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Chapter 9

Sanitation management knowledge value chain

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Chapter objectives

The aim of this chapter is to help the reader to understand the working of the Sanitation Management Knowledge Value Chain, which shows the linkages between knowledge enterprises that source, acquire, create, distribute and utilize sanitation knowledge to produce effective, functional and sustainable novel and innovative solutions. Other issues to be covered under this chapter include but are not limited to sanitation knowledge, sanitation management knowledge and learning, sanitation knowledge management processes, and sanitation management knowledge marketplace.

9.1 INTRODUCTION

The knowledge of sanitation management and about sanitation is embedded in various activities, several organisations and individuals with different focus, disciplines and in different sectors as sanitation has become everybody's concern (TBC, 2017). Sanitation is no longer just a development concern, but increasingly an integral aspect of enterprises' operations because providing access to safely managed sanitation has shown spillover benefits for occupational health and safety (OHS), environmental sustainability, socioeconomics and cultural sustainability, corporate social responsibility (CSR) and even business success (ADBI, 2019; TBC, 2019a). Creating and using knowledge is now central to sanitation management for both public and private sector (Simard, 2006) and is probably why knowledge and learning in sanitation management has seen increased focus in the last two decades. When sanitation knowledge is properly managed and disseminated then quality and effective innovations will ensue (Darroch, 2005). The SDG 6 and its targets for sanitation and the related links to other SDGs like end poverty, health, education, sustainable cities, clean energy, gender equality and collaborative partnerships among others have opened up an urgent need to create and share knowledge across sectors, disciplines and regions for deeper understanding and innovative and contextual solutions (TNUSSP, 2018). The demand for increased access, improved service and inclusivity has stirred up a drive for innovation that requires sanitation

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management professionals to operate with up-to-date knowledge and opportunities to learn what is required to deliver quality and innovative products and services.

However, the dispersed nature of sanitation management knowledge, whereby content required to build on the quest for safely managed accessible and inclusive sanitation is scattered among diverse groups with different perspectives and no authoritative sources of knowledge (Becker, 2001; Dew *et al.*, 2004), creates uncertainties in the sanitation sector and too many actors with different ideas and practices. But, when the myriad of data, information and existing knowledge about sanitation and its knowledge are tied together as one coordinated systemic whole, that is gathered or collated and organised in order, then a clear and comprehensive picture of the complex and dynamic nature, problems and solutions of the sanitation phenomena can be addressed (Becker, 2001). This is where knowledge and learning management service providers find their place in the Integrated Functional Sanitation Value Chain (IFSVC) as they create, use and distribute relevant knowledge content, products and services that support innovation and management in sanitation. They operate in the Knowledge Economy (KE) as support mechanisms for sanitation management enterprises and organisations as well as those in related industry that need sanitation knowledge (Sani-K). In fact, the IFSVC (proposed in this book) cannot function effectively and sustainably without a sanitation knowledge market (Sani-KMart) where there is a demand and supply of knowledge about sanitation and its management that will enhance the creation, manufacture and delivery of related content, products and services. In essence, the sanitation sector will be strongly dependent on the acquisition, creation, distribution and utilization of knowledge to produce effective, functional and sustainable novel and innovative solutions towards the progress of the SDG 6 related Targets (Kefela, 2010) with knowledge as both input and output.

As has been pointed out by many scholars, the global economy has transited to a Knowledge Economy (or digital) (Powell & Snellman, 2004) that depends primarily on knowledge as the key asset for knowledge-intensive activities, which creates added value to advancements in innovations that are heavily reliant on human and intellectual capital (Powell & Snellman, 2004; Pluta-Olearnik, 2013; World Bank, 2007). Knowledge has quickly and easily become an important tool for value creation with ideas as the ingredients and intellectual property as the merchandise that fuels the drive for change in the face of society's demands for smart solutions that offer more convenience and affordability (Bryan, 2004). The knowledge economy (KE) is directly based on the acquisition, creation, distribution and utilisation of knowledge more effectively for novel innovations toward progress in society (Kefela, 2010) – with knowledge as both significant input and output. This implies that for the sanitation sector to meet the demands and expectations of clients and users, it must rest strongly on knowledge drawn from information and data, and also the experience and expertise of highly skilled workers, as well as the increasing need for readily accessed knowledge input and output sourced for, produced and used by private and public entities across industrial sectors (Bryan, 2004; World Bank, 2007) to sustainably and effectively manage sanitation at all levels; enterprises and organisations that anchor their competitive advantage on knowledge-based innovations and solutions will drive the sector (EMCC, 2005; Miles, 2005, 2007; Miles *et al.*, 1995; World Bank, 2007). It becomes imperative that knowledge-intensive activities and services become essential to the complex and dynamic innovations and inventions that will move the sanitation economy to the next level. Sanitation management enterprises and organisations that produce content, products and services for industries, governments, businesses, communities and households will have to shift to knowledge-intensive interactions, internally and externally (e.g., research, customer engagement, training, education, etc.) to activate new knowledge and use available

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knowledge in conjunction with new knowledge to enhance their deliverables, customer management and to meet the SDG Targets.

As safe sanitation management demands for innovations and novelty in product manufacture and service delivery rises, in turn, the demand for knowledge content, products and services has become an urgent necessity. Considering that knowledge is regenerative and can keep reproducing itself or another version of itself or even a new knowledge entirely in a different area, and can be delivered as a product or service that is available for distribution based on demand and supply (i.e., there are those who will provide and those who will pay for them) (Simard, 2006), the sanitation knowledge market (Sani-KMart) is crucial to all stakeholders in the IFSVC. In fact, this is big business as the art and act of turning knowledge into products and services is a key competitive advantage for sanitation enterprises, organisations, professionals and also for economies and societies of the future. The Sani-KMart creates a circular platform for sharing and/or exchanging information as well as distributing knowledge sources between users and suppliers – either for a fee (e.g., IWA) or free (e.g., Susana) (Simard, 2006). They are made up of problem-solving, innovations, civil/social, business and research activities, and are transactional systems that trade on contents, agents' experiences and relevant interactions determined specifically through the dynamic properties of intellectual capital creation and exchange (Carrillo, 2016; Pluta-Olearnik, 2013). Sani-KMart are the conduits from which transactions in knowledge products and services are conducted to provide content, support, guidance, and other merchandise towards the demands of consumers (OECD, 2013, 2012; St Clair & Reich, 2002). There are four ways to deliver Sani-KMart as a service (Simard, 2006): generate content, develop products, provide assistance and share solutions. Sanitation knowledge services (Sani-KServ) could then include, education, training, research/development, ICT, design, media content, databases, repositories, legal, finance, marketing, and other professional services while sanitation knowledge products could be reports, manuals, publications, agreements, contracts, and so on. They could be produced and/or provided by knowledge-intensive firms/organisations (KIFs/KIOs) by employees and/or outsourced to knowledge-intensive business services firms (KIBSFs) (Alvesson, 2004; Den Hertog, 2000; EMCC, 2005; Khadir-Poggi & Keating, 2013; Muller & Doloreux, 2009; Swart & Kinnie, 2003) in the sanitation economy.

The characteristics of sanitation knowledge (Sani-K) consumers are diverse as are their expectations, but one thing is common, supply of solutions that meet the knowledge demand are equally wide and far-reaching. This indicates that the Sani-KMart is not linear, but exists within the circular economy whereby relevant knowledge is also desired by users outside the core sanitation sector (e.g., transport, healthcare, construction, tourism and hospitality, events management, etc.) and by the producers of Sani-K. But, surviving in the knowledge marketplace is highly dependent on seamless and high access to knowledge and the ability to create and use knowledge faster than others (Amidon, 1997; Davenport & Prusak, 1998; Nonaka & Konno, 1998; Simard, 2006) as this could enhance efficiency, novelty, innovation and competitiveness (World Bank, 2007). Thus, knowledge should drive the IFSVC as the push towards better sanitation management fuels the need for innovations in developed and developing countries. This value chain rests strongly on knowledge drawn from information and data, history and the repository of experience and expertise of highly skilled workers, and upon the increasing need for ready access to knowledge input and output by private and public entities across industrial sectors (World Bank, 2007). It operates as actors in the sector acquire, create, disseminate and apply knowledge that facilitates sustainable growth and innovative progress in accessibility, inclusivity, functionality, affordability and profitability. The increasing need for safe, inclusive, sustainable,

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practical and affordable sanitation facilities that are accessible to all and acceptable in different contexts highlight the importance of a strong Sani-KMart that will rest heavily on knowledge production, sharing and workers (Davenport, 2005). Sanitation enterprises and organisations can trade on (i.e., buy and sell) knowledge for innovative solutions for products and services (World Bank, 2007). In fact, the Bill and Melinda Gates Foundation's (BMGF) 'Reinventing the Toilet' program has created a knowledge-driven paradigm in sanitation management by funding research to develop novel and affordable toilet options.

Contemporary societies and economies are knowledge-driven and the creation of value and innovative progress is often dependent on knowledge utilization and/or new knowledge (Landry *et al.*, 2006; Venkatraman & Venkatraman, 2018) as the need to exchange knowledge-based products and services continue to increase (Simard, 2006). Managing knowledge sourcing, acquisition, creation, transformation, dissemination and usage is key to developing innovations and competitive advantage (Holsapple & Singh, 2003; Lee, 2016) where Sani-K is not just a resource, but a product or service, that when value is added to or created by available knowledge capital/assets, could produce improved performance, capabilities and competences in individuals, organisations and industrial sectors (Alawneh *et al.*, 2009; Lee, 2016; Malik *et al.*, 2010; Marr *et al.*, 2003). But while knowledge can be considered a resource in and of itself, the manner in which it is used and managed will determine the quality of whatever it produces (Darroch, 2005). In essence, when knowledge resources (KRs) are gathered and coordinated, they can be used to build skills, abilities and capacities of individuals, organisations, governments and communities of practice (CoPs). However, this depends on the knowledge capital, that is, the sourced, acquired and stored knowledge available in the enterprise, government and/or community of practice. This means that Sani-K capital and the management thereof is vital to productivity and quality performance at any level of the IFSVC (Bernet *et al.*, 2005; Lee, 2016; Lowitt *et al.*, 2015; Saliola & Zanfei, 2009). The knowledge management services of the IFSVC consists of individuals, enterprises (business and social) and government organisations that manage, produce and deliver knowledge products and services whether internally as knowledge workers or externally as expert consultants, contractors or businesses. This is chapter addresses the sub-value chain of the IFSVC referred to as the Sanitation Management Knowledge Value Chain that explores the value creation processes within the sanitation knowledge management (Sani-KM) of enterprises and organisations and even governments in domestic, regional and global levels. It considers a knowledge value chain (KVC) for operations within sanitation KIFs/KIOs and KIBSFs and then proposes a creative concept map for Sanitation Management Knowledge Value Chain (SaniM-KVC) in the sanitation industry. These proposed concepts are not yet tested but could be a guide for research into the KVC for sanitation management. To proceed, it is important to comprehend the concepts of sanitation knowledge (Sani-K) and learning, sanitation management knowledge (SaniM-K), sanitation knowledge management (Sani-KM) processes and the sanitation knowledge market place (Sani-Kmart).

9.1.1 Sanitation knowledge (Sani-K), sanitation management knowledge (Sani-KM) and learning

Translating Sani-K into valuable resource transits from an understanding and identification of what constitutes Sani-K and the ability to manage this resource (i.e., Sani-KM); and is crucial for making up a sanitation management knowledge value chain (SaniM-KVC) that will support the IFSVC. Although sanitation is such a prevalent topic for discourse in development quarters, according to Revilla *et al.* (2021), only 51 (out of 18,329) academic papers in the top development journals globally focused on sanitation

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and related issues. Sanitation is the different ways that excreta and urine (i.e., faecal sludge) as well as menstrual blood (UNICEF/WHO, 2020) and wastewater is collected and treated to prevent human exposure and environmental contamination (Naughton & Mihelcic, 2017; UNICEF/WHO, 2020) while **sanitation management (SaniM)** is the process (which could include facilities, products, services, and systems) for safely managing the collection, transportation, disposal, treatment and conversion of sanitation matter to protect the socioecological integrity of contextual locations and **sanitation management knowledge (SaniM-K)** is the knowledge about all of these. Sani-K is the body of information, data, wisdom, expertise, skill and experiences embedded in individuals, firms and organisations in either tacit and explicit (or both) about what makes up faecal sludge and the processes that are involved within the sanitation service chain (SSC); and **sanitation knowledge management (Sani-KM)** is how Sani-K can be and is used to design, develop, build and provide Sani-K content, products and services that ensure the safe management of the SSC and the activities that lead to the production of faecal sludge and could be used to engender innovative solutions in products, services, processes and/or governance towards SDG 6 Targets and how it relates to other SDGs as well as growing and strengthening the IFSVC.

This Sani-K/Sani-KM is embedded in people, processes and best practices of firms, organisations and governments and also constitutes a potentially regenerative resource (Davenport & Prusak, 1998; Nonaka & Takeuchi, 1995) that enhances competitive advantage and economic value generations, and is strongly dependent on the ability to learn, innovate and change (Khadir-Poggi & Keating, 2013). Learning is acquiring and imbibing knowledge assets/capital and skills as resources to use, exploit or create for problem-solving – and/or decision-making. It can be received through study, experience, or instruction; with the ultimate aim to improve performance (whether know-how, what, when, where or why). Learning requires a balanced interaction between people, organisations, knowledge-providers and technology – culture, governance. The purpose of learning is to improve the knowledge base and competences (Bereiter, 2002; Maclellan & Soden, 2007) and to allow the sustainable utilisation of knowledge (King, 2009), and the acquisition of knowledge that replaces old existing knowledge with new content, behaviours and skills, which in turn adds value to the overall (Ermine, 2013; Nonak, 1994). The process of learning improves the individual/group's knowledge base and performance, which then culminates in knowledge-building (different from just arbitrarily learning (Maclellan & Soden, 2007)), creates and articulates solutions and/or new knowledge with added value (Bereiter, 2002).

Sani-K/Sani-KM facilitates learning as individuals, groups and teams build up knowledge in a way that enables consistent and effective continuous improvement (Argyris, 1999; King, 2009; Pedler *et al.*, 1997). Knowledge-building produces critical and transformative learning, and so learners of sanitation management need to understand how to integrate old and new knowledge to create solutions and/or even more new knowledge (Maclellan & Soden, 2007). Knowledge and learning fuels competency, capability and strategic abilities (Grant, 1991; Sveiby, 2001) that increases innovative capacities of individuals, groups, teams, enterprises, organisations, and CoPs. It will also improve domestic activities, economies and global relationships and interactions (King, 2009). Without learning, knowledge-transfer/sharing/dissemination remains at the abstract level and cannot be translated into any value addition or creation for innovation and inventions. Therefore, knowledge-building in the sanitation management sector is key to innovation that adds and creates value; and this makes Sani-KM essential to any SaniM-KVC. It should lead to informed actions and competence (Ermine, 2013), and when used appropriately, it should improve performance, decision-making, problem-solving and competitive advantage.

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Table 9.1 Knowledge characteristics (King, 2009; Lundvall & Johnson, 1994; Powell & Snellman, 2004; Pluta-Olearnik, 2013).

1	Know what	knowing the facts as to what actions to take in given circumstances, for example, knowing which toilet system is appropriate for peculiar contexts
2	Know how	knowing how to respond in any given situation, that is, the appropriate, experience, skills and expertise, for example, determining the best treatment system as per sewage versus faecal sludge
3	Know why	having a deep understanding of theoretical basis, causal relationships, interactive effects and uncertainties
4	Know-who	having the ability to reach out to key persons or groups, that is, experts that possess the appropriate knowledge needed
5	Know-when	having the ability to comprehend and predict times, variations, seasons, and so on.
6	Know-where	knowing how to determine and comprehend peculiar contexts, locations, geographies, culture, and so on.

Determining what is sanitation knowledge (see Table 9.1) and the processes of learning will help to identify and collate knowledge capital and/or assets. Sani-K involves learning what, how, where, when and why; whether it is from stored, codified and formal data/information (explicit knowledge) and personal experiences, perceptions, intuition and insights (tacit knowledge).

Sani-K can be explicit knowledge, which is tangible, searchable and can be easily found in books, documents, repositories, libraries, and so on.; can be recorded and expressed in texts, numbers, codes, formulas, programmes, and so on., making transfer easier (King, 2009; Lee, 2016; Nonaka & Takeuchi, 1995), for example, policy documents and research findings. People acquire explicit knowledge through formal training, education, dialogue, reading, viewing and listening to codified knowledge content (Bryan, 2004). On the other hand, it could be tacit knowledge that is intangible and locked in the individual mind and not easily transformed into tangible forms. It is built from experiences on the job or life, from experts and/or peers, lectures/classes, norms, cultures, traditions, and so on. It makes up about 95 percent of all knowledge and is mostly transferred from one person to another through personal interactions like conversations (training, discussions, stories, etc.) and/or practical tasks (supervision, coaching, mentoring and apprenticeship/internship, etc.) (IRC, 2006; King, 2009; Lee, 2016; Nonaka & Takeuchi, 1995; Sandelin *et al*., 2019). However, tacit knowledge can be presented as explicit knowledge when it is codified and formally communicated in a way that can be captured, stored and disseminated (Allee, 2003; Nonaka & Takeuchi, 1995), while Wilson (2002) argues that knowledge can be implicit when tacit knowledge that is expressible is not expressed. Sani-K is greatly reliant on indigenous knowledge, which is an example of tacit knowledge, in particular for contextual cases for rural communities and specific communities in urban centres. This tacit knowledge is generally embedded in the minds of residents and is developed over time (IRC, 2006; Nonaka & Takeuchi, 1995) and to transfer such knowledge will require a process of translating into explicit knowledge by collating, organising, documenting and archiving/storing or data-listing (King, 2009).

Progress and sustainability in the sector, thus, rest upon the quality and quantity of knowledge that is available and accessible and how they are applied. This implies that Sani-K should be used and managed as a value-adding resource that extensively and expansively contributes to society in and of itself as well as other activities, systems and

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processes (Landry *et al.*, 2006). Sani-K is multi- and trans-disciplinary and sometimes cross-disciplinary giving it a unique dynamic and complex learning curve that requires skills and content from a myriad of disciplines. Ultimately, creating knowledge innovations (KI) that fuel the progress and success of the SDG 6 and other agenda towards sustainability and continuous improvement in sanitation management across all levels as well as in the Sani-KMart (Kostas & John, 2006). These KIs are made up of processes that create, evolve, exchange and apply new ideas towards commercialised situations that boost the bottom line of sanitation enterprises, sanitation industry and economy as well as societies in general (Amidon, 1997).

Making sense of existing knowledge (and knowledge waiting to be discovered) in the universe as well as those available in tacit and explicit forms will require human capital and ICT infrastructure to source, discover, create (and recreate), store, transfer/share and use (Bhagwath, 2014; Gunday *et al.*, 2011; Lee, 2016; Marr *et al.*, 2003; Venkatraman & Venkatraman, 2018); as well as knowledge agents, individuals (i.e., workers, students, experts, etc.), groups (teams, units, departments, etc.), networks (professional associations, communities of practice, etc.), and entities (enterprises, organisations, state and non-state actors, industry, academic and research institutions, etc.) that manage the diffusion of these knowledge to create innovations at different levels (Lee, 2016; IRC, 2006; Landry *et al.*, 2006; Venkatraman & Venkatraman, 2018). This is the Sani-KM processes within companies and organisations that make up the SMKVC.

9.2 SANITATION KNOWLEDGE MANAGEMENT (SANI-KM) PROCESSES

Sanitation Knowledge management (Sani-KM) involves the planning, organising, motivating and controlling of people, processes and systems to improve knowledge assets and effectively use them. O'Dell and Hubert (2011) describe Knowledge Management (KM) as a systematic approach for presenting knowledge that will 'grow, flow and create value' through processes that provide appropriate knowledge to where it is needed so that it can aid actions that improve performance. It is concerned with the generation, capture, storage and sharing of knowledge with an intent to take timely actions for increasing an organisation's competitive advantage (Venkatraman & Venkatraman, 2018), and relates to activities such as learning and innovation, benchmarking and best practices, strategy, culture and performance measurement (Nonaka & Takeuchi, 1995). Some have argued that knowledge cannot be managed, and that even the 'knower' can only know imperfectly (Wilson, 2002); what can be managed is the way knowledge is 'created, discovered, captured, shared, distilled, validated, transferred, adopted, adapted and applied' (Collison & Parcell, 2004). The ultimate goal of KM, then, is to leverage and improve organisations', government agencies' and/or enterprises' knowledge assets in order to strengthen and upgrade existing competitive advantage, knowledge workers abilities, and overall performance (King, 2009). Thus, KM services are very important for Sani-K creation and transfer to stakeholders and clients at different levels and for varied purposes (Bratianu, 2015; King, 2009; Sandelin *et al.*, 2019).

In this knowledge-driven economy, competitive advantage is dependent on what is known (individual or organisation), how the 'known' is used and how fast the 'known' can be transformed into valuable assets (Prusak, 1996). These knowledge assets could be used to create value that translates to innovations (Sveiby, 2001) and include intangible resources of intellectual capital (IC) (Kok, 2007) derived from tacit and explicit knowledge. The process of managing knowledge assets in such a way that motivates knowledge sharing, creation, acquisition, storage and dissemination will lead to improved productivity, performance, problem-solving, innovation and decision-making

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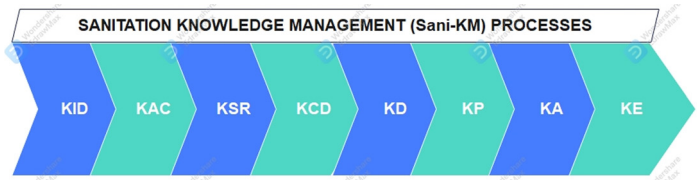

Figure 9.1 Sanitation Knowledge Management Processes. (Source: Authors)

(Bhagwath, 2014; Dei & van der Walt, 2020; Kok, 2007; Lev, 2001; Marr *et al.*, 2003; Tsuneo, 2001) for those enterprises and organisations that operate in the sanitation management sector. Based on literature, the Sani-KM processes include the following (see Figure 9.1):

(1) ***Knowledge Identification/Sourcing:*** This is where the relevant and related knowledge required for safe sanitation management product manufacture and service delivery is determined. The process of searching and discovering necessary information, data and knowledge from across boundaries (sourcing) and then selecting and classifying such content (identification) to determine what is available and what is required to create a knowledge inventory that guides what knowledge resources (KRs) exist as assets and also what KRs need to be acquired (Ermine, 2013; Landry *et al.*, 2006; Probst, 1998; Wang & Ahmed, 2005; Weggeman, 1997, 2000). This could reduce the multiplication of knowledge across different organisations with differing interpretations. Knowledge products and services include codification, learning, research, analysis, collation, organise, publications, and so on.; while players could involve experts/specialists; knowledge workers; higher education institutions; research institutions; knowledge service providers; media; media; publishers; state and non-state actors; enterprises; networks and CoP.

(2) ***Knowledge Acquisition/Capturing (KAD):*** This is the process of locating, discovering and capturing relevant knowledge assets or resources from different sources (individuals, groups, organisations, stakeholders, etc.) and continuously updating knowledge capital in the sanitation sector, organisation, economy or Sani-K expert/CoP. Knowledge could be acquired internally or externally through personal interactions and/or physical artefacts like books, articles, repositories, and so on. it involves learning via training, research, education, and other intuitive forms (Carrillo, 2016; Darroch, 2003; King, 2009; Landry *et al.*, 2006; Lee & Yang, 2000; Nonaka & Takeuchi, 1995; Probst, 1998; Venkatraman & Venkatraman, 2018). Activities, products and services comprise personal development and one-on-one interactions (tacit knowledge); search engines; repositories and inventories (codified info); libraries and archival systems; intellectual property and patents; knowledge sharing platforms; document management systems; expert network systems; digital products (e.g., software, apps, etc.); data and information management systems; media (audio-visual, print, social); education, training and research; publications; industry/sector reports; and so on.; and players are state and non-state actors; enterprises; networks and CoP; experts/specialists; knowledge workers; higher education institutions; research institutions; knowledge service providers; media; media; publishers; primary/secondary schools; consumers and other stakeholders in the community/society; professional service providers (e.g., legal, accounting, financing, marketing, design, management, etc.); educators and trainers, and so on.

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(3) ***Knowledge Storage and Retrieval (KSR):*** This process involves activities that store and retrieve acquired knowledge for future use. It includes building knowledge capital that could be stored as individual (i.e., tacit), organisational, institutional and industry/sector memory (i.e., explicit) from resources acquired and retained in individuals, groups/teams, organisations and institutions (tacit) from processes, products, services, systems, activities, best practices, routines and/or socioeconomic interactions (e.g., producer/user, buyer/seller, etc.) (Cross & Baird, 2000; de Jesus Ginja Attunes & Pinheiro, 2020; Irani *et al.*, 2009; King, 2009; Lee & Yang, 2000; Nonaka & Takeuchi, 1995; Venkatraman & Venkatraman, 2018; Walsh & Ungson, 1991). They comprise personal development and one-on-one interactions (tacit knowledge); digital repositories and inventories (codified info); libraries and archival systems; intellectual property and patents; knowledge sharing platforms; document management systems; expert network systems; digital products (e.g. software, apps, etc.); data and information management systems; media (audio-visual, print, social, web); education, training and research; workshops/seminars, and so on.; publications; organisational/institutional/sector memory (e.g., industry/sector reports); and so on.; and players are enterprises; networks and CoP; experts/specialists; knowledge workers/providers; experts and peers; higher education institutions; research institutions; knowledge service providers; media; media; publishers; professional service providers (e.g., legal, accounting, financing, marketing, design, management, etc.); educators and trainers, and so on.

(4) ***Knowledge Creation and Development (KCD):*** This is the process of creating new sanitation knowledge resources (Sani-KRs) with available and acquired Sani-K that have been transformed, refined, combined and integrated at both individual and collective levels, internally (organisation, enterprises, institutions, industry/sector, profession, discipline, communities of practice, etc.) and externally (inter- and transdisciplinary, sectors, organisations, etc.). It involves filling knowledge gaps via learning and knowledge-building to integrate tacit and explicit from individual and collective intuitions and shared experiences to generate new knowledge content with added value for consumer use, optimal performance and competitive advantage. This is also referred to as knowledge innovation (Lee, 2016) whereby combined and integrated knowledge are used to develop commercialised sanitation merchandise (products/services), which could contribute to the viable growth of enterprises, industry/sector, economies and societies. This accrues from the capacity to transform knowledge into actions, decisions, products, services, and even policies by integrating knowledge assets from different sources (individuals/collective and internally/externally) and transdisciplinary interactions. Knowledge is created by individuals, groups and organisations. Research can create knowledge innovations (KI) and intellectual capital (IC) that produces new (and/or upgraded) products and services, applications, processes, policies, and so on. – which could be commercialised for sale to users or for further research (Amidon, 1997; Giebels *et al.*, 2020; Landry *et al.*, 2006; Lee, 2016; Lee & Yang, 2000; King, 2009; Nonaka & Takeuchi, 1995; Probst, 1998; Simard, 2006; Venkatraman & Venkatraman, 2018; Weggeman, 2000).

(5) ***Knowledge Dissemination (KD):*** This is the process of distributing KRs between individuals (sharing) and groups (transfer) across boundaries. It is the transmission of new and valuable information, data, expertise, ideas and knowledge from different sources – that is making SaniK available to those who need it (free or for a fee) in organisations, industry, sectors, governments,

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enterprises, institutions, societies, and so on. It drives the creation of new knowledge from the gaps in existing knowledge to develop innovations. Knowledge dissemination includes transfer, sharing, diffusion, donation and convection depending on the process of transmission. Knowledge-sharing is the process by which an individual imparts knowledge to others (e.g., expertise, insight, understanding, etc.) whether tacit or explicit (Ford & Staples, 2010) and is the most important mode of knowledge-dissemination (Bratianu & Bejinaru, 2017). As a key component of KM and a driver of innovation, it reaches a broad and generic audience to make relevant knowledge available to others to support value creation, problem-solving and decision-making; and disseminated information for appropriate use (Bartol & Srivastva, 2002; Chyi Lee & Yang, 2000; Liu & Cheng, 2007). Knowledge transfer is focused and purposeful and is diffused when knowledge is made available far and wide across borders. Knowledge convection is when knowledge-holders move with their knowledge (cognitive, emotional, spiritual, etc.) from one place to another and then transfer or share such knowledge with others in a different place (Bratianu & Bejinaru, 2017; Bartol & Srivastva, 2002; Berends *et al.*, 2011; Braunerhjelm *et al.*, 2010; Cowan & Nicolas, 2004; King, 2009; Landry *et al.*, 2006; Lee, 2016; Lee & Yang, 2000; Liu & Cheng, 2007; Venkatraman & Venkatraman, 2018).

(6) ***Knowledge Protection (KP):*** This is the process of preserving KRs within a system and also guarding knowledge assets, mostly tacit knowledge – for example expert employees. It involves legal mechanisms for protecting intellectual capital (i.e. intellectual property), patents, copyrights, trademarks, brands and also specific know-how of processes for innovations, inventions and such likes (Chyi Lee & Yang, 2000; Probst, 1998).

(7) ***Knowledge Application (KA):*** This is the process of using available SaniK to perform tasks, create new knowledge and innovations, make decisions and also respond to acquired and available knowledge with appropriate actions and interactions (e.g., response to customer feedback). It involves exploiting and exploring existing knowledge capital and/or memory to perform tasks, make changes, updates and upgrades, reach decisions and innovations (including new knowledge). The productive deployment or application of knowledge resources for developing safe sanitation management products, services, and best practices could lead to new knowledge, new processes and systems, new business/enterprise ideas and practices, new merchandise, new academic fields, new programmes, new markets, new policies and a host of other results from applying Sani-K for different purposes (Darroch, 2003; Probst, 1998; Rowley, 2001; Venkatraman & Venkatraman, 2018).

(8) ***Knowledge Evaluation: (KE):*** Knowledge evaluation or measurement is the ultimate purpose of knowledge management. It seeks to determine if KM has made any inputs on productive and market performance and if knowledge assets are worth the investments. Measuring the SaniKRs gained and available, and growth impacts (on organisations, institutions, enterprises, industry/sector, economies, governance, societies and individuals) against specific mission, vision, goals and strategies to determine future actions and investments (King, 2009; Landry *et al.*, 2006; Probst, 1998; Simard, 2006) will provide new knowledge for decision-making, strategic actions, and even content, product and service design.

These processes create a demand for knowledge workers and experts in Sani-KIFs/KIOs and the services of KIBSFs in the Sani-KMart that create a SaniM-KVC in the IFSVC.

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9.3 SANITATION MANAGEMENT KNOWLEDGE MARKETPLACE

In this section, the term Sani-K and SaniM-K will be used interchangeably. An overview of the Sanitation Knowledge marketplace will seek to identify the operations, activities and interactions that take place within the Sani-K (at domestic and global levels) and explore how they relate within the overall value chain (Miles, 2005; Springer-Heinz, 2018a, 2018b; TBC, 2019a, 2019b). It is anchored on activities within the knowledge management processes, and actors, enterprises, organisations and operations that make up the sanitation knowledge marketplace. The sanitation knowledge sector has been mostly operated by donor and charity funds and some profit-making ventures; thus, this value chain will consider both streams of income as they both contribute to the IFSVC. Actors are primarily made up of knowledge workers, knowledge experts, knowledge brokers, knowledge-intensive firms (KIFs), knowledge-intensive organisations (KIOs), knowledge networks, knowledge-intensive business services firms (KIBS), governments, NGOs and end-users (Figure 9.2). This overview of the sanitation marketplace highlights the businesses, social enterprises and entrepreneurs within the SaniM-KVC and how their interactions within the IFSVC and other external linkages grow and expand the opportunities that exist and could exist. The core players perform different functions along the Sani-KM processes to ensure a continuous stream of new ideas and innovative knowledge to move the sector closer to the SDG sanitation targets, sustainability and profitability.

These functions include activities that produce knowledge content and other products and also provide knowledge services to end-users such as householders, governments, businesses and social enterprises, industry, networks, professionals, students, and so on. The main activities include: knowledge sourcing and acquisition, data and information processing, knowledge storage and retrieval, knowledge (content, product and service) conceptualisation, knowledge design and development, knowledge creation and production, knowledge assets and capital protection, knowledge management systems, knowledge dissemination, knowledge utilisation and evaluation. The sanitation marketplace will be enabled by government at different levels, multilateral organisations and certain non-state-actors (NSAs); and also supported by other sectoral product and service providers and contributors whether as financial donors or investors, clients or contractors, partners or stakeholders, and so on. The circular flow that operates in the marketplace will be driven by the demand, needs and preferences of end-users of the knowledge products and services, and these end-users can also be and/or depend on supply from designers and manufacturers of sanitation management products, provide sanitation management services and facility managers (e.g., treatment plants, disposal sites, etc.). These two groups make up the sanitation knowledge market.

The different aspects of the IFSVC as deliberated upon in the other chapters of this book cut across manufacturing and operate in sectors of the economy at global, national, local and regional levels. They consider value-adding enterprise opportunities that contribute to the sanitation economy via manufacturing and service activities. There are enterprises that manufacture toilets, septic tanks, disposal trucks, treatment and conversion facilities, ancillary items (e.g., pipes, taps, etc.) and other hygiene-related products (e.g. hand-wash basins, diapers, menstrual items, etc.). Then, there are those enterprises involved in construction, installation, collection, emptying, transportation, recovery, recycling and reuse and maintenance. These are mainly service providers and could be individual entrepreneurs and/or workers (e.g., masons, plumbers, etc.) or companies in the formal and informal sectors, and within these companies are managers of operations, administration, finance and human resource management. On the social side, we have enterprises and organisations that attempt to bridge the gaps of access to safe sanitation in urban and rural settings. They could be local facilitators (NGOs, CBOs,

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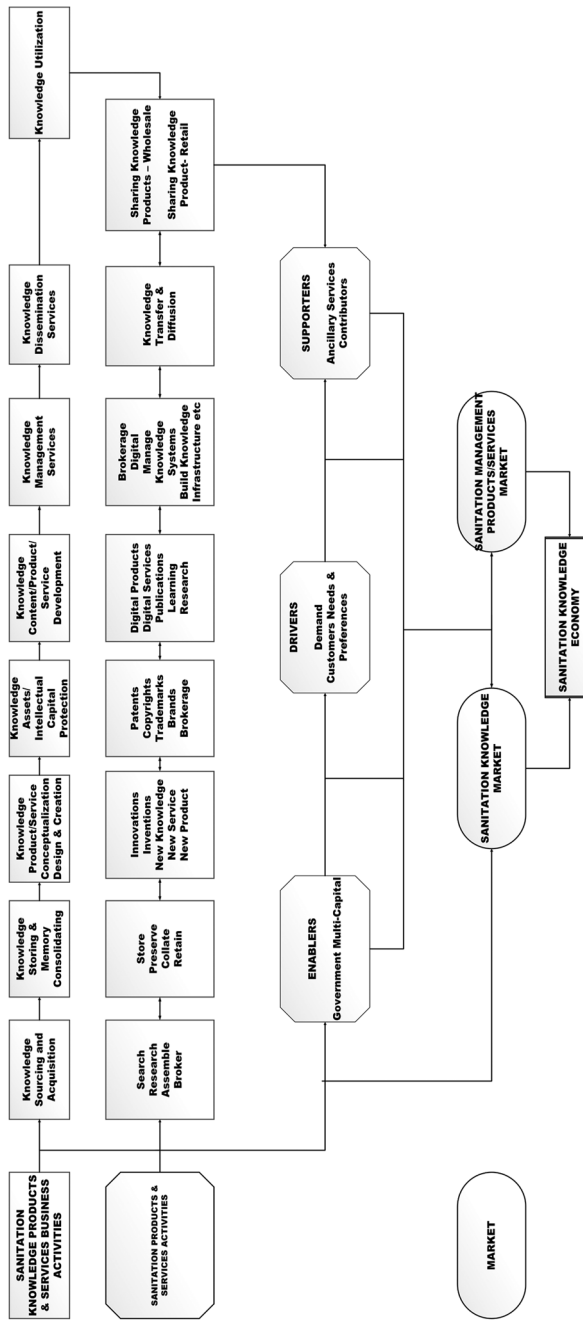

Figure 9.2 Sanitation Knowledge Marketplace. (Source: Authors)

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other NSAs or CSR departments of large companies) and/or global interventionists (multilateral organisations, charities, INGOs).

To support this socioeconomic contexts are the investors and funders (financiers, fund managers, etc.), market analysts and advert/promo providers, research and development organisations (e.g., universities, research institutes, public agencies, etc.) that provide novel and innovative solutions; and also professional networks and communities of practices (CoPs) and government institutions that manage and regulate domestic and international interactions within the sanitation market at all levels. These players operate in the sanitation industry that is diverse, complex, dynamic and wicked; adding either economic or social value (or a combination of both) at various degree by supplying services and/or products that are needed in the marketplace or to meet customers' demands and preferences (Figure 9.3).

KM is typically viewed from within organisational/company boundaries, but it can also find calculable value outside these borders. With increasing digital and knowledge interactions among market and sector players, the external marketplace is where KM meets industry economics. Knowledge flows between players (internally and externally) combines the adaptive nature of networks and the tendency of markets to create transactions based on demand and supply; that is assuming that there are buyers (users of such knowledge) and sellers (providers of such knowledge). Buyers of Sani-KRs will be motivated to buy if the knowledge offered is valuable and at a price that is worth their time and effort, but still lower in costs than alternative sources and/or forms (Bryan, 2004). For Sani-K to be valuable though, it cannot be regular, generic and common place, but insightful, relevant, accessible, easy to find and assimilate (Bryan, 2004; Hansen & Haas, 2001; World Bank, 2007), which then determines its value in cost and reputation so that it can be traded in the marketplace (World Bank, 2007). Markets will expectedly

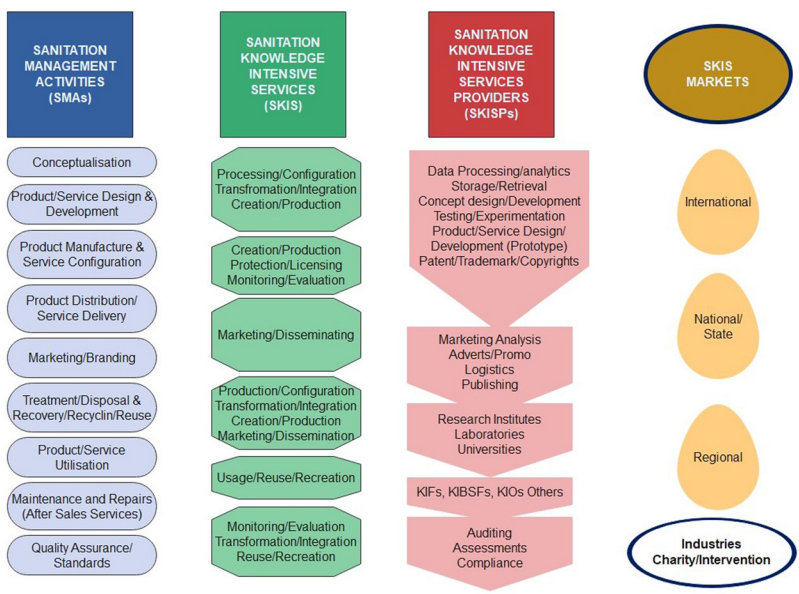

Figure 9.3 Knowledge Intensive Services Activities (KISA) in the IFSVC. (Source: Authors)

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form around distinctive knowledge that captures the interest of buyers and sellers (Bryan, 2004), but only Sani-K that creates innovative ideas (i.e., KI) has value enough to be traded. It has been argued that for this to happen, there must be a balance between the economic realm (commercialisation) and the physical realm (laws of nature = reality and practicality), which determines whether people will pay for it and what they are willing to pay (Zubair, 2021).

The value of a Sani-K marketplace depends on the quantity and quality of the available content churned out to buyers and users. And so, the Sani-K marketplace should consist of intra-trading (i.e., Sani-KMart within organisations) and inter-trading (i.e., Sani-KMart in the public space) between seekers and suppliers of Sani-K content, products and services. It is part of the KE whereby knowledge-based resources related to sanitation and its safe management are exchanged whether on a fee-based basis (i.e., purchased at a price) or free-based (i.e., made available for public good) (Simard, 2006; Stewart, 1999). In other words, assuming that there exists Sani-KRs to be transacted upon and there are users and providers to operate such exchanges, then the job of the Sani-KMart is to bring them together. Sani-K is, however, distinctively different from other products and services in the sanitation marketplace because of its unique features. For one, it can be at several places at the same time; never runs out of supply; buyers need only purchase it once (but can be renewed); and it is regenerative (Stewart, 1999). This means that the K-Mart of the sanitation sector will operate differently from other aspects of the value chain, especially as those who provide KRs, sometimes, also use them and so there is a continuous cycle whereby KRs are provided and used at multiple points and by many different agents (i.e., multisectoral and industrial) (OECD, 2006; Simard, 2006) (see Figure 9.4).

9.3.1 Sanitation knowledge-intensive services activities (Sani-KISA)

Enterprises and organisations in the Sani-KMart will require high quality knowledge innovation (KI) to pursue novel creations that target customers' demands and

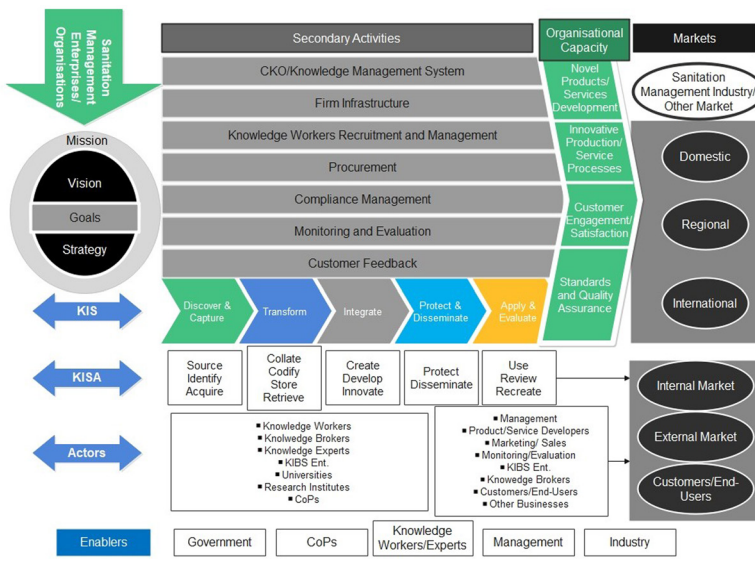

Figure 9.4 Sanitation KIFs/KIOs Value Chain. (Source: Authors)

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expectations, foster viable progress and return-on-investments (ROI) and also achieve the SDG 6 Targets on sanitation. The KI will be derived from Knowledge-intensive Services Activities (KISA) (OECD, 2006; Windrum & Tomlinson, 1999). Knowledge-intensive Activities (KIAs) are those tasks, functions and operations that source, acquire, collate, manage and use knowledge resources and assets in the IFSVC. The performance of these activities provides services internally and externally for enterprises and organisations by knowledge workers (KWers), knowledge experts (KExps), knowledge entrepreneurs (KEnts) and knowledge businesses/organisations even governments.

These Knowledge-intensive Services (KIS) are those functions that rely on professionalism and expertise that relate to particular technical or functional domains to provide forms of data, information and knowledge (through reports, manuals, trainings, consultancies, etc.) or major inputs to manufacturing and service delivery processes (Windrum & Tomlinson, 1999). The OECD (2006) also recognised the corresponding activities as KISA that is the regular activities of business and public sector actors to support manufacturing and services and could be initiated, produced and delivered internally (within firms, organisations and government agencies and knowledge workers) or by external KR providers to add capabilities that may not be available internally in a bid to activate creative, fresh and independent perspectives and also possibly provide support for compliance, certifications and in some cases reduced HR costs (OECD, 2006). There are KISA enterprises that support the sanitation industry with knowledge inputs and they also provide Sani-K to other related businesses and organisations, even in different industry sectors, that need Sani-K outputs. Essentially, for innovation to thrive in the sanitation sector, a high demand for KISA is critical, particularly as external providers like safe sanitation management enterprises and organisations need a wide set of skills and knowledge that are often beyond their capabilities (Andreeva & Kianto, 2011; OECD, 2006), for example, delivering new types of faecal sludge management services in a city or producing new types of prefab septic tanks for the contextualities of a particular location or recovering and producing new resources from sanitation matter. These KISA are performed by KWers and KExps for their employers in knowledge-intensive business or social enterprises, multilateral organisations and governments (knowledge-intensive firms and organisations-KIFs/KIOs), but some KIS are also outsourced to KEnts and/or to external parties (knowledge-intensive business services firms-KIBSFs) who provide the needed artefact or deliver the required services on behalf or in conjunction with their clients (EMCC, 2005). They make up the core players of the Sanitation Management Knowledge Value Chain (SaniM-KVC) presented later in this chapter. For this chapter, Sani-KIFs are those sanitation management enterprises that require a high level of knowledge intensity to produce sanitation devices and/or equipment for safe sanitation management and deliver safe sanitation management services through the tacit and explicit knowledge of workers, experts and organisational practices; who may also source for the services of Sani-KIBSFs. On the other hand, Sano-KIOs are those social enterprises and public agencies that deal primarily with sanitation management and its related activities. Sani-KIBSFs provide those knowledge products and services that support the internal operations of Sani-KIFS and Sani-KIOs and their relationships with their customers and users of their products and services.

9.3.2 Sanitation knowledge-intensive firms (Sani-KIFs)/knowledge-intensive organisations (Sani-KIOs)

KIFs and KIOs in the IFSVC are businesses and organisations where knowledge is more important than other inputs (Starbucks, 1992) and that employ mostly highly skilled personnel with the capacity to provide innovation and strategic renewal (Bontis, 1998) as these employee's skills and expertise are very key contributors to the creation of added

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value, competitive advantage and survival (Starbucks, 1992; Swart & Kinnie, 2003). Expertise in KIFs/KIOs could be considered from the perspective of individual tacit expert knowledge (internally and externally) as well as expertise embedded in machines and routine processes – that is people, technology and practice (Starbucks, 1992). These enterprises and organisations create commercial value by offering knowledge-based products and services through the use of knowledge innovation and highly skilled and knowledgeable employees to develop novel and dynamic solutions to complex problems of their clients and societies (Alvesson, 2004; Cavaliere *et al.*, 2015; Khadir-Poggi & Keating, 2013; Starbucks, 1992; Swart, 2007; Swart & Kinnie, 2003). Alvesson (2004) classifies KIFs into two broad categories: *professional services firms (PSFs)*, which deal predominantly on intangible products (and services) where KWers often have a high and direct contact with the market; and *research and development firms (RDFs)*, which are science-based companies that deal with tangible output and contact between KWers and customers are less direct and minimal. Lowendahl (1997), on the other hand, classifies KIFs as other firms that deal primarily with clients and are individual-controlled (client-based); or provide creative problem-solving and innovative skills for bespoke solutions and usually work in teams (problem-solving); or adapt available solutions to problematic situations and are often controlled by organisations (output-based).

Sani-KIFs and Sani-KIOs will lean heavily on the expertise and know-how (i.e., skills) of their employee-base and their ability to solve problems through creative and innovative solutions (Sveiby, 1997; Swart, 2007), and also generate, distribute and apply knowledge for safe sanitation management product manufacture and service delivery (Defillippi *et al.*, 2006). These KIAs could also serve to initiate, facilitate and develop innovations (for internal activities and client organisations) and also express innovations through the transfer of existing knowledge for new applications among or within organisations, industries, networks, and so on. (OECD, 2006). Some examples of KIFs/KIOs (Khadir-Poggi & Keating, 2013) include ICT and software development (Alvesson, 2004; Chasserio & Legault, 2010; Cleary, 2009; Marks & Baldry, 2009; Rajala *et al.*, 2008; Scarso & Bolisani, 2010; Swart & Kinnie, 2003; Timo & Arto, 2009), research and development (Whelan *et al.*, 2010), engineering (Erhardt, 2011), university and scientific consultancy (Garcia, 2007), Law and legal services (Forstenlechner & Lettice, 2007; Windrum & Tomlinson, 1999) and others such as sanitation management treatment and disposal and recovery and recycling facilities, sanitation-derived products reuse and processing, safe sanitation service delivery, and so on. Table 9.2 highlights the Sani-KIFs/Sani KIOs and related businesses under these classifications.

9.3.3 Sanitation knowledge-intensive business services firms (Sani-KIBSFs)

Sani-KIBSFs are those businesses that provide knowledge-intensive inputs to the business operations of sanitation management enterprises and organisations (EMCC, 2005; Muller & Doloreux, 2009) and other related public and social sector clients (EMCC, 2005) by helping them deal with problems for which external services are required. They are now a prominent part of the KE in global and domestic economies (EMCC, 2005; Muller & Doloreux, 2009). Such KIFs have been referred to as knowledge-intensive business services firms (KIBSFs) and are highly reliant on professional and technological knowledge and expertise that are related to specific disciplines or domains to provide intermediate knowledge-based products and services not available within clients' internal systems (Den Hertog, 2000; Miles, 2005; Toivonen, 2004; Windrum & Tomlinson 1999). They typically employ highly skilled workers and to a larger extent more than other sectors in the economy (EMCC, 2005) and their core tasks involve economic activities that include the accumulation, creation, dissemination, and utilisation of knowledge to develop and produce bespoke (i.e., custom) innovative and novel solutions

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Table 9.2 Classifications of sanitation management and related KIFs/KIOs.

	Client-based	Problem-solving-based	Output-based
Professional Services Firms (PSF)	• Providers of sanitation services (collection, emptying, etc.) • Installation and Construction • Marketing and branding • Advert/Promo/PR	• Faecal sludge management laboratories • Facility Management • Advocacy • Intervention • Awareness creation • Suppliers of sanitation management products and services	• Sanitary wares manufacturers • Resource recovery, recycling and reuse Plants • Treatment plants • Disposal sites • Sanitation management equipment manufacturers • Sanitation-related products manufacturers • Providers of sanitation facilities
Research and Development Firms (RDF)	• Research design and development • Data processing and analytics • Information processing and development • Content generation, design and development	• Universities • Research institutions • Testing and experimentation centres	• Public agencies • NGOs/INGOs • Multilateral organisations

to satisfy their clients' needs (Bettencourt *et al.*, 2002; Dobrai & Farkes, 2009; Miles, 2005); mostly working directly with clients to co-produce Sani-K content, processes, products and services (Zieba, 2013). They could be producers and users of knowledge as well as suppliers of knowledge contents, products and services and are of competitive importance to their client base and also typically depend on outsourcing from client organisations/firms (EMCC, 2005). Workers in SaniKIBSFs use their knowledge assets to diagnose the needs of their clients and then determine a solution, propose a course, and sometimes, implement it on behalf of the client (Bettencourt *et al.*, 2002); which could also involve non-human assets such as inventories, technology, installations and equipment (Nordenflycht, 2010). Even when the service is delivered as an artefact (i.e., book, manual, proceeding, app or technology), the knowledge content is often more valuable than the product itself (EMCC, 2005).

Generally, KIBSFs are made up of traditional professional services (e.g., legal, accounting, architectural, management consultancy, marketing, etc.) and technology-based services (e.g., research and development, engineering, ICT, software/app development, construction, etc.). Sani-KIBSF either operate as suppliers of products primarily used to source and manipulate information, data and existing knowledge or suppliers of specialist knowledge that facilitate support for their clients' business processes (clients, which could be other businesses or KIFs/KIOs in the economy (e.g., sanitation management product and services companies), the public sector (governments), social sector (voluntary organisations like NGOs/INGOs, charities, CSOs, multilaterals, etc.) and sometimes, households and individuals that wish to install, maintain or repair sanitation devices. They are only able to serve based on availability and efficacy of knowledge at their disposal; but could also serve as

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intermediaries between entities that produce knowledge and users of knowledge (Hipp, 1999) such as other KIBSF or KIFs that need salient knowledge for innovation, business activities or compliance requirements – whether as service integrators (EMCC, 2005), coordinators (Toivonen, 2004) or brokers (Bao & Toivonen, 2014; EMCC, 2005) to provide specialised and/or wider set of inputs and operate as suppliers/subcontractors for other firms who wish to sell their in-house Sani-KISA to other organisations (EMCC, 2005).

KIBSFs are a strength of the KE and are growing so rapidly that they outpace all other sectors, particularly in the European Union (EU) as they supply a wider range of services across all industrial and public sectors (Dobrai & Farkes, 2009; EMCC, 2005; Den Hertog, 2000; Makó *et al*., 2009; Miles, 2005; Miles *et al*., 2018; Toivonen, 2004). Santos (2020) also points out that KIBSFs are known to foster and generate innovation nationally and regionally (Fischer, 2015; Miozzo *et al*., 2016) and they are of great significance to emerging economies (Miles *et al*., 2018; Zieba, 2013). This makes Sani-KIBSFs a critical part of the IFSVC and the sanitation economy as a whole and it is important that studies are conducted to explore their impacts on the management of sanitation globally, nationally, regionally and locally.

9.3.4 Sanitation knowledge workers (Sani-KWers) and experts (Sani-KExps)

A Sani-KWers is someone works primarily with their ability to think (Davenport, 2005) and their work is described as ever-changing, dynamic and autonomous (Drucker, 1959); they are critical to the IFSVC as they support businesses and organisations with problem-solving and innovation creation (Davenport, 2005; Davenport & Prusak, 1998). These workers depend on knowledge capital and employ their brain more than their might by using their intellect and innate skills to translate data, information and knowledge to knowledge resource (KR), and then develop wisdom in expertise to deliver solutions, processes and products and services for the sectoral market (Davenport, 2008; Davenport & Prusak, 1998) to create value-added assets. They primarily engage in thinking, solving complex problems, collaborations and networking (Davenport, 2005; Reinhardt *et al*., 2011) and although there is no agreement on a precise definition for KWers (De Sordi *et al*., 2021; Reinhardt *et al*., 2011). Davenport (2005) describes them as employees with high levels of expertise, education, training and experience focused on tasks that have to do with the creation, distribution, or application of knowledge. They make up a very important ingredient for the success of sanitation knowledge-intensive businesses and organisations as they hold the knowledge abilities that enhance competitive advantage and innovation (Davenport, 2008; Miles, 2005).

In recent times, particularly in the Covid-19 era, KWers have been known to work remotely from locations outside a formal office, and with collaborators and teams across the globe (Moravec, 2013) without being restricted by space and distance. These KWers are referred to as 'Knowmads' or digital nomads (Iliescu, 2021; Makimoto & Manners, 1997; Moravec, 2013), that is, nomadic workers who use their creativity and imagination to do innovative work with almost anybody, anytime and anywhere; and this is creating new opportunities (Iliescu, 2021; Moravec, 2013; Moravec & van den Hoff, 2015). Sanitation Knowledge entrepreneurs (Sani-KEnts) are those dynamic knowledge experts that have specialised knowledge in their field and may work as consultants or maintain a KIBSF where they continue to innovate and serve their clients (Cooke & Porter, 2007). Most Sani-KWers, Sani-KEnts and Sani-KExps are now Knowmads who work from remote locations for clients from across the globe and in all sectors. This indicates that the SaniM-KVC is not static, but dynamic and complex with producers and providers collaborating and working from different points in the world at the same time and on the same project.

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The depth of knowledge intensity of any sanitation and related organisation and enterprise is determined by how much they primarily rely on knowledge (intellectual) capital rather than physical and financial capital, and manual labour (Alvesson, 2004; Khadir-Poggi & Keating, 2013; Starbucks, 1992; Swart & Kinnie, 2003). Khadir-Poggi and Keating (2013) suggest that knowledge intensity can be characterised on the use of intellectual and analytical capabilities of KWers acquired through theoretical education and experience (Alvesson, 2004) as their conceptual skills, knowledge expertise and cognitive skills generate substantial added-value that sets such businesses apart (Nordenflycht, 2010). It could also be embedded in the organisation itself, while inclusive of human capital, the organisation serves as the platform in which knowledge can be generated, created and disseminated; and in the relationship between the KWers and their organisations (Khadir-Poggi & Keating, 2013).

9.4 SANITATION MANAGEMENT KNOWLEDGE VALUE CHAIN (SANI-KVC)

In a Sani-KMart, value is embedded into knowledge, that value is then advanced along the stages of a value chain, and then extracted to yield results at different levels and customers (Simard, 2006). The value of any knowledge is based on the degree of usefulness (functionality and importance of the knowledge unit's utility in valuation) and desirability (demand for the knowledge product or service) (Stocker, 2012). This means that value is not just created when Sani-k is produced, but when it is used to solve problems or satisfy the needs of customers and/or society either through artefacts (i.e., products such as VIP latrines, prefab septic tanks, sanitation-derived products like fertiliser, energy, reuse water, disposal trucks, etc.) and/or services (such as emptying, disposal, transportation, training, education, research, repairs, installation, construction, facility management, advocacy, etc.), and such knowledge could also be created, modified, or reconfigured (Stabell & Fjeldstad, 1998 in Stocker, 2012). Therefore, the SaniM-KVC is dependent on the Sani-KMart as it is buyer-driven – that is it rests on the desirability and subsequent demand of customers and society (Simard, 2006).

A value chain (VC) is the range of activities required to bring a product or service from raw material supply to production (conceptualisation) through to final consumption/end-use/consumption (Lowitt *et al.* 2015; Porter, 1985). It is critical for systematically comprehending the interactions between actors and processes/stages/phases/levels in a market and interpreting the development and innovative possibilities within specific sectoral and locational contexts (Humphrey & Schmitz, 2002; Lowitt *et al.*, 2015). The Sani-KVC should provide products and services that lead to the production and delivery of new and improved solutions (products and services), programmes, processes and interventions for societies, governments and people (Chyi Lee & Yang, 2000; Holsapple & Singh, 2003; Landry *et al.*, 2006). It should also proceed from acquiring knowledge and mapping the interactions through the processes in-between up to the production of new and improved solutions and interventions that add value for people (Landry *et al.*, 2006).

In sanitation management organisations, knowledge is continually sourced, acquired and dispersed within their knowledge management (KM) systems and the set of activities that make up the entire process is referred to as the Knowledge Value Chain (KVC) (Chyi Lee & Yang, 2000; Ermine, 2013; Lee, 2016; Powell, 2001; Wang & Ahmed, 2005; Weggeman, 1997, 2000). The KVC applies Porter's Value chain (Porter, 1985) to knowledge processing and production, and operates as a model for Sani-KM framework of Sani-KIFs/KIOs/KIBSFs (Chyi Lee & Yang, 2000; Ermine, 2013; He & Wong, 2004; Holsapple & Jones, 2004; Lee, 2016; Powell, 2001; Wang & Ahmed, 2005)

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that organise knowledge activities in a series of intellectual tasks in stages and steps towards the transformation and creation of commercially valuable knowledge products and services (Chyi Lee & Yang, 2000; Ermine, 2013; Lee, 2016; Powell, 2001; Strambach, 2008). It illustrates the processes that Sani-KWers and Sani-KEnts of Sani-KIFs/KIOs/KIBSFs use to transform data to intelligence and then onwards to contributing to performance outcomes (King & Ko, 2001; Powell, 2001) and enhance their employer's/clients' competitive advantage, knowledge absorptive capacity, innovation capabilities and socioecological benefits (Lee, 2016). In the SaniM-KVC, the raw material is data, information and existing knowledge; the sequential activities on the chain include value-adding processes at each stage and makes up the building blocks that finally deliver products or services that is valuable to customers/end-users/clients (Probst, 1998) and contribute to the innovative capacity and competitive advantage of enterprises and organisations whether public or private, business or social (Ermine, 2013).

Actors in the SaniM-KVC are delineated into knowledge phases and categories (Table 9.3) and three knowledge bases that serve as the key dimension of knowledge relevant for innovation in specific industries (Malerba & Orsenigo, 2000; Strambach, 2008) as supplier-dominated, production-intensive and science-based; and the knowledge base determines what is produced and provided, and how. There are knowledge categories that work within each knowledge base and sometimes cut across: analytical (i.e., use of science-based deductive knowledge), synthetic (i.e., use of existing knowledge and new knowledge) and symbolic (i.e., use of ideas, symbols, social constructs and culture). Furthermore, Sani-KIFs/KIOs/KIBSFs go through knowledge phases of exploration, examination and exploitation. Knowledge exploration is the search for new products, services, concepts, processes, content, resources, knowledge, competencies, market domains, innovations, technologies, alternatives, possibilities and opportunities (Benner & Tushman, 2002, 2003; Danneels, 2002, 2007; He & Wong, 2004; Katila & Ahuja, 2002; March, 1991; Sinha, 2015; Strambach, 2008). It involves actions and activities that include search, research, risk-taking, experimentation, discovery, variation, flexibility, play and innovations (Li *et al*., 2008; March, 1991; Popadiuk & Vidal, 2009; Sinha, 2015). Knowledge examination, on the other hand, is where testing, piloting, reviewing, evaluation and validation occur to improve internal knowledge assets and make them appropriate for commercial value adding purposes (Cooke, 2005; Cooke & Leydesdorff, 2006; Cooke & Porter, 2007; Strambach, 2008). The third phase, knowledge exploitation is where existing knowledge and competencies are used to refine existing merchandise and create new products and services, knowledge, resources and competencies in new dimensions and for new markets as well as competitive advantage and market strategies; and involves production, implementation, execution, innovation, efficiency and selection (Benner & Tushman, 2002, 2003; Danneels, 2002; He & Wong, 2004; Katila & Ahuja, 2002; March, 1991; Sinha, 2015; Strambach, 2008). Table 9.3 illustrates the interactions of KIBSFs between knowledge categories and phases.

The knowledge categories (analytical, synthetic and symbolic) and knowledge phases (exploration, examination and exploitation) of KIBSFs enable them to deliver composite knowledge products and services that could complement or even change the knowledge base of their clients through integrated knowledge provision services (Strambach, 2008).

The KVC has been applied in different contexts of research such as e-learning (Wild *et al*., 2002), competitive tendering (Dewagoda & Perera, 2019), KIBS (Bao & Toivonen, 2014), supply chain management (Lee & Han, 2009), organisational performance (Chyi Lee & Yang, 2000; Lee, 2016; Wang & Ahmed, 2005), new product development (Gurd & Jothidas, 2009; He & Wong, 2004), competitiveness (Holsapple & Jones, 2004), research and development (Un & Asakawa, 2015), work performance (OuYang & Lee, 2019), health (Landry *et al*., 2006) and government services (Simard, 2006)

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Table 9.3 Sani-KIBSFs according to knowledge categories and phases.

	Knowledge Categories		
Knowledge Phases	**Analytical**	**Synthetic**	**Symbolic**
Exploration	• Contract research, design and development • Conceptualisation • Content development	• Information processing and content generation • Website and app design • Architectural design • Content generation and design • Engineering design services	• Market research and analysis • Business and corporate management consultancy • Fund-raising and management services
Examination	• Research design and development • Data processing and analytics • Testing and validation • Auditing	• Proto-type development • Research in natural/applied sciences, technology, social sciences and humanities • Experimentation laboratories • Accounting • Finance Management	• Financial management consultancy • Tax consultancy • Knowledge workers recruitment and management
Exploitation	• Legal services (registrations, patents, copyright, trademarks, agreements, etc.) • Biotechnology • Software development • Website and app development • Computer services • ICT consultancy/supply • Specialist consultancy	• Construction and installation • Facility management • Maintenance and repair	• Biotechnology production and services • Piloting • Publishing • Legal services (litigations) • Advertising/public relations • Promotions/awareness creation • Knowledge management and brokerage services • Insurance

among several others. There are no studies on sanitation management or related KIFs/KIOs/KIBSFs in the sector. With the considerations of this chapter, it seems obvious that an understanding of the KVC within the sanitation economy and corresponding IFSVC will give insights into the knowledge flow, impacts and management and how this affects competitive advantage, performance, knowledge work and innovation in the sector. According to Chyi Lee and Yang (2000), the KVC model indicates the progress of competitive advantage from the KM structure of any KIFs/KIOs/KIBSFs. Thus, this Chapter proposes the Sanitation Management Knowledge Value Chain (SaniM-KVC) as a model that could describe the knowledge flow within sanitation KIFs/KIOs/KIBSFs, which contribute to the core operations that generate value for innovations in products and services in a way that enhances competitive advantage and knowledge diffusion in the industry and communities of practice (CoP). The focus is on transforming sanitation

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knowledge into new products and services (He & Wong, 2004) with commercial value, practical functionality and consumer satisfaction.

This chapter considers KVC for operations within Sani-KIFs and Sani-KIOs (Figure 9.5) and Sani-KIBSFs (Figure 9.6) and then proposes a creative concept map for the Sanitation Management Knowledge Value Chain (SaniM-KVC) in the sanitation industry. They are adapted from the KVC models of Weggeman (1997, 2000), Chyi Lee and Yang (2000), Wang and Ahmed (2005) and Simard (2006) as well as Porter's value chain (Porter, 1985). These proposed concepts are not tested yet, but should be further explored in the contexts of the different stages of the IFSVC and their impacts on the sanitation economy.

Figure 9.5 illustrates the Sani-KVC for KIFs and KIOs in the SE highlighting the value-adding activities whereby each stage adds value to data and information and existing knowledge that is then translated into products and services. They provide intermediate inputs that add value along the sequential stages to the final products or services and is the major ingredient for innovation (Albors-Garrigos *et al.*, 2009; Santos, 2020). This Sani-KVC considers what happens in sanitation management enterprises and organisations and is driven by their missions, visions, goals and strategies; and the KM system comprises of the Sanitation Knowledge-intensive Services (Sani-KIS) conducted through Sanitation Knowledge-intensive Services Activities (Sani-KISA) and together make up the core activities that provide resources for conceptualisation, design, development, production and delivery. These activities are played out by internal sanitation knowledge workers and experts that coalesce tacit and explicit (analytical, synthetic and symbolic) knowledge through exploration, examination and exploitation phases towards organisational goals and strategies. In addition, Sani-KIS and Sani-KISA could be outsourced to external actors that search, produce and deliver knowledge-intensive business services (KIBS) on behalf of their clients.

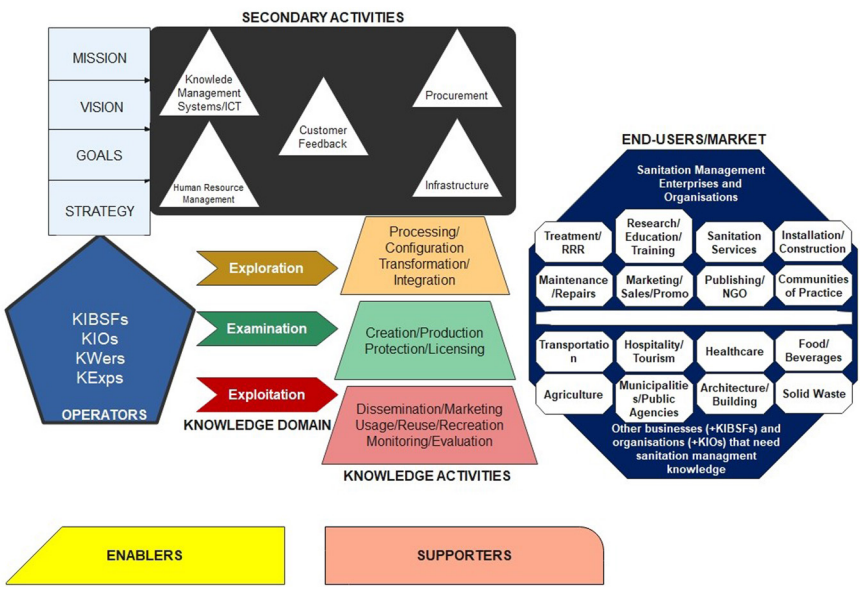

Figure 9.5 Sani-KIBSFs Value Chain. (Source: Authors)

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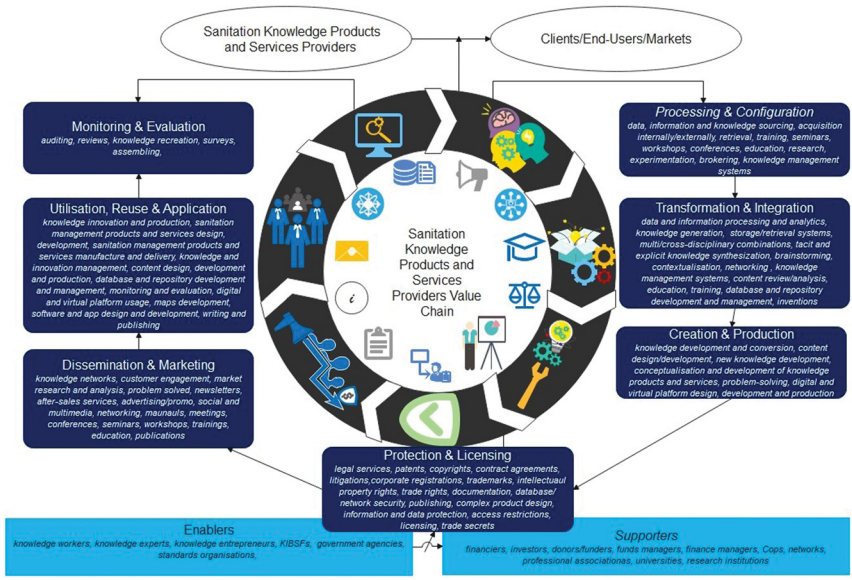

Figure 9.6 Sanitation Management Knowledge Value Chain. (Source: Authors)

However, in the middle of the diagram is the secondary activities, and it is important for the enterprise and/or organisation to build its own Knowledge Management System (KMS) overseen by a Chief Knowledge Officer that manages the process of processing, producing and sharing valuable knowledge across the entire community. The secondary activities support the core activities like hiring and managing knowledge workers (KWers), firm infrastructure (administration, finance, legal, etc.), and even customer feedback and engagement to ensure a seamless transition from the knowledge bank to the area of need like marketing, sales, management for decision making and actions, planning, and so on. At the bottom of that middle phase is the enablers that provide foundation for the sanitation KIFs/KIOs in their search, research, acquisition, transformation, integration, creation, dissemination and protection of their knowledge assets. When all of these are appropriately commissioned then it could positively affect organisational performance and outcomes (hanging on the side of the secondary activities) and then subsequently (as seen on the top right of the diagram) existing products and services are improved and new products and services are introduced to the market place, sometimes at domestic, regional and international levels or all levels. Meanwhile, the Sani-KIS and Sani-KISA produce knowledge products and services that feed the internal knowledge market of the sanitation management KIFs/KIOs and could also be outsourced to Sani-KIBSFs and supplied to other enterprises and organisations that use sanitation and related artefacts and services (e.g., transportation, tourism and hospitality, healthcare, etc.); and sometimes, directly to end-users who need the knowledge for research or home use.

Figure 9.6, on the other hand, highlights the value-adding stages along the Sani-KISA involved with providing Sani-KIS for the clients of Sani-KIBSFs who serve as business enterprises or not-for-profit organisations that provide Sani-K content, products and services to sanitation management entities and other related establishments in the

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SE and the structure of their operations is also driven by the mission, vision, goal and strategy designed for the existence from the onset. The difference between the Sani-KIBSFs and Sani-KIFs/KIOs is that Sani-KIBSFs are primarily knowledge providers and their core activities are KISA to produce and provide knowledge products and services to their clients, which could also be other KIBSFs or companies that have sanitation concerns to deal with. The secondary activities here are essentially designed to be able to aptly and accountably serve their clients with their primary activities of producing and providing knowledge in cooperation with their clients (which makes customer feedback and engagement crucial). The Sani-KISA is split according to the phases of knowledge where exploration, examination and exploitation take place. Subsequently, on the right of the diagram, are the end-users or market of the KIBSFs, split into two types: sanitation management enterprises and organisations, (which include academic institutions, research institutions and professional networks as well) and then other businesses (which include other Sani-KIBSFs and Sani-KIFs) and organisations (Sani-KIOs) that need sanitation management knowledge and expertise. Enablers and supporters provide a base for the Sani-KIBSFs by contributing to marketing and financing (banks, investments, grants and sales) and policies, legislation and regulations as well as other government support and incentives.

Figure 9.6 illustrates a creative concept overview map for the value chain activities of the sequential processes that follow sanitation knowledge products and services. These products and services could be provided as composite units by a single KIBSF (or several units of a KIF/KIO), but most often enterprises, knowledge entrepreneurs, knowledge experts, and knowledge workers operate with clients (Santos, 2020) and employers in specialised areas of two or three or in a particular knowledge base and/or phase. The Sani-KISA here operate in a circular flow that indicates the value-adding steps in the process of sourcing, acquiring, and up to using knowledge content, products and services that accrue as the sum of the value-added at each stage.

Table 9.4 shows a description of knowledge products, services and content that are exchanged in the Sani-KMart and Table 9.5 addresses the activities in the Sanitation Management Knowledge Value Chain.

The Sani-KIAs begin at the point of processing and configuration where data, information and existing knowledge are sourced (through research, education, training, search, etc.) by Sani-KIFs/KIOs and even Sani-KIBSFs as well as KEnts acting as brokers or coordinators; and then material relevant to the need is identified (whether available or not within the system); and subsequently acquired through KWers tacit knowledge, codified and stored explicit knowledge and/or purchased from third parties as an artefact in itself or by hiring knowledge experts and or specialised KIBSFs (Lonnqvist and Laihonen, 2017; Rajala *et al.* 2008). The next stage is when the units acquired and configured are transformed to usable material whereby the different perspectives, levels, phases and categories of knowledge from different sources have been integrated into one composite package for specific purposes (Berends *et al.*, 2011; Gabbay *et al.*, 2020; Holsapple & Singh, 2003; Krome, 2014; Paralič *et al.*, 2013; Schneider, 2012; Welo & Ringin, 2018; Zahra *et al.*, 2020). The composite knowledge drawn from the transformation and integration stage enables the creation and production of knowledge content, products and services in sanitation and its management specific to required and relevant sectoral needs and expectations and novel innovations (Brix, 2017; Ramirez *et al.*, 2012; Yu *et al.*, 2017).

Knowledge protection (KP) may not be so critical for KIBSFs and KIOs, but it is often really important for KIFs (Chyi Lee & Yang, 2000; Probst, 1998; Probst *et al.*, 1999; Simard, 2006); it serves as a means to protect their tangible and intangible assets from

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Table 9.4 Sanitation knowledge products, services and contents.

Item	Description	Examples
Sanitation Knowledge Products	Knowledge products are the tangible outputs that could be used to generate, create, store, distribute, diffuse, use, evaluate and transform existing and new knowledge either for or of itself (IUCN, 2004)	Books, Reports, Guidelines, Journals, Maps, Software, Apps, Websites, Podcasts, Media Programmes, Databases, Repositories, Inventories, Virtual Platforms, and so on.
Sanitation Knowledge Services	Knowledge services are the KISA operated internally and externally for clients and users through the tacit and explicit knowledge embedded in knowledge workers and organisational practices and technologies (IUCN, 2004)	Customer Feedback Management, Knowledge Workers/Experts Recruitment, Education and Research, Research and Development, Training and Development, Science and Technology research, Social Science and Humanities research, content generation, design and development
Sanitation Knowledge Content	Sanitation knowledge content generated, designed, developed and produced by KWers, KExps and knowledge entrepreneurs for clients and employers	Manuals, procedures, guidelines, standards, regulations, policies, legislation, training materials, seminar/workshop/conference proceedings, journal articles/publications, books, magazines, newsletters, blogs, podcasts, curricula development, programme design and development. Adverts/promo materials, and so on.

expropriation and imitation (Bolisani *et al.*, 2013; Elliot *et al.*, 2019). Considering that knowledge innovation, particularly for new content, product and service development, is primarily tacit knowledge that exists in the brains of knowledge workers and other experts, and also requires a number of interactions that could unwittingly expose key knowledge assets (Bolisani *et al.*, 2013; de Faria & Sofka, 2010; Elliot *et al.*, 2019; Manhart & Thalmann, 2015; Paallysaho & Kussisto, 2008, 2011), the process of preventing this involves a number of mechanisms and KISA. The outcome of the Covid-19 pandemic has resulted in more people working and interacting remotely and has made KP more dicey as knowledge assets are shared across communication lines that are not completely under the control of organisations, their contractors and collaborators (Bolisani *et al.*, 2013; Elliot *et al.*, 2019; Ha *et al.*, 2021; Paallysaho & Kussisto, 2011). Thus, knowledge-intensive enterprises and organisations in the sanitation management sector need to make use of formal and informal mechanisms to keep their valuable and sensitive knowledge assets vaulted (Bolisani *et al.*, 2013; Elliot *et al.*, 2019; Manhart & Thalmann, 2015; Paallysaho & Kussisto, 2008, 2011), but they are faced with the challenge of balancing knowledge protection and knowledge sharing internally and externally (Bolisani *et al.*, 2013; Elliot *et al.*, 2019; Manhart & Thalmann, 2015; Manhart *et al.*, 2015; Paallysaho & Kussisto, 2011).

The next step is to determine which knowledge is to be freely shared, vaulted, licensed, and how much of it should be shared, and then the manner in which it should be shared. These are activities that fall under the dissemination and marketing stage. Sani-KIOs may mainly share their knowledge units as public goods, but also keep private certain valuable aspects within lock and key as much as possible. But, Sani-KIBSFs and Sani-KIFs (in particular) are stuck with the dilemma of determining what knowledge is available for disseminating, especially as they are much dependent on

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Table 9.5 Sanitation knowledge products and services value chain.

Core Activities	Secondary Activities	SKPSPs (Actors: KIFs, KIBSFs, KIOS & OTHERS)	End-users/Market
Processing/Configuration Generating data and information; Sourcing and identifying and acquiring existing data, information and filling knowledge gaps **Transformation/Integration** Data processing and management; Information verification and management; Collation and Codification; Storage and retrieval **Creation/Production** Content generation and development; Conceptualization; Product and Service design and development **Protection/Licensing** Patent; Trademarks; Copyright; contracts; agreements **Dissemination/Marketing** Branding; Customer Engagement; Multimedia	• Planning and administration • Human Resource Management • Infrastructure • Knowledge Workers/Experts Recruitment and Management • Knowledge Management Systems • Procurement • Compliance Management • Audit and Certification	• Universities • Research Institutes • Knowledge workers and experts • Testing and Experimentation • Concept Design and Development • Content generators • Data generation and processing • Digital platform development • Software, app and Website development • Marketers, disseminators • Publishers • Operations, maintenance and repair	• Architecture and Building Construction • Transportation • Hospitality and Tourism • Entertainment and Event Management • Sanitary ware manufacturers • Healthcare and Welfare • Sewage and faecal sledge management • Sanitation Services Providers • Advocacy and Intervention organisations • Municipality and City managers • Government agencies

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Usage/Reuse/Recreate Sanitation Education and training; Sanitation Research and Development; Sanitation Product and Service Design and Development; Sanitation governance instruments and agencies	• Engineering consultancy	• Schools and Public Places (e.g. markets, parks, cinemas, event centres, etc.)
Monitoring/Evaluation Auditing; Assessments; Data and information gathering		
Supporting Services Banking; Funds Management; Corporate Management; Administration	• Business and Management Consulting • Accounting and Tax management • Financial Management • Digital and ICT product/service providers • Publishing	
Enablers Taxes; Policies; Legislations; Regulations; Standards; Public Private Partnerships; Incentives	• Public Agencies and Intervention Agencies • Communities of Practice • Management • Industry • Knowledge Workers and Experts • Donors and Funders • Finance Institutions and Investors	
Outcomes Performance; Competitive Advantage; Improved Capabilities	• Standards and Quality assurance • Clients' Engagement and Customer Satisfaction • Innovative Production and Service Delivery Processes • New Products and Services Design and Development	

marketing and collaborations with external parties (Bolisani & Scarso, 2014; Bolisani *et al.*, 2016; Diehr & Wilhelm, 2017; Kohlbacher, 2008). In any case, there are various ways of distributing knowledge content, products and services to the society (public), employees, clients/customers, third parties (e.g., partners, collaborators, etc.), industry, and end-users. When knowledge assets are made available, whether free or fee based, they can be utilised in several ways within the entities that they were created or third-party partners/clients and/or other end-users. They could be used to create sanitation management knowledge content, or specific sanitation products, services, processes, technologies, and so on., in particular as it relates to the circular economy (Ddiba *et al.*, 2020; Mallory *et al.*, 2020; Moya *et al.*, 2019; TBC, 2017) and the COP26 methane mitigation goals (UN, 2021); and they could be used to design sanitation solutions across sectoral industries such as transportation (airlines, ships, buses, trains, etc.), tourism and hospitality, healthcare, and so on. They could also be used to create new knowledge or to create new content, products, services and other commercially valued commodities (Diehr & Gueldenberg, 2017; Diehr & Wilhelm, 2017; Holsapple & Singh, 2003; Simard, 2006; Song *et al.*, 2005).

At this point, the process of monitoring and evaluation becomes vital to determine the efficacy and efficiency of knowledge resources and assets accumulated through all stages of the value chain (as a whole or just for specific stages), how they have added value to the organisations, enterprises, society and industry that they served, and what additional value they might still be able to add (Janus, 2016; UNDP, 2002). The cycle continues from this point as M&E is able to generate new knowledge that could be re-introduced to the value chain system at the various stages and the circular knowledge flow will resume again. At the top and base of the value chain are key stakeholders that contribute to the performance and sustainability of the value chain and market it represents. The providers of the sanitation and vital related knowledge content as well as products, services, processes, and so on., and those that purchase/obtain what they sell and/or final users down the chain. The enablers are those that give authentication and legal backing for the activities and players in the VC; while the supporters are those that provide services that enable and enhance the operations of SaniM-KVC enterprises and organisations.

9.4.1 Key aspects of the SMKPSVC

There are some key aspects of the SKMPSVC that drive the process towards value-adding and creation in the IFSVC and they include CoPs, education, research and training.

9.4.1.1 Communities of practice (CoPs)

Emphasis of KM is to work smarter by acquiring relevant and high-quality knowledge; and this could be achieved through CoP (Venkatraman & Venkatraman, 2018). KM includes motivating individuals to participate in overall goals and create the social processes that will facilitate success. Such social processes include communities of practice and expert networks. This is vital because individual knowledge (and also indigenous knowledge) will suffocate unless it can be shared through groups, teams, networks and associations. CoPs help to manage knowledge assets and resources (Wenger *et al.*, 2002) and their members can work across organisations, sectors and disciplines. They are regarded as an important component of a human-oriented KM (Huysman & Wulf, 2006; Newell *et al.*, 2006) as individual and collective learning take place simultaneously (Lesser & Storck, 2001) and they support learning and knowledge exchanges (Bolisani & Scarso, 2014).

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To understand and expand the reach of the social interactions within the SaniM-KVC, especially in the complex and sensitive sanitation sector, may be better explored from the concept of 'communities of practice' (Lave & Wenger, 1991; Lowitt *et al.*, 2015; Wenger, 1998). The transfer of knowledge and learning opportunities between and within CoP in a VC are critical to the productive quality and effectiveness of sanitation management and achieving the SDG 6 (Bammann, 2007). Thus, understanding and developing a knowledge management value chain in sanitation will be effective from the perspectives of sanitation communities of practice (Sani-CoPs) and their related social interactions within and across sectors, spatial scales and landscapes of communities in knowledge transfer and learning (Lowitt *et al.*, 2015). The purpose and aspirations of the Sani-CoPs will drive any SaniM-KVC (Landry *et al.*, 2006), especially as it regards domestic and global expectations such as the SDG 6 and other agenda.

Sani-Cops share a concern or a passion for specific areas in sanitation and its management, and learn how to do things better as they interact regularly (Lave & Wenger, 1991) by focussing on the social relationships that allow people to learn together or from each other. Thus, to understand the operations of social interactions within the SaniM-KVC, the concept of communities of practice is key (Lowit *et al.*, 2015). Multiple Sani-CoPs can come together to form larger 'landscapes' of practice with the potential to support social learning and innovations and also enable cross-learning (Dei & van der Walt, 2020; Wenger-Trayner *et al.*, 2015). In fact, the SaniM-KVC comprises of CoPs within the different stakeholders and organisations it brings together (even across landscapes of practice) (Lowitt *et al.*, 2015) such as sanitation = health, water hygiene, climate, governance, behaviour, economics, and so on.). This highlights the social interactions, knowledge-sharing and learning as vital resources for the IFSVC. They could also be crucial to facilitating coherence and coordination in the knowledge value chain activities of the sanitation management sector (Chisholm & Nielson, 2009; Lowitt *et al.*, 2015; Nahapiet & Ghoshal, 1998). They can provide a pool of knowledge and make it available through education, training, research and archival platforms (e.g., databases, repositories, publications, etc.) and other forms of knowledge-sharing and learning (e.g., conferences, seminars, experts, peers, etc.) for sanitation management problem-solving, decision-making and innovations (Kling & Courtright, 2003; Venkatraman & Venkatraman, 2018); and are involved in creating and sharing knowledge in literature (Hartlung & Oliveira, 2013). They could also add value and contribute to competitive advantage (Kim *et al.*, 2012) by improving old artefacts (i.e. products, services, processes, tools, etc.), creating new knowledge, products, services, and so on., solve problems faster and smarter, disseminate best practices, develop professional skills and support recruitment and talent retention (Wenger & Snyder, 2000). In addition, Sani-CoPs support social capital, which has been described as the structural and cognitive characteristics of social organisations that share values, norms, and trust to facilitate coordination and cooperation for mutual benefits (Nahapiet & Ghoshal, 1998; Putnam, 1995) by providing learning networks of individuals with common interests, drawing people together to generate/share knowledge and learn in a way that breeds trust and then through created and shared stories about the norms and values, they develop and maintain sector registers and terms that can be transferred to others (Lesser & Storck, 2001; Lowitt *et al.*, 2015).

Members of Sani-CoPs will share experiences within a particular domain of Sani-K/SaniM-K that allows them to develop perspectives, practices and particular approaches (Wenger *et al.*, 2002) and then engage in collective learning in a subject matter of common interests (with perhaps divergent focus); for example a group of sanitation professionals interested in research towards innovative solutions for contextual safely managed

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sanitation (Wenger-Trayner & Wenger-Trayner, 2015) that support learning, sharing and stewarding knowledge and could deepen knowledge and expertise (Bolisani & Scarso, 2014; Lesser & Prusak, 1999; Wenger-Trayner & Wenger-Trayner, 2015). However, they do not just share existing knowledge, but also provide innovations, inventions and solutions to problems; and create new knowledge, expand practice, define new territory, introduce new disciplines and develop a collective and strategic voice (Wenger-Trayner & Wenger-Trayner, 2015). These CoPs have the capacity to drive knowledge creation and dissemination since individuals and groups can share and transfer knowledge that improves practice, productivity and fosters innovations within organisations and even personal growth (Aljuwaiber, 2016; Dei & van der Walt, 2020; Hislop, 2003; Wenger, 2004) and also encourage cross-learning amongst landscapes of practice (Probst & Borzillo, 2008; Wenger-Trayner *et al.*, 2015). But, for sanitation practice to be able to properly realise its potential through the knowledge and skills of the Sani-CoPs, a clear picture of the SaniM-KVC is necessary (Wenger & Snyder, 2000). Therefore, research is urgently needed in this area.

9.4.1.2 Sanitation education, research and training (Sani-ERT)

No cause can succeed without first making education its ally (attributed to Victor Hugo) as education provides individuals with knowledge and skills necessary within society and the labour market for their own enlightenment, empowerment and participation; and to increase social advantage in several ways (Exley, 2016). The sanitation knowledge economy (Sani-KE) obviously requires highly qualified and knowledgeable workforce to achieve the SDG targets related to sanitation, so education and professional training is a strong driver while research drives intellectual capital for innovation (Carrillo, 2016; OECD, 2012). To accomplish the goal and targets of SDG 6 and other key related SDGs (e.g., SDG 3, 7, 8, 9 and, 11), and the success of sanitation businesses, investments in human capital and human development are crucial (Jacinto & Garcia de Fanelli, 2014). Strengthening the capacity of domestic citizens and professionals to plan, implement, manage, govern and implement as well as innovate, produce and serve effectively and with enhanced value additions and creations will enable national and local governments in conjunction with global partners to address contextual and interconnected sanitation challenges more successfully. The significance of Sani-ERT in perpetuating safe sanitation management is indisputable – even though this has not yet gained traction in the development and academia arena.

All aspects of the IFSVC are dependent on the learning connections of SERT. There can be no progress without adequately and appropriately trained and equipped human resource in the sanitation sector of any country, in particular, developing countries. Knowledge sharing and creation produces the capacity for innovative solutions and implementation of relevant and effective policies. When ERT is properly designed and positioned in any sector of any given economy, then the sector is strengthened to deliver on expectations and solve contextual and interconnected problems. But, above that, the sector will be equipped to create value-added products and services across the spectrum and beyond. The complex and dynamic nature of the sanitation system and processes make it an interdisciplinary discipline with contextual peculiarities, thus value-added activities are not restricted to technology alone, and this will require capacities at various levels and different aspects.

Knowledge-sharing and transfer rest greatly on education and training while knowledge-creation, translation, exploitation and dissemination through research and development is key for innovation and transformation. The capacity to acquire, source, create, share, transfer and apply knowledge is significant to the ability to tackle sanitation and related problems and to provide sustainable solutions. And so, the instruments of

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SERT will be able to round-up all dispersed knowledge and provide tracks of learning that could transform the sanitation management sector and provide effective, knowledgeable and skilled manpower capacity, primarily in developing countries. Sani-CoP are useful to facilitate research, teaching and learning in universities in this regard.

In addition, the capacity that enables individuals, organisations and societies (economies) to identify and understand existing development challenges and trends, solve attendant problems, perform appropriate tasks effectively, efficiently and sustainably through an active learning and knowledge-sharing process is embedded in ERT (Alaerts & Kaspersma, 2009). Weak or inadequate capacity at any level could translate to the inability to achieve goals and targets and even further hamper the progress of any society, economy and/or organisation. For sanitation management capacity to be relevant in any economy or society, however, it must cover the quality and quantity of contextual abilities needed at individual and institutional levels required to match the challenges and expectations; and this capacity should include the combination of attributes that enable the creation and addition of value at different phases and stages of the IFSVC. Providing and strengthening capacity with knowledge transfer (or sharing) and creation happens via ERT.

Capacity development that represents knowing the what (e.g., conceptualisation, creation and integration), knowing the how (e.g., process, procedure, replication), and knowing the where/when (contextualisation, location, climate, time) are primarily learned through education and research. On the other hand, the practice of knowledge that leads to skilling is mainly learned through training (on-the-job, mentorship, apprenticeship, coaching, etc.). now, knowledge is transferred through different levels of education (primary, secondary, technical/vocational and tertiary) while knowledge-sharing and creation comes through research. Skill training can be delivered on the shopfloor or through apprenticeships, mentoring/coaching, internships, seminars, workshops, classes and/or self-taught acquisitions (Alaerts & Kaspersma, 2009).

Knowledge, skills and the ability to understand the nuances in sanitation management and governances are dependent on the agencies of SERT. It is impossible for the sanitation sector to thrive without an above average capacity within its human capital stock to deliver top-notch quality, functional, efficient and sustainable solutions on a continuous basis. SERT are significant mechanisms to provide learning and innovation that improves and delivers home-based solutions and would also contribute to local and national economies with a strong potential for creating a sanitation economy and unique job opportunities. Research and formal higher education drive innovation, design production, finance, technology, management, governance, service and advocacy to meet national and local demands while vocational and technical education and training (formal and informal) provide intermediary level skills for installation, maintenance, operations, service delivery and sales/marketing. In addition, professional and on-the-job trainings provide room for continuous learning to ensure sustainability. Meanwhile, sanitation education at the primary and secondary levels equip citizens and residents with basic critical knowledge about sanitation, which influences a better understanding, appreciative perception and pre-emptive behaviour towards safe sanitation management as adults.

9.5 CONCLUSION

Building the sanitation sector will call for innovations in sanitation products and services, operations/maintenance, installation, design, management/governance and advocacy as well as education, research and training and the interactions of sanitation management communities of practice. The sector will, however, need to develop a

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strong foundation to carry the knowledge market for the Sani-KMart to survive in the fast-growing general KE. The World Bank (2007) suggests four key pillars to this foundation:

(I) the availability of highly skilled workforce and a quality education system for sanitation management;
(II) availability and accessibility to a dense and modern ICT infrastructure and systems;
(III) vibrant and effective inn0vation landscape and interactions between academia, industry, government, public and the environment;
(IV) institutional support and incentives that target entrepreneurship and the use of knowledge.

The success and acceleration of any knowledge-based growth (whether in North or South countries), however, is dependent on how integrated the two ends of the knowledge spectrum are: that is, a seamless connection flow between the exploration of new knowledge (e.g., research, create, test, and experience) and the diffusion and use of existing knowledge (World Bank, 2007). It is also crucial that government players maintain a strong role in the knowledge market as they also create, use and disseminate data, information and knowledge that support the sanitation industry and governance as well (Simard, 2006). In addition, innovation is central to the future of safe sanitation management and the effectiveness of innovations is dependent on available knowledge capital that is based on a collation of created and shared content within a community (or communities) of practice (e.g., sanitation management) and/or interconnected CoPs (e.g., gender, technology, governance, health, water, hygiene, etc.); and the value of such knowledge capital is determined and weighed by how it is utilized (when and where) (Khadir-Poggi and Keating, 2013; Lee, 2016; Simard, 2006). However, when knowledge content is shared (i.e., knowledge-sharing) amongst individuals or groups in a CoP (and its connections) as relevant ideas, information, suggestions and expertise, it builds and strengthens the practice (Bartol & Srivastva, 2002) and also provides the potential to develop new ideas which is integral to value creation and addition. This leads to complex interactive processes of creating (and recreating), transferring and transforming knowledge from one community of practice to another and then to users in societies, industries, governments, and so on., in a value creating loop, where knowledge is traded as a commodity (Landry *et al.*, 2006).

Thus, promoting the value creation and addition in the sanitation sector required for progress will entail the understanding and managing of relevant knowledge of the complex dynamics in sanitation systems and processes to unlock the value within different stages and interactions. In other words, the process of sourcing, acquiring and storing sanitation information and content need to be coordinated and assembled strategically as knowledge capital available to communities of practice (CoPs) form translation and transformation into practical solutions and exploitation/utilization that will result in wide-reach usage as well as the creation of new knowledge, which could then be transferred, stored and disseminated (Holsapple & Singh, 2003; Lee, 2016) as intellectual capital for policy, implementation, products, services and innovation (Alawneh *et al.*, 2009). This intellectual capital is developed through knowledge innovation, that is, the creation, transformation, transfer, and application of new ideas drawn from old and new knowledge capital pool to develop value in products/services and decision-making with competitive advantage and improved performance and capacities that deliver on expectations and requirements in communities of practice, for clients, societies, economies, governments, and industry (Darroch, 2005; Kostas & John, 2006; Lee, 2016).

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All of these activities take place in the sanitation management knowledge value chain (SaniM-KVC) and this is why studies are urgently needed in this area of the IFSVC where there is no previous data or information.

9.6 Take action

(1) Identify the sanitation knowledge intensive business services enterprises and sanitation knowledge intensive firms and organizations in your country and at global levels.
(2) Contact a sanitation knowledge intensive business enterprise in your city and conduct interviews on their operations, challenges and opportunities.

9.7 Journal entry

(1) What is the role of the sanitation management knowledge value chain in the overall IFSVC and its impacts on the sanitation economy?
(2) Why is sanitation no longer just a development concern, but increasingly an integral aspect of enterprises' operations?

9.8 Reflection

(1) Reflect on the sanitation knowledge marketplace and the sanitation management knowledge value chain and how they influence the IFSVC and the sanitation economy.
(2) What is the role of the sanitation knowledge market in the implementation of IFSVC?

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