Queen Ndlovu: opening the throttle on her drone business

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In April 2023, Queen Ndlovu, CEO and founder of QP Drone Tech, a provider of drone business solutions, was considering options to fulfil her original dream of manufacturing drones in South Africa. She encountered obstacles to achieving the same in 2019, and had decided to focus on providing commercial drone consulting services. However, her dream had not extinguished, and in 2022, she decided to restart her efforts. She found practical support from The Innovation Hub, an incubator that was supporting her business, which enabled her to enhance the prototype of her drone. She then had to think about how she would manufacture drones locally by ensuring she had access to production infrastructure, funding, partners and customers. Would she be able to gain a competitive advantage that would differentiate her from competitors? Or should she reconsider whether she should be manufacturing in the first place, as there are risks and benefits for smaller businesses in this regard.

Profile of Ndlovu

Born in the township of Soweto, west of Johannesburg, Ndlovu (see Exhibit 1) radiated passion, enthusiasm and ambition – qualities she had inherited from her grandmother who had raised her from the age of nine in Mamelodi, east of Pretoria. Her grandmother was the first black principal at a school in Transvaal (now Gauteng) and a staunch Catholic. She led by example, instilling in Ndlovu a belief in the importance of education and telling her that "the sky is the limit". Her mother and uncles were testimony to that sentiment, as all of them were well-educated; her mother was a professional nurse. Her uncles were prosperous in their own businesses and their lifestyle inspired Ndlovu to have her own business one day [1].

But the values she was taught in her formative years – to make a difference, be kind to people and try and help, without judging – were equally important. Ndlovu went on to qualify as a teacher at the Transvaal College of Education [2]. It was a profession that suited her, and she explained: "I like facilitating, I like coaching and I like advising" [1].

Ndlovu taught for a year before pursuing a BA degree at the Vista Distance Education Campus, which later merged with the University of South Africa, a distance learning institution. Subsequently, she completed an honours degree in psychology at the Medical University of Southern Africa (Medunsa) [3]. Following her graduation, she spent 18-months at a consulting firm [4].

Entering the business world

However, the idea of establishing her own business stayed with Ndlovu. "I always challenge myself. How do I as an individual make a difference in my own country? And my vison was capacitation, but also creating jobs," she noted [1].

Ndlovu did not wait for opportunities to come to her, but opened her first training business, Basetsana Consulting in 1998, offering management consulting and training with the idea of training people to become more employable. Her business found plenty of support from government departments, among others (The Nanyan, 2019). She received so many requests for management consulting that she partnered with a qualified person and established another company called QC to cater for the demand [4].

This freed Ndlovu, who considered herself to be a "serial-entrepreneur", to establish other businesses; among them was a large laundry and dry-cleaning business with 18 employees, and she also set up a Technical Vocational Education and Training College and Trade Centre to manage its training [4].

However, 20 years later, Ndlovu realised that the training market in South Africa had become saturated. If she did not enter a new market, she would lag behind. Therefore, she considered her next move, recognising an opportunity to become a global player in the technology space and the potential of this sector to create jobs and change the lives of young South Africans. Setting very clear expectations for herself, she explained how she planned to do this: "I needed to be in the manufacturing business, because through that you create even more job opportunities. If you build something, you can employ at the same time" [1].

The idea for QP Drone Tech

Always eager to improve herself, in 2017, Ndlovu enrolled at Wits Business School to study Master's in Entrepreneurship and New Venture Creation. The course aroused her interest when she noticed that the subjects included technology, high growth entrepreneurship and global entrepreneurship – topics that were right up her alley (Chibba, 2022).

During her studies, drone technology caught her eye as an emerging technology, and she became fascinated with the potential of the industry. While researching drones, she discovered about Shenzhen, a high-tech city often referred to as China's Silicon Valley, which hosted many start-up companies in China (The Nanyan, 2019). China emerged as one of the few global leaders in the development of drones, which further ignited Ndlovu's interest in delving deeper into China's advancements in this field [5].

After finishing her studies, an opportunity arose in 2018 to attend Peking University HSBC Business School in Shenzhen as an exchange student and to pursue a postgraduate degree in global entrepreneurship. The six months spent in China were invaluable, and Ndlovu was dedicated to absorbing the experience: earning good grades and learning Chinese business culture (The Nanyan, 2019).

Identifying a business opportunity

One day, during a coffee break on campus, Ndlovu was looking out the window and noticed a drone flying by. She rushed out and met Qin Longjun, a doctoral student who was operating the drone and instructing other students on its capabilities. "I approached them because I could not lose this opportunity. How to spot opportunities and grab them quickly is what they told us in business school," she recalled. "This was the business I came to China for!" (The Nanyan, 2019).

Longjun was a rising specialist in the field of drone imaging for agricultural and environmental applications, and a fellow entrepreneur. The two instantly connected, and everything fell into place. Ndlovu wanted to start a drone business in South Africa and Longjun was eager to be a part of it. Ndlovu was confident she could find clients in South Africa with needs for drone applications in agriculture, land conservation and public safety, whereas Longjun had the skills to design the hardware and software tailored to specific client needs (The Nanyan, 2019).

Ndlovu was particularly impressed by the organisational structure of one Chinese drone company: "They have an industrial site with a big factory where they build the drones, a training academy on the side, and a corporate office." What she wished for – to combine training with manufacturing to create employment – was indeed achievable; it aligned with her vision of using drone technology to empower and uplift communities [1].

Launching in South Africa

Back in South Africa, two more partners joined the venture, Phumi Makatini, a South African, and another partner from China. Consequently, in late 2018, QP Drone Tech LLC [6] was officially established in South Africa and was authorised to trade in drones (The Nanyan, 2019). Longjun already maintained an office in Shenzhen that would function as a satellite office for QP Drone Tech. The plan was for the services segment of the business, involving consulting and advising clients on using drone technology, to play a crucial role in helping QP Drone Tech navigate its initial years.

The business was initially located in Johannesburg, but by the end of 2019, Ndlovu relocated to the premises of The Innovation Hub [7], an incubator in Pretoria that supported start-up entrepreneurs. In 2020, her South African business partner resigned to take on a corporate position, leaving Ndlovu to independently manage the business in South Africa.

Ndlovu entered the drone industry at a time when it had just started gaining interest and momentum. South Africa was a major player in the military drone sector in the 1980s and 1990s, when organisations such as the Council for Scientific and Industrial Research (CSIR), a research organisation, Denel Dynamics, a manufacturer of defence equipment, and Milkor, a defence and aerospace company, developed and manufactured drones for military purposes (Key Military, 2019). However, after the abolishment of apartheid, in 1994, the focus shifted from military to other issues, which led to South Africa falling behind other African countries in drone technology. Rwanda, for example, was using drones for years for the delivery of medical supplies (Malinga, 2021a).

A cumbersome regulatory environment

When Ndlovu launched her business in South Africa, one of the challenges she faced was navigating the regulatory process. With the rising interest in drone technology, the South African Civil Aviation Authority (SACAA), responsible for aviation safety, introduced a legal and regulatory framework for the commercial use of drones in 2015, making South Africa the first country in Africa to issue commercial drone licences. While it became legal to fly drones in South Africa, stringent regulations were put in place (Martin Vermaak Attorneys, 2023). Officially drones were referred to as remotely controlled aircraft and called unmanned aerial vehicles (UAVs), unmanned aerial systems or remotely piloted aircraft systems (RPASs) (Unmanned Approvals, 2023).

The Department of Transport and SACAA were responsible for the licencing, requiring the institution to have suitably qualified personnel in various posts as per the regulations. To operate a drone for commercial purposes, an institution had to acquire an air services licence from the Department of Transport and a remote operating certificate (ROC) [8] from an accredited aviation training organisation. Once a business had obtained the two licences, SACAA would then grant them the right to operate RPAS operations licence and an ROC. Obtaining an ROC was a lengthy process and could take anything from 18 months to 3 years (Shilubana, 2022). In contrast, in Rwanda, an RPAS operator certificate could be secured on average in two months (WESGRO, 2022; Visit Rwanda, 2023). Jack Shilubana, chief operations officer (COO) at QP Drone Tech, pointed out that owing to these delays, there were cases in the public service where drones were procured but were not used, as the institutions did not have an ROC or licenced pilots (Shilubana, 2022).

The cost of obtaining a licence posed another barrier to entry, with a drone pilot licence costing approximately R25,000 and a drone pilot operator ranging between R150,000 and R200,000, making it unaffordable for small and medium businesses to enter the market (WESGRO, 2022).

Believing that the South African authority had not done enough to support the development of the commercial drone industry, stakeholders established the Drone Council of South Africa in July 2020. The council's mandate was to address challenges faced by the industry and to facilitate its growth. One major challenge was capacity restrictions within public sector structures that led to delays in approving licences for drone operators and pilots (Malinga, 2021b). Consequently, the red tape in the drone sector discouraged foreign companies from investing in South Africa's drone sector. To worsen matters, Shilubana knew of a South African drone company that was compelled to move overseas in search of a more enabling environment [9]. However, Ndlovu added that the regulatory landscape had changed since 2020, with ample engagement between the Drone Council of South Africa and SACAA, which was making the industry more accessible [10].

A growing market

Ndlovu found encouragement in the fact that, despite the barriers, drone technology had gained traction in South Africa. In 2021, there were over 200,000 drones operating in South Africa (Malinga, 2021b). However, by early 2023, there were only 97 ROC holders registered with SACAA (SACAA, 2023). As Shilubana pointed out, numerous drone companies were active in the industry that used the services of registered drone licence holders [11].

Drones were used for a variety of purposes. For instance, in mining, they were used to mitigate the risk of cable theft at night. Farmers used them for precision farming, engaging in activities such as tracking crop fertility and identifying areas for the application of fertiliser and pesticides. They were used for disaster mitigation, logistics and surveying, as well as for entertainment (Moross, 2022). In the insurance industry, drones were used for the immediate assessment of car accidents, and there was an increased demand for drones in the construction industry to help reduce theft and vandalism. Within the health-care sector, the South African National Blood Service (SANBS) had partnered with the Western Cape Blood Service to introduce a nationwide blood delivery service using drones. The SANBS delivered over 1.2 million blood products in eight provinces (Malinga, 2020).

In 2020, the Western Cape Government's Health Emergency Medical Services became the first government institution to obtain a license for RPAS and ROC specifically for rescue operations (Western Cape Government, 2020). Ndlovu noted that the adoption of drone technology in the public sector was gradually increasing, as it was evident from announcements in the media from ministers who were incorporating drone technologies in their departments for services such as security and preventative maintenance of critical infrastructure [10].

Industry stakeholders believed that South Africa could become an industry leader if the regulatory barriers to entry were addressed. According to Statist, a market statistics portala, the revenue of the South African drone sector was estimated to reach US$8.93m (around R 163.8m) in 2023 and grow to $134.5m (around R 2.5bn) by 2025 (Statista, 2023; Roberts, 2022). Furthermore, research conducted by the Commercial Unmanned Aviation Association of South Africa indicated that a well-developed industry could create as many as 40,000 jobs over a ten-year period (WESGRO, 2022).

Market players

Owing to its growth potential, Ndlovu operated in a reasonably competitive market that consisted of numerous companies that designed, developed, assembled and imported

drones for commercial and security applications (Key Military, 2019). Some of these companies also provided drone training for obtaining required licences, as well as consultation and surveillance services to clients. Among the larger drone companies were UDS UAV & Drone Solutions, which specialised in providing aerial security surveillance operations to deter and detect criminal activity, and Droneworld, South Africa's largest authorised distributor of top-quality DJI drones and accessories. In addition to offering drone repairs and support, Droneworld also dealt with other consumer electronics devices (UDS, 2023; Droneworld, 2023).

Milkor, a defence and aerospace company, offered turnkey defence solutions in air, land and sea systems, and ALTI Unmanned Aircraft Systems designed, manufactured, sourced and supplied aircraft systems globally for demanding operations (Milkor, 2023; LinkedIn, 2023).

Among the local drone manufacturers were Alpha Drones, part of the Alpha One Group, and iPhiko UAV and Automation, a start-up that researched and developed multi-purpose drones and was also competing for government funds to manufacture drones (Alpha Drones, 2023; Drone News, 2020). In addition, Aerial Monitoring Solutions (AMS) designed and manufactured custom UAVs that had applications in multiple solutions, including wildlife management, health and safety, agriculture, security and infrastructure (AMS, 2023).

Deciding to focus on consulting

From the beginning, Ndlovu wanted to pursue her idea of manufacturing drones. However, she faced several seemingly insurmountable hurdles at the time. The drone industry was still in its infancy, and investors were reluctant to take on the risk of funding a small factory. They were also unwilling to invest in her company, owing to its partial Chinese ownership [1], [12]. Ndlovu then explored the possibility of collaborating with organisations that were already manufacturing drones, approaching CSIR, Denel Dynamics and two privately owned manufacturers. Unfortunately, none of them were willing to partner with her.

At the time, it was frustrating at the time, but looking back, she realised she had learned something from this process: "I am ambitious with what I am proposing, so there were trust issues as well. We are a small company wanting to do this big thing. I only now understand that a big company would find it risky to partner with a small enterprise" [1].

She realised the need to change her approach and temporarily focused on consulting. Her decision was reinforced by her experience at the Mzansi Aerospace Technologies' drone accelerator programme in February 2020. This programme was based on the theme, *The Lean Start-up: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses* by Eric Ries. "One of the key take-aways was to avoid being in love with my solution, in this case local manufacturing. Rather be in love with solving customer pain points, by becoming flexible, adaptable, and agile on our business offerings," she recalled (Ndlovu, 2023a). Subsequently, she joined Startup Circles, later known as Pranary, an accelerator programme. A major take-away for Ndlovu from this experience was that of learning how to pitch to investors and the power of pivoting whilst one was applying other revenue-generating models [10].

Growing QP Drone Tech

QP Drone Tech provided consulting and advisory services, which included mapping, inspection and surveying. Its target market included industries such as disaster management, mining, security, smart agriculture for precision farming, telecommunications and construction, among others (QP Drone Tech, 2023a).

However, Ndlovu faced obstacles when attempting to import drones from China, which was her initial plan. These challenges included difficulties in obtaining an import licence, administrative red tape, delays at customs and a highly competitive environment. Moreover, her partnership with the Chinese technical partners had ended in the recent past.

Therefore, she decided instead to form partnerships with local organisations. "I started contacting businesses that already had drone operating licences and a fleet of drones, to see if they could do the surveying part on QP Drone Tech's behalf. My role would be to focus on commercialising QP Drone Tech, and we will work together. My strength is in helping people grow their businesses and that is how I survive in that space," she explained [1].

Selecting partners for growth

Because QP Drone Tech was a start-up company, Ndlovu knew the business needed something to differentiate it from others in the market. "Clients are still not comfortable in giving us sizeable projects due to lack of trust, therefore we have to work extraordinarily hard to prove ourselves. I do that by partnering with well-established brands. This gives an easy entry, whilst learning and leveraging on each other's resources and branding," she explained (Ohaeri, 2022).

She noted that the ability to find the right partners at the right time had always been one of her skills. While intuition played a large role in her choices, she would also look for certain characteristics in a potential business partner. These included possessing the right skills and product knowledge, but she also sought loyalty and a certain humility when deciding who would stand by her and share her vision for QP Drone Tech. "God has given me that talent to attract the right people when it comes to business and see the person that has all of this," she commented [1].

Forming networks

Ndlovu never hesitated to approach businesses for help. "So, I pitch to 100 people to get one. I follow up, some reject us. I become persistent, go back and ask again. I get a lot of rejection, but others would give me opportunities," she smiled [1].

QP Drone Tech had established strategic partnerships with prominent local and global companies, such as the US-based geographic information systems company Esri, the professional business services firm PricewaterhouseCoopers SA (PwC), Insurer Santam and telecommunications company Telkom (Ndlovu, 2023b). Ndlovu expressed gratitude for the support provided by her partners. PwC, a long-standing partner, played a crucial role as its enterprise development partner, offering strategic business advice to facilitate the growth of her consulting services. "I felt that I need a lot of help, so it came at the right time. On my own I don't have the capacity to do that," she admitted [1].

By 2023, QP Drone Tech had developed a client portfolio that included the Chemical Industries Education & Training Authority, the Gert Sibande District Municipality, the Liberty Group – a financial services organisation, Mnambithi mines, Save the Children Sweden – an international NPO, V8.TECH – a digital business solutions group and The United Nations Children's Fund–South Africa (UNICEF-SA) and Generation Unlimited – a UNICEF initiative and its partners that invested in the upliftment of young people (Ndlovu, 2023b).

Building trust

Ndlovu also applied her criteria not only when she sought potential executives (whom she regarded as partners within the company) but also when selecting directors and advisors. Consequently, they all become trusted friends rather than just colleagues. At a drone conference in 2021, she met Shilubana, an experienced and licenced drone pilot with a B.

Sc. in Applied Mathematics, a postgraduate degree in information technology (IT) from a UK institution, over 20 years of experience in the IT sector and a deep knowledge of the drone industry. They got along so well that later in 2021, he resigned from his previous aviation and drone company to join QP Drone Tech full-time as a partner with preferential shares [13], executive director and the company's COO. Ndlovu spoke highly of him and his support in growing the business. Shilubana shared his perspective on the relationship: "We complement each other. She is strong on business development and client relationship management and my focus is on technology and operations, and we both share a never give up attitude and passion for what we do" [13].

Ndlovu also spoke highly of Gcinumuzi Obed Radebe, who had 24 years' experience in information technology and the aviation sector, obtained after completing his master's degree in safety, quality and aviation in France. Ndlovu initially brought him into the business in April 2022 to work full time as chief information officer under the same conditions as Shilubana. Although, he resigned in August 2022, Radebe continued to serve as non-executive director and work on a consulting basis for QP Drone Tech. Radebe described Ndlovu as "a visionary, a charmer and go-getter of note". He added: "Her business acumen, strengthened by her humility and kindness, is off the charts. She will clinch that deal and ensure that the resources follow through with delivery. When the deadline is lurking, no one is spared!" [14]

Strategic advisor, non-executive director and chairperson on the company's advisory board, Sharon Maasdorp, understood Ndlovu's vision and freely shared her experience in the corporate world with her. "Queen is a go-getter, a big thinker, a visionary with a tenacious spirit. She makes the most of every opportunity given, with a unique ability to turn challenge into opportunity. No obstacle gets her down," said Maasdorp [15].

By 2023, the business consisted of six permanent employees, two part-time advisors and other strategic partner entities, but Ndlovu took pride in the high quality of human capital in QP Drone Tech, and considered it to be the company's competitive edge (Ndlovu, 2023a).

Social impact

The more Ndlovu learnt about the drone industry, the more she was driven to engage with every sphere of the industry. This led her to become involved in WeRobotics, an international non-profit organisation (NPO) that aimed to empower local experts to use robotics for the betterment of their communities. WeRobotics had established the Flying Labs Network, a global network of experts in professional drone, data, robotics and artificial intelligence (AI) services. The purpose of the network, among other goals, was to share knowledge amongst its members, introduce drones and robotics to rural children and unemployed youth and respond to humanitarian crises with the support of local experts in each country (Flying Labs, 2023a).

Ndlovu immediately recognised an opportunity in Flying Labs to merge drone technology with her passion for educating and training youth and women. Consequently, South Africa Flying Labs was launched in March 2021, with her serving as the managing director, Shilubana as the operations director and Radebe as the technical director (Flying Labs, 2023b). She was in her element in this environment, and together with two consortium partners – ROC partner Vula Air Technologies and WITS Enterprise – they began providing science, technology, engineering and mathematics (STEM) related training, as well as Fourth Industrial Revolution (4IR) training to unemployed youth, local schools and start-up businesses. Drone training formed part of the offering and covered disaster management training, data processing and a master class for safety and regulations [16]. (refer to Exhibit 2 for some of the training sessions).

Over time, South Africa Flying Labs began providing training in additional emerging technologies, such as 3D printing, virtual reality and gaming simulation. Ndlovu also planned to offer training programmes for drone soccer, a fast-developing robotics air sport,

played by two teams of five players [17]. Before players could compete, they first needed to build, programme, fly and repair drones, and Ndlovu planned to incorporate these skills into her training programmes [4].

Her involvement with Flying Labs served as a prime example of the power of business networks, as she leveraged the global awareness about this organisation to open doors to UNICEF South Africa. "I saw that they and other agencies believe in education and uplifting the community, so I approached them. But it took time for them to take me seriously," she noted. Finally, 18 months later, in April 2022, UNICEF South Africa began supporting Ndlovu's efforts to provide STEM-related training to young women in Alexandra (a township to the north of Johannesburg) to train them as disaster management champions using drone technology (UNICEF, 2022).

Moreover, South Africa Flying Labs' social impact training had the knock-on effect of generating much-needed brand awareness for Ndlovu. In turn, this led to increased demand for training, Ndlovu's first love, reminding her of her wish to have a 4IR training academy of her own. This academy started to materialise as The Innovation Hub offered one of its township sites in Ga-Rankuwa on the outskirts of Tshwane, where South Africa Flying Labs could establish a 4IR Academy and offer training to surrounding unemployed youth and school children. In addition, another site would become available in Soweto for a pilot exercise in 4IR and STEM training [4].

But because South Africa Flying Labs was an NPO, Ndlovu needed industry partners to help with social impact funding. So, finding these partners was added to her already long to-do list.

Scanning opportunities for growth

In early 2022, while the team was brainstorming opportunities to grow the services side of the company, Shilubana suggested that they focus on disaster management and humanitarian aid response – the latter being in line with one of Flying Labs' goals.

The focus on disaster management and humanitarian aid response would open opportunities in the public sector and working with United Nations agencies [4]. Ndlovu strongly believed that drone services could have been invaluable during the 2021 flood disaster in the province of Kwazulu-Natal. "With the looming threat of climate change, a lot more natural disasters can occur. Drones can help the government respond swiftly and efficiently. Their adoption by both the public and private sectors in South Africa is scant, with just a few noteworthy projects to date," she added (Chibba, 2022). Focusing on disaster management would also allow QP Drone Tech to train disaster management and emergency personnel to use drones as part of their toolbox (Malinga, 2021a). The team then decided to strive to become a thought leader in disaster management [1]. That said, the team decided not to shut any doors and would still accept any other work coming their way.

To illustrate the effectiveness of drone surveillance and mapping to local government, in March 2022, QP Drone Tech launched a project in Alexandra, using drones to fly over the suburb and assess its vulnerability to disaster preparedness. The intention was to use this as a proof of concept that one could use drones not only for responding in a disaster but also for mitigation and preparedness [1].

Reigniting her manufacturing dream

Although Ndlovu pursued her passion for training and uplifting the community (which now took up to 60% of her time), she could not let go of the idea of manufacturing drones in South Africa. It remained in the back of her mind, and she was always "waiting for the right moment". That moment arrived in 2022, when the Gauteng Department of Economic

Development singled out manufacturing as the best vehicle to uplift small and medium enterprises and announced that it had funds to support small and medium manufacturing businesses (Gauteng Provincial Government, 2023). This announcement had the effect of creating increased interest in drone manufacturing.

In pursuit of funds

Ndlovu had known all along that her dream would not come cheap. "It is expensive to operate in the drone industry, whether you want to become an operator, a drone pilot or a manufacturer," she pointed out (Ohaeri, 2022). She had calculated that setting up a fully equipped factory, including the site, could cost more than R50m.

But the time was ripe, and Ndlovu started seeking funding for this venture with her typical enthusiasm. Something that counted in her favour was that by 2022, QP Drone Tech had a prototype that lent credibility when she made her case [1]. It weighed under eight kilograms and was categorised as a small drone. According to Shilubana, although small, this type of drone could lift a loudspeaker of two kilograms with ease and it was cost-effective to manufacture. The drone was designed for disaster management, as it had an additional speaker for announcements to direct people on the ground to safety during a disaster. Such a drone could also be adapted for other uses, such as precision farming, where the speaker could be removed and replaced with a camera [1] (See Exhibit 3 for an image of the prototype).

There was a growing demand for small drones [18]. According to the market research firm IndustryARC, this was because of their size and speed use in multiple applications. In addition to tasks such as medicine deliveries and disaster management, small drones were also used for inspection of infrastructure by energy suppliers and communication networks, as well as for body temperature scanning purposes, among other uses (IndustryARC, 2023).

Over the years, Ndlovu's involvement in the drone industry and her considerable exposure in the media for her contribution towards driving drone adoption and innovation had made her well-known both locally and internationally (refer to Exhibits 4 and 5 for a list of her awards and a photo of the latest award). Consequently, she was frequently invited to showcase QP Drone Tech's services at conferences, trade shows and other events [1]. These events proved effective in generating business for QP Drone Tech's services in the past, and she therefore decided to organise a conference on the use of drones in disaster management, in the hope that this would help with her fundraising efforts [1].

With sponsorships from UNICEF South Africa, Santam and the Environmental Systems Research Institute (ESRI), among many others, South Africa Flying Labs and QP Drone Tech presented a conference, *Incorporating Drones and Robotics into Disaster Management and Humanitarian Aid*, in October 2022. (See Exhibits 6 and 7 for photos of the conference.) Ndlovu's efforts paid off: "That was a big opportunity for us to mention manufacturing drones. The delegates would say, "But we could use something like this", and suddenly, the government realised that they need drones for disasters" [1].

Encouraged by the enthusiasm of local government officials, the team followed up on its Alexandra project by conducting a change detection process with the drones and found that recent floods had indeed caused a change, confirming their view that using drones could be useful in identifying risk areas in urban settlements. The team presented their findings to the relevant stakeholders in local and provincial governments, as well as to UNICEF and the United Nations Development Programme [1]. Ndlovu and her team then followed up on other leads as well: some promising, others not. Some government agencies and equity funders required some security upfront, which QP Drone Tech could not afford (Seda, 2023). Other potential funders, although interested, had budget constraints.

By the end of 2022, despite the team's efforts to find funding for the factory, nothing solid had materialised. However, another opportunity had opened up, which allowed Ndlovu to proceed with her plans, albeit more slowly than anticipated.

Joining incubator in manufacturing prototypes

The Innovation Hub was occupied with its own plans to assist the companies in its incubator in manufacturing prototypes of their products to present to potential funders for mass production. The organisation began construction of a building for its Product Development Lab in late 2022. Kenneth Moiloa, commercialisation specialist at The Innovation Hub, explained that this would allow its ten internal incubatees and external start-ups to manufacture a prototype of their products on the premises, with the financial assistance of The Innovation Hub's funding partner, the Technology Innovation Agency [19].

Under this programme, The Innovation Hub funded the development of prototypes and the enhancement of Ndlovu's existing prototype, helped the incubators find an organisation that could manufacture the drone and then assisted them to find a customer, either locally or overseas, who would place an initial order. With a letter of intent from this customer, The Innovation Hub introduced the incubatees to organisations that might be able to fund the manufacturing of this first order [19]. Ndlovu, preferring not to accept too much assistance, went ahead on her own accord and started searching for manufacturers and funders.

She wished to employ an aeronautical engineer, in accordance with her vision to create jobs for South African people. Her keep-it-local vision extended to the manufacturing process of the prototype, where she wanted to use locally made hardware in the manufacturing and assembling of the prototype. Where necessary, she considered using 3D printing for some parts, by partnering with Pretty Printing, another entrepreneur in incubation [4] (refer to Exhibit 8 for more on drone parts).

But finding a local affordable aeronautical engineer proved to be challenging. Ndlovu and her team identified a small designer who initially agreed to take on the job, but the owner later withdrew, citing time constraints that prevented him from investing in something other than his own business [1]. So, their search continued [4]. Ndlovu hoped that mass production could become a reality within a year, so she had already sent out feelers to find a drone manufacturer whose infrastructure she could use once she closed her first order [4].

Manufacturing was not her only concern. She had to find customers, and here she was competing for customers with established South African drone manufacturers as well as international manufacturers. While Ndlovu visited Nigeria in late 2022 as part of a road trip for small companies sponsored by the Tshwane Economic Development Agency and the South African Electrotechnical Export Council, one company showed interest in obtaining drones from her, saying, "If you are pitching for the selling of actual drone products, we can give you an order. China can give us what we want but we would rather support you, our African sister" [1]. These words encouraged Ndlovu, but she believed that breaking into the local market first would be preferable.

Planning her next steps

Achieving her manufacturing dream seemed to be the biggest challenge Ndlovu had faced in her career. She was confident that she could do it, but given the slow progress thus far, she wondered about the following available options: focusing on one or several supply chain niches and markets or customer segments; outsourcing some components of manufacturing or assembling to focus on her capabilities; developing a network of partners for creating, marketing and delivering the product and service; scaling the business to

generate profitable and sustainable revenue streams; and delivering new value for prospective customers, even though the precise forms that new value would take were as yet undefined (in other words by innovating, she could potentially increase the businesses' value generation through the possible development of intellectual property). These were important considerations that affected the future trajectory of her business and her ability to achieve her long-held dream.

Keywords:
Entrepreneurship, Innovation, Technology, Women in STEM, Technology management

Notes

1. Personal interview with Queen Ndlovu, 24 February 2023, Pretoria.
2. During the restructuring of the teacher training sector and the higher education sector post 1997, the decision was made to locate teacher training in higher education and all teacher training colleges were closed. This meant that teacher training became one unit in a larger university faculty rather than a separate faculty with its own funding dedicated to teacher training. [Source: Clarke (2010)]
3. MEDUNSA was renamed as the Sefako Makgatho Health Sciences University in 2014 [Source: SMU (2023)].
4. Personal interview with Queen Ndlovu, 11 April 2023, Pretoria.
5. Personal interview with Queen Ndlovu, 12 April 2023, Pretoria.
6. A South African limited liability company (locally known as a "proprietary limited company" or Pty. Ltd.) could be set up with one director and one shareholder, both of whom could be foreigners residing abroad [Source: Healy Consultants (2023)].
7. The Innovation Hub is a wholly owned subsidiary of the Gauteng Growth and Development Agency, an agency of the Gauteng Provincial Government [Source: The Innovation Hub (2023)].
8. The remotely piloted aircraft systems operations license (RPAS) (ROC) is the final approval and means that the drone and its operator are approved by SACAA for commercial operations [Source: Lowvelder (2018)].
9. WESGRO (2022) and email correspondence with Jack Shilubana, 28 March 2023.
10. Email correspondence with Queen Ndlovu, 2 June 2023.
11. Email correspondence with Jack Shilubana, 28 March 2023.
12. This reluctance, and the fact that the banks required so much administrative red tape when it came to doing business with overseas partners, convinced Ndlovu to end those two partnerships [Source: Personal interview with Queen Ndlovu, 11 April 2023, Pretoria)].
13. Preference shares allow an investor to own a stake at the issuing company with a condition that whenever the company decides to pay dividends, the holders of the preference shares will be the first to be paid [Source: The Economic Times (2023)].
14. Email correspondence with Obed Radebe, 29 March 2023.
15. Email correspondence with Sharon Maasdorp, 22 April 2023.
16. Chibba (2022) (accessed 21 March 2023).
17. Drone soccer is played in a netted arena with radio-controlled quadcopters in protective exoskeletons – designed for collisions – and is recognised under eSports [Source: Mitchell (2022)].
18. Email correspondence with Jack Shilubana, 11 April 2023.
19. Personal interview with Kenneth Moiloa, 11 April 2023, Pretoria.

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Exhibit 1. Queen Ndlovu

Plate E1

Source: Photo courtesy of Queen Ndlovu, 12 April 2023

Exhibit 2. Training young people on drone technology

Plate E2

Source: QP Drone Tech (2023b)

Exhibit 3. Initial prototype of QP Drone Tech's drone

Plate E3

Source: Photo courtesy of Queen Ndlovu, 16 March 2023

Exhibit 4. Queen Ndlovu: Awards

- nominated as finalist for Women in Tech (2020) by the South African Tech Innovation Summit;
- selected as finalist in the 2020 Fem-In-Tech Demo Day;
- nominated as finalist for the 2022 IT Personality of the Year 2022 by the IITPSA President's Awards;
- won the Telkom Future Makers pitching competition; and
- The Inaugural Charlotte Maxeke African Women Leadership Award winner of Women in ICT in Africa award (2023) for her exceptional contributions and achievements in, and influence on the drone industry.

Other achievements

- Co-authored *Drone Professional 2*, the second book in a series in which international drone experts contributed their best thinking on drone technology, best practice and business success.

Exhibit 5. The Inaugural Charlotte Maxeke Award: Women in ICT to Ndlovu, 25 March 2023

Plate E4

Note: Queen Ndlovu, recipient of the award, handed to her by Mr Dominic Khumalo, MTN Strategic Public Affairs
Source: Photo and award information courtesy of Queen Ndlovu, 27 March 2023

Exhibit 6. Images taken at the Conference on Incorporating Drones and Robotics into Disaster Management and Humanitarian Aid, held in October 2022

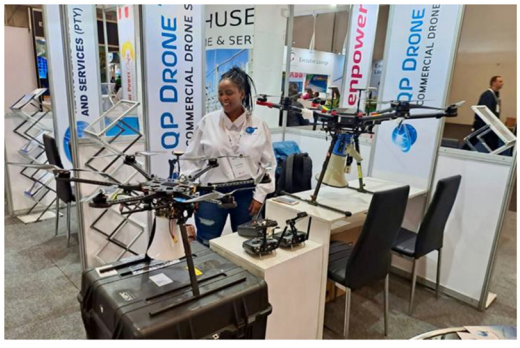
Plate E5

Note: The Organisers of the Conference: Obed Radebe, Queen Ndlovu and Jack Shilubana
Source: Photo courtesy of Queen Ndlovu, 12 April 2023

Exhibit 7. QP Drone Tech Exhibiting at the Conference

Plate E6

Plate E7 Queen Ndlovu at the exhibition stand



Source: QP Drone Tech (2023b)

Exhibit 8. Different components of a drone

Propellers. The propellers are the part of the drone that allows it to lift off the ground and fly. Depending on the model and quality, propellers can be made of plastic or carbon fibre. Both are lightweight materials that allow for better flight, longer range and reduced noise. Therefore, good maintenance of the propellers is vital for ensuring a drone's performance, efficiency and stability.

The motor. The motor turns the propellers and propels the drone off the surface from where the flight starts. There are usually two types of motors. The three-phase motor is the most common, owing to its lightness, power and precision. Furthermore, it consumes less energy while delivering a higher rotation speed. On the other hand, the two-phase motor is significantly larger and heavier and consumes more energy.

The frame. The frame is known as the skeleton of the drone. This structure provides rigidity and stability to the drone. It prevents interference or vibrations that may occur when the propellers start turning.

The battery. Batteries are responsible for transmitting power to the drone, with lithium polymers being the most commonly used. Choice of batteries depends on the application.

The camera and/or loudspeaker. Depending on the intended functions, the drone may or may not have a camera/loudspeaker. There are cameras with higher resolution for retrieving activities such as audio-visual production, and some UAVs come with professional 4K cameras.

GPS. This component is crucial for expanding the operation of a drone. Drones with GPS provide the latitude, longitude, elevation and direction, as well as the different reference points. This technology also enables one to determine the location to facilitate a safe return in case of signal loss due to some kind of failure or incident occurring during the flight.

Flight controller. This part of the drone is vital to its proper operation, as it is considered the "brain" of the UAV. The board is responsible for controlling and managing all the data and information sent by the operator. On the board of the controller, there are several elements such as the gyroscope, the compass, the position sensors, the velocity sensors and the altitude and height sensors. All of the above elements are responsible for gathering information about the drone such as its location or status.

Source: HPDRONES (2022)

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Teaching notes

Boris Urban and Stephanie Althea Townsend

Synopsis

Born in the township of Soweto, west of Johannesburg, Queen Ndlovu radiated passion, enthusiasm and ambition. After finishing her studies, an opportunity arose in 2018 to attend Peking University HSBC Business School (PHBS) in Shenzhen as an exchange student and pursue a postgraduate degree in global entrepreneurship. One day, during a coffee break on campus, Ndlovu was looking out the window and noticed a drone flying by. Ndlovu realised she wanted to start a drone business in South Africa, where she could locate clients with needs for drone applications in agriculture, land conservation and public safety.

In April 2023, Ndlovu, now CEO and founder of QP Drone Tech, a provider of drone business solutions, was considering options to fulfil her original dream of manufacturing drones in South Africa. Upon encountering obstacles to achieving this in 2019, she decided to focus on providing commercial drone consulting services. Her dream had not extinguished; however, in 2022, she decided to restart her efforts. She has since found practical support from The Innovation Hub, an incubator that supported her business, which enabled her to enhance the prototype of her drone. She now had to think about how she was going to manufacture drones locally by ensuring she had access to production infrastructure, funding, partners and customers. Would she be able to gain a competitive advantage that would differentiate her from competitors? Or should she reconsider whether she should be manufacturing in the first place, as there are risks and benefits for smaller businesses in this regard.

Case teaching purpose

This teaching note is designed to offer an organised agenda that will help the facilitator and students navigate key learning points successfully. The case study promotes an understanding of critical issues related to start-ups in general, as well as technology entrepreneurship and market dynamics in South Africa. Students should be able to identify and analyse complex problems from an entrepreneurial, lean start-up perspective in the context of emerging market entrepreneurial eco-system.

The case study covers a wide spectrum of important topics on start-ups, entrepreneurial process, entrepreneurial eco-systems, technology innovation, lean start-ups, enterprise growth and sustainable business practices. The target audience for this case study included masters and final-year students of general management, entrepreneurship and innovation management , but this case study can also be used in short learning programs targeted at middle managers in the technology aviation industry.

The key objective of this case study is to improve students' decision-making ability by developing their diagnostic skills and critical reasoning with reference to the case study material through a relevant theoretical lens.

Positioning

The fields of start-ups and technology entrepreneurship are relevant to a far-reaching audience considering the changing landscape that many businesses are facing in both developed and developing countries. The fields of technology and innovation provide a platform to understand how entrepreneurial ventures can achieve high-growth and improve competitiveness.

The case study highlights Ndlovu's journey in operating in a reasonably competitive market, which includes numerous companies that designed, developed, assembled and imported drones for commercial and security applications. In this context, various issues related to start-ups and technology entrepreneurship are highlighted within an entrepreneurial eco-system and relevant theoretical framework.

Alignment with recent developments in the field

The case study illustrates several conceptual and practical issues pertaining to start-ups and technology entrepreneurship in the context of South Africa as an emerging market economy. Students will evaluate the challenges faced by entry-level entrepreneurs in South Africa, in terms of access to finance and discuss potential opportunities, including innovative business models.

Integration with a broader knowledge base

The case study provides a deeper understanding of the individual nested within an entrepreneurship ecosystem with its attendant institutional challenges and strategies, such as diversification, used by start-ups in overcoming challenges. Analysing the case will enable students to navigate the process of entrepreneurship and to identify different frameworks to explain each process phase. Additionally, critical issues associated with the development of human, technical and social capital are highlighted in terms of achieving sustainable technology entrepreneurial ventures.

Research methods

Primary and secondary data collection methods were used. In-depth interviews with the key stakeholder, Queen Ndlovu, were held over a four-month period, and various databases were sourced to provide relevant secondary data.

Learning outcomes

After completion of this case study, students should be able to evaluate the journey of launching a business in an emerging market context and judge how opportunities and challenges can be navigated to build sustainable enterprises; assess the relevance of individual attributes and process skills which are necessary for entrepreneurial agency to transform social structures through entrepreneurial action; formulate an argument highlighting the role of the entrepreneurial ecosystem in growing a competitive business in an emerging market context; make an informed decision and critique how accelerators and incubators affect the development of ideas and access to finance in South Africa; and propose various strategic options available for technology entrepreneurs, considering the challenges they face in emerging economies.

Reading resources

The following list forms part of the entrepreneurship theory and practice module, as well as technopreneurship module's required readings. This case study is best discussed towards the latter part of the module where each of the resources is linked to specific learning outcomes (LOs).

Textbook

Urban, B. (2021). Entrepreneurship and SMMEs in South Africa. In A., Oqubay, F., Tregenna and I., Valodia (Eds), *The Oxford Handbook of the South African Economy* (pp. 622–645), Oxford University Press, (LO 1; LO 2).

Articles and reports

McMullen, J. S., Brownell, K. M., & Adams, J. (2021). What makes an entrepreneurship study entrepreneurial? Toward a unified theory of entrepreneurial agency. *Entrepreneurship Theory and Practice*, *45*(5), 1197–1238, doi: 10.1177/1042258720922460 (LO 1; LO 2).

Pruthi, S., & Wright, M. (2019). Social ties, prior experience, and venture creation by transnational entrepreneurs. *International Journal of Entrepreneurship and Small Business*, 36(1/2), 41–73 (LO 1; LO 2; LO 3; LO4).

Shepherd, D. A., & Gruber, M. (2021). The lean startup framework: Closing the academic-practitioner divide. *Entrepreneurship Theory and Practice*, 45(5), 967–998, doi: 10.1177/1042258719899415 (LO 3; LO 4; LO 5).

Urban, B. (2020). Entrepreneurial alertness, self-efficacy, and social entrepreneurship intentions. *Journal of Small Business and Enterprise Development*, 27(3), 489–507, (LO 1; LO 2; LO 3; LO5).

Teaching plan and approach

In teaching this case study, it is best to first present the course material related to start-ups and technology entrepreneurship in general. Here, the task of the instructor is to provide meaningful insights and lessons learnt from theory and practice as they relate to the case

study. Learning requires the student's constructive participation and active involvement in both live and online class discussion forums, and small group syndicate discussions using PowerPoint presentations, videos and online links.

The case study is presented via live webinars and asynchronous lectures and activities. Preferred modes of interaction are the university course site, MS Teams and emails. Group discussions will be held to address specific topics as provided by the instructor. Each group will have its own virtual syndicate room.

Before tackling each question, it is useful to identify what problems are at the root cause of the situation (20 min). Following in-class discussions (40 min), it is useful to wrap up (10 min) by consolidating the lessons learned.

Thus, the suggested framework for the 90-min multimedia teaching plan is as follows:

- online opening discussion and drawing of timeline 20 min;
- off-line group discussion of root causes 20 min;
- live in-class discussion using PowerPoint presentations 40 min; and
- live in-class wrap-up session 10 min.

At the beginning of the case study, students are advised to formulate a chronological list of events, by drawing up a timeline of noteworthy events that have occurred in the case study up to this point in time (20 min).

An effective approach to addressing the case questions involves emphasising the integration between theoretical models, constructs and relevant case facts for each question. Students should be familiar with background readings and incorporate examples from their own experiences. Students are expected to analyse the case and respond to the case questions by taking positions that are backed by theory and by constructing coherent and logical arguments.

Students are required to view YouTube videos and visit various websites to gain an overview of the topics under investigation, for example:

- The entrepreneurial ecosystem of South Africa: A strategy for global leadership: www.allangrayorbis.org/wp-content/uploads/2017/03/The-entrepreneurial-ecosystem.pdf
- Roberts, L. (2022). Boom or buzz: Drones on the rise in Africa. *Forbes Africa*, 22 April. Retrieved from: https://twitter.com/forbesafrica/status/1517529163346894856

The in-class discussion, which includes answering all questions and the related class conversations, normally takes 40 min or longer. Typically, case questions are addressed in teams or syndicate groups to encourage diverse opinions, but this practice should only be done after individual case reading.

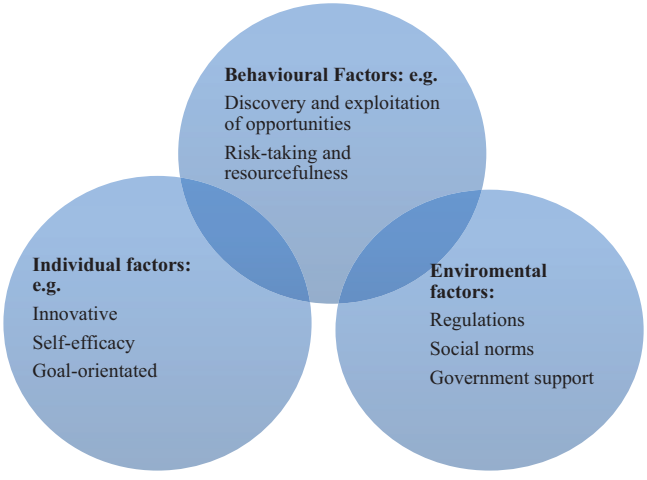
The purpose of the in-class discussion is to enhance the students' critical thinking and decision-making ability. Students are expected to use their analytical skills and critical reasoning, among other things, be add to the facts presented in the case study by making reasonable assumptions regarding many aspects of the case situation. A poor analysis confuses the symptoms with the real problems. It is important that, as a facilitator, you consistently question "why" until you are satisfied that students have identified the root problem(s). It is important to note that entrepreneurial decision-making is seldom based on perfect or complete information. Therefore, the ability to make reasonable assumptions and decisions under uncertainty is pivotal.

During the in-class discussion, students are encouraged to put themselves in the shoes of the individuals in the case study. Moreover, they should consider themselves in distinct roles, relating to the various stakeholders in the case study. Some scenario-planning activity catering to the aviation industry can also be used, as this will ensure that the students are immersed in the case and, at the same time, are navigating the journey with the individuals in the case. Following in-class discussions, it is useful to wrap up (10 min) by consolidating the lessons learned.

Suggested theoretical framework to support the case questions

Social cognitive theory (SCT) favours the concept of interaction based on triadic reciprocity (see Figure 1). Here behaviour, cognitive and other personal factors and environmental influences, all operate interactively as determinants of each other – the term reciprocal

Figure 1 Overarching conceptual and theoretical framework for the case



Source: Adapted by author from Bandura (1986, 1997, 2001); Urban (2020); Venter and Urban (2015)

refers to mutual action between causal factors (Bandura, 1997, 2001). However, reciprocal does not mean symmetry in the strength of bi-directional influences, as the relative influences exerted by the three sets of interacting factors will vary across different activities, different individuals and different circumstances.

Research highlights that explanations of behaviour, especially cognitive behaviour, are domain (context) specific, and as a result, patterns of entrepreneurial cognition vary depending on the individual's intentions. Being an agent involves intentionally bringing about events through one's own actions (Bandura 2001). Entrepreneurs pursue certain opportunities, enter new markets and offer new products, all of which reflect the process of intentional behaviour (Urban, 2020).

Each of the factors in Figure 1 is requisite for entrepreneurial action which is conceived as "opportunity identification, such that entrepreneurship is used as a strategy to expand the scope of one's horizons" (McMullen et al., 2021; Urban, 2020). Research considers that individuals exist within a total situation or configuration of forces described by two pairs of factors: one being cognition and motivation, and the other being the person in the situation. Recognising there is growing interest in examining how ability, motivation, opportunity, institutions and process skill are necessary for entrepreneurial agency to transform social structures through entrepreneurial action (McMullen et al., 2021), it is anticipated that by drawing on an integrated framework, such as Figure 1, each of the case study questions can be discussed coherently through the theoretical lens of the SCT.

Case questions

Q1. To make an informed decision on launching a business in an emerging market context, evaluate Ndlovu's journey in terms of her start-up process.

Q2. Assess and characterise the individual attributes and skills that Ndlovu portrayed, and which activated her entrepreneurial agency into action.

Q3. Formulate an argument highlighting the role of the entrepreneurial ecosystem in which Ndlovu attempted to grow her business.

Q4. Reflect on the accelerator programmes attended by Ndlovu and critique how the lean start-up methodology influenced the development of her ideas.

Q5. Evaluate the various strategic options available to Ndlovu to grow her business and gain a competitive advantage in the drone industry.

Question analysis

Q1. To make an informed decision on launching a business in an emerging market context, evaluate Ndlovu's journey in terms of her start-up process.

The SCT framework is useful in answering this question, as starting a new venture is "not a smooth, continuous, orderly process but disjointed, discontinuous, unique event and we need to understand the change in the antecedent variables that trigger the event" (Bygrave, 1989:14).

Students could rely on the SCT framework to analyse the entrepreneurial process, which involves founding (or re-inventing) a business venture and growing it into a thriving, agile enterprise (McMullen et al., 2021; Urban, 2021). In the case, Ndlovu navigated this process by grasping at the "opportunity to become a global player in the technology space, and the potential of this sector to create jobs and change the lives of young South Africans." Ndlovu then entered the drone industry at a time when it had just started picking up again. When she launched her business in South Africa, she faced the challenge of dealing with the regulator. With the rising interest in drone technology, the South African Civil Aviation Authority (SACAA), responsible for aviation safety, introduced a legal and regulatory framework for the commercial use of drones in 2015, making South Africa the first country in Africa to issue commercial drone licences. While it became legal to fly drones in South Africa, stringent regulations were put in place.

Instructors could add to and extend the student responses given by highlighting that the primary factor that sets into motion entrepreneurial activity is the predisposition (personal factors) of the entrepreneur, and that individual-level variation among people in their willingness to pursue opportunities is pivotal in explaining venture formation. Doing this would differentiate between what students should derive from applying the SCT to the case and what instructors can add, insofar mentioning perhaps that intention plays a prominent role in the self-regulation of behaviour, whether expressed in determination to engage in a specific course or to perform, and intentions increase the likelihood that sought futures will be realised (see Bandura, 2001). As noted in the case the idea of having her own business stayed with Ndlovu. "I always challenge myself. How do I as an individual make a difference in my own country?"

Students may also use one of the basic principles of the SCT, which is that interacting factors will vary across different activities, different individuals and different circumstances (see Bandura, 2001). Research highlights that explanations of behaviour, especially cognitive behaviour, are domain (context) (Urban, 2021). In the context of the case study, an African emerging market context, regulatory institutions, such as the SACAA, have a significant influence on entrepreneurial behaviour. While in developed economies, markets tend to have well-established functioning regulations that support entrepreneurship, and in many emerging economies, there are primarily under-developed legal and regulatory institutions resulting in ambiguous and unreliable business contexts for start-ups. This was not the case for Ndlovu, who had to start her venture under strict legal and regulatory frameworks developed for the commercial use of drones.

The following case facts are useful to evaluate Ndlovu's journey in terms of her start-up process: to operate a drone for commercial purposes, it is mentioned, an institution had to acquire an air services license from the Department of Transport, and a remote operating certificate (ROC) from an accredited aviation training organisation. Obtaining an ROC was a lengthy process and could take anything from 18 months to 3 years. Moreover, the cost of getting a licence posed another barrier to entry, with a drone pilot licence costing approximately R 25,000 and a drone pilot operator ranging between R 150 000 and R 200 000, making it unaffordable for small and medium businesses to enter the market. Believing that the South African authority had not done enough to support the development of the commercial drone industry, stakeholders established the Drone Council of South Africa in July 2020. However, Ndlovu noted that the "regulatory landscape had changed since 2020, with lots of engagement between the Drone Council and SACAA, which was making the industry more accessible". Ndlovu was encouraged by the fact that, despite the barriers, "drone technology had gained traction in South Africa."

Instructors could add to the student responses, as a vital component of the entrepreneurial process is the "marshalling phase" which involves assembling resources to bring the venture into existence (see Urban, 2020). To establish a business, the entrepreneur gathers (marshals) necessary resources, and in the case study, Ndlovu decided instead to form partnerships with local organisations. "I started contracting businesses that already had

drone operating licences and a fleet of drones, to see if they could do the surveying part on QP Drone Tech's behalf. My role would be to focus on commercialising QP Drone Tech, and we will work together. My strength is in helping people grow their businesses and that is how I survive in that space," she explained. In this manner her venture, QP Drone Tech, had formed strategic partnerships with large local and global companies, including the US-based geographic information systems company Esri, the professional business services firm PricewaterhouseCoopers SA (PwC), Insurer Santam and telecommunications company Telkom. Ndlovu's actions in this regard represent the implementing phase which requires that the entrepreneur grow the business and ensure the sustainability of the venture. To this end, the more Ndlovu learnt about the drone industry, the more she was driven to engage with every sphere of the industry. This led her to become involved in WeRobotics, an international non-profit organisation (NPO) that aimed to empower local experts to use robotics for the betterment of their communities. WeRobotics had established the Flying Labs Network, a global network of experts in professional drone, data, robotics and artificial intelligence (AI) services. The purpose of the network, amongst other goals, was to share knowledge amongst its members, introduce drones and robotics to rural children and unemployed youth and respond to humanitarian crises with the support of local experts in each country. Ndlovu immediately recognised an opportunity in Flying Labs to merge drone technology with her passion for educating and training youth and women.

In summary, students need to appreciate that Ndlovu's journey in terms of her start-up process typifies the dynamics and reiterative nature of the process insofar starting a business can be seen as a "gestalt of variables," where its complexity can only be adequately explained in terms of how variables interact with each other, as theorised by the SCT.

Q2. Assess and characterise the individual attributes and skills which Ndlovu portrayed, and which activated her entrepreneurial agency into action.

Students will discover from the case that Ndlovu exhibited entrepreneurial qualities of commitment, dedication and perseverance. Born in the township of Soweto, west of Johannesburg, Ndlovu radiated passion, enthusiasm and ambition. But the values she was taught in her formative years – to make a difference, be kind to people and try and help, without judging – were equally important. "I like facilitating, I like coaching and I like advising."

Building on to the discussions on the entrepreneurial process, in *Q1*, the instructor could explain that new ventures are not random events of environmental influences, but rather, they are direct outcomes of individuals' intentions and consequent behaviours. The entire entrepreneurial process unfolds, as individual entrepreneurs act and are motivated to pursue opportunities (Bygrave, 1989; Venter and Urban, 2015). In this case, the relevance of such motivation to pursue opportunities is manifest in the idea of having her own business which stayed with Ndlovu. "I always challenge myself. How do I as an individual make a difference in my own country? And my vison was capacitation, but also creating jobs," she noted. Ndlovu taught for a year before pursuing a BA degree, then an honours degree in psychology at the Medical University of Southern Africa, as well as a master's degree in Entrepreneurship. Following her graduation, she spent 18 months at a consulting firm. Furthermore, Ndlovu did not wait for opportunities to come to her but instead opened her first training business.

Relying on the SCT, students could invoke the theory on human capital attributes, such as education, experience, knowledge, commitment and perseverance, which have long been argued to be a critical resource for growth and success in entrepreneurial ventures (Marvel et al., 2016; Urban, 2021). As demonstrated by Ndlovu, she dedicated herself to absorb the experience to attend PHBS in Shenzhen as an exchange student and pursue a postgraduate degree in global entrepreneurship, earning good grades and learning Chinese business culture.

Instructors could add to student discussions here by highlighting the relevance of the human capital and how it is aligned with the SCT framework dimension of cognitive behaviour, which has to do with individuals' mental processing (thoughts) when interacting with their environments. Because explanations of behaviour, especially cognitive behaviour, are domain (context) specific, one can expect patterns of entrepreneurial cognition to vary depending on a person's purpose (Bandura, 1997, 2001). This is why, in essence, entrepreneurial cognitions involve understanding how entrepreneurs use simplifying mental models to piece together previously unconnected information that helps them to identify and invent new products or services and to assemble the necessary

resources to start and grow businesses, as well as pursuing opportunities. Ndlovu's enterprising spirit led her to continually see the next opportunity – "I approached them because I could not lose this opportunity. How to spot opportunities and grab them quickly is what they told us in business school," she recalled. "This was the business I came to China for!"

Students will recognise from their readings (Bosma et al., 2020; Pruthi and Wright, 2019; McMullen et al., 2021) that once engaged in the entrepreneurial process, such individuals should also have superior ability in successfully exploiting opportunities, which resonates with Ndlovu where she says, "One of the key take-aways was to avoid being in love with my solution, in this case local manufacturing. Rather be in love with solving customer pain points, by becoming flexible, adaptable, and agile on our business offerings," she recalled. A major take-away for Ndlovu from this experience was that of learning how to pitch to investors and the power of pivoting whilst one was applying other revenue generating models (Shepherd and Gruber, 2021).

The instructor could end this question's discussion by emphasising that a new venture has few resources other than entrepreneurial attributes such as motivation and knowledge of the entrepreneur. Therefore, as demonstrated by Ndlovu, her capacity to gain new knowledge and her abilities during the start-up process are critical to new venture growth success. Such personal attributes are essential to control and apply to resources which may lead to a competitive advantage.

Q3. Formulate an argument highlighting the role of the entrepreneurial ecosystem in which Ndlovu attempted to grow her business.

An effective argument that students could formulate would be to invoke the entrepreneurial ecosystem which relates to the external environment and how the entrepreneur and his/her environment interact and influence each other, reflecting key elements of the SCT. Here, the instructor could extend discussions by noting that researchers have generated a substantial number of studies, demonstrating that entrepreneurial activity depends on interactions between three components: individuals, organisations and institutions (Bosma et al., 2020).

It would be prudent for students to recognise that while an effective entrepreneurial ecosystem is best designed as a set of interdependent "actors and factors," a crucial point, however, is to distinguish how the wider ecosystem structure of the South African economy affects entrepreneurship. Several structural factors impede the South African entrepreneurial ecosystem, such as a poor-performing economy in terms of GDP growth and an economy dominated by large firms, which is exacerbated by inadequate education and energy infrastructure, and an unusually low share of employers and self-employed people in the labour force which leads to persistent poverty and inequality (Urban, 2021).

Useful case facts, students could use in highlighting the role of the entrepreneurial ecosystem in growing the business, are that the entrepreneurial ecosystem in which Ndlovu attempted to grow her business was stifling insofar she believed that the South African authority had not done enough to support the development of the commercial drone industry and, subsequently, industry stakeholders established the Drone Council of South Africa in July 2020. The council's mandate was to address challenges faced by the industry and to facilitate growth in the commercial drone industry. One major challenge was capacity restrictions within public sector structures, that led to delays in approving licences for drone operators and pilots. Therefore, the red tape in the drone sector discouraged foreign companies from investing in South Africa's drone sector. However, Ndlovu added that the regulatory landscape had changed since 2020, with lots of engagement between the Drone Council and SACAA, which was making the industry more accessible. Additionally, it is clear from the case that Ndlovu was encouraged by the fact that, despite the barriers, drone technology had gained traction in South Africa. In 2021, there were over 200,000 drones operating in South Africa. At the same time, however, in early 2023, there were only 97 ROC holders registered with SACAA.

Students should derive from the case that in terms of the SCT framework, the environment is made up of institutions that guide social norms, where social capital refers to the relationships and networks from which individuals are able to derive institutional support and resources accessible through an actor's network of relationships (Urban, 2020). Social capital has emerged as a contextual accompaniment to theories focusing on individual traits by acknowledging that entrepreneurs are embedded in a social context that enables and constrains their behaviour (Bosma et al., 2020; Pruthi and Wright, 2019). In this regard, Ndlovu then explored the possibility of collaborating with organisations already involved in

manufacturing drones, approaching the Council for Scientific and Industrial Research, Denel Dynamics and two privately owned manufacturers. None of them were willing to partner with her. Instead, she decided instead to form partnerships with local organisations. "I started contracting businesses that already had drone operating licences and a fleet of drones, to see if they could do the surveying part on QP Drone Tech's behalf. My role would be to focus on commercialising QP Drone Tech, and we will work together. My strength is in helping people grow their businesses and that is how I survive in that space," she explained. Moreover, her involvement with Flying Labs served as a prime example of the power of business networks, as she leveraged the global awareness about this organisation to open doors to UNICEF South Africa. She noted that the ability to find the right partners at the right time, had always been one of her skills.

In conclusion, the instructor may wish to re-emphasise that elements of the broader entrepreneurial ecosystem interaction in complex and specific ways that lead to unique configurations of different local ecosystems. As evident in the case study, larger firms in terms of knowledge spill-overs influence small and medium enterprises (SMEs) and are important as Ndlovu demonstrates to gain access to networks and to collaborate with other players in the ecosystem.

Q4. Deliberate on the accelerator programmes attended by Ndlovu and critique how the lean start-up methodology influenced the development of her ideas.

Students can invoke case facts to support their deliberations, specifically in terms of Ndlovu's experience at the Mzansi Aerospace Technologies' drone accelerator programme that she attended, she was exposed to the lean start-up methodology and her key take-away "was to avoid being in love with my solution, in this case local manufacturing. Rather be in love with solving customer pain points, by becoming flexible, adaptable, and agile on our business offerings."

Instructors are well advised to extend students' deliberations by referring to models such as the lean start-up framework, which is one of the most popular contributions in the practitioner-oriented entrepreneurship literature. In this case study, Ndlovu seems to have adopted new insights into how new ventures are started in terms of the five main building blocks of the lean start-up framework (business model, validated learning/customer development, minimum viable product, perseverance vs- pivoting, market-opportunity navigation) (Collis, 2016; Shepherd and Gruber, 2021).

Returning to the case facts, students could reflect on the major principle of the lean start-up methodology insofar many start-ups begin with a product idea and then spend considerable time, effort and financial resources on perfecting it without knowing whether they would be able to meet customer needs and generate revenues. In the case, Ndlovu subsequently joined Startup Circles, later known as Pranary, an accelerator programme. A major take-away for Ndlovu from this experience was that of learning how to pitch to investors and the power of pivoting whilst one was applying other revenue-generating models. The lean start-up method allows for constant adjustments with a steering wheel called the build–measure–learn feedback loop, where an entrepreneur can learn when and if it is time to make a sharp turn called a pivot or whether they should persevere along our current path. Furthermore, the lean start-up framework proposes that there are benefits to setting learning milestones as triggers for accumulating information to make persevere-or-pivot decisions, as these milestones test the assumptions the entrepreneur made explicit at the beginning of the startup process (Collis, 2016; Shepherd and Gruber, 2021).

Ndlovu was clear on setting learning milestones as triggers for accumulating information to make persevere-or-pivot decisions – because QP Drone Tech was a start-up company, Ndlovu knew the business needed something to differentiate it from others in the market. Additionally, manufacturing was not her only concern. She had to find customers, and here she would be competing for customers with established South African drone manufacturers as well as international manufacturers.

Instructors may wish to point out that similar to the SCT, the lean start-up methodology also considers the importance of contingency factors, insofar it is important to understand under what conditions (situational factors) the lean start-up framework may lead to more or less beneficial outcomes. Several internal and external contingency factors seem pertinent and have also been noted by researchers, which include the availability of significant amounts of funding in start-ups that may decrease the need for a lean approach (Shepherd and Gruber, 2021). Thus, the availability of financial resources conditions the relationship between the lean start-up approach and performance. In Ndlovu's case, as indeed in many emerging markets, a lack of access to funding is a problem for entrepreneurs. Ndlovu knew

all along that her dream would not come cheap. “It is expensive to operate in the drone industry, whether you want to become an operator, a drone pilot or a manufacturer,” she pointed out. By the end of 2022, despite the team’s efforts at finding funding for the factory, nothing solid had materialised.

As a closing remark, instructor could contextualise the relevance of the above discussions by alluding to SMEs in emerging markets, where access to finance is hindered by a range of demand- and supply-side obstacles, such as skills shortages, poor management practices and workforce training limiting their productivity and innovation (Urban, 2021). Similar to many developing and emerging nations, start-up funding in South Africa often comes from personal savings or from family’s money. In addition, South Africa has little tradition in business angel investment activity, despite being a key funding option for entrepreneurs worldwide (Venter and Urban, 2015).

Q5. Evaluate the various strategic options that are available to Ndlovu to grow her business and gain a competitive advantage in the drone industry.

Achieving her manufacturing dream seemed to be the biggest challenge Ndlovu had faced in her career. She was confident that she could do it, but given the slow progress thus far, she wondered about the available options as listed below:

1. Focusing on one or several supply chain niches and markets or customer segments.

In the case study, it is clear that drones were used for a variety of purposes. For instance, in mining, they were used to mitigate the risk of cable theft at night. Farmers used them for precision farming, engaging in activities such as tracking crop fertility and identifying areas for the application of fertiliser and pesticides. In insurance industry, drones were used for the immediate assessment of car accidents, and there was an increased demand in the construction industry to help reduce theft and vandalism. In the health-care sector, the South African National Blood Service had partnered with the Western Cape Blood Service to introduce a nationwide blood delivery service using drones.

Students could consider another market niche by aligning their discussions with a focus on how drones were also used for disaster mitigation, logistics and surveying, as well as for entertainment. Ndlovu strongly believed that drone services could have been invaluable during the 2021 flood disaster in the province of Kwazulu-Natal. “With the looming threat of climate change, a lot more natural disasters can occur. Drones can help the government respond swiftly and efficiently. Additionally, Ndlovu could consider any one of the abovementioned market niches and contemplate the following criteria: For each major customer segment how intense is the competition among existing firms? Evaluate the threats from potential entrants and substitute products. What is the bargaining power of suppliers and customers? How attractive/profitable is the market and its submarkets, both now and in the future?

2. Outsourcing some components of manufacturing or assembling to focus on her capabilities.

Outsourcing does not seem to have been considered as a strategic option by Ndlovu. Students may identify benefits to both in-house development and outsourcing some components of manufacturing or assembling. In the case study, by 2023, the business consisted of six permanent employees, two part-time advisors and other strategic partner entities; Ndlovu is proud because of the high quality of the human capital in QP Drone Tech, and considers it to be the company’s competitive edge. On the other hand, as Ndlovu considers her venture’s human capital quotient as capabilities, she could use outsourcing to focus on some other aspects of the business, spinning off the less critical operations to outside organisations. Outsourcing noncore activities could improve efficiency and productivity in her venture because another entity performs these smaller tasks better than the venture itself, which may also lead to faster turnaround times and reduced overall operational costs (Venter and Urban, 2015).

3. Developing a network of partners for creating, marketing and delivering the product and service.

Developing a network of partners seems to be Ndlovu’s talent. Because QP Drone Tech was a start-up company, Ndlovu knew the business needed something to differentiate it from others in the market. “Clients are still not comfortable in giving us sizeable projects due to lack of trust, therefore we have to work extraordinarily hard to prove ourselves. I do that by partnering with well-established brands. This gives an easy entry, whilst learning and

leveraging on each other's resources and branding," she explained. Moreover, QP Drone Tech had formed strategic partnerships with large local and global companies, including the US-based geographic information systems company Esri, the professional business services firm PwC, Insurer Santam and telecommunications company Telkom. Ndlovu expressed gratitude for the support provided by partners. PwC, a long-standing partner, played a crucial role as its enterprise development partner, offering strategic business advice to facilitate the growth of her consulting services. Her involvement with Flying Labs served as a prime example of the power of business networks, as she leveraged the global awareness about this organisation to open doors to UNICEF South Africa. Students could reflect that entrepreneurs who can best develop and proactively build networks and trust with critical resource providers should have a higher success rate and quickly overcome any liability of newness(Venter and Urban, 2015).

4. Scaling the business to generate profitable and sustainable revenue streams.

Based on the case study facts, there was a growing demand for small drones. According to the market research firm IndustryARC, this was attributed to their size and speed, making them suitable for various applications. In addition to tasks such as medicine deliveries and disaster management, small drones were used for inspecting infrastructure by energy suppliers and communication networks, as well as for body temperature scanning purposes, among other uses Ndlovu could take advantage of such a growth market by establishing organisational structures in her venture that enable the exploitation of opportunities beyond the initial local level through the capture of economies of scale and scope. Growth and development can be made up of various different activities, which are often related to developing a range of products, developing the resource base, venturing into new markets and building a stronger organisation. Many industries including law and security enforcement, movie and news production and construction are using drones instead of manned aircraft for their operations, all of which represent opportunities (Venter and Urban, 2015).

Recognising that access to markets is pivotal to the sustainability and profitability of businesses, she could try and reduce her transaction costs, which influence the access to bigger markets. Research shows that "systemic entrepreneurs" seek and exploit opportunities that are wide enough to exist over an extended space and that involve complex coordination of multiple inputs, often resulting in the production of many products with a complex chain in between. Here, she could leverage her excellent networks and create even more "systemic connections," in the form of commercial transactions between individuals who are separated over a large geographical space and across many business networks (Urban, 2021). Ndlovu could forge connections with different people involved in her supply chains, distribution and other businesses, as it eases accessibility to specific resources. In this sense, she could engage in more downstream and upstream activities in the value chain and integrate her drone business activities via backward and forward linkages.

5. Delivering new value for prospective customers, even though the precise forms that new value would take were as yet undefined (in other words by innovating, she could potentially increase the businesses' value generation through the possible development of intellectual property).

In essence, to create value, offerings should be market-driven and offer a product/service for which consumers are willing to pay enough to make it profitable (Collis, 2016). By enabling Ndlovu to identify a portfolio of market opportunities and to choose the most promising starting position for her customer development and business model design, the Market Opportunity Navigator provides an important learning layer within the lean start-up framework (Shepherd and Gruber, 2021). Criteria which may be applied to test the value of an opportunity include:

- an attractive market, which is profitability;
- intellectual property development rights;
- cost competitiveness and access to the necessary capital; and
- the ability of the entrepreneur to leverage the opportunity, which is matched with a strong management team.

By focusing on opportunities that favour new businesses, such as creating intellectual property, Ndlovu can increase her likelihood of success. Several pieces of legislation provide protection for a variety of forms of intellectual property in South Africa, namely, the

Copyright Act, the Patent Act, the Designs Act and the Trademark Act. Application for the protection of intellectual property can be made to the Companies and Intellectual Property Registration Office (Venter and Urban, 2015).

Conclusion

Wrap up: discussion question

In the final 15 min of the classroom session, students could be asked to motivate their decision on how Ndlovu could generate greater social impact for her drone business.

Social impact is considered to be "[. . .] the consequences to (communities) that alter the ways in which people live, work, play, relate to one another, organize to meet their needs, and generally cope as members of society (i.e. different capabilities)" (Venter and Urban, 2015).

South Africa faces numerous social challenges, many of which are exacerbated by historical inequality. In particular, the rate of unemployment is a major contributor to the elevated level of poverty in South Africa. Their interconnected nature makes them wicked problems which need to be addressed if South Africa is to prosper at any level (Venter and Urban, 2015). In this regard, Ndlovu immediately recognised an opportunity in Flying Labs to merge drone technology with her passion for educating and training youth and women. Moreover, South Africa Flying Labs' social impact training had the knock-on effect of generating much-needed brand awareness for Ndlovu. In turn, this led to increased demand for training, Ndlovu's first love, reminding her of her wish to have a 4IR training academy of her own. This academy started to materialise as The Innovation Hub offered one of its township sites in Ga-Rankuwa on the outskirts of Tshwane, where South Africa Flying Labs could establish a 4IR Academy and offer training to surrounding unemployed youth and school children. In addition, another site would become available in Soweto for a pilot exercise in 4IR and science, technology, engineering and mathematics training.

In South Africa, social enterprises reflect the diverse initiatives and activities that typically manifest through philanthropic efforts, NPOs and non-governmental organisations (NGOs), as well as broader organisational social initiatives such as corporate social responsibility projects. Social entrepreneurship has direct relevance to South Africa in terms of its transformative role in reducing severe inequalities (Venter and Urban, 2015). There is evidence in the case that the more Ndlovu learnt about the drone industry, the more she was driven to engage with every sphere of the industry. This led her to become involved in WeRobotics, an international NPO that aimed to empower local experts to use robotics for the betterment of their communities. WeRobotics had established the Flying Labs Network, a global network of experts in professional drone, data, robotics and AI services. The purpose of the network, amongst other goals, was to share knowledge amongst its members, introduce drones and robotics to rural children and unemployed youth and respond to humanitarian crises with the support of local experts in each country.

It seems plausible that Ndlovu could build on her networking strength and seek more alliance-building, as the effectiveness of any social initiative is in building its social capital through developing networks of key stakeholders to bring about social impact. She needs to continue to collaborate with others or complement their work. In addition, Ndlovu could engage in active lobbying by influencing and garnering positive government and NGO support for her social initiatives. Engaging stakeholders in the strategy process will lead to better decisions and provide her with additional legitimacy to take on social projects while spreading ownership of the social project.

Moreover, she could increase the performance and effectiveness of her social projects by generating an income to fund and sustain them over an extended period of time. Ndlovu could create "fee-paying" markets for the products/services she is offering to subsidise her scaling activities (Cosa and Urban, 2023).

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Abstract

Title – *Queen Ndlovu: opening the throttle on her drone business.*

Learning outcomes – *After completion of the case study, students will be able to evaluate the journey of launching a business in an emerging market context and judge how opportunities and challenges can be navigated to build sustainable enterprises; assess the relevance of individual attributes and process skills that are necessary for entrepreneurial agency to transform social structures through entrepreneurial action; formulate an argument highlighting the role of the entrepreneurial ecosystem in growing a competitive business in an emerging market context; make an informed decision and critique how accelerators and incubators affect the development of ideas and access to finance in South Africa; and propose various strategic options available for technology entrepreneurs, considering the challenges they face in emerging economies.*

Case overview/synopsis – *In April 2023, Queen Ndlovu, CEO and founder of QP Drone Tech, a provider of drone business solutions, was considering options to fulfil her original dream of manufacturing drones in South Africa. She had encountered obstacles to achieving the same in 2019, and had decided to focus on providing commercial drone consulting services. However, her dream had not extinguished, and in 2022, she decided to restart her efforts. She found practical support from The Innovation Hub, an incubator that was supporting her business, which enabled her to enhance the prototype of her drone. She then had to think about how she would manufacture drones locally by ensuring she had access to production infrastructure, funding, partners and customers. Would she be able to gain a competitive advantage that would differentiate her from competitors? Or should she reconsider whether she should be manufacturing in the first place, as there are risks and benefits for smaller businesses in this regard.*

Complexity academic level – *This case is intended for discussion in postgraduate diploma in business and Master of Business Administration courses.*

Supplementary material – *Teaching notes are available for educators only.*

Subject code – *CSS 3: Entrepreneurship.*