Market-driven management of start-ups: The case of wearable technology

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Abstract

The purpose of this paper is to identify and describe the drivers of lean approaches and successful management of wearable technology start-ups. The paper is a descriptive study that employed a case study methodology based on semi-structured interviews with ten start-ups' managers in Wearable Technology 2017 conference. Participants were selected based on convenience sampling and the pre-set criteria. The current study contributes to this field through the main findings, which suggest that four stages need to be considered by starts-up for a successful market readiness, including the time of entry and overcoming market entry barriers, product attributes, product development process, and commercialization. Finally, findings were categorized in the form of an iterative learning loop model and also, practical strategies and methods were recommended for successfully going through each stage.

Keywords Wearable technologies, Start-up, Commercialization, Lean, Market-driven management

Paper type Original Article

1. Introduction

Start-ups firms are the backbone of new technological products and services as well as economic growth. By introducing new products or services, start-ups can substantially contribute to a country's competitiveness [33]. Wearable Technologies (WTs) refer to embedded portable computers and advanced electronics that integrate seamlessly into people's daily lives in order to have them interact with a smart environment (i.e. home appliances) anytime and anywhere [11]. Smartwatches, smart glasses, clothing, headbands,

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wristbands, and jewelry (e.g., bracelets, rings, necklaces, and earrings) are examples of smart wearable products.

A report by the International Data Corporation [28] estimated that global wearable vendors would account for roughly 214 million shipments by 2020. According to wearable technologies database (Vandrico) in [54], 431 devices have been identified as WTs across a range of industries, including the medical, entertainment, fitness, industrial, gaming, and lifestyle sectors. More specifically, WTs will become ubiquitous shortly due to reduced cost, enhanced connectivity, increased reliability, improved usability, and long battery life [12]. Accordingly, Dehghani and Dangelico [13] forecasted a demand increase on wearable products related to the entertainment and healthcare markets.

Despite the fast-paced growth of the WTs industry, it is still in its infancy stage; some technology and market-related barriers hinder market expansion and sales growth [46]. In this situation, the success of the WTs start-ups and market growth have fallen below expectations and are not in line with forecasts and cost, low perceived usefulness, the overlap between WTs and smartphones, appearance, comfort, and privacy are among the main barriers (Page, [40]. Shively [50] mentioned similar factors including health, comfort, look, privacy, and expense as parts of the challenges to launch and develop their new smart wearable products. Other challenges subsume overestimation of market size, poor design, and high product development costs [24].

According to Berglin [3], the number of applications for WTs that have made a commercial impact is disappointingly low. On the other hand, small enterprises that have proven to be successful tend to be restricted to smaller markets, such as novelty outerwear and luxury sportswear. As adoption of wearable devices rises among consumers, start-ups will face more barriers to enter the market and detect the right time of entry. Furthermore, despite the existence of theories and models for product development process, start-ups seek lean, flexible and market-driven methods, which are in line with the fast-changing environment of high-technology markets. Consequently, commercialization has always been entwined with uncertainty and key indicators (i.e., market size, technology forecasting, operation, time of entry, competitor behavior and barriers to entry) which are continuously changing and difficult to predict [1].

The absence or lack of marketing and business skills often results in the underestimation of essential business and marketing forces such as consumer preference, market demands and commercialization. Given these problems, this paper contributes to the field through highlighting strategies of the successful WTs start-ups and explain their success factors through a case study of ten successful start-ups in WTs market. In doing so, this research investigates WTs market, entry barriers, and challenges of determining the right time of entry. Additionally, this study discusses the strategic principles and methods used by successful WTs start-ups to decide about the strategic selection of the product capabilities and product design, product development process, and commercialization. In sum, the paper categorizes the findings in reasonable stages in the form of a loop model, which has iterative characteristics and is nourished by internal and external feedbacks provided in all the stages. Continuous revolve of this iterative model may serve and also creates knowledge for learning enthusiast organizations and start-ups.

2. Data collection and sample

This paper is a descriptive study and employed a case study methodology which is based primarily on semi-structured interviews according to Yin [58] since enabled us to understand (rather than merely measure) start-ups' activities. Interviews were conducted with ten executives of start-ups who agreed to participate in this inquiry. Participants include CEO, co-founder, and industrial designer who attended the Wearable Technology (WT 2017)

conference. Managers represent different international WTs start-ups across the globe (Table 1). The WTs companies were selected using convenience sampling method and only those early-stage start-ups that fulfilled the selection criteria of the present study (i.e., high performance, high sales volumes and having a marketable product or at least completed the first prototyping stage) were chosen for an interview. It could insight researchers to obtain first-hand information from the start-ups that have recently faced all the difficulties of this complex process from start to finish, giving the opportunity to highlight bottlenecks and enabling factors.

WT's spans into several business sectors and industries, to avoid bias this was taken into consideration. The interviews were conducted face-to-face to get superior and quality data, and to reduce the risk of potential misunderstandings about the nature of the questions; and also, to facilitate the fluidity of the discussions. This type of data collection allows respondents to elaborate on their opinions, views, and experiences, and to reduce the subjectivity of interpretations to the minimum [21]. Drawing upon existing literature and in the light of Peng's [43,44] questions 'what drives company strategy and what are the factors of success or failure in business, we derive the research questions as follows:

1- What is your general perception of the wearable technologies market?

2- How big is the wearable technology market for your product? How fast is it growing?

3- Which are the main barriers to entering the current market and what is your opinion about the time of entry?

4- What is your strategic approach towards selecting product capabilities and product design process?

5- What is your strategic approach toward product development process?

6- What are the challenges in commercialization of your product?

3. Case study analysis

This section describes the approaches and activities of 10 start-ups and their representatives following the order of the defined research questions, which is complemented and enriched by related literature. The suggested strategies and methods mentioned in sections were extracted directly from managers' responses; while others were derived from stated clues in the obtained responses which have been enriched using related literature. Due to the word limit, only a small number of the start-ups' responses are presented.

3.1 General perception regarding the market

Wearables in the high technology industry are deemed to be a profitable market shortly. The technology of these new devices is certainly something that will be the key to the optimal operating of a future society [51,15], especially in sectors such as healthcare and entertainment that are seen as a means to enhance competitiveness, as opined by some executives' quotes:

> "*I may be a little biased because I'm trying to enter this market, but I believe the smart wearable is here to stay and can only grow. My point is, when the general public will be introduced to niche market for wearables instead of fitbits and apple watches, we will see exponential growth in different sectors (company C).*"

> "*In the future, we will be developing new functions in healthcare sectors. For example, one that helps remind you when to take your medicine. Our bracelet will also make smart analyses and will be able to inform your family if you wander off or are lost (company A).*"

Table 1.
Characteristics of the analysed start-ups, as of march 2017.

Company Name	Number of employee	Establishment date	Located in	Product description	Role of the interviewee
Company A	9	2016	Netherland	A wearable device connecting people with care providers, medical specialists for Elderly care (fall detection, fall prevention and a personal alarm)	(CEO)
Company B	4	2016	Italy	a wearable device for fashionable women; it is a collection of technological bracelets beautifully designed and made in Italy with Murano glass and Carrara marble, able to connect a smartphone or smartwatch to the jewel that will act as notifier	(CEO)
Company C	3	2017	Denmark	A smart jewellery device that brings families together in a new, fun and innovative way. Expecting parents now have the opportunity to share the feeling of the pregnancy, involving the fathers-to-be in this unique wonder of carrying a child. The baby's kicks are monitored and shared through an elegant, smart bracelet imitating the movements, kickings and hiccups	(Co-founder)
Company D	4	2017	Netherland	A device that tracks and analyzes information about the brain and body throughout the sleep cycle with an advanced auto-learning software algorithm	(Co-founder)
Company E	3	2016	USA	A wearable device for-profit social enterprise engineering affordable and sustainable healthcare solutions to combat newborn mortality	(CEO)
Company F	6	2015	Belgium	A smart wristband connected via an app to one or several smartphones. In an emergency, the wearer simply presses a button on the device, which then automatically alerts all the connected users in the app on their phone along with the location of the wearer. Connections can include an unlimited number of family members, friends, neighbours and specialised emergency services	(Co-founder)
Company G	3	2016	Germany	It combines the functionality of a smartwatch and fitness tracker in order to find the best way around bringing connectivity to classic watches	(Industrial designer)
Company H	8	2015	South Korea	Fashionable Tracker Accessory	(Co-Founder)
Company I	5	2017	Australia	A smart backpack dotted of an array of sensors that communicates with a smartphone to guide you safely	(CEO)
Company J	3	2016	CANADA	A sleeve wearable that allows wears to ascertain a more complete picture of their overall health	(CEO)

> "Wearables are a fast-growing market, and we are excited to see new players enter the field of lifestyle and healthcare (company E)."

According to executives' opinions, it can be concluded that many start-ups are exploring the potential applications for new wearable devices. Furthermore, the market will see new players in the niche markets, due to expenditure growth in the healthcare sector and a wide range of products for each demographic segment will be introduced for different occasions. Further, according to interviews of the case study, four unique use cases for WTs were revealed, including health and fitness, lifestyle, productivity and organization, and enterprise.

3.2 The time of entry and overcoming barriers for entering the market

The prior literature emphasizes the right time to enter a market as an essential success factor, with great interest on the demand side of the market and less on competition between different players of technology-driven markets [5,18]. Entering the market in an earlier time may provide the first mover advantage and path dependence if the technology has a clear advantage to consumers [2]. Indeed, competitors can be followers that copy a product or those start-ups that have discovered opportunities independent of one another. A manager of start-up described his opinion in this regard as follows:

> "*My product is still in a small niche "travel, lifestyle." However, I am trying to make it overlap with other wearable categories like "sports and personal safety. So, acting as a first company in order to be dominant in the market for each demographic requirement, our company can benefit from its profit… (company D)*."

On the contrary, there is a possibility that the product launch receives a warm welcome if a start-up enters the market early and the advantages of the product are not clear to consumers [49].

> "I agree that smartwatches are still immature, and it is somewhat risky to enter this market, as benefits of the products are widely missing. However, this is changing rapidly due to incredible advances in sensor technology, app development, going into smartwatch-related R&D. So, penetrating a specific segment of the market will bring us a valuable advantage (company G)."

Start-ups are always under the pressure of right time to enter to market and need to move rapidly, and in return, technical and product quality may be treated with a low priority because of excessive increase in the speed of entering the WTs market [26]. However, *being a first mover* is a significant source of competitive advantage for start-ups due to low buyer switching costs and technological leadership [32]. Therefore, to take advantage of being either first mover in a niche market or a technical and quality leader, *marketing related activities like market research and manufacturing related activities like R&D should be performed and paid attention simultaneously and in an aligned manner*.

It is essential for start-ups to possess the skills, capabilities and know-how required at different stages of business development. Accordingly, Qureshi [45] identified the importance of balanced and complementary skills and also made emphasis on *developing both technical and business skills* in start-ups. Generally, a notable weakness among start-ups is the disability to develop successful marketing strategies as a barrier to enter a market [29].

> "*Many of the traditional care providers 'think' problems – not being aware of what modern [cloud] alternatives offer. This is because of the lack of marketing strategies (company B).*"

Also, Cooper and Sommer [8] highlighted the importance of *digital marketing* capabilities in the successful introduction of technology; this is often seen as a key to start-up successes (see also [4,22,47].

On the on hand, Dodet [16] mentioned that high growth markets with low entry barriers like wearable technologies are more subject to deal with competitive overcrowding. Nevertheless, the acceptance of WTs products has faced a formidable obstacle due to the current users, especially early majorities who do not consider poor product performance as the decisive factor in purchase decisions, as is proved by low retention of the gained customers. In this situation, *more significant investments in marketing activities like advertising and brand building activities* were mentioned by managers as ways to bypass this obstacle. Utilizing all of the models, approaches, and methods discussed in the different section of the present article can break down barriers of entering the start-ups market, in particular, WTs products. Dodet [16] study on WTs at the entry stage, identified three main challenges for early stage WTs. These challenges have been discussed as follows:

- ***Overcome lack of value-added services***: Adopting wearables just for the sake of it does not provide enough motivation to purchase and is not persuasive enough. Therefore, beyond intrinsic motivation, extrinsic drivers like functional motivation such as linking people to each other in a different situation, context-specific features embedded in products and social engagement features can overcome lack of value-added services.
- ***Interoperability***: Producing interoperable products and services lead to controlling and deriving benefits from high fragmentation of the market and expanding a vast range of use cases for WTs products and increasing users' utility.
- ***Business processes re-orientation***: Rigid hierarchical structures leading to assumption-based models can overcome by taking into account user-generated data in decisions. Involvement of potential and present users and stakeholders in generating ideas which use for producing features and design comes in handy. Applicable methods to perform this market-driven approach will be suggested in the product design process and product development process sections.

During the interview, some managers mentioned to taking advantage of strategic business models to overcome market entry barriers and obtain a competitive position in the market, including *The Business Model Generation Canvas* [39] and *The Lean Canvas* [34] Maurya [34]. The study changed the sequence of Osterwalder' building blocks of the business model generation canvas and replaced four blocks with new ones and transformed it into "Lean Canvas." Accordingly, lean canvas emphasizes more on Problem, Solution, Key Metrics, and Unfair Advantage blocks which were replaced with Key Partnerships, Key Activities, Key Resources, and Customer Relationships blocks respectively.

Besides, the sequence of the Osterwalder' building blocks of the business model generation canvas changed like this: Problem, Unique Value Proposition, Solution, Channels, Cost Structure and Revenue Streams, Key Metrics, and Unfair Advantage. Mostly, startups invest in producing the wrong product or MVP, so recognizing the *Problem* is of great importance when designing a technology-based product. When the problem is characterized, the *Solution*—in the form of the MVP—can be determined. The *Key Metrics* block helps start-ups come to the realization that which are their main drivers of progress and advancement to measure how business is running at the moment, before receiving the sales report.

3.3 Selecting product attributes; capabilities and design

The term "*customization*" refers that the customer has to be involved in the product design process at some points [30]. Because consumers considerably vary in shape, dimension, and size, to engage them, devices should enable customization through considering varies aspects according to its uniqueness and the degree to which a customer is involved [36].

> "*A greater level of variation in design is key for smart wearables to be successful. For an industry that emphasis so much value on originality, that's a huge problem. If everybody wears a same watch, we'll all look the same eventually… moreover, being the "same" is equivalent to fashion death (company I).*"

The "*fashionability*" refers to how smart the technology device is, integrating it into a current landscape and making the device more ubiquitous. Fashionability can affect the perception of desirability and the comfort of a device [36].

> "*Our consumers should like the design, and the design of the wearables must complement their style or provide something new to their wardrobe. Therefore, our first aim was to make something different aesthetically and give them different stylistic choices in how they wear tech for different occasions in their lives (company H).*"

In smart WTs market, many consumers will have their first internet access capability via a mobile device [57]. Therefore, *"connectivity"* with the expanding array of applications and smart devices has become essential. One of the executives' quotes expresses this concern:

> "*Connectivity is one of the important factors As the notion of wearables has determined to connect you directly with smart devices that you use on a daily basis (no mobile phone required and automatic data transfer to application or service is done (company B).*"

Another indispensable frequently mentioned issue by the interviewees was related to "*Ergonomic Design*" which has received attention from some start-ups such as Horus Technologies, a manufacturer of smart glass for visually impaired individuals [16].

As Zhang and Duan [59] pointed out, amongst factors which profoundly affect the success of the innovation-based firms, a tendency toward market and customer orientation make a profound impact on start-ups' triumph. Manager of a start-up described his opinion in this regard as follows:

> "*Only products and capabilities which fulfil customers' expectation should be developed. Therefore, only products and capabilities should design which are considered as valuable ones by the majority of the potential market. In this regard, market research is a useful tool which can assure taking into account the essential capabilities of the markets (company A).*"

In this regard, Davis [10] model was designed to assess newly developing markets. The model suggests that users' purchase behaviours in new markets are influenced by key factors which are crucial determinants of user acceptance and should be taken into account in designing wearable products not only regarding appearance but all the features and capabilities, namely *Perceived Usefulness, Perceived Ease of Use*. Chesbrough [6] identified two other important factors in this regard through investigating WTs start-ups, including *Perceived risk, and Social and aesthetic factors*.

3.4 Product development process

Product development process is categorized into four stages, namely Concept, Prototype, Mass production and Shipping [56]. *Prototyping* points out a quick and economical way that serves to achieve understanding and evaluation of what final products should be [55]. In other words, the working version of a physical product successfully shows the key features and functionality of the final version of the product. From start-ups' perspectives, starting with a product version that collects the maximum amount of validated learning regarding customers with the least effort is the key. It may provide start-ups with the flexibility to react to new information and resolve uncertainties by a rapid prototyping process. Also, some interviewees pointed out that *new advancements in rapid prototyping processes (e.g. 3D printing or additive manufacturing)* could change the process to more creative design. Moreover, the introduction of product ideas using a so-called *MVP (minimum viable product)* without actual product implementation is the key.

> "*The rapid prototyping process at this moment in time cannot meet the quality requirements for parts that we produce in terms of features' sizes, positional tolerances, and material surface. We are excited to see where advancements in 3D printing are going because we believe it will be a significant enhancement to the creative design process (company G)*"

According to some interviewee's opinion, to utilize non-traditional approaches and in line with the unique characteristics of innovation-oriented markets, especially wearables, utilizing innovative market-driven frameworks in product development process can lead to sustainable competitive advantages. The innovation and start-up literature suggest that this approach can be adopted utilizing two methods: *"The Lean Start-up Methodology"* [48] and *"The Customer Development process"* [4].

Business world witnesses failure of almost 90% of the start-ups established every year [42,19]. Generally speaking, there are many reasons for start-ups failures spans from wrong products, draining investments, scheduling problem, scaling up quickly, to hiring wrong people [9, 37]. Furr and Dyer [23] discussed the lean start-up methodology aims at rectifying some of these failures and flaws, which has become the entry barriers of technology-intensive markets dominated by established firms. In comparison to traditional approaches, the lean start-up approach, which was presented by Reis [48], is a synthesis of the foundations for agile methodologies and lean procedures. Furthermore, a customer-oriented method, which lays increased emphasis on the manufacturing of an efficient type of prototype-minimum viable product (MVP)-instead of utilizing time, money, and effort consuming frameworks and strong and inelastic methods [9].

One of the primary tools which provide a practical and straightforward learning loop for implementing the lean start-up methodology is the build-measure-learn feedback loop, which introduced by Reis [48]. It relies on the notion that start-ups can considerably decrease the likelihood of failure and time, effort, and cost of the development process using iterative experimentations and share, test, and validate prototypes and ideas by the involvement of the early adopters who can anticipate the start-up landscape since the product ideation stage. The customer development process which is flexible was introduced by Blank [4], this process help to eliminate drawbacks of the old product development model. Analogous to the new product development process [60]; the customer development process is a four-stage iterative process which is capable to simultaneously assess product development and customers' feedback comprising customer discovery, customer validation, customer creation, and learning and company building.

3.5 Challenges in the commercialization process

Prior studies highlighted the importance of commercialization as a benchmark for new products in the early stages (manufacture related stages), because of its critically to accelerate innovation strategy [56]. Accordingly, *commercial expertise for technically based scientists* is a competitive advantage in the commercialization process of high-tech products. This issue is described by an executive's quote as follows:

> "*My product is changing right now. The challenge is that I have reached the limitation of my developer skills and I need to meet a senior developer who knows commercialization and business. The first concept design was going to fail for sure. I was trying to unite a backpack to an IOT (*the Internet of Things) device *but is prone to failure (company H)*."

A fierce competitive market that is characterized by a high growth rate and market fragmentation makes coopetition inevitable. *Coopetitive strategy* is composed of both competitive and cooperative strategies and is a driver of market expansion. According to Dodet (2016, pg.5), "competitive business environments are characterized by actors collaborating on aspects such knowledge creation and the exploration of new products while competing at the same time for market share acquisition."

There is a time that companies collaborate with their competitors and complementors (producers of complementary goods or services). Therefore, start-ups are encouraged to engage in *collective production of complements* through an open technology strategy and utilize sponsorship if it needs production capability or expertise to manufacture a sufficient range of complementary goods in a particular time [49]. Furthermore, first movers in market have more time to develop (or push others to develop) complementary goods that boost the perceived value and attractiveness of their products and also, the availability of complementary goods could create a competitive advantage over later offerings. The issue of complementors is considered as a significant challenge, which start-ups face in the market.

> "*There are inherent risks and challenges in engineering and manufacturing. For example, while designing our product, we visited numerous manufacturers as the production process such as inner body and leather skirt. However, as a first mover advantage, we need more time to develop our complementary products in order to make our products in a more stylish and customized design (company A).*"

As it has been done by Sendrato and TZOA companies, which are WTs companies, while most WTs companies have targeted B2C markets, *B2B markets strategy* provides golden opportunities for this type of companies to broaden their commercialization options, particularly for the companies that are able to structurally obtain the outcomes associated with broader and more granular information. Therefore, this group should be considered as one of the early adopters in the targeted market segments in a marketing plan to accelerate the commercialization process and reduce the adoption risk [16].

Based on the outside-in part of "the open innovation model" introduced by Chesbrough [6] a firm acquires ideas from both internal and external sources. New technologies can enter the business process at various stages. Thus, projects which are not compatible with the business model can make money for the firm using different ways such as *Spin-off venture companies, outlicensing, and divest.* In addition to the prevalent and traditional method of selling final products through the company's own established sales and marketing channels.

According to *Network Externality or Network Effect*, raising the value of a product through increasing its network size accelerates commercialization and helps attract more consumers. Network Externality explains that a consumer's utility is not only a function of the quality, product characteristics, and price but is influenced by other consumers who have purchased the product too [31]. High technology does not necessarily generate value for customers, therefore, to increase value for possible and potential customers, interaction among consumers within the network should be encouraged.

According to the case study-based analysis of start-ups, it has been discerned that four stages need to be considered by starts-up for successfully enter the market. The four-stage model is provided in Figure 1. Paying attention to two inherently embedded characteristics of the model is crucial. First, this model is an endless learning iterative loop, and due to the interdependence of the stages, each of them should be interpreted as a feature of the whole process, not separate stages; so that the output of each stage can be utilized as an input of the succeeding stage. Second, as illustrated by the feedback loop, the feedbacks of each stage can be utilized for other stages.

In regard to taking advantage of the time of entry, and how to overcome market entry barriers stage, WTs start-ups should utilize and materialize the advantage of first mover to gain market share and competitive advantage [32] and strategic agility [25]. Some strategies that can facilitate and stabilize the first mover position includes addressing and aligning technical and quality factors (i.e., R&D), marketing aspect (i.e., market research), developing managers' both technical and business skills [45,29], and investing more in marketing activities (i.e., advertising, brand building, and digital marketing). Besides, adhering to three principles, including overcoming lack of value-added services, interoperability, and business

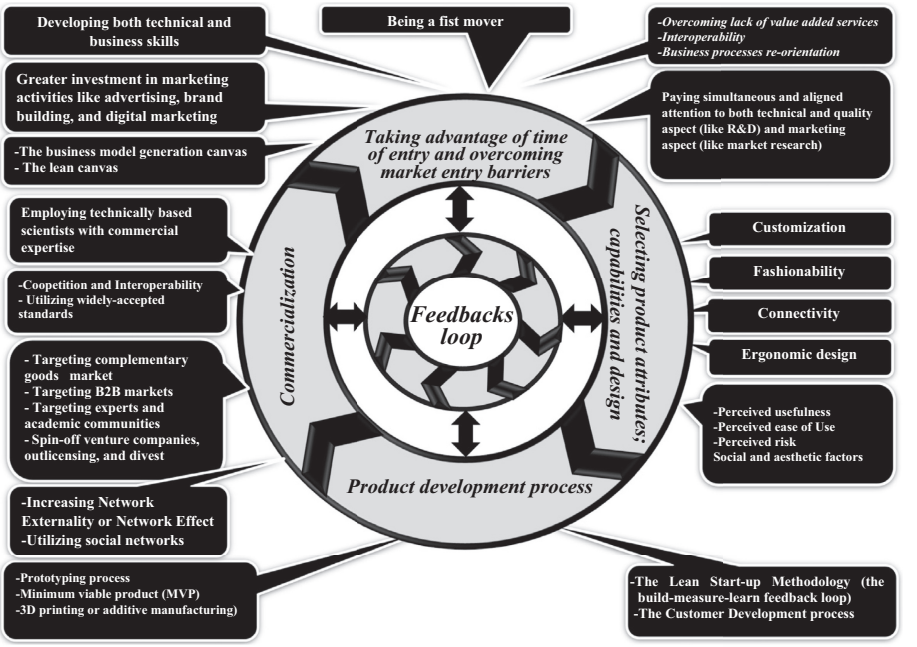

Figure 1.
An iterative learning loop approach of the drivers of lean and market-driven management of start-ups (WTs market).

processes re-orientation can lead to prevailing over market entry barriers [16]. Moreover, start-up firms should take advantage of a strategic kind of business model, which could accelerate the market readiness and obtaining a competitive position, including business model generation canvas [39] and the lean canvas [34].

In the second stage (selecting attributes of product; capabilities and design), targeted and positioned market segments should be satisfied by strategically selected capabilities and customer-friendly designed products. In this regard, four fundamental factors exist, namely customization, fashionability, connectivity, and ergonomic design. Furthermore, customer-oriented principles should be applied in determining which capabilities should to be incorporated in the products and how they should be designed, including perceived usefulness, perceived ease of use [10], perceived risk, and social and aesthetic factors [6].

In the third stage (product development process), WTs start-ups are advised to develop new and innovative market-driven frameworks for product development process that is suitable for volatile and fuzzy technology-intensive markets. This framework could have the potentials to allow sustainable competitive advantages ranging from prototype process, minimum viable product (MVP), and additive manufacturing (i.e., 3D printing). Moreover, utilizing lean, flexible, and customer-oriented product development frameworks, which may nurture continuous learning, is recommended. For example, start-ups may deploy a customer development process [4] and the lean start-up methodology (the build-measure-learn feedback loop) as noted by [48].

In the fourth stage (commercialization), following the guidelines in various fields of commercialization, WTs start-ups can accelerate commercialization. The guidelines include employing personnel with both technical and commercial expertise's that are widely accepted in the market [16]. Furthermore, targeting complementary goods market, B2B market, experts and academic communities can provide start-ups with alternative markets.

According to Chesbrough [6], Spin-off venture companies, out-licensing, and divest can transform unwanted products and ideas into money. Moreover, increasing network externality or network effect utilizing social media would result in raising the value of the products and customer satisfaction [31].

4. Discussion and conclusion

As demand for wearable technologies is increasing tremendously; more and more players are entering into the multi-billion dollar market. This intense competition calls for the development of a niche in the industry. All these new devices (e.g., smartwatches, smart glasses to name but many) are generating a tsunami of data, the implications of which we are only beginning to realize. WTs are undoubtedly able to accelerate the rapid progress of developing dependent industries (e.g. health, education and so forth) and its market is overlapping and merged with other markets such as apparel and healthcare [14]. The infancy of WTs provides the opportunity for the first mover start-ups to influence the market and eventually shape market orientations profoundly.

Consequently, this stimulus has prompted WTs start-ups to act based on the market-driven, lean, and flexible frameworks and guidelines which support continues learning process. In order to adapt to this process, start-ups are transforming into learning organizations, agile and lean businesses; mainly because of the fast-changing environment of the technology-intensive high-technology industry. This paper presents a market-driven and customer-oriented practical guideline that was extracted from managers' responses of WTs start-ups and synthesized the essential interrelated stages of competitively managing WTs start-ups. According to our study, the ten interviewed start-ups indicated how wearables fit into and enrich four sectors: health and fitness, lifestyle, productivity, organization and enterprise. Besides, the model in this study turns a start-up into lean learning approaches, which injects feedbacks and knowledge of all stages gained from internal (company) and external (market).

At the first step of the process discussed in the model, start-ups should derive the benefits of competitive advantage of being a first mover and at the same time prevent from excessive speed to enter market, which leads to quality and technical shortcomings, entering an immature market and/or premature market entry [32]. Moreover, to avoid the trap of being merely a manufacturer-driven start-up, first mover start-ups should simultaneously concentrate on both technical and quality facet (i.e., R&D) and marketing facet (i.e., market research). Besides, they should hone managers' both technical and business skills [45,29]. Further, to meet customer expectations, start-ups managers are recommended to pave the way for formulating marketing strategies, pursuing digital marketing strategies. To overcome barriers to market entry, three strategies have been presented as follows:

First, the barrier of the lack of value-added services can be broken down. In the other word, adding context-specific features embedded in products, adding social engagement features, and connecting users in different situations using comparing athletic performance, music festival and others such as Adding 'Augmented Reality' to WTs functions that would provide users with entertainment or information on their environment. Second, to take advantage of interoperability strategy, start-ups should actively cooperate with their rivals and related companies in an open ecosystem to develop shared platforms, manufacture products and services that can boost the performance and capability to produce complementary products collectively. Third, collective and user-generated information gathered through beneficiaries of both inside and outside the organization (i.e., stakeholders) and rivals should be considered in decision making to resolve the problem of excessive optimistic, unrealistic illusions. The strategy could aid the successful products designed using the traditional organizational

up-bottom structure decision-making style. Accordingly, Troster [53] and Page [40] believed that poor sales of WTs could be ascribed to insufficient interaction with customers or lack of customer consideration which often lead to the poor design and insufficient attention to "wearability." Finally, start-ups should be managed through a strategic business model based on the business model generation canvas [39] and the lean canvas [34]. Dal Lago, Corti & Pedrazzoli [9] reported that CLARA Swiss Tech, a successful Swiss start-up in the WTs sector applied Lean Canvas to manufacture and launch CLARA smart jacket; confirmed the benefits and agility of this managerial tool.

Entering the market as a first mover and utilizing other strategies in the first stage should be supported by the second stage called "selecting attributes of product, capabilities and design." The stage could play a central role in the success of the WTs start-ups as their benefits can be effectively and communicated merely by start-ups. First, according to customization strategy, products should be customized based on customers' demands and expectations. In this regard, technologies such as cloud computing and Internet-of-Things (IoT) can make a substantial contribution in gathering consumer information and products preferences. Second, drawing on fashionability strategy, WTs start-ups' focus is still on the technological aspect of devices. Thus, moving from the technological side of innovation to fashionability, coupled with the identification of strong use cases for non-technologist customers, would allow drawing early majority users. Third, connectivity strategy mentions the added comfort and welfare created by expanding users' communication with their surroundings. In this regard, IoT concept has implications to enhance connectivity and mentions to the general idea of making routine items such as food, luxury items, household appliances, clothing, buildings and so on connected to the Internet to provide integrated and intelligent supervision on several services and devices. Forth, the ergonomic design should be considered in the product design stage. One of the essential ergonomic issues is providing physical comfort for consumers and ergonomic design. The study undertaken by page [40] revealed that wrist-worn devices such as smartwatches and arm mounted devices would continue to be popular, but head-mounted devices need to provide users with the more ergonomic design.

Due to the importance of customer-driven approaches in choosing capabilities and design of products, we suggest four market-oriented strategies as well. First, start-ups should stress on perceived ease of use in the product design. It should be noted that there is a common belief that wearable technologies are more likely to be eagerly adopted by tech-savvy early adopters accepting new technologies just for novelty's sake. These individuals possess the knowledge and know-how required to benefit from the added value of new products in comparison to ordinary users. Second, markets' perceived usefulness toward products should be improved through identifying and designing required, preferred capabilities for the potential target market and provide them with well-designed customer-friendly capabilities which are useful for daily life. Demographic information such as gender and age should be the center focus on the design process to customize the products accordingly. Third, to eliminate the perceived risk of using data-driven and technology-oriented products, emphasizing on a futuristic design which is beyond universal design and functional core competence of the product is beneficial. Also, regarding personal biometric data-driven capabilities, ensuring market from protecting users' privacy using different manners, for instance, designing warning reminders in the form of notification proved to be advantageous. Consistent with this result, many studies found that customers consider privacy issues as one of the major sources of concern. Privacy issues concerning 'personal metrics' are contributing factor why WTs have become unpopular (e.g., [35,27]; Page, [41]. Fourth, the effects of social and aesthetic appeals suggest that the need to pay attention to products' appearance and sociability factors in order to facilitate social acceptance. This implies that the design of WTs must consider sentiment, social, communicative, and sensual factors to enhance interactions

and social connectivity in line with fashion culture design. In this regard, 'fashiontech' term discuss keeping a balance between social, aesthetic, and technological aspects [52].

Apart from the first two stages, the third stage is product development stage. Utilizing innovative market-driven methods in the product development may help transform start-ups into lean and agile strategies, especially for those operating in a highly volatile environment characterized by high uncertainty and fast-changing technology. Prototyping allows them to satisfy early customers and provide feedback for future development. Most importantly, how consumers will react to different colours, sizes, and weights of the product. Moreover, utilizing new advancements in rapid prototyping processes like 3D printing or additive manufacturing is advantageous. Other alternatives include minimum viable product (MVP) technique in the prototyping process can be deployed instead of traditional frameworks that consumes time, money, and effort. Secondly, some frameworks including the lean start-up methodology (the build-measure-learn feedback loop) proposed by [48] and The Customer Development process are recommended.

The last stage of the model represents strategies and methods to accelerate commercialization. First, employing technically-based scientists who boast commercial experience helps manufacture marketable products. Second, we proposed three alternative markets for expanding wearables technologies market, namely complementary goods market, B2B markets, and experts and academic communities. Besides, ideas and products which are not consistent with the goals of the company can make money for the firm using *Spin-off venture companies, outlicensing, and divest* [6]. A good strategy for start-ups to overcome the low usage rate and perceived value of WTs devices is to sponsor the production of complementary goods or even sell them at low prices to increase awareness and boost the desirability of the technology. Availability and accessibility of complementary goods (e.g. applications) affect the size of the installed base, which in turn will encourage production of a higher number of complementary goods and eventually this process creates a steadily growing cycle. Third, utilizing coopetition strategy and using widely-accepted standards help start-ups supply their products to more customers and these strategies can be regarded as a market catalyst [16]. Coopetition strategy boasts a variety of benefits for both demand-side and supply-side of the markets. From a user perspective, the strong interdependence of wearable devices with the smartphone ecosystems and IOT offers access to products and services that work together and generate added value for users rather than devices alone. Consistent with this strategy, Google is giving smartwatches powered by Google-made software even if that means treading into enemy territory and recently this search giant announced smartwatches that run Android Wear, the Google-made software tailored for wearable devices, will now work with Apple's iPhones [38]. Fifth, by Network Externality or Network Effect phenomenon [31], utilizing capabilities of the social networks increases the connection between potential and actual customers in the product's network and leads to the higher utilization of the whole consumers and consequently facilitates persuasion and commercialization [7]. Furthermore, this phenomenon boasts powerful protective benefits, including lock-in effects, excess inertia, switching cost, and even a natural monopoly [17,20].

4.1 Limitations and future research

The research is limited by the fact that it highlights insights from only ten start-ups. By having more participants, additional insights may be produced. Also, due to inherent drawbacks associated with a case study-based method as provided by Yin [58], it is suggested that further studies would be required in order to ensure the validity of the findings, in particular, quantitative studies. Therefore, the generalizability of the results is limited. Our results have revealed the strategies of implementing wearables products for entering the current market. Future researches could also include other perspectives (e.g.

consumers' needs), to provide a more balanced understanding of the sharing economy. Further, this study has considered start-ups in the developed countries. Due to an increasing number of start-ups in developing countries, a future study could provide more insights into this domain accordingly.

Notes

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