

# Assessing the Preparedness of Technology Business Incubators to Provide Services Aligned to the 4<sup>th</sup> Industrial Revolution: A South African perspective

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## Abstract

The fourth (4<sup>th</sup>) industrial revolution is fast becoming part of modern operations for businesses globally. Technology based enterprises find themselves in a position where they have to potentially adapt to this new arising phenomenon. In certain instances, technology-based enterprises undergo the business incubation process in order to be better equipped when entering various industrial operations and markets. This paper seeks to reflect the services provided by business incubators in South Africa (SA) and verify their relevance to assist and prepare technology-based firms for the 4<sup>th</sup> industrial revolution. The article is a conceptual paper, which examines existing literature on the subject matter and providing narrative on the status quo. The results are presented in a thematic manner and reflect gaps for the introduction of potentially new services that can be provided by technology business incubators in SA. These are concluded in an introduction of new a term, one we call *incubation 4.0*. This term seeks to explore the integration of physical, biological and digital aspects to service provision by business incubators, which are of course central and core to the 4<sup>th</sup> industrial revolution phenomenon at large.

**Keywords:** Technology, Business Incubation and Operational Services

## 1. Introduction

The fourth (4<sup>th</sup>) industrial revolution (industry 4.0) has been receiving a lot of attention from scholars and industry since its conception at the World Economic Forum (Schwab, 2017). The emergence of industry 4.0 means that technology-based enterprises must be able to function in this environment and be able to operate and survive. More especially technology-based enterprises. Many of which undergo incubation. Technology business Incubation is the process that entails a number of mechanisms that are aimed at assisting firms at their nascent developmental stage (Hackett and Dilts, 2004). The mechanisms of assistance are in the form of services, these services are but not limited to; business support, coaching, training, infrastructure provision and networking opportunities. Given that technology

business incubation can be considered a tool for assisting innovative business, it is of interest to determine whether the current services they provide are aligned to industry 4.0 needs. This paper seeks to assess the current business incubation services in SA and their alignment to the fourth industrial revolution.

## 2. Literature review

Given that the two concepts (incubation and industry 4.0) which are of interest have been developed at different time zones which are decades apart, it was deemed necessary to look at their developments separately initially, but eventually examined in combination. Business incubation as concept has been conceived about sixty years ago (Kilcrease 2012), whilst the fourth industrial revolution only being formally conceived about less than half a decade ago at the WEF (Schwab, 2017), Nevertheless, it is worth noting that their combination has been emerging to a certain extent of late and this was considered. This literature review section approaches the referenced text in a manner which unpacks incubation up to its integration with industry 4.0 and examples from SA.

### 2.1. Business Incubation

According to the South African Incubator establishment handbook, Business incubators are facilities that assist the in nascent stage of SMEs by providing services such as, funding access, access to the physical space and business development. From an international perspective, historically business incubation as a concept can be traced as far back as 1959, with the Batavian Industrial Center (BIC) being recognized as the first of its kind and introducing the now common term of business incubation, which has since spread globally (Kilcrease 2012). In all the years preceding the inception of the BIC, it is interesting to note that the types of services provided by business incubators have evolved. For instance, the early incubation services comprised mainly infrastructure support (Bruneel et.al, 2011), with the progression of time incubation services included business support, but eventually of late these have expanded to include the provision of networks (Hansen et al., 2000). In south Africa, it can be safe to say that incubation can be traced to the early 1980s in the form on hives of industry (Kongolo, 2010), however it was mostly in the 2000s that this was formally deemed an important instrument for development of technology-based enterprises. This is reflected on policy document Department of Trade and Industry (DTI) Incubation Support Programme. Table 1 below reflects some of the selected key incubators that form part of this program. As per the incubators reflected on the table below it is evident that SA incubators serve a wide number of industries. These range from agriculture, biotechnology, chemicals, manufacturing, precious metals and ICT.

Table 1: SEDA incubators

1) Chemin – chemicals industry	2) Seda Construction Incubator (SCI) - Construction
3) Downstream Aluminium Centre for Technology (DACT) – Aluminium fabrication & casting	4) Seda Agricultural & Mining Tooling Incubator (SAMTI)
5) EgoliBio - Bio & Life Sciences	6) Seda Automotive Technology Centre (SATEC)
7) Furntech – Furniture manufacturing	8) Mpumalanga Stainless Steel Initiative (MSI) -
9) Lepharo - Copper, zinc and base metals	10) Seda Limpopo Jewellery Incubator (SLJI) –
11) Mapfura Makhura Incubator (MMI) -	12) Agrifood Technology Station (ATS)
13) Mpumalanga Agri-skills Development & Training (MASDT) –	14) Invotech, mixed high tech
15) Seda Nelson Mandela Bay Information and Communication Technology (ICT) Incubator (SNMBICTI) - ICT	16) Soshanguve Manufacturing Technology Demonstration Centre (SMTDC) - Low-cost small-scale manufacturing

17) Seda Platinum Incubator – Platinum Jewellery	18) SoftstartBTI – ICT
19) Seda Sugar Cane Incubator(SESUCI) - Sugarcane	20) Timbali - Floriculture

From a SA perspective, business incubation services include but not limited to; business development services; provision of physical space and resources and funding assistance such as grants, equity, debt/loan. In this combination of services an assumption is made that these could possibly not be sufficient for industry 4.0 especially when considering that elements of physical, big data and biological sphere don't seem to be mention as part of the offerings.

### 2.2. Technology-based SMEs

Technology based companies (TBCs) are mainly start-up enterprises which are established to commercialise an innovation which is characterised by higher technical and market risk (Tidd et al., 2008). In order to achieve this hard process of conquering these risks, TBCs can lend themselves to incubation services, which are offered from interventions such as: Pre-incubation (setting-up of a business plan), Incubation (TBC gets finance to do product development) and finally Post-incubation/graduation (the TBC is ready to go independently).

South Africa is not short of technologies which can be part of industry 4.0 from a TBC perspective. An example being a world's first surgery utilising 3D printed middle ear bones to treat conductive hearing loss, by the University of Pretoria. However, in the main the question remains as to whether the current incubation services are aligned to the fourth industrial revolution and more importantly are they sufficient to prepare TBCs for it, particularly as they progress through stages of technology commercialization.

### 2.3. Industry 4.0

Industry 4.0 can be defined as a fusion of technologies that blur the line between the physical, digital, and biological sphere (Schwab, 2017) . It is further identified as revolutionary change characterised by mobile internet, cheaper, smaller and stronger sensors; and artificial and machine learning. What becomes central to this definition is the use of cyber-physical systems. This becomes even apparent when in comparison to the preceding industrial revolutions, Figure 1 below bears testimony to that as it indicates this distinction.

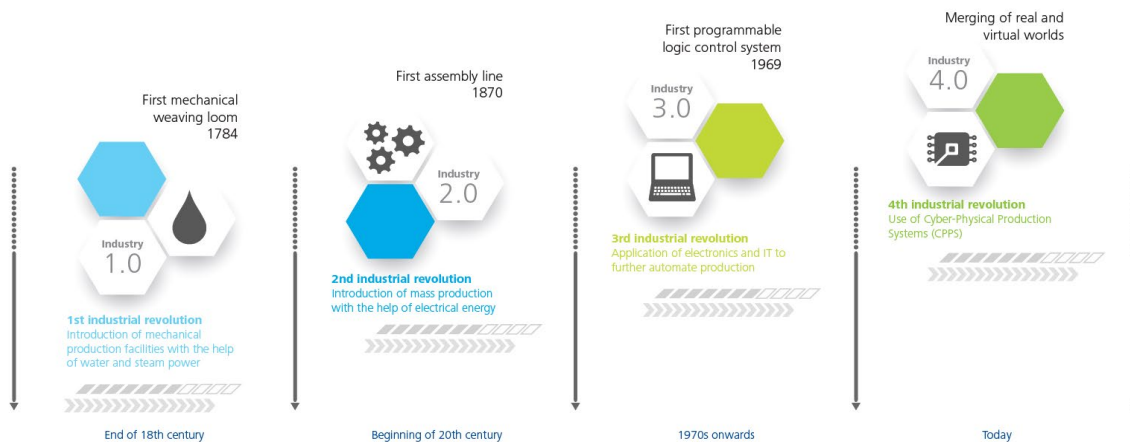


Figure 1: Industry 4.0 (source: Deloitte report)

Also important to note is that some of the technologies that will drive this relate to mention 3D. Although SA is regarded slow in adopting industry 4.0 some special cases are emerging such as the first ear implant was conducted by a University of Pretoria surgeon transplant of the 3-D printed middle ear.

#### **2.4. The implementation of industry 4.0 in technology incubation**

Given that industry 4.0 is part of industries in general to an extent that a question has now been asked in terms of how industry can respond to it in terms of technology (Lee et.al, 2018). They for instance cite certain aspects of which we reduce the list to the selected following technologies;

- *Cyber physical systems*
- *Combinational technologies*
- *Smart factory, autonomous machines, 3 D printing*

Furthermore it is worth noting that at a strategy level, considerations have to be made on how new combination business models can be explored, especially exploring digital and technology enabled platforms. Chio et.al, 2002 further looked at how techno parks (TPs) can support technology-based enterprise in the fourth industrial revolution within Kora. This reflects a concentrated effort of connectivity from TPs which could lead to lessons learned by incubators. Some practical examples are emerging in South Africa.

Firstly, there is an example of the Incubation Centre 4, a incubator dedicated to industry 4.0 has been established.

Secondly the example of Siemens launching an incubator at the University of the Witwatersrand which is aimed at developing the next generation of digital mining experts.

Thirdly mentions being made that Former Dimension Data CEO Brett Dawson will be launching a new Fourth Industrial Revolution (4IR) startup incubator.

From the three examples above, it is evident that SA business incubation industry is embracing the adoption of mechanisms that enable alignment to industry 4.0 to a certain extent.

### **3. Research Method**

This study entailed the utilization of document analysis which is a procedure for reviewing or evaluating documents systematically. Requiring that data be looked and assessed in a manner that elicits meaning, gain understanding, and develop empirical knowledge (Corbin & Strauss, 2008). Given this a number of documents which contain information relating to business incubation in South Africa were analysed and discussed in section 4 below.

### **4. Results and discussion**

The results from the document analysis is presented below in at thematic format, one of which is an analysis that reduces the data into workable themes and the emerging conclusions (Castleberry and Nolen, 2018). Table 2 below starts off by categorising the services analysed as per selected industries.

Table 2: Clustering of services to industry

Industry	Incubation services
Industry 1: Chemicals	Shared manufacturing facilities, laboratories for product development, enterprise development
Industry 2: Biotechnology	Piloting, market development, fund raising, technology launch, training, networking events
Industry 3: ICT	Infrastructure support, mentoring coaching and training, fund raising, marketing and communication
Industry 4: Minerals and precious metals	Growthwheel feasibility assessment, technical assessment and feedback, Business mentorship & counselling, training and advice, networking opportunities, registration of new businesses and compliance with statutory obligations
Industry 5: Construction	Mentorship, outreach, coaching

The analysis of results from Table 2 above seems to reflect of a pattern of services which can be placed in three themes of services. These are similar to what was mentioned on section 2:

- *business development services*
- *provision of physical space and resources*
- *funding*

What is of particular interest is that these seem to fall within the categories of the three generations which were developed over the past 60 years. The future of incubation services are moving towards acceleration and potentially new models that consider industry 4.0 as reflected by examples on section 2.4

## 5. Conclusion

The data presents a case for consideration of new service development for business incubators in SA, with the spirit of new generation services. It can be concluded that incubation services have shown to evolve as seen with generation of services from first to third generation (Bruneel et.al, 2011), and also of late with the inclusion of acceleration. In conclusion we propose a term for incubating technology-based companies for the fourth industrial revolution, a term we call *incubation 4.0*. central to this term is the element of cooperation. This cooperation happens at two levels. Level one being cooperation within incubators amongst themselves especially ones that might possess capabilities of data and biological spheres, a practical case in point would be linking up Softstart Bti with Egolibio incubators. a second form of cooperation could be of incubators with other related institutions such as a technology station e.g. 3D printing with an incubator in construction creating new generation materials for building. Lastly a new incubator can be created by SEDA following the model of where this deals directly with the fourth industrial revolution. The ultimate incubator within *incubation 4.0*.

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