

## THE EVOLUTION OF QUALITY MANAGEMENT SYSTEMS TO ASSIST MANUFACTURING ENTREPRENEURS IN INCUBATION CLUSTERS

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### ABSTRACT

Quality management systems are important for any organization to sustain growth, develop technologies and to manage innovation. However, the cost of quality can make it challenging for start-up enterprises to be competitive. South Africa needs to establish successful incubation models that can assist the country's government to reach key economic development milestones. The transformation of quality management systems in these incubation clusters to assist start-up enterprises is still not clearly understood. A quality management framework can assist to recognise the life cycle position of an incubation cluster and the phases to grow from a start-up into established value streams. In this study several manufacturing incubators in South Africa were visited to conduct an incubator quality management systems capability analysis. The stage of cluster growth of these incubators were plotted onto the quality management framework. Current best practices are highlighted and future work discussed.

**Key words:** Quality management systems, incubation, sustainable growth.

### INTRODUCTION

Manufacturing paradigms are continually changing and shifting to create sustainable value. Sustainable value has emerged to target not only ecological sustainability, but also social and economic values (Ueda, et al., 2009). Having a strong manufacturing base is important to any society or community, because it stimulates all the other sectors of the economy (Koren, et al., 2013) to be productive. Incubation clusters evolved from this need to develop the next generation of manufacturing systems in response to the emerging need for manufacturing to respond rapidly and be flexible.

Incubation clusters provide a sound basis for competitiveness, innovativeness and agility by enabling the interconnected partners to (1) form long-term business coalitions, (2) share information, knowledge, resources, competencies and risks, (3) develop mutual understanding and trust, (4) jointly react to business opportunities, and (5) gain synergetic effects by collaboration and cooperation. Thus, they combine good characteristics of large companies with the advantages of

SMME's and introduce new possibilities and potentials for innovation. Innovation is usually one of the strongest motivation factors for establishment of a cluster (Jura & GA, 2014).

Incubation clusters are geographic concentrations of interconnected companies and institutions in a particular field that compete and collaborate at the same time. These clusters also reflect the specializations of regions in activities, within which companies (Association, 2013) can gain higher productivity through accessing external economies of scale or other comparative advantages. This support model gains competitive strength because of its better access to trained and experienced employees, suppliers, specialized information and public goods, as well as from the motivating forces of local competition and customer demand. The ability to identify opportunities co-creatively and bring innovative products to market effectively in an efficient way also enhances the incubation cluster's competitiveness (Al-Shaikh, 1998).

South Africa adopted this concept almost ten years ago with the support from the Small Enterprise Development Agency (SEDA). The country has now established more than 40 incubators across the country. This has reduced the failure rate of SMMEs in the first two years of their operation from 90% to about the current 70% (Industry, 2013). The failure rate of these SMME's in the first two years was reported to be over 60% in Africa and other developing countries. Still, these SMME's incubated from these clusters struggle to grow from a start-up into established value streams, due to the absence and stagnation of their quality management systems.

Quality refers to those features of a product which meet customer needs (Juran, 1988) and does not pertain to a single aspect of a product, but a number of different dimensions (Jacobs & Chase, 2011). These dimensions of quality include performance, special features, conformance, reliability, durability, and service after sale (Stevenson, 1999). Evolved quality management systems provide structured and standardized processes and procedures to do things within companies and ensure the required product quality is maintained.

A quality management framework can assist to recognise the life cycle position of an incubation cluster and to navigate SMME's through the different phases. In this study several manufacturing incubators in South Africa were visited to conduct an incubator quality management systems capability analyses. This research is a continuation (Jura & GA, 2014) on quality management systems for manufacturing incubators in clusters.

## **QUALITY MANAGEMENT FRAMEWORK**

A dynamic cluster can't be isolated and in order for an incubation cluster to prosper it needs an inflow of people with different skills, social development grants, innovative materials, technologies and products and; constant progress of quality management systems.

The early period of an incubation cluster is often identified with a few people, termed the heroes of a cluster as illustrated in figure 1. As the cluster grows through creativity, direction and delegation phases the identifiable cluster begins to emerge.

As the cluster matures in the growth through delegation and co-ordination phases, the cluster matures and certain production strategies will be structured. As economics of scale starts to play an increasing role the quality management systems become standardised according to the external environment.

Ultimately, the incubation cluster goes into decline, finally reaching the museum state or alternatively leapfrogs onto a cycle of renaissance based on the development of innovative intellectual property. Once the incubation cluster reaches critical mass and starts to grow, there is often a strong cumulative process that locks the cluster. In order for these clusters to grow and prosper from the hero (entrepreneurship) phase through a mature economics of scale phase the quality management systems also need to evolve from a chaotic state to a standardised quality management system.

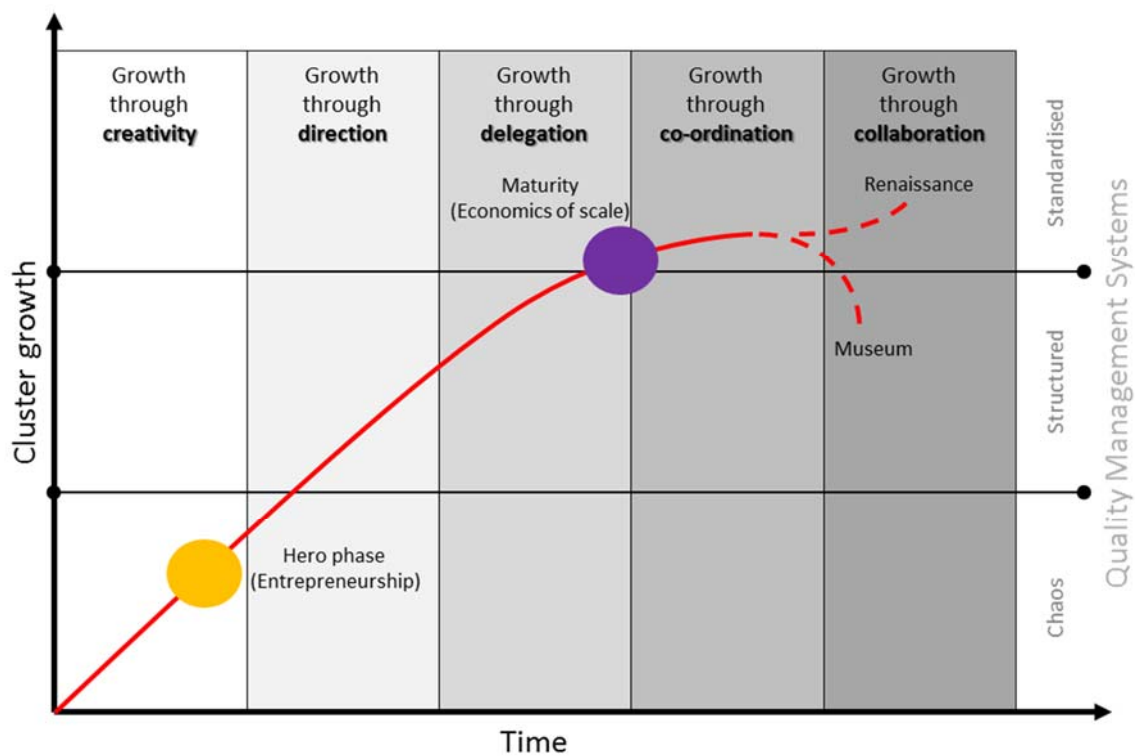


Figure 1: Quality management framework for incubation clusters (Jura & GA, 2014)

This needs to be balanced with factors like demand sophistication, factor upgrading and specialisation and emerging strategies from competition. In addition to this the emergence of new entrants, cluster and quality management system development involves continuous collaboration and emerging social capital.

### Chaos stage of quality management systems

This phase represents the very conception or birth of a new business. In this chaotic stage there are no documented procedures in place. Most seed stage companies (Adeya, 2001) will have to overcome the challenge of market acceptance and pursue one niche opportunity. Resources commitments must not be spread too thinly. At this stage of the business the focus is on matching the business opportunity with skills, experience and passions. Other focal points include: deciding on a business ownership structure, finding professional advisors, and business planning. Early in the business life cycle with no proven market or customers the business will rely on cash from owners, friends and family. Other potential sources include suppliers, customers, government grants and banks (Jura & GA, 2014).

During the start-up phase the business is born and now exists legally. Products or services are in production and a company registers its first customers. If the business is in the start-up life cycle stage, it is likely to have overestimated money needs and the time to market (Janssen, n.d.). The main challenge for entrepreneurs is not to burn through what little cash they have. The entrepreneur must learn what profitable needs their clients have and do reality checks to see if the business is on the right track. Start-ups require establishing a customer base and market presence along with tracking and conserving cash flow (G. Oosthuizen, 2013). Money sources include the owner, friends, family, suppliers, customers, grants, and banks. Knowledge would rest in the owner or management and there are constant referrals for decisions. In the case of a manufacturing facility, there is reactive funds allocation to specific projects. The factory layout is not properly defined and the technology in use is simple. As such, the execution of similar tasks is different depending on who does the particular task. There is no research work that can improve the performance of a business and little or no benchmarking activity occurs.

### **Structured stage of quality management systems**

In this structured stage of quality management systems documented procedures are in place. Revenues and customers are increasing with many new opportunities and issues. Profits are strong, but competition is surfacing. The biggest challenge growth companies face is dealing with the constant range of issues bidding for more time and money.

Effective management is required and a possible new business plan. Entrepreneurs must how to train and delegate to conquer this stage of development [9]. Growth life cycle businesses are focused on running the business in a more formal fashion to deal with the increased sales and customers. Better accounting and management systems will have to be set-up. New employees will have to be hired to deal with the influx of business.

The money sources include banks, profits, partnerships, grants and leasing options. More advanced technology tools and work methods are in use. Planning horizon is normally 6 to 12 months. Some review of performance occurs with key performance indicators (KPIs) in place. These companies would have an organizational structure in place that is functioning and the factory layout would be defined. There is some minor involvement in research and considerable benchmarking. Knowledge sharing occurs at this stage.

### **Standardized stage of quality management systems**

The period the business has now matured into a thriving company with a place in the market and loyal customers refers to the mature phase. Sales growth is not explosive but manageable. Business life has become more routine. The entrepreneur can easily rest during this life stage. One has worked hard and earned a rest but the marketplace is relentless and competitive. There is need to focus on the bigger picture. Issues like the economy, competitors or changing customer tastes can quickly end all one has worked for (Janssen, n.d.). An established life cycle company will be focused on improvement and productivity. To compete in an established market, one requires better business practices along with automation and outsourcing to improve productivity (Janssen, n.d.). Sources of money include profits, banks, investors and government.

This expansion life cycle is also characterized by a new period of growth into new markets and distribution channels. This stage is often the choice of the business owner to gain a larger market

share and find new revenue and profit channels [7]. Moving into new markets requires the planning and research of a seed or start-up stage business. Focus should be on businesses that complement existing experience and capabilities. Moving into unrelated businesses can be disastrous. Addition of new products or services to existing markets or expand existing business into new markets and customer types. Sources of funding include joint ventures, banks, licensing, new investors and partners, profits, banks, investors and government.

In this standardized stage of quality management systems the organization conducts business review meetings based on KPI monitoring. The planning horizon is now more than 12 months and the latest work methods and/or technologies are in use. The cash flow is sound and attractive to investors and funding agents. The organization would now be doing extensive research activity and there is a high degree of networking. The benchmarking process is established and a sound organogram would exist. These organization that is certified to a recognizable quality management system would have formalized systems that are used to review performance.

### RESEARCH METHODOLOGY

The objective of this research was to visit several manufacturing incubators in South Africa to conduct an incubator quality management systems capability analyses. This research was divided into different phases as illustrated in figure 2. The first step constituted of a literature study on incubators and quality management systems.

Several case studies were studied in order to understand how incubators operate and then look at opportunities of improving their operations by using quality management systems.

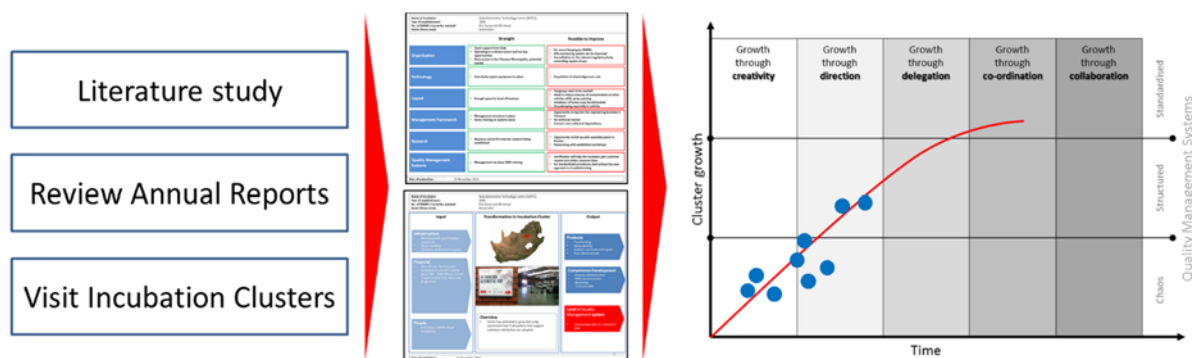


Figure 2: Research methodology to conduct an incubator quality management systems capability analyses

The published annual reports from 2005 – 2013 on SMME development by SEDA in these incubation cluster were also reviewed. Thereafter, 15 Small Enterprise Development Agency (SEDA) funded incubators (12 Gauteng, 2 Limpopo and 1 in North West provinces) and 4 privately supported incubators were visited to conduct an incubator quality management systems capability analyses. The stage of cluster growth of these incubators should then be plotted onto the quality management framework and current best practices should be highlighted.

## EXPERIMENTAL RESULTS AND DISCUSSION

Several case studies were studied in order to understand dynamics of clusters and the issues and opportunities of implementing quality management systems within these clusters (G. Oosthuizen, 2013; Jura & GA, 2014). The value creation processes in these success stories were also studied.

The published annual reports from 2005 – 2013 on SMME development by SEDA in these incubation cluster were then reviewed. Figure 3 shows the number of incubators that are supported by SEDA in South Africa.

The number of incubators in the various provinces shows the potential that is there in South Africa to grow entrepreneurs by applying engineering management principles. This growth would lead to employment.

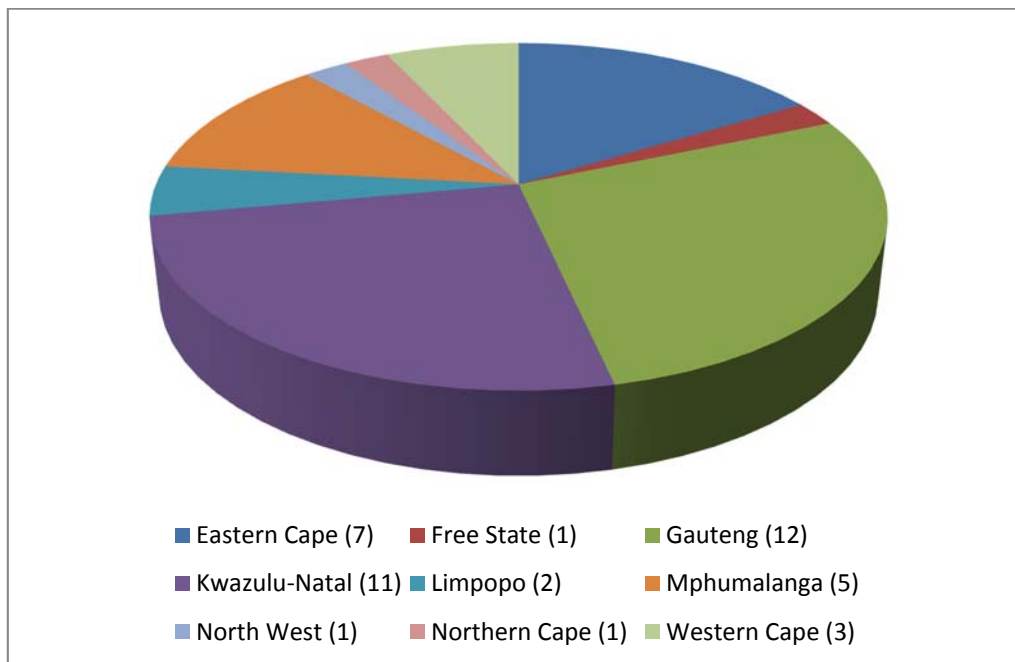


Figure 3: Number of incubators by province (SEDA, 2006 - 2014)

During the research, a review of the number of enterprises that were created every year from 2006 till 2014 were also determined based on the review of the annual reports and summarized in figure 4.

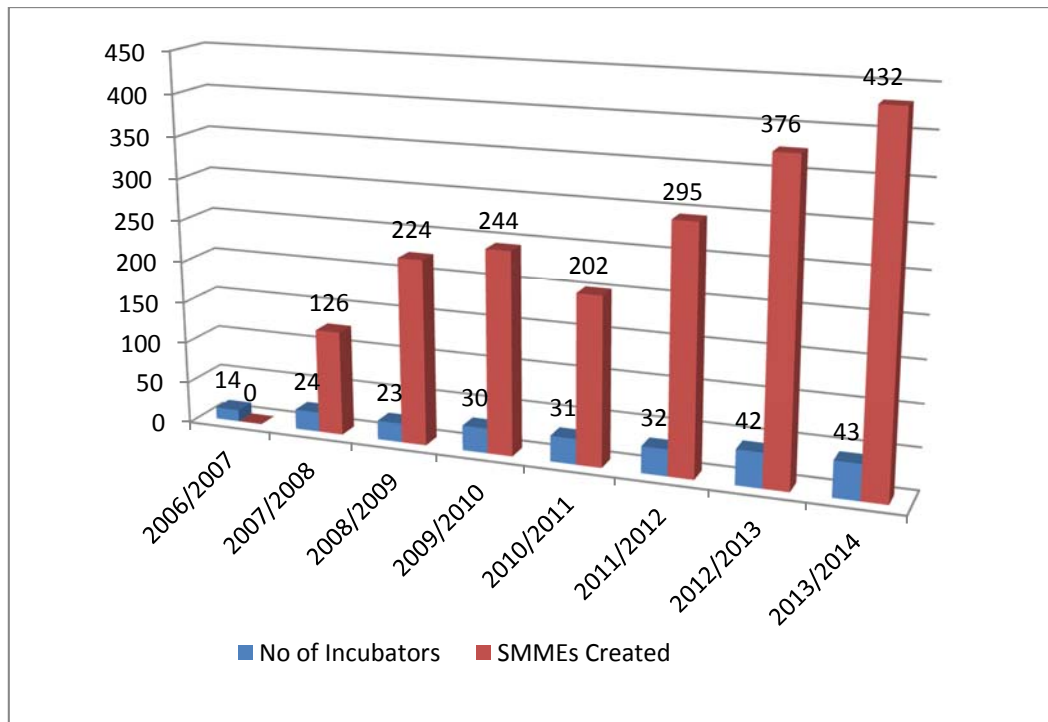


Figure 4: Annual number of SMMEs created (SEDA, 2006 - 2014)

The reviewed annual reports show a steady growth in incubators over the years. Incubators that are funded by SEDA have grown from 14 in 2006 to 43 at the moment. A systematic approach to tracking performance across all the incubators becomes important. During the visits to the different incubators the following findings were made:

- (a) The incubators have in-house and virtual clients (individuals and SMMEs).
- (b) In all cases, it is the client that approaches SEDA for support.
- (c) Those incubators that are being established by other companies are mostly still in their infancy.
- (d) The following was observed during visits to the established incubators:

The management approach differs across all incubators. Each incubator has its own way of conducting their business. However, while the incubation approach is centre-specific, the Centre Managers across all incubators are experienced in business incubation. In one incubator, the board was seen to be directly involved in the progress of the entrepreneurs being developed. Every quarter, two entrepreneurs are selected to present to the board. Incubators where the board was more involved have achieved greater success. The factory layouts were different for all incubators and at different stages of complexity in factory layout. However, with proper procedures in place, this could be changed. The marketing efforts by these incubation clusters faced challenges as most have several niche focus areas. After visiting these incubator cluster to conduct an incubator quality management systems capability analyses the stage of cluster growth could then be plotted onto the quality management framework as illustrated in figure 5.

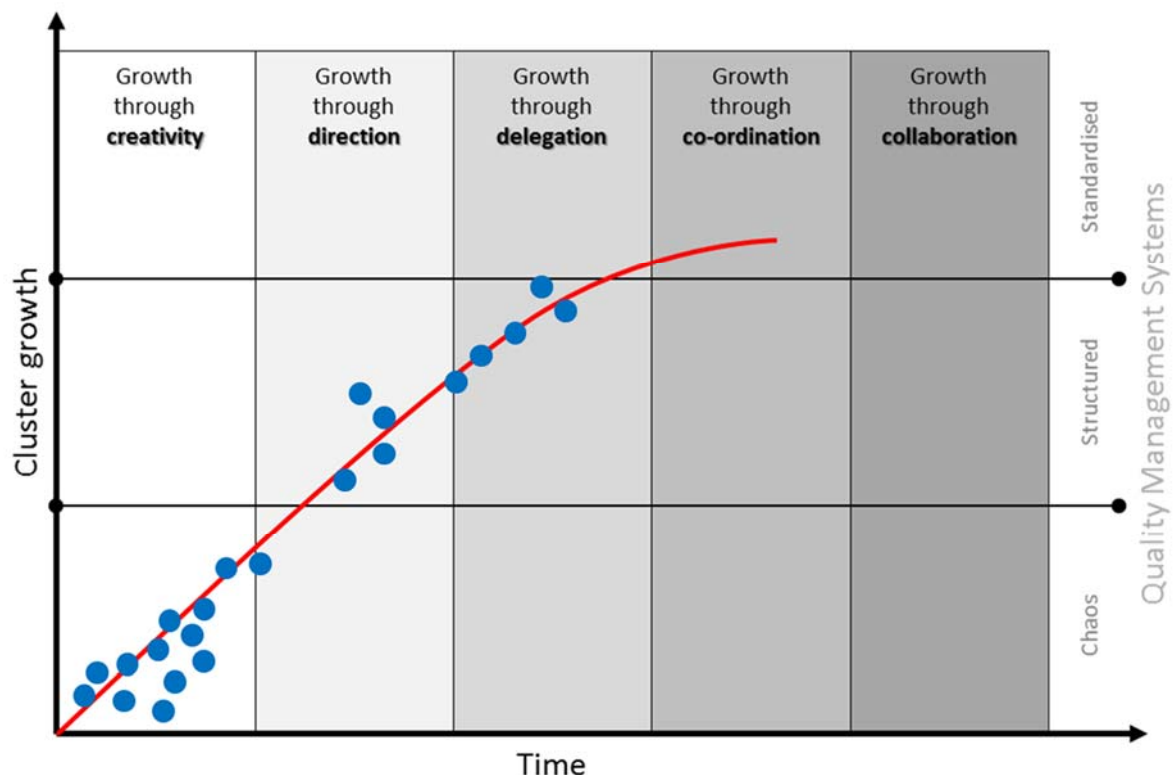


Figure 5: Plotting the stage of incubation cluster growth onto the quality management framework

Twenty two of the incubators were mapped onto the quality management systems framework. Only 9 of the 22 had a structured form of quality management system in place.

The results from the incubation capability analysis were tabulated on some of the key quality management systems elements with a rating to determine the level of readiness.

Table 1: Readiness rating of incubation clusters (☺-Satisfactory, ☹-Needs Improvement & 😐-Not Satisfactory) according to number of QMS elements

QMS ELEMENT (ISO, 2008)		REMARKS
General and Document Requirements	☹	No documentation as yet. Only one incubator is certified to ISO 9001:2008.  The commitment is there and the focus on the customers was clear. However, policy issues, planning and general communication would need improvement.
Management Responsibility		
Commitment	☺	
Customer Focus	☺	
Quality policy	☹	
Planning	😐	
Communication	😐	



QMS ELEMENT (ISO, 2008)		REMARKS
Management review	☹	
Resource Management		<p>There is a lot resource commitment from government and the private sector.</p> <p>However, the marketing of the products by the incubated enterprises is a challenge.</p>
Provision Of Resources	☺	
People	☺	
Infrastructure	☺	
Work environment	☺	
Product realisation		
Planning of Product Realization	☹	
Customer Related Processes	☹	
Design and Development	☹	
Purchasing	☹	
Production and Service Provision	☺	
Control and Monitoring of Measuring Equipment	☹	
Measurement, Analysis and Improvement		<p>Monitoring and measurement is vital. At the same time, control of non-conforming product and traceability issues will become vital as a business grows and serves a large and diverse market.</p>
Monitoring and Measurement	☹	
Control of Nonconforming Product	☹	
Analysis of Data/ Improvement	☹	

During the visits to incubators, it was noted that the incubator which is certified to ISO 9001 : 2008 has been able to implement its training programs and enterprise growth initiatives faster and in a more predictable manner.

## CONCLUSION

A quality management framework that can assist to recognise the life cycle position of an incubation cluster and the phases to grow from a start-up into established value streams were illustrated and discussed. In this study 22 manufacturing incubation clusters in South Africa were visited to conduct a quality management systems capability analyses. The stage of cluster growth of these incubators were plotted onto the quality management framework. Only 9 of the 22 had a structured form of quality management system in place. Current best practices are highlighted on different quality management systems elements. Only one of the incubators that were part of the study is certified according to ISO 9001:2008 requirements.

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