading processes [54].

The most obvious lesson found for GVC's, from innovation studies is that the outcome of integration in a GVC will be determined by the effort made inside the firm, the regional and national context as well of the specificity of the industry [51]. Where in turn the GVC approach may assist in understanding the limitations of the national system perspectives and strategies in relation to innovation in a globalised world [55][56].

Global value chains acknowledge not only the actors and components but also include end markets as well as a supporting business environment – providing a quite comprehensive cover of the various actors in the system. Furthermore, the upgrading and governance dynamics allows for the analysis of power relations and their effects along the value chain – this has an implication for how we consider inclusiveness. Lastly, GVC approaches provide some insight into competitiveness issues that have implications for the long-term sustainability of value chains through barriers to entry analysis; systematically identifying the rents and the sustainability of those rents.

In conclusion, the process of exclusion as a systems function brings a new dimension to consider the development of inclusive innovation systems. This will have implications for the actors and components as well as the dynamics between them. GVCs may help to identify the places where the biggest benefit may be gained for the poor. The GVC framework also provides a much more structured method for considering the role and place of actors in the system – allows for acknowledging the exclusions dimensions that IS and GVC approaches are able to accommodate.

C. Next steps

We propose that this discussion now be taken forward to develop a case study-based congruence analysis study to develop a more practical framework for uncovering inclusive innovation opportunities. Such a framework may uncover novel ways through which GVC and IS approaches may be integrated to inter alia, considering inclusion and exclusion a process, uncover opportunities due to changes in manufacturing practices, the dynamics of the informal economy and how systemic processes may be engaged with to strengthen innovation systems to empower the marginalised. We propose the following steps be integrated in the study where the same case will be analysed from a IS and GVC perspective.

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TABLE 6: STEPS FOR A FUTURE CONGRUENCE ANALYSIS CASE STUDY APPROACH (ADAPTED FROM [11])

Step	Summary goal of step	Description of the step
Research questions and research goals	Which explanatory approach provides more/new insights	<ul style="list-style-type: none"> Compare the descriptive and explanatory merits of the IS and GVC frameworks as an approach (to some extent covered in this study)
Focus	Two comprehensive frameworks	<ul style="list-style-type: none"> How do these frameworks complete or complement each other?
Selection of cases and theories	Reasons for selecting each of these theories	<ul style="list-style-type: none"> Arguments and basis of the cases to be compared Arguments and basis of the frameworks to be compared
Data generation	Drawing causal inferences for the cases under investigation	<p>Descriptive inference:</p> <ul style="list-style-type: none"> How do the frameworks allow for developing practical strategies and actions? <p>Impact hypotheses:</p> <ul style="list-style-type: none"> What are recognized methods used to analyse the systems? How do they assist in operationalising the listing of observations that can confirm or deny expected mechanisms to drive outcomes
Data analysis	Differences among the theories in respect to the level of congruence between expectations and observations.	<ul style="list-style-type: none"> Here the two methods will be evaluated against each other based on the analysis of the above cells. This will comprise of an in-depth analysis of the pro's and cons' and how the frameworks can complement each other in order to create a more comprehensive framework.
Generalization	Drawing conclusions beyond the cases under investigation	<ul style="list-style-type: none"> What works and does not work? Compare the frameworks in terms of an explanatory typology of usefulness

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