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COLLABORATIVE CONSUMPTION: CONCEPTUAL SNAPSHOT AT A BUZZWORD

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ABSTRACT

Considerable work has focused on Collaborative Consumption (CC) from a managerial standpoint. Little academic research has been conducted into this specific concept. This paper proposes two theoretical contributions in that regard: 1) a definition of CC that enables to determine effectively whether any given resource distribution system can be labelled as CC or not; 2) *The scope and limits of CC by contrasting it with other forms of exchanges. Consumers' capacity to switch side from obtainment to provision or from "obtainer" to "provider" role constitutes the key criteria to identify a resource distribution system as being a form of CC.*

We define CC as the set of resource circulation systems which enable consumers to both obtain and provide, temporarily or permanently, valuable resources or services through direct interaction with other consumers or through a mediator.

Collaborative Consumption is therefore a concept which stands in sharp contrast with the notion of Conventional Consumption. Conventional consumption – which underlies classic marketing thought – is a type of resource distribution system which involves passive consumers (not obtainers), who cannot, or are not given the capacity to, provide any resource or service (not providers). Incapable of engaging either in obtainment or in provision, their role is limited to that of buying – monetary exchange - and consuming organization-made resources or services, and, in the case of tangible resources, to discard them. In contrast, Collaborative Consumption involves not mere "consumers" but "obtainers" who may also be "providers". In sum, consumers' capacity to switch roles from provider to obtainer and from obtainer to provider, in a given resource distribution system constitutes the key distinguishing criteria between conventional consumption and CC.

We also introduce the consumer process that is specific to Collaborative Consumption by emphasizing that CC involves not only delegation, such as in conventional consumption, but also empowerment and quasi-empowerment. More specifically, delegation assumes that there is a clear distinction between organizations which produce and sell goods and consumers who buy those goods produced and sold by organizations. Consumers rely on organization-made advertising, texts, logos, labels, trademarks, brands and other communication to choose among the broad array of goods or other types of resources that are offered to them.

Empowerment means that consumers are empowered to collaborate directly with each other. They organize, arrange and negotiate informally the terms and conditions of the exchange of valuable resources, including goods or services. Under the concept of empowerment, consumers engage in what we call pure collaboration, where both the obtainer and the provider are consumers, such as in a secondhand purchase or sale at a flea market.

As a middle-ground between delegation and empowerment, quasi-empowerment involves consumer-to-consumer exchanges that are mediated by a third-party, which is typically an organization. Under the concept of quasi-empowerment, consumers engage either in sourcing

collaboration or in trading collaboration. Sourcing collaboration means that the provider provides a resources or service to the obtainer through a mediator. On the other hand, trading collaboration means that the obtainer obtains a resource from the provider through that specific mediator.

INTRODUCTION

According to "The Mesh Directory", managed by business author and consultant Lisa Gansky, there are more than 9,000 online platforms across the world, which enable people and organisations to make temporarily available their private resources for others' usage (Owyang, 2014). These platforms represented a global market worth 15 billion dollars, in 2014; 29 billion dollars, in 2015; and are expected to reach 335 billion dollars, by 2025 (PricewaterhouseCoopers, 2015). Focusing on tangible goods only, the Canadian-based Kijiji Secondhand Economy Index of 2016, estimated that about 84% of consumers acquired or disposed of pre-owned goods through secondhand marketplaces (secondhand purchase and resale), gift-giving, swapping or temporary renting (out), through either online or offline exchange channels. According to the Kijiji Secondhand Economy Index of 2015, the Canadian secondhand market, alone, was estimated at 230 billion dollars, in 2015. Through co-creation, some CEOs now want customers, not only their workers, to help them define the firm's new products and services (Prahalad and Ramaswamy, 2004). What do these practices all have in common? They form part of a rising global phenomenon called 'Collaborative Consumption' (CC) (Botsman and Roger, 2010) or, more colloquially, "the sharing economy" (Gansky, 2010).

Despite the increasing use of the term Collaborative Consumption (CC) to denote a wide array of new Peer-to-Peer (P2P) business models or innovative technology-enabled exchanges, no consensus on the definition has yet been reached. This lack of agreement has made it difficult for scholars to determine the impact CC has for the study and practice of marketing as well as for society at large. It remains difficult to compare different studies and their results since each of them uses a different conceptualization.

A clearer definition of CC could have several benefits. First, delineating the phenomenon can guide future research and produce useful contributions and recommendations for marketing practitioners who are keen on learning more about how to adapt their business model to the rising CC phenomenon. Second, a clear conceptualization avoids confusion of terms. CC is often conflated with the notion of "sharing", as epitomized in the expression of "sharing economy" or "commercial sharing programs" (e.g. ridesharing, bikesharing, carsharing, tool-sharing, and so forth), which are also widespread in academia (Lamberton and Rose, 2012; Fishman et al., 2013; Parkes et al., 2013; Cohen and Kietzmann, 2014; Bardhi and Eckhardt, 2012), starting with Yochai Benkler (2004). CC is also confounded with access-based business models which involve access to goods without transfer of their ownership (Bardhi and Eckhardt, 2012). Overall, a clearer conceptualization of CC will allow further useful theoretical studies on the subject.

TOWARDS A DEFINITION OF COLLABORATIVE CONSUMPTION

Review of Previous Definitions

Collaborative Consumption (CC) has been first coined by Felson and Spaeth (1978) who themselves drew upon Hawley's (1950) theory of human ecology to theorize collaborative consumption as events requiring a high spatio-temporal concurrence and which must be analyzed in terms of human coordination and human competition. They made it clear that, from a consumer behaviour perspective, the unit of analysis is "people", or "consumers" This early conceptualization (see Table 1) is however too broad as it could include such trivial activities as having beer with friends or using a washing machine for family laundry.

Table 1
PREVIOUS DEFINITIONS OF COLLABORATIVE CONSUMPTION

Authors (year)	Definition of collaborative consumption	Web-facilitated	Offline	Transfer of ownership	Free exchanges	Company-owned resources
Felson and Spaeth (1978)	"Those events in which one or more persons consume economic goods or services in the process of engaging in joint activities with one or more others" (p.614)				X	
Botsman and Rogers (2010)	"The rapid explosion in swapping, sharing, bartering, trading and renting being reinvented through the latest technologies and peer-to-peer marketplaces in ways and on a scale never possible before" (p.xv)	X		X	X	X
Belk (2014)	"people coordinating the acquisition and distribution of a resource for a fee or other compensation" (p.1597)	X				X
Hamari *et al.* (2015)	"Peer-to-peer based activity of obtaining, giving, or sharing the access to goods and services, coordinated through community-based online services" (p. 2)	X		X	X	

More recent definitions which characterize the current phenomenon have therefore been developed but each tends to overemphasize one specific aspect of CC and misses out others.

First, based on the review of studies that sought to define the precise concept of "Collaborative Consumption", there is a common tendency to consider CC as being mainly web-driven. Belk (2014), for example, considers that the common denominator to CC ventures is "an Internet facilitated ability to help people find things" (p.1598). Harvey, Smith and Golightly conflate CC with a "computer-mediated economy". Similarly, Hamari, et al. (forthcoming),

conceive CC, primarily and even exclusively, as a technological phenomenon because Peer-to-Peer (P2P) collaboration finds its origins in open source programming, and file-sharing. Online cooperation and digital sharing formed the basis of web-facilitated exchange platforms (Botsman and Rogers, 2010; Gansky, 2010; Airgrain, 2012; Nissanoff, 2006). The technological terminology (e.g. start-ups) and metaphors (peer-to-peer) employed in the discursive construction of CC, are also explicit references to this close relationship between technology and CC (John, 2013a, p.13).

Actually, the Internet enabled to increase the scale and scope of practices that are not inherently new but which have always existed before and have been given a new impetus through web technologies (Ritzer, 2015). The web technology merely increased the scope of previously geographically- or community-ascribed exchange systems. As an example, the semantic field surrounding "collaboration" has not only been used to designate strangers exchanging any type of resource from any part of the globe, but also close neighbours joining for a street-corner yard sale on a Sunday afternoon, such as in Herrmann and Soiffer' s (1984) study on American garage sales. CC is therefore an incremental evolution rather than a discrete revolution (Ritzer, 2013). Since it accrues from previously offline-based informal exchanges, these should not be cast out of the way but rather regarded as founding practices of current CC. As such, "offline exchanges" should fit within the conceptual delimitations of CC, mainly because they are no less collaborative than Internet-facilitated modes of value exchange.

The Web technology also enabled unprecedented business models to emerge. Giesler's (2006) analysis of the Napster file-sharing platform emphasized the impact of the Web in transforming previously discrete dyadic (on-to-one) exchanges into networks of polyadic (one-to-many) and rhizomatic (many-to-many) exchanges. Informal product exchanges, resource pooling or jobbing have always existed, yet online applications such as Über or Airbnb tremendously increased both the scope and the intensity of such undeclared practices, which poses, among others, numerous legal issues. In essence, CC is not solely limited to technology-enabled exchanges. Yet, technological advances, especially Web 2.0, increased collaboration between individuals and thus the emergence of new exchange types, which conflate de facto with CC.

Second, since most of CC models are based on leasing and rental schemes, CC has been related to what Bardhi and Eckhardt (2012) termed 'Access-Based Consumption' (e.g. Belk, 2014, p.1597), which can be related to 'commercial sharing systems' (Lamberton and Rose, 2012), 'product service systems' (Tukker, 2004), 'use rather than owning schemes' (Leisman et al., 2013), or 'leasing-rental agreements' (Fisk, 1973), in which access to resources is favoured over their ownership (e.g. Ostrom and Hess, 2007). What is valuable is the service that the good offers rather than the good in itself (Varian, 2000). This approach to CC may be problematic. Focusing solely on product service systems or access-based consumption, excludes a great variety of exchanges such as secondhand purchasing, reselling or swapping, and which are also collaborative (Botsman and Rogers, 2010). Whether offline or computer-mediated, these exchange schemes have often been reported as entailing high levels of P2P cooperation and interaction (Guiot and Roux, 2010; Belk et al., 1988; Herrmann and Soiffer, 1984; Bardhi and Arnould, 2005; Sherry, 1990; Stone et al., 1996; Gregson and Crewe, 2003). The recent literature that started to examine informal and alternative consumption practices, emphasized further that technology – especially the Internet – has favoured the withering of the distinction between prototypical exchange systems (gift-giving vs. swapping vs. commodity exchange) (Arsel and Dobscha, 2011; Albinsson and Perera, 2012; Scaraboto, 2015; Harvey et al., 2014). Instead, there is a simultaneous presence and

complementary interaction between different forms of resource circulation systems (Corciolani and Dalli, 2014; Scaraboto, 2015). In other terms, it makes little sense to refer to CC as being limited to temporary access-or granting of access to-resources, since collaboration between consumers can be found in permanent acquisition and disposition as well. Besides, online collaborative platforms tend to blur the frontiers between exchange paradigms anyways. A conceptualization of CC which leaves permanent disposition and acquisition aside would be at best, incomplete, and at worst, irrelevant since it would miss out a substantive portion of CC.

Conceptual Delineations of Collaborative Consumption

Although being predominantly performed online (Belk, 2014; Hamari et al., forthcoming), offline-based exchanges should not be omitted from CC. Neither should non-access based consumption schemes which involve transfer of possessions. In line with a consumer-focused approach to collaboration, what should however be clearly kept aside form CC, are resource circulation systems which exclude consumer input either at, what we call, the "provision" and the "obtainment" level. In other words, collaboration should not be merely conflated with P2P, or even online systems, but rather with consumers' capacity of being both "providers" and "obtainers" of resources, in a given "resource circulation system". By taking Scaraboto's (2015) theory on hybrid economies, this means that consumers are able to "switch roles, engage in embedded entrepreneurship and collaborate to produce and access resources" (p. 166). The "resource circulation system" equates the metaphor of a "supply chain", much inspired from the discipline of operations management and logistics. CC is therefore characterized by the fact that a consumer could be both an obtainer and a provider of a given resource. Companies have traditionally sold products and services to consumers, they now start pulling on their resources too (Prahalad and Ramaswamy, 2004). Consumers were classically conceptualized in marketing as buyers whereas they have also always been pushers too (Ritzer, 2015). Consumers invite themselves in the value creation process, as consumers and not as formal workers, employees or suppliers, to successfully reconcile their personal interests. Conversely, organizations tap into the sphere of private assets and skills, as formal organizations and not as family, friends, or acquaintances, to make profits or reach other objectives. A consumer is not only a consumer anymore but also an obtainer who may have the additional opportunity to endorse, if wanted, a provider role. More specifically:

1. The obtainer is the consumer who seeks to obtain a resource or service that is provided directly by another consumer (i.e. the provider), or indirectly through the mediation of an organization known as the "mediator" (for profit or non-profit). "Obtainment" entails secondhand purchase, free receiving, swapping, accessing resources for free or for a compensation (excluding conventional consumption access), reconditioned / refurbished consumption, and to a lesser extent, recycled consumption;
2. The provider is the consumer who provides a specific resource or services either directly, to a consumer (i.e. the obtainer) or, indirectly through a "mediator". "Provision" involves reselling, giving for free, and swapping, providing access for free or in exchange of compensation, recycling or trading in with an organization.

CC may be better conceived of in a broader perspective of resource circulation systems incurring differential levels of collaborative intensity, which can be categorized as: (1) pure collaboration (P2P, or Peer-to-Peer); (2) sourcing collaboration (P2O, or Peer-to-Organization); and (3) trading collaboration (O2P, or Organization-to-Peer).

1. **Pure collaboration:** both the obtainer and the provider are consumers (e.g. a secondhand purchase/sale at a flea market);
2. **Sourcing collaboration:** the provider provides a resource or service to the obtainer through a mediator (e.g. resale of a pre-owned television set to a secondhand electronics shop);
3. **Trading collaboration:** the obtainer obtains a resource or service from the provider through a mediator (e.g. the consumer who purchases the television set from the secondhand electronics shop).

Pure collaboration involves direct P2P exchanges, in which consumers directly exchange a specific resource or service. For example, on online platforms (e.g. Peerby, Kijiji, eBay or Couchsurfing), consumers directly provide and obtain resources or services. Although these online platforms are intermediates they are not "mediators", because consumers are free to devise the terms and conditions of distribution and consumption of the resource or service together, whereas mediators interfere in the devising. For example, the Canadian-based "ridesharing" website Amigo Express does not allow obtainers (service obtainers) and providers (service providers) to get into contact to arrange the terms of the ride, rather each needs to separately contact and pay a fee to the website in order to, respectively, obtain and provide the service. Most P2P websites are online platforms and operate on the freemium model, where the use of the website is free, but premium features must be paid for (e.g. Kijiji) (Scaraboto, 2015, p.164). Others have a donationware mode of exchange, whereby website use is free but financial donations are requested or accepted to offset production and maintenance costs (e.g. The Khan Academy) (Scaraboto, 2015, p.164).

Sourcing collaboration includes, for example, refurbished or reconditioned products, sold by conventional organizations, but provided by providers who were, for some reason, dissatisfied with the products in question. Other examples include antique dealers, consignment shops or pre-owned books dealers on Amazon.com. Similarly, online platforms which take a percentage off the transaction cost in supposedly P2P exchanges (e.g. Über, Instacart, Task Rabbit, Airbnb), actually outsource the fulfillment of specific tasks or jobs to consumer A in order to efficiently redistribute those to consumer B. In short, instead of manufacturing / purchasing a good or delivering a service by themselves, such organizations rely on providers and obtainers to perform both. They benefit from the Internet to mediate, at a cost and more efficiently, exchanges that would otherwise be authentically P2P exchanges. New technologies have therefore sparked entrepreneurial creativity to develop new breeds of intermediates. They claim to challenge conventional business, and they do so, because they operate business differently, without delivering or producing anything, but by capitalizing on the logics of 'crowdsourcing'. Also, a tangible resource may circulate across multiple organizations (intermediates) from the provider to the obtainer. For example, a car sold by a consumer to a professional car dealer may then be sold and resold by several other car dealers, before being eventually resold to a consumer.

Trading collaboration is the corollary of 'sourcing collaboration'. It is consumer B who obtains a cheap refurbished iPhone or who enjoys a Montreal-Toronto commute in a high-end car driven by consumer A, via ÜberXL. It is the converse of sourcing collaboration, in that it refers to the obtainer who enjoys a resource mediated by an organization but originally provided by a provider via sourcing collaboration.

CC is therefore salient in a multiplicity of resource circulation systems in which the core characteristic is that consumers are able to switch sides. As obtainers, they perform trading collaboration with organizations or pure collaboration with providers; as providers, they engage in sourcing collaboration with organizations, or in pure collaboration with obtainers. In sum, CC can be defined as:

The set of resource circulation systems which enable consumers to both obtain and provide, temporarily or permanently, valuable resources or services through direct interaction with other consumers or through a mediator.

SIMILARITIES AND FRONTIERS WITH RELATED CONCEPTS

Discriminatory criteria

Consumers' capacity to switch roles from provider to obtainer and from obtainer to provider, in a given resource distribution system, constitutes the key distinguishing criteria between conventional consumption and CC. Conventional consumption – which underlies classic marketing thought – is a type of resource distribution system which involves passive consumers (not obtainers), who cannot, or are not given the capacity to, provide any resource or service (not providers). Incapable of engaging either in obtainment or in provision, their role is limited to that of buying – monetary exchange - and consuming organization-made resources or services, and, in the case of tangible resources, to discard them. Although a whole literature stream started to acknowledge consumers' capacity to provide resources in addition to obtaining them (Stone et al., 1996; Gregson et al., 2007; Harrell and McConocha, 1992; Hanson, 1980), today, however, academia has devoted precious little research to integrate disposition practices and alternative means of consumption-other than conventional consumption-into theory development and consumer behavior studies. So, from a paradigmatic perspective, the marketing discipline still appears to conceive the consumer as being confined to a role of goods and services buyer-destructor with a limited input in other consumers' consumption processes or in organizations' supply chains.

Acknowledgement of CC challenges that conception. Once it can be acknowledged that consumers can dispose of resources, it follows that they become suppliers or providers of that resource to another party. They cooperate or collaborate with other actors in the market. The idea of cooperation or collaboration has generally been confined to production and B2B relationships (Robert et al., 2014; Perret, 2015). CC epitomizes the overspilling of cooperation or collaboration outside of the production sphere toward that of exchange (Perret, 2015). CC disrupts therefore marketing because it clamps market economies into the social while inserting economic activities into social networks (Laville, 2008; Scaraboto, 2015; Lessig, 2008). It embodies practically the abstract idea that "economies are not the product of intersection between two pure, existing economies [market and nonmarket economies] but are constituted by an interplay of logics and modes of exchange that could occasion a hybrid if their struggle (...) persist or move toward becoming more of a market or nonmarket-like economy should performativities favouring one set of logics and modes of exchange prevail" (Scaraboto, 2015, p.157).

The consumer process

After having defined CC and the different concepts that are attached to it, it is also useful to define the process by which consumers perform CC. According to Actor Network Theory (ANT) and convention theory (Latour, 1997, 2005; Boltanski and Thévenot, 2005), the market is a dense network of mechanisms and possibilities e.g. prices, retail spaces, social conventions and norms that enable market actors to coordinate their actions (Callon, 1986 in Dubuisson-Quellier and Lamine, 2008). It prioritizes networks and behaviors over human agency (Bajde, 2013; Loyal and Barnes, 2001). These mechanisms produce consumer processes of delegation or empowerment (Dubuisson-Quellier and Lamine, 2008).

1. **Delegation:** Delegation relates to the ANT concept of purification, a modernist conception characterized by critique and separation (Latour, 1997; Bajde, 2013). Purification displaces culture and technology. It is most common and most effectual in conventional consumption practice and in consumption studies (Bajde, 2013, p.236). Purification thus assumes a clear distinction between "organizations / production and society / consumption" (Perret, 2015) or "market economies" vs. "nonmarket economies" (Scaraboto, 2015). Consumers on the society / consumption side, delegate the supply of resources to organizations / production and perform exclusively conventional consumption. They rely on organization-made advertising, texts, logos, labels, trademarks, brands and other communication cues to choose among the vast morass of goods or other types of resources that are offered to them (Miller, 1987, 1998). This situation is stable in that consumers cannot obtain or provide anything. Hence the purchase of staples in groceries; of (semi-)durables or semi-durables in commercial centers; of lodging in hotels; of leisure and entertainment in cinemas, amusement parks, restaurants; or of financial management in banks and insurance firms;

2. **Empowerment:** Empowerment refers to the ANT concept of translation (Latour, 1997; Bajde, 2013), a postmodernist concept characterized by assemblages (actor-networks) and proliferation in which things are distributed, transported through assiduous association and transformation (Kjellberg and Helgesson, 2007). Contrarily to delegation, consumers are empowered to collaborate directly with each other (Dubuisson-Quellier and Lamine, 2008). Through co-constituted assemblages, they organize, arrange and negotiate informally the terms and conditions of production, distribution and consumption. For example, in farmers' markets, farmers are considered as peers, with whom consumers negotiate directly about conditions in which produce should be cultivated (Dubuisson-Quellier and Lamine, 2004, 2008);

3. **Quasi-empowerment:** In the case of CC, a third hybrid category entitled Quasi-empowerment could be added. While empowerment involves clearly pure collaboration, quasi-empowerment involves both sourcing and trading collaboration. As a middle-ground between empowerment and delegation, in cases of sourcing collaboration, consumers provide inputs into production or distribution in collaboration with a third-party, but the third-party is responsible for the successful trading of the resource or service to other consumers. For example, consumers may be allowed to co-produce or co-create goods or services with established organizations (Prahalad and Ramaswamy, 2004); or they may be allowed to trade-in used games for new ones with video games merchants (Guiot and Roux, 2010, p.397). In both cases, the mediator keeps an important level of control over most the production and the distribution process, which is why consumers only enjoy quasi-empowerment.This is the second example of listed material.

These three consumer processes, which could be considered as a continuum from delegation to empowerment with quasi-empowerment in-between, can be positioned against another axis scale of perceived distance (Sahlins, 1972, in Arnould and Rose, 2015, p.6). Smaller scales of social distance involve processes that take place with family, friends, relatives and then acquaintances, while larger scales denote collaboration with strangers. Because increased capacity to connect strangers lies at the crux of the current re-emergence of CC as a phenomenon (Botsman and Rogers, 2010; John, 2013a), the focus will be put on large-scale social distance, i.e. people with whom levels of sociality are very low.

Forms of Collaborative Consumption and Frontiers with Other Concepts

Table 2 introduces the concepts referring to different resource circulation systems, according to the level of collaborative intensity (sourcing, trading, or pure) that they involve as well as the consumer process (delegation, empowerment, quasi-empowerment), that each of them entails. As discussed previously, the focus is put on resource circulation systems which imply large social distances, thus excluding close social circles such as family, relatives and friends.

Table 2
RESOURCE CIRCULATION SYSTEMS, COLLABORATIVE INTENSITY AND CONSUMER PROCESS

Resource circulation systems	Collaborative			Collaborative consumption	Consumer process	Examples involving tangible and intangible types of resources
	Sourcing	Trading	Pure			
Conventional consumption	None	None	None	No	Delegation	-Consumers buying resources at a cost from conventional retailers or directly from manufacturers (e.g. Buying a Chromecast receiver from a Best Buy store)
Reconditioned /refurbished consumption	Yes	Yes	None	Yes	Quasi-empowerment	-Consumers trading in/buying pre-owned resources with/from an organization (e.g. Ikea trade-in programs) -N/A to services
Sharing	N/A	N/A	N/A	No	Empowerment	-Neighbors share a tree located in-between their respective house properties -Colleagues share a 'Potlatch' meal
Free P2P access	None	None	Yes	Yes	Empowerment	-Consumers borrowing/renting out resources temporarily for free from/to other consumers (e.g. Peerby) -Consumers obtaining/providing services for free from/to other consumers (e.g. Couchsurfing)
Compensated P2P access	None	None	Yes	Yes	Empowerment	-Consumers renting (out) a resource temporarily at a cost from (to) other consumers (e.g. Rentable) -Consumers obtaining/providing a service temporarily at a cost from/to other consumers (e.g. Covoiturage.org)
Free mediated access (peer resources)	Yes	Yes	None	Yes	Quasi-empowerment	-Consumers borrowing/renting out pre-owned resources temporarily for free from/to an organization (e.g. community sharing center) -Consumers obtaining/providing a service temporarily for free from/to other consumers through the coordination of a third-
Compensated mediated access (peer resources)	Yes	Yes	None	Yes	Quasi-empowerment	-Consumers renting (out) a resource temporarily at a cost from (to) other consumers via a for-profit mediator (e.g. Getaround, Turo, EasyCar Club, Drivy, RenttheRunway) -Consumers providing/obtaining a service temporarily at a cost to/from other consumers via a for- profit mediator (e.g. Über, Airbnb, Livementor, Lyft, TaskRabbit, Instacart, Tok
Free mediated access (organization resources)	None	None	None	No	Delegation	-Consumers renting a resource for free from an organization (e.g. public libraries, toy-lending libraries) -Consumers access services provided by organizations for free (e.g. Fab Labs)
Compensated mediated access	None	None	None	No		-Consumers renting a resource at a cost from a commercial rental scheme (e.g. Bixi, Car2Go, Zipcar, Lokéo, U-Haul, Rent-a-Car, Avis, Hertz, Stylelend, LendingLuxury, Vestiaire
P2P marketplace	No	No	Yes	Yes	Empowerment	-Consumers purchasing/reselling secondhand from/to consumers (e.g. flea markets, car boot sales, garage sales, eBay/Amazon pre-owned goods sections, Kijiji, Gumtree,
Mediated marketplace	Yes	Yes	No	Yes	Quasi-	-Consumers buying secondhand/reselling goods from/to mediators (e.g. consignment shops, antique dealers, thrift stores, retro-shops, auctions sales, secondhand stores or
P2P swapping	No	No	Yes	Yes	Empowerment	-Consumers swapping resources with other consumers (e.g. swap meets, SwapTree) -Consumers swap skills and services with other consumers
Mediated swapping	Yes	Yes	No	Yes	Quasi-empowerment	-Consumers swap resources from a set of resources pooled by a mediator (e.g. Troc-t-Trucs) -Consumers swap skills and services through a mediator-

P2P gift-giving	No	No	Yes	Yes	Empowerment	-Consumers giving/receiving resources for free to/from other consumers (e.g. Freecycle) -N/A to services
Mediated gift-giving	Yes	Yes	No	Yes	Quasi-empowerment	-Consumers giving/receiving pre-owned resources for free to/from an organization (e.g. charities, food banks, GoFundMe) -N/A to services
Mediated hybrids	Yes	Yes	No	Yes	Quasi-empowerment	-Consumers give resources for free to organizations which then resell them (e.g. Yerdle, The Salute's Army, Minitrade, examples from 'mediated marketplace' when consumers do not resell but give away resources for free) - N/A to services

Conventional consumption designates a resource circulation system in which consumers follow a delegation process, because they can neither provide resources to organizations, nor obtain such resources. Consumption becomes collaborative as soon as empowerment possibilities are offered by the conventional manufacturing and retailing system to consumers (e.g. trade-in schemes), involving sourcing and trading collaboration, and which is called refurbished / reconditioned consumption, a form of quasi-empowerment that applies essentially to tangible resources.

Sharing is defined as "the act of distributing what is ours to others for their use and/or the act and process of receiving or taking something from others for our use" (Belk, 2007, p.126). Under sharing, provision or obtainment become attenuated and irrelevant, since the resource is not exchanged but owned jointly (Belk, 2007, 2010). Yet, attenuation and irrelevance does not mean suppression, because under specific situations (e.g. divorce), previously latent ownership rights become salient again (Arnould and Rose, 2015; McAlexander, 1991). Instead of sharing, Arnould and Rose (2015) have proposed the concept of "mutuality", a higher-order orientation underlying forms of exchanges, as a metaphor of inclusion, nearing concepts such as generalized reciprocity (Sahlins, 1965), social utilitarianism (Giesler, 2006) or communal sharing (Fiske, 1992). It is "action that entails the assumption that another party would act toward the first party in a similar, mutual, fashion if circumstances were reversed, as guaranteed by their mutual inscription in a common social frame" (Arnould and Rose, 2015, p.14-15). Resources are allocated without calculating returns, and there is a low level of formality as well as a low need to acknowledge what is taken and given (Fiske, 1992). It is most prominent in the household sphere (Belk, 2010; Douglas and Isherwood, 1979).

Either sharing or mutuality may be used, and both denote "a metaphor of inclusion" (Arnould and Rose, 2015). More specifically, in a given resource circulation system, both usage and ownership are shared. Sharing neutralizes thus, at least temporarily, the distinction between provider and obtainer and thus the switching between both roles. If one draws a line in a sand spot, crossing that line is made possible but if no line is drawn in that sand spot, then there is nothing to cross, although the same sand spot is being walked upon. Sharing boils down to the erasing of that line in the sand, and to the recognition of one common spot in the sand instead of that spot being separated into two distinct areas. In other words, sharing is a tacit or implicit agreement related to a supposedly permanent denial of obtainer(s) and provider(s) statuses, of the notion of a resource circulation system and thus of the notion of exchange.

As explained earlier, specific life events or circumstances such as divorce or interpersonal conflicts, may threaten sharing so that original ownership rights may ultimately resurface. Once a

consumer reclaims a resource that was originally pooled and subject to joint usage and ownership (shared usage and shared ownership), the 'alienation' of that resource from the sharing system reinstalls potentialities of collaboration (Curasi et al., 2004), because that consumer may provide the resource to potential obtainers.

Further, because sharing refers to the mental model of Communal Sharing in which people treat - or at least, pretend to treat - material objects as things they have in common (Fiske, 1992), it is therefore rooted in empowerment. The resource is theoretically regarded as a commons, without regard for how much any individual uses or takes; everything belongs to all together and individual shares and property are not marked (Fiske, 1992, p.694). There may be certain hierarchies and levels of ownership intensity within a given sharing sphere (Ostrom and Hess, 2007), but distinguishing between obtainer and provider is irrelevant since resources do not undergo discrete exchange patterns and thus ownership and usage transfer. Rather, they are embedded in a continuous and evolutive (narrowing or widening) circle of ownership and usage sharing (Albinsson and Perera, 2012, p.306). Considerations of sourcing, trading or pure collaboration are thus irrelevant since sharing is not rooted in exchange.

Although this assertion might be counter-intuitive because sharing is inherently something that appears collaborative, for the present conceptualization of CC, it is not. The case of sharing is also an excellent one to demonstrate the independence between consumer process and collaborative intensity. Consumer process refers essentially to the extent to which consumers are emancipated from conventional retailing (Dubuisson-Quellier and Lamine, 2008). Empowerment signals maximal emancipation and is at its highest when no intermediary is involved (i.e. P2P) or when the logic of exchange, derived from the notion of commodity exchange and underlying the mental model of market pricing (Fiske, 1992, p.196; Komter, 2005), is bypassed (i.e. sharing). For each type of resource distribution system that integrates pure collaboration (i.e. P2P), empowerment is adjunct because it signals independent consumers who are the only ones responsible for the exchange. Besides, for each type of resource distribution system that does not acknowledge the existence of individual property, empowerment is similarly adjunct, because such a system transcends the notion of exchange and exclusion in favour of mutuality (or commensalism [Hawley, 1950]) and inclusion (Arnould and Rose, 2015).

Collaboration, on the other hand, is rooted in exchange and characterizes the various levels through which, consumers collaborate with each other or with other organizations to make resources circulate across closed-ended ecosystems of sharing, through temporary or permanent transfer of ownership rights. As such, although P2P exchanges involve empowerment, they are still rooted in the notion of exchange and, as such, qualify for attributions of collaborative intensities.

In brief, sharing overlaps with CC when consumers (re-)associate the ownership rights of a resource with (a) particular consumer(s); or when compensations are provided to the supposed owner / provider, in order to use the resource. Both conflate respectively with free and compensated P2P access. They also refer to empowerment.

Access and related concepts are temporary acquisition or disposition of a resource. More specifically they refer to "transactions that may be market mediated in which no transfer of ownership takes place" (Bardhi and Eckhardt, 2012, p.881). Contrarily to sharing, which involves shared usage and shared ownership, access does not involve joint ownership (Bardhi and Eckhardt, 2012). Usage is shared but ownership is not. For example, different consumers who share the usage of a car to get from Montreal to Toronto share the usage of the car, but car ownership rights remain legally attached to the car owner. Also, Access may be free or compensated; and P2P or mediated.

Therefore, certain aspects of Access overlap with CC but others are clearly excluded from it.

First, there is a thin line between free P2P access and sharing. However, sharing involves joint ownership (Belk, 2007, 2010), or at least, a temporary and tacit recognition that ownership rights are being detached from a specific individual and shared with others. Free P2P access, on the other hand, involves no transfer of ownership or joint ownership (Ostrom and Hess, 2007; Bardhi and Eckhardt, 2012).

Second, the provision of compensation to the lending consumer would indicate a shift toward compensated P2P access. Whether free or compensated, the fact that consumers interact directly to discuss the terms and the conditions of the access, would mean that they follow an empowerment process.

Third, some organizations may also grant free access to resources sourced collaboratively such as in community centers, where, usually, not for profits coordinate the process in which consumers may rent out their goods for free to others and may take them back whenever they want. Such a system corresponds to quasi-empowerment. In Table 2, this practice refers to free mediated access (of peer resources).

Fourth, when resources to which an organization grants compensation-based access, have initially been provided by consumers, CC is manifest through sourcing (trading) collaboration. Consumers on both ends enjoy quasi-empowerment. Usually, the third-party or mediator takes a certain percentage on the price of the transaction, or requests users to pay membership. Entrance or listing fees and other types of charges are added in certain circumstances such as "late charges" for obtainers or providers who do not behave on time, "no show up charges", for obtainers or providers who do not show up at all. Über and Airbnb, for services, or Zilok and BMW's Drivy, for goods, are prominent examples into that category of compensated mediated access (of peer resources) (Table 2).

Fifth, access offered by organizations such as Zipcar, Daimler's Car2Go or tool libraries are compensated mediated access (of organization resources) (in Table 2). They do not allow for any form of collaboration and involve delegation. They correspond therefore to the access-based form of conventional consumption.

Sixth, there are many instances were organizations provide goods, and especially, services to consumers. In public libraries or toy-lending libraries, consumers borrow goods for free. Similarly, consumers may access to fab labs (i.e. fabrication laboratories) which are open innovation centers that provide access to modern means of invention to consumers, for free. Access to any type of resources comprised within a fab lab, university, or museum, including towels in the bathroom, do not involve CC. Consumers delegate the whole process of providing the resource and infrastructures to organizations, and they do not provide or obtain any type of resource, which indicates therefore absence of CC. The paragraph about hybrid economies brings some nuances to that assertion.

In addition to temporarily accessing to resources, consumers may also acquire or dispose of them permanently.

First, P2P marketplace refers to monetary exchanges in which consumer purchase or resells pre-owned goods directly with one another. The intensity of their collaboration is therefore high because it is P2P and the consumer process involved is one of empowerment.

Second, in mediated marketplace, consumers are able to purchase from and to resell to a mediator such as a conventional store or a second hand store; collaboration become of trading or sourcing nature and the consumer process is quasi-empowerment.

Third, P2P swapping indicates that consumers directly exchange resources in person, involving pure collaboration and empowerment.

Fourth, the introduction of a mediator between swappers causes the consumer process to become one of quasi-empowerment because consumers exchange indirectly through a coordinating mediator, which is mediated swapping.

Fifth, consumers may give away resources for free without any compensation in return. P2P gift-giving involves consumers who give and others wo receive, without any mediator. The process is one of empowerment.

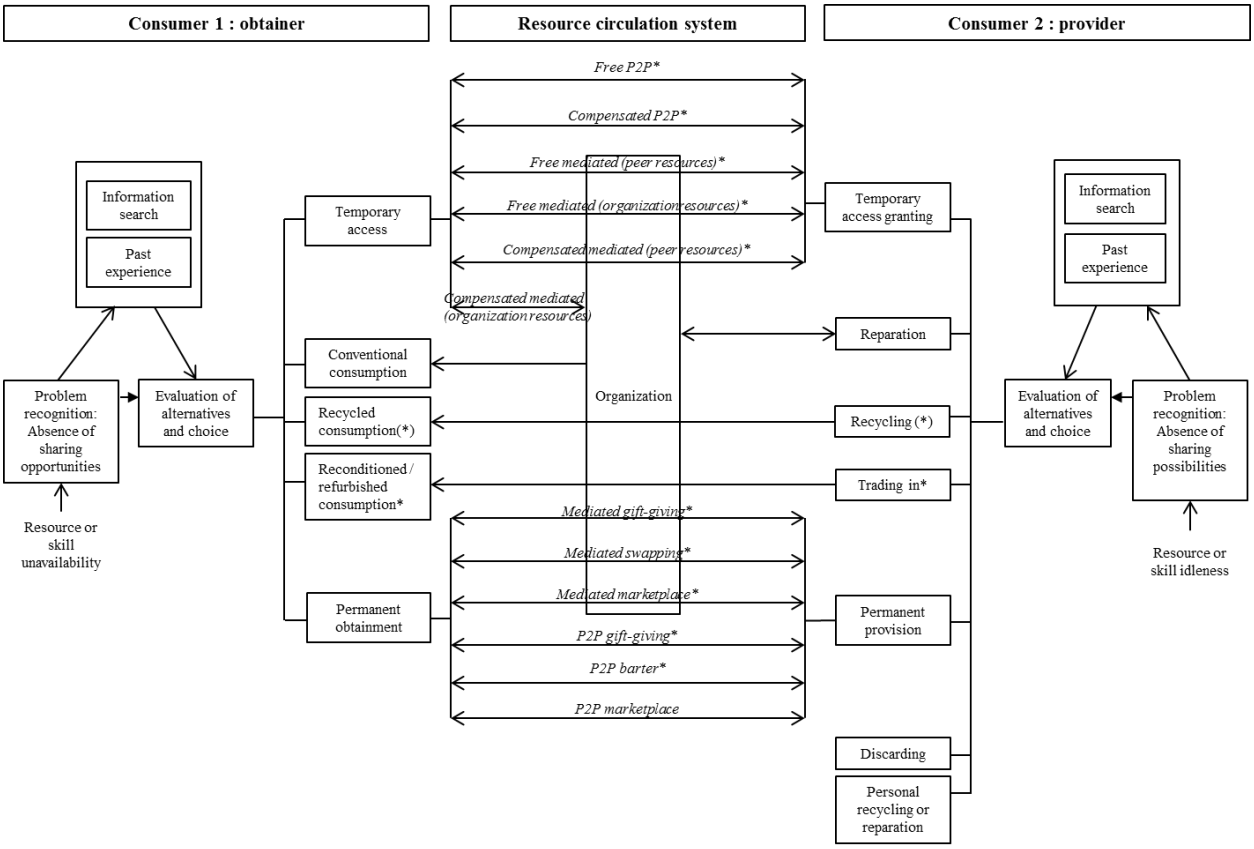
Sixth, in an attempt to render git-giving and resource redistribution more efficient, some mediators such as online platforms (e.g. Kiva) or charities redistribute resources to consumers who need them. Through mediated gift-giving, the intensity of collaboration is therefore of trading and sourcing type and the consumer process is one of quasi-empowerment.

Hybrid economies designate resource circulation systems in which different modes of value exchange paradigms (gift-giving, swapping or monetized exchange), occur within a given resource circulation system (Corciolani and Dalli, 2008; Dalli and Corciolani, 2014). All the different resource circulation systems listed so far, in Table 2, involve the same exchange paradigm across both obtainment and provision. For example, "free P2P access" involves a consumer who may rent out a Playstation 4 for free and another consumer who borrows it. In both cases, free access occurs. As another example, in 'mediated marketplace', a consumer may resell a used car to a car dealership, and that car may be ultimately purchased by another consumer. Usually, consumers get vouchers or gift cards for trading in their pre-owned products, which is equivalent to money. More importantly, both the obtainment and the provision phases, involve a permanent monetary exchange. Scaraboto (2015) defines hybrid economies, as the "coexistence of multiple logics and modes of exchange in a mutually beneficial dynamic, and where new logics and modes for the distribution of resources emerge that resemble but are nevertheless distinguishable from the ones commonly associated with either market or nonmarket economies" (p.155). Therefore, hybrid exchanges indicate the presence of both market and nonmarket practices within a single resource circulation system. For example, many secondhand stores, such as The Salute's Army are donation centers, which receive goods from consumers for free and resell them at a cost to other consumers. Some retailers enable consumers to swap their used goods, which will then be reconditioned or refurbished, to be resold at a cost. In some resource circulation systems labelled as free mediated access (of organization resources), libraries may use procurement systems to purchase new books, but consumers may also supply books that that will be available at libraries. For example, Ozanne and Ballantine (2010) identified that consumers give toys to toy-lending libraries which are then rented out for free to other consumers. These are forms of hybrid economies.

The Collaborative Consumption Stages

By drawing on previous works from the literature stream about disposition (Jacoby et al., 1977; Hanson, 1980; Paden and Stell, 2005; Harrell and McConocha, 1992), the classic stages in the consumer decision making model (Engel et al., 1968) can be adapted to depict CC, as exhibited in Figure 1.

Figure 1
COLLABORATIVE CONSUMER DECISION-MAKING PROCESS



On the left hand-side, Figure 1 starts with the realization of the unavailability of a resource or skill. The absence of sharing opportunities constitutes a problem that is acknowledged by the consumer. Problem recognition then triggers recollection of past experiences involving conventional consumption or obtainment and/or information search on ways to conventionally purchase or obtain the resource (Gregson et al., 2007). The search and memories recollection process may also be bypassed. The consumer then evaluates obtainment alternatives, in addition to conventional consumption ones, and further decides whether to access to the resource temporarily or acquire it permanently. Double arrows indicate temporary access with the resource returning to the initial proposer (i.e. access).

Going to the right hand-side of Figure 1, Botsman and Rogers (2010) indicated that one of the key foundations of CC was 'resource or skill idleness'. Sharing possibilities are absent, perhaps because a former sharer has died, divorced, moved or relinquished ownership rights. A tangible good may be underused, unused or unwanted and falls prey to provision (Curasi et al., 2000). Similarly, a skill may be underused or unused because of a job loss or a lack of opportunity to exert that skill for useful purposes. Consumers' evaluation and choice of an appropriate disposition system is influenced by past experience (Gregson et al., 2007) as well as information search, but could also bypass those steps, such as when a consumer thinks spontaneously of providing a resource to a consumer with whom she is interacting and who may be in need of the resource. For example, one consumer may be speaking of her need of a child's bed while the other realizes that

she has one and gives it to her. Consumption is collaborative when the consumer, who becomes a provider, either disposes permanently or temporarily of a resource through P2P exchanges (pure collaboration), or mediated exchange (sourcing collaboration). Sharing is again outside of the scope of CC. When consumers rely on organizations or professionals to discard resources, they follow a process of delegation which deters them from switching sides. When they perform either repairing or recycling personally (e.g. composting) and with their own private means, they do not exchange but follow empowerment, because they rely upon themselves. Just as for sharing, personal recycling (e.g. composting) and repairing as well as discarding, are cases in which collaboration is thus irrelevant. Mediated recycling is more ambivalent because the resource is destroyed by an organization and used as input for other types of resources, which is different from all the other types of exchanges which incur an integer or slightly modified resource (e.g. reconditioned, refurbished). Therefore, mediated recycling is a type of ambivalent collaboration which involves sourcing and trading exchange, through a consumer process of quasi-empowerment. If you have extremely complex figures, or if you have trouble placing them in the manuscript, you may need to consider engaging us to process the figures. You may contact us for a price quote for any aspect of the formatting process.

DISCUSSION AND IMPLICATIONS

Theoretical Contributions

This paper seeks to contribute to the emerging literature gravitating around the concept of collaborative consumption (Lamberton and Rose, 2012; Bardhi and Eckhardt, 2012; Arsel and Dobscha, 2011; Albinsson and Perera, 2012; Harvey et al., 2014; Hamari et al., forthcoming; Belk, 2014). Given the lack of any clear definition of CC, and a common confusion with the "sharing" concept, the most important contribution of this paper is to suggest a conceptualization of CC and to clarify its relation to adjacent concepts such as sharing or access. CC is defined as, the set of resource circulation systems which enable consumers to both obtain and provide, temporarily or permanently, valuable resources or services through direct interaction with other consumers or through the mediation of a third-party. The key discriminatory criteria to distinguish between CC and other forms of resource circulation systems (e.g. conventional consumption), can thus be expressed in terms of collaborative intensity: any exchange channelled through a resource circulation system which allows consumer to switch sides from 'obtainer' to 'provider', can be deemed collaborative, whether it is free or compensation-based, peer-to-peer or organization-mediated, online or offline, involving a transfer of ownership or not.

Belk (2014) suggested that CC is a subset of Bardhi and Echardt's (2012) 'Access-based consumption'. Instead, the aforementioned definition implies that the concept of Access, as originally defined in the property rights literature (Ostrom and Hess, 2007; Hess and Ostrom, 2007; Schlager and Ostrom, 1992), is a specific form of CC. Regardless of whether it is P2P (free or compensated) or mediated (free or compensated), whenever the resource being exchanged has been initially sourced by another consumer, the resource circulation system embedding exchange encapsulates CC. Therefore, not all forms of access-based consumption pertain to CC, especially if they are market-mediated and use solely organizational private assets, contrarily to what has been reported in the literature (e.g. Lamberton and Rose, 2012; Bardhi and Eckhardt, 2012; Belk, 2014). Resource circulation systems which involve compensated mediated access (to organization resources) such as Car2Go, Zipcar, Communauto, Bixi and likes do not correspond to collaborative forms of consumption since: 1) they do not involve trading or sourcing collaboration and, 2) they

put consumers into a delegation process. By now, the complete irrelevance of such resource circulation systems with sharing is even more evident. More genuine CC schemes refer, for example, to Daimler's Drivy which is a P2P platform enabling consumers to rent (rent out) their car from (to) others, and the website takes a percentage on the renting price, which corresponds to sourcing and trading collaboration, as well as a quasi-empowerment consumer process.

This paper also makes a strong case in recusing the concept of 'sharing economy' that has been recurrently utilized by many business press outlets, commentators and analysts, even in negative critics. Rather, CC is everything but sharing as it starts where sharing ends and it ends where sharing starts (see Figure 1). Sharing involves de jure or de facto joint ownership and usufruct (Arnould and Rose, 2015; Belk, 2007, 2010), whereas the modes of value exchange headed under CC imply either permanent transfer of ownership and usage rights (reconditioned / refurbished consumption, gift-giving, barter and marketplace) or transfer of usage rights only (access).

It appears that the only setting involving genuine sharing and which is characterized by large social distances, is the digital context, and especially Web 2.0, whose constitutive activity is sharing (John, 2013b). Both usage and ownership are de facto being shared (Giesler, 2006; Airgrain, 2012). Digital examples of sharing abound such as open source P2P money systems (e.g. Bitcoin, Bristol Pound), user-generated content platforms (e.g. Wikipedia, YouTube), open source software and operating systems (e.g. Linux/Unix), P2P file-sharing (e.g. BitComet), and hybrid which involve sharing and other types of exchanges (e.g. Creative Commons, Dailymotion's pay-per-video option). Many online platforms reclaiming themselves from the so-called "sharing economy" involve no sharing at all. They do enable collaboration by extending its scope to unprecedented levels or drive collaboration by encouraging its materialization in offline and more diversified settings and many of them are P2P (John, 2013a), but the type of resource circulation that they involve is not 'sharing'. The future of the "sharing economy", if one may allow the term, may rather lie with participatory web cultures such as folksonomies, which are "archive sites where users contribute data to the archive and metadata to organize the archived content" (Beer and Burrows, 2010, p.5), such as YouTube, Flickr, Creative Commons or Wikipedia, which are now well-known and valuable cultural brands (Beer and Burrows, 2010).

Managerial Implications

The study suggests that conventional organizations, especially companies, are not the desperate losers as the media often portray. Rather, they are central not only for conventional consumption but also for a variety of CC forms of exchange. Organizations are part of resource distribution systems which aim at offering maximized value for consumers (Kotler and Keller, 2006). Yet, for consumers, value may not be limited to the purchase of a good or a service. Exchange is source of value (Simmel, 1978), and since exchange involves two facets, for consumers, value may not only reside in acquisition but also in proposition. Overall, marketers – regardless of their industry sector – may benefit from reconsidering how they consider 'maximizing consumer value'. Allowing consumers to play a more active role, beyond participation in advertising or product design as discussed in the co-creation literature (e.g. Ramaswamy and Pralahad, 2004), may have several advantages. It creates value for consumers in that the brand or company is now associated to a valuable partner in consumer economies, but may also lead to synergies in selling i.e. cross-selling, up-selling (Paden and Stell, 2005), and attract new segments of consumers who prefer to acquire lower-priced or re-used resources (Chu and Liao, 2007).

Marketing communications could emphasize the recourse through collaborative sourcing as a sustainable effort on part of the company to not only increase usage intensity through access but also foster environmental protection through the reuse of pre-owned resources. In other terms, this means coupling the advantages of access (practicality, intensity of usages) to the circular economy (extension of the resource lifecycle, reconditioning, reuse) (Robert et al., 2014). Companies offering CC access would also benefit from marketing the difference in cost between resource ownership and resource access (Leisman et al., 2013).

Because of cognitive lock-in resulting from the perception of a higher efficiency in re-using web platforms that are already mastered i.e. the Power Law of Practice (Johnson et al., 2003), consumers consult generally only a few websites in order to access various resource distribution systems (e.g. secondhand purchase, carsharing, gift-giving). For a company, as long as congruence is observed with its market positioning and branding, it may be worthwhile to develop a P2P consumer marketplace along conventional consumption offerings, on a unique website. For example, a sports equipment retailer website could include a forum or platform on which consumers can swap, donate, resell or purchase resources secondhand, organize homeswapping or carsharing for trekking outings, and so on. Previous research demonstrated that a cannibalization effect may be offset by the fact that consumers may easily dispose of resources on the website in order to acquire new ones, which would in turn lead to more product sales form the retailer (Paden and Stell, 2005). Some consumers even buy with the intention to resell which brings them cash to recover the original purchase payment and re-purchase other new or pre-used goods more easily (Chu and Liao, 2007, 2010; Liao and Chu, 2013; Nissanoff, 2006). Such efforts may also generate more favourable attitudes toward the organization, increase loyalty, trust and satisfaction.

Eventually, for companies which need to constantly remain in close contact with their markets because those represent rapidly shifting consumer subcultures such as, for example, Schouten and McAlexander's (1991) Harley Davidson biker community, the integration of consumers in co-production and co-creation is an interesting instance of CC through sourcing collaboration.

The current hype surrounding the 'sharing economy' is already driving existing and new organizations to position themselves in the so-called 'sharing segment' or 'sharing economy', and exposing themselves often quite unwillingly to 'sharewashing'. Yet, if companies position their business as sharing, while it is indeed compensation-based access (or even free-mediated access), this could undermine their credibility and reputation in the eyes of consumers and critics. Emphasizing economic, social and environmental advantages of their business model, with direct positive impacts on consumers' lives (Carrigan and Attalla, 2001), would be more honest, more credible, foster consumer trust and direct attention to distinct competitive advantages, because now everybody trumpets to be in the so-called "sharing economy" anyways.

Societal Implications

The present study enlightened the fact that many so-called "P2P business models" claiming to be part of the "sharing economy", are actually "compensated mediated access of peer resources". But verbal misuses have already been discussed and if that would all there was to discuss, everything would be just fine. However, such organizations are at the heart of rising polemics because they also often cause negative effects on society at large. For example, in a comment posted to The Press Project Blog on Friday 24 in 2014, P2P business models do not contribute to social welfare systems, impose disloyal competition to established economic agents, generate the emergence of a multiplicity of intermediaries (e.g. organizations taking fully in charge the posting

of ads on Airbnb, or of the cleaning of properties listed on that same platform), and put providers in a precarious situation (e.g. absence of legal work contracts, absence of social benefits scheme, undefined professional status). From a social perspective, these organizations extend the market to the private sphere contributing to an increased commodification of all aspects of life (Perret, 2015). According to the comment posted on The Press Project Blog cited previously, every privately-owned asset or act of mutual aid (e.g. housing friends for free), has an opportunity cost which undermines genuine sharing or free giving away. Extended commoditization is marketed under a rosy package of appealing values such as mutuality, collectivism and disinterestedness. While some organizations are genuinely based on values of mutuality, cooperation, benevolence and financial disinterestedness such as Couchsurfing, or Local Exchange Trading Systems, others clearly take advantage of the legal, financial, fiscal or political – and obviously, conceptual - mist surrounding CC and the "sharing economy" to design peer-sourced business models that are everything but sharing (in addition to sharing being everything but CC). Rather, they deploy heavy lobbyism to curb institutional attempts to regulate their practices, are committed to shareholder value maximization and the implementation of aggressive / predatory business strategies to achieve organizational goals (Cohen and Kietzmann, 2014).

They do offer useful services in many instances such as temporary employment, additional income or increased savings (Dillahunt and Malone, 2015). They are also innovative, from an entrepreneurial viewpoint, because consumers do not only provide their labour and skills but also their own personal and private resources in order to perform jobs that are in demand but for which there is a shortage in the offer. In October 2014, Juliet Schor wrote in an essay on the Grassroots Economic Organizing website that, through 'new technologies of P2P activity' providers may regain bargaining power compared to regular employees in conventional consumption organizations, but this would require democratizing both ownership and governance of these online platforms. In other terms they should become truly P2P and involving empowerment, because as this study shows they are currently mediated and entail, at best, quasi-empowerment.

Deeper discussions about the normative aspects of these business models are beyond the scope of this article, rather what is contended is their affiliation to a so-called "sharing economy" and scholars' re-use of that same misleading rhetoric. Rather, and very beneficially so, because they involve sourcing and trading collaboration (not pure collaboration and not sharing), they are manifest instances of CC.

Limitations and Avenues for Future Research

Inter-organization as well as intra-organizational collaboration has been the subject of a large corpus of research in the strategic management literature (e.g. Martin and Eisenhardt, 2010; Galunic and Eisenhardt, 2001), because it is an important source of economic value for organizations (Bowman and Helfat, 2001). Similarly, collaboration is on the rise in consumer marketplaces because it enables consumers to derive more value-not only economic, but also practical, social, hedonic, symbolic, or ecological-than through conventional consumption (Belk, 2014; Mano and Elliott, 1997; Guiot and Roux, 2010). This novel form of consumption entails therefore important implications for strategic management.

As a first step to dig into the vast concept of collaborative consumption, this study sought to define CC. By so doing it introduced several new key concepts in strategy which are essential to understand the conceptual mapping surrounding CC, and to provide a conceptual framework for subsequent research in strategic management into that domain. Such concepts include: "resource circulation system", "obtainment" and "obtainer" as well as "provision" and "provider";

"delegation", "empowerment", "quasi-empowerment", "pure collaboration", "sourcing collaboration" and "trading collaboration". Other concepts are more straightforward. One key construct that has been used throughout this article is "resource" which, in addition to "services", has been voluntarily kept as large as possible. Many CC exchange schemes involve not only goods or services but land, money, time, skills or space. Since the focus of the article was mainly at delineating the CC concept, potential nuances between different types of resources have not been eschewed. For example, a service is delivered and there is no transfer of either ownership or usage. Skills and knowledge are not only exchanged but become, very likely, shared as soon as they are transferred. Future research could provide a more specific conceptualization of the collaborative process according to the type of resource involved in the exchange, and particularly when that resource is more intangible such as in the case of a service or a skill.

Second and related to the previous point, the variety of collaboration configurations (e.g. C2C, C2B, B2C, G2C, C2G) through highly differentiated forms of resource circulation systems , makes the study of collaborative consumption schemes a complexity phenomenon often termed an "edge of chaos" in the literature (Davis et al., 2009). In addition to the framework proposed into this study, future research could adapt the classic cross-business-unit collaboration framework (Martin and Eisenhardt, 2010) to examine the various collaborative configurations that may exist between consumers and organizations. This kind of research could be of particular value in order to further our understanding of co-creation and co-optation between firms and consumers as initially discussed by Prahalad and Ramaswamy (2000) or Ramaswamy, Venkat and Gouillart (2010).

Third, the media and firm communications have contributed to introduce CC as an "innovation" and discussed it as a strategy to change consumer behaviour to reduce the environmental impact of consumption (Meijkamp, 1998; Shaheen and Cohen, 2007; Jonsson, 2006). Several professional works contributed and still contribute to positioning CC as an innovative concept with intrinsic social benefits (Meijkamp, 1998). Such professional works include most notably Benkler (2006), Botsman & Rogers (2010), Gansky (2010), or Owyang, Samuel & Grenville (2014). The CC innovation was presented as a way to improve the "production process" or certain end results which can be called "units of service" for the consumer, the whole being defined as "consumption technology" (Meijkamp, 1998). Examples of units of service may include, getting a loan, a lift, a meal or accessing clothing. Their corresponding consumption technologies are peer-to-peer lending, carpooling, co-lunching, and secondhand systems. These consumption technologies and the eco-efficient units of services that they allow are therefore introduced as an innovation strategy (Meijkamp, 1998). While posing the whole of CC as being innovative is debatable, most of its web-mediated components are. Future research could investigate in more details to what extent innovative CC schemes (e.g. web-mediated ones) are more eco-efficient than their conventional counterparts.

Further, this study shows the depth of collaboration in consumption and it is actually huge. Although special attention has been granted to be as exhaustive as possible in identifying resource circulation systems in which consumers are able to switch sides from obtainers to providers and conversely, some may have been omitted, either because they have not (yet) been documented in the literature or because their link with CC is ambiguous. For example, a car that is put at the scrapyard by a consumer may involve discarding or recycling. The scraper may also remove valuable parts from the car and resell them to professionals or to other consumers, which corresponds to sourcing-trading collaboration and quasi-empowerment. Varying forms of collaboration are involved but their exact designation implies close scrutiny of the scrappers'

activities. Further research could therefore develop more specific categorizations within each specific type of resource circulation system.

A final remark concerns consumer agency in the decision-making process. Very often, some resources are imposed on the consumer rather than the consumer deliberately seeking a resource, as well as comparing and choosing between different options to get it. This is very prominent in gift-giving where consumers are being "imposed" a good or a service which they did not necessarily ask for. Such circumstance of lower consumer agency, often trigger subsequent disposition intentions, which increase in salience when consumers are aware of CC alternatives to get rid of unwanted items (Chu and Liao, 2007, 2010). This abridges the consumer's decision-making process from its initial phases and may also increase the velocity of resource circulation because the consumer will quickly seek to get rid of the resource. Future research could therefore investigate the extent to which lack of agency in a collaborative acquisition process could be counterbalanced by a (n) (pro) active collaborative disposition process in order to confirm one's capacity to act upon the world.

CONCLUSION

Despite increased attention for Collaborative Consumption (CC), both in academia, by scholars, and in practice, by marketers, a clear definition of Collaborative Consumption is still missing. This study delineates the concept of Collaborative Consumption and compares it to other consumption schemes such as conventional consumption, sharing, access-based consumption or the sharing economy. It posits that Collaborative Consumption refers to all those resource distribution systems which enable the consumer to be either the acquirer of a resource or the proposer of that resource. As such, it defines Collaborative Consumption according to three levels of collaboration and it also introduces the type of process consumers follow in different systems of resource channeling. The implications of this study are then discussed and limitations are highlighted in order to provide avenues for future research in the domain.

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AN OPPORTUNITY EVALUATION FRAMEWORK FOR INTRODUCTORY COURSES IN ENTREPRENEURSHIP

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ABSTRACT

We present a robust framework for opportunity evaluation especially suitable for introductory entrepreneurship courses where an important learning goal is the ability to evaluate business opportunities. The framework is divided into three main elements: Opportunity, Resource Requirements, and Entrepreneur(s). We have used it to guide first-year business students through the business opportunity review process during our introductory entrepreneurship course in a systematic and thorough manner. It is particularly useful when making sense of typically complex entrepreneurial situations. The framework should interest entrepreneurship educators and practitioners engaged in the design and delivery of entrepreneurship curriculum. It specifically addresses two key learning goals recommended for future entrepreneurs: it assists them acquire an understanding for action based on the main entrepreneurial behaviors and ensures they are able to apply entrepreneurial heuristics valuable in start-up and other contexts.

The framework underpins a significant portion of a required Introduction to Entrepreneurship course at our university and has been successfully employed in nearly 150 iterations of the course over the past number of years. It was recently adopted by a Canadian provincial department of education for use at the secondary school level. The experience of both students and instructors has tended to be highly positive. Business educators outside the entrepreneurship domain who often deal with small firm contexts (e.g. marketing, retail management) have also expressed interest in the framework.

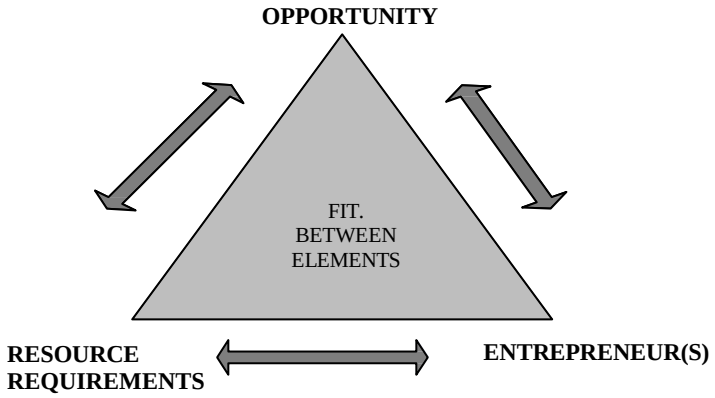
The paper is primarily qualitative in nature, relying on description, critical discussion and logical development of our story. It addresses the concern over the lack of paradigms available to guide curriculum development through the sharing of practice and by stimulating critique and discussion to improve the tools and models available to entrepreneurship educators. At another level we contribute to the wider debate in entrepreneurship education (EE) on what is appropriate entrepreneurship curriculum. We begin by examining the relevant literature and then proceed to describe the history, development, and framework's use at our university, which leads to reflections on its implementation and effectiveness as a tool for EE. We conclude that the framework is suited for students in an introductory entrepreneurship course, entrepreneurs, and a wider audience who wish to understand how an entrepreneurial opportunity can be evaluated. Future work could usefully focus on further empirical validation of the framework.

INTRODUCTION

In this paper we present a framework for opportunity evaluation (for the sake of brevity we will refer to it as the 'framework') especially suited for introductory entrepreneurship courses where the ability to evaluate entrepreneurial opportunities is an important learning goal. The framework is divided into three elements (Figure 1): Opportunity, Resource Requirements, and Entrepreneur(s), each of which is analyzed separately, beginning with the opportunity. After

addressing the three elements the student is asked to evaluate the 'fit' between them, leading to the overall final evaluation.

Figure 1
OPPORTUNITY EVALUATION FRAMEWORK



Adapted from Ronstadt (1984) and Timmons (1999).

This paper is descriptive rather than empirical in nature and consequently lacks a methodology in the standard sense. We rely instead on precise description, critical discussion and logical development of our narrative. The framework should interest a broad range of entrepreneurship educators and practitioners engaged in the design and delivery of entrepreneurship curriculum. The framework underpins a significant portion of a compulsory (for undergraduate business faculty students) Introduction to Entrepreneurship course at our university and has been successfully used in 148 course offerings over the last 10 years. Recently it was adopted by a provincial department of education for use at the secondary school level. Business educators outside the entrepreneurship domain who often deal with small firm contexts (e.g., marketing or retail management) have also expressed interest in the framework. The experience of both students and instructors with the framework has tended, in respect of achieving the learning objectives, to be highly positive.

Effective entrepreneurship education (EE) is arguably more important than ever for economic growth in a globalizing economy. Whilst the growth of EE is well documented (Bechard & Gregoire, 2005; Katz, 2003; Kuratko, 2005; Solomon, Duffy, & Tarabishy, 2002; Winkel, Vanevenhoven, Drago, & Clements, 2013), an appropriate paradigm for teaching entrepreneurship remains the subject of debate (Fiet, 2001; Solomon, Fernald, & Dennis, 2003). As Rideout and Gray (2013) observed, "EE appears to be one of those phenomena where action and intervention have raced far ahead of the theory and pedagogy and research needed to justify and explain it" (p. 346). Indeed, much research has failed to provide convincing evidence that we are actually teaching the skills most important to future entrepreneurs (see, for example, Edelman, Manolova, & Brush, 2008). Despite these criticisms, Martin, McNally, and Kay (2013), in a quantitative meta-analysis of EE, recently concluded that EE is positively associated with both entrepreneurship-related capital assets and entrepreneurship outcomes (pp. 219-222). This paper addresses part of these concerns through the sharing of practice and by stimulating critique and discussion to improve the tools and educational models available to entrepreneurship educators. At another level

we contribute to the wider debate in EE over what should be in our curriculum. We proceed by, first, briefly examining the relevant literature; secondly, describing the history and development of the framework; thirdly, discussing our use of the framework; and fourthly, reflecting on its implementation and discussing its appropriateness as a tool for EE.

LITERATURE REVIEW

The literature relevant to this work focuses on the areas of curriculum development and appropriate teaching and learning tools, methods, and strategies. The scholarship related to curriculum development in a business school context is extensive and has been very useful in assisting entrepreneurship educators improve our students teaching and learning experience (see for example, Fayolle, 2013; Fiet, 2001; Gibb, 2002; Honig, 2004; Rae & Carswell, 2001; Rideout & Gray, 2013; Solomon et al., 2003). There have been three key messages in this literature: firstly, the complexity and uncertainty of entrepreneurial efforts should be reflected in course curricula; secondly, students should be encouraged to develop and understand entrepreneurial tools and behaviors; and finally, more rigorous teaching and learning theory should be applied and elaborated to support our efforts.

These messages are exemplified in the work of a number of scholars. Gibb (2002) called for a paradigm of EE based on a more holistic approach combining the 'for, about, and through' curricula that reflected the complexity and uncertainty entrepreneur's face. Fayolle (2013) proposed a bi-level theory to assist curriculum development (see also, Jones, Penaluna, Matlay, & Penaluna, 2013). He suggested that at the first level educators engage in a philosophical discussion of what they mean by EE. Once this has been addressed, the second or didactic level would have the educator assess their particular audience needs. This is a crucial and helpful point as an audience of potential entrepreneurs will have markedly different learning goals from, for instance, those expecting to become managers. We agree with Gibb (2002) that there are three main student audiences in entrepreneurship: those who want to become entrepreneurs, those who will not become entrepreneurs but will need to use entrepreneurial tools/behaviours to do their managerial work better (i.e. enable the development of what are often called "enterprising" skills), and those who will be in positions to help entrepreneurs (e.g. if they work for government support agencies or with venture capital funds). Following this reasoning, students should leave a mandatory introductory entrepreneurship course where all three student audiences are likely to be represented with a basic knowledge of entrepreneurship, including both entrepreneurship theory - the "about" - and also some of the practical tools, approaches, and behaviours for dealing with the more common problems facing entrepreneurs - the "for" and "through".

A variety of authors have debated appropriate teaching and learning tools, methods, and strategies that could be used in an entrepreneurship course. Some have addressed the question of whether we actually teach the necessary skills (Edelman et al., 2008; Martin et al., 2013; Rideout & Gray, 2013; Vanevenhoven, 2013). Certainly, the need to ensure relevance for particular audiences is becoming more evident. An excellent example of this debate can be seen in the discussion of business planning, a traditional and near universal entrepreneurship teaching tool that has recently come under intense scrutiny (Blank & Dorf, 2012; Bridge & Hegarty, 2011; Honig, 2004; Jones et al., 2013). The debate revolves around whether using a business plan is an appropriate entrepreneurship teaching tool and, if so, for which student audience(s). Many propose that a business plan is an effective entrepreneurship teaching tool as the student must articulate

and therefore learn about the key operational and financial aspects of the proposed business. Others suggest that the learning from business plan creation is largely irrelevant to many students and, indeed, to a real start-up. Another relevant example, closer to this paper's topic, is provided by Clydesdale (2012), whose work arguing that the ability to identify entrepreneurial opportunity can be taught ran contrary to the belief amongst many entrepreneurship instructors. The central message in all of this literature is that we, as entrepreneurship educators, must be careful to use tools appropriate to the learning goals and audience(s). It is to this area that our paper seeks to contribute.

While there is not yet a generally accepted EE teaching paradigm (Fayolle, 2013; Fiet, 2001), we suggest our framework fits well with aspects of EE theory and practice for two main reasons. Firstly, few would contend that opportunity evaluation is not a key skill for entrepreneurs - and arguably those students who will work with entrepreneurs need it too. Edelma et al. (2008), in their insightful comparison between what is taught versus what is practiced by entrepreneurs, observed that "defining the market opportunities/customers, competitors" and "invested own money" are two of the most important nascent entrepreneurial practices. Secondly, using the framework requires a measure of active learning, as students must apply it to their ideas or those of an entrepreneur. Many scholars have theorized that EE should require students to engage in activities that exercise entrepreneurial behaviours, what has been variously termed as "action learning" (Gielnik et al., 2015), "practice-based" learning (Neck, Greene, & Brush, 2014) or learning "for and through" (Gibb, 2005). These ideas derive in large part from Piaget's (1950) and Kolb's (1984) learning theories whereby students learn by iteration and reflection. More generally, theories of knowledge focused on knowing in practice, whereby knowledge is created during the doing of the practice in question (Berger & Luckmann, 1966; Brown & Duguid, 2001) also underpin the framework.

HISTORY & DEVELOPMENT OF THE FRAMEWORK

In the late 1980's, like many business programs at that time, Memorial's entrepreneurship offerings were limited to one elective course offered once per year at the MBA and undergraduate levels. The undergraduate course was targeted at students in their third year of a four-year business degree and was roughly organized into three content themes: first, an overview of entrepreneurship topics such as the role and importance of entrepreneurship, characteristics of entrepreneurs, women entrepreneurs, family business, etc.; second, start-up and small business topics such as market research, marketing, operations, etc.; and finally, the business plan.

Beginning in 1991, and over a period of approximately six months, six faculty members with an interest in entrepreneurship began to meet regularly at the university's Faculty Club to discuss the possible introduction and design of a specialization or "option" in entrepreneurship within the Faculty's undergraduate program. What emerged from this skunkworks-type effort was a proposal for a slate of undergraduate courses, one of which, Introduction to Entrepreneurship, would be mandatory for all undergraduate business students. In a largely unprecedented move, this course (along with the proposed slate of four other entrepreneurship courses) was subsequently approved by the Faculty and first offered in 1993. This marked, to our knowledge, the first compulsory business undergraduate entrepreneurship course in Canada.

The framework comprising the subject of this paper has provided the conceptual foundation for our introductory entrepreneurship course since 2003, following a major and controversial decision to abandon the use of a textbook due to instructor dissatisfaction with the

course format. Three factors seem to have been most important in our decision to develop a conceptual framework to underpin the course. First, there was a strong desire to move away from rote memorization and traditional examinations. Although the use of a textbook does not in itself require a traditional course format, the use of textbooks does tend to have a strong impact on student expectations that often interferes with other types of desired learning outcomes. Second, there was interest in promoting greater skill development among students; we hoped to place less emphasis on knowledge acquisition and considerably more on the application of that knowledge. Moreover, we wanted to provide an environment where those (application) skills could be developed and strengthened through practice over the course of a semester, resulting in demonstrable improvement in student performance over time. Finally, because the course was a required course with up to 14 offerings per year taught by multiple instructors, it was our intention that a common conceptual framework would provide some consistency in course content across different instructors and classes while still providing instructors a degree of creative freedom.

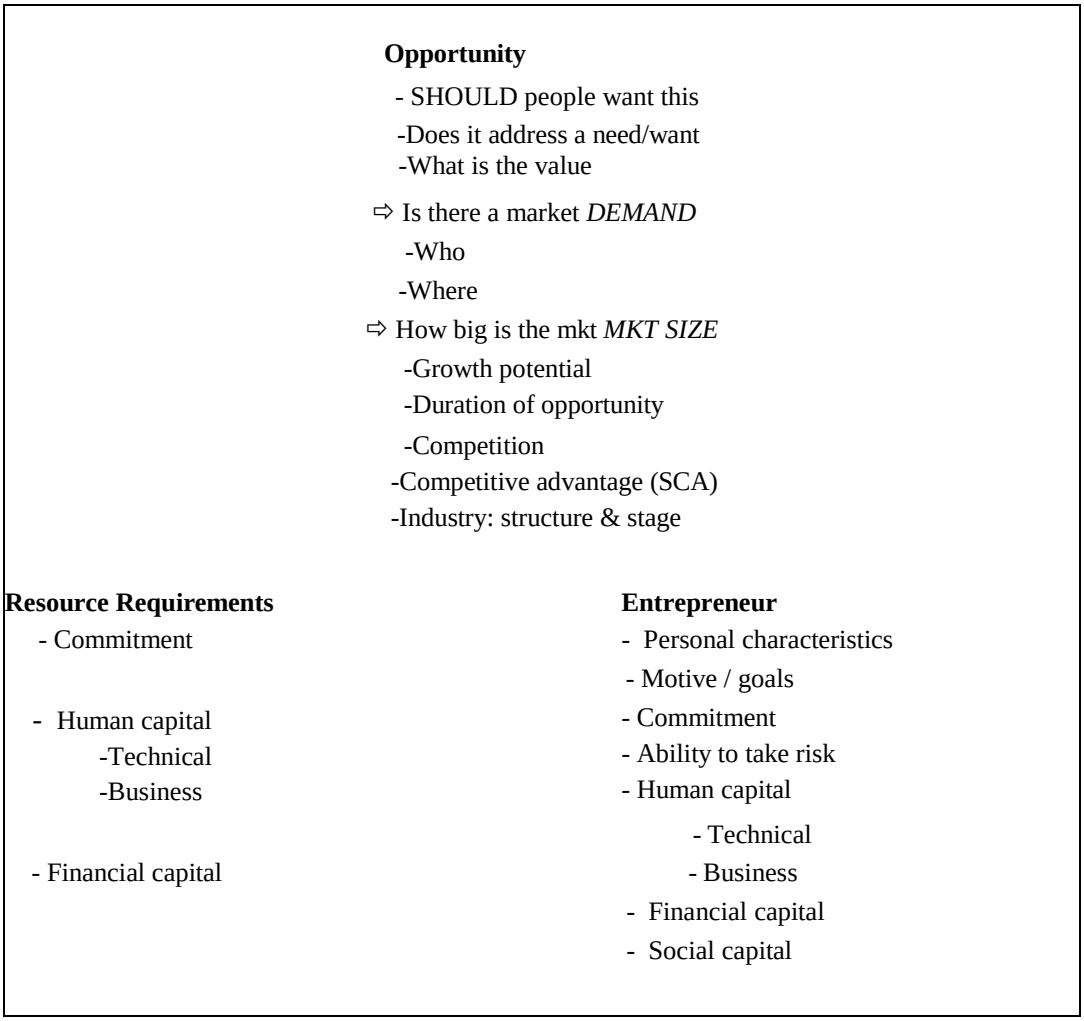
Our framework has historical roots that trace back to the theoretical models proposed by Ronstadt (1984) and Timmons (1999). Ronstadt argued that entrepreneurship is a dynamic, long-term process and that the unit of "analysis" for entrepreneurial activities should be the entrepreneurial career, causing him to overlay the entrepreneur's current education and experience on the assessment of a venture. Importantly, he suggested an evaluation examining the entrepreneurial career in the context of the type of venture, and the environment (i.e., is it "…the right kind of venture…at the right time and place, to build the kind of career…that is right…" for the entrepreneur?). While championing the entrepreneur, Ronstadt also acknowledged the contextual elements that can affect an opportunity's viability. Throughout his explanation of the model he was at pains to emphasize that the three factors - entrepreneur, venture, and environment - are interrelated and will change continuously in real time during the entrepreneurial process. The final part of Ronstadt's model was the assessment, which he suggested should occur along four dimensions: qualitative, quantitative, strategic, and ethical.

Timmons (1999) model, appearing over a decade later, bears some strong similarities to Ronstadt's framework. Timmons also highlighted the necessity for the entrepreneur to balance a dynamic process, going so far as to diagram his ideas using a fulcrum and three balls (representing opportunity, team, and resources). Timmons, however, focused more on the single opportunity (or in Ronstadt's terminology the "venture") and was perhaps more concerned with high growth potential opportunities. Under "resources" Timmons directed attention to the financial assets and people available to support the team, while also noting the importance of bootstrapping as the team's resources are likely to be limited.

The Ronstadt and Timmons models provide the broad theoretical underpinnings for our framework (Figure 1) and serve to highlight the dynamic between factors that influence opportunity selection. In our experience such high-level models can be applied productively by MBA students, but in our view a more detailed roadmap was needed to provide greater hands-on guidance for undergraduates. We therefore added to the framework by developing a moderately detailed list of criteria (Figure 2) to be considered and analyzed under each of the three major framework elements. These criteria can usefully serve as "checklists" for students to help them ensure they conduct a thorough analysis. Most scholars will recognize these criteria as "standard fare" in introductory entrepreneurship textbooks. Indeed, most of the concepts would be regarded as being central to mainstream entrepreneurship theory, even though their theoretical origins are often quite diverse, including strategic management (e.g. industry structure and the resource-based

theory of sustainable competitive advantage, organization theory (e.g. industry stage), psychology (e.g. personal characteristics), economics (e.g. human capital), etc.

Figure 2
OPPORTUNITY EVALUATION FRAMEWORK – CRITERIA



Today the framework, although modified over the years, continues to be used in the course. Students are mainly first-year undergraduate business students who, at Memorial, are normally in their second year of studies. The size of each class is typically limited to 40-50 students who attend two 75 minute classes a week over 13 weeks. There is also an online version of the course which was recently adapted to provide a comparable experience to the on-campus course. The framework provides the core curriculum for the course over the first six weeks of the semester.

Students are evaluated both formally and informally on their use of the framework on several occasions during the course, using a variety of assessment methods. Formal examinations are typically based on a case analysis. Although the course emphasis shifts mid-semester from opportunity evaluation to start-up activities, the framework (or at a minimum, the opportunity portion) continues to be applied for the duration of the semester. Our approach has been to give students lots of practice in applying the framework so that they have the opportunity to develop

their proficiency and witness their own progress. We also provide regular diagnostic feedback so they are able to take corrective action and improve their performance. When asked to provide informal feedback on their course experience, students have often indicated the framework helps them make better decisions.

USING THE FRAMEWORK

Using the framework is straightforward. After an initial introduction, the framework criteria are gradually "revealed" over the course of five or six classes. In a typical class the framework is applied after students have reviewed an entrepreneurship case presenting a business opportunity. Cases may appear in a variety of forms, including written (often 1-2 pages in length), video (15-20 minutes) or may be inferred from a presentation by a guest speaker. The instructor typically divides the class into small groups of 4-6 students and assigns each group one of the main elements of the framework triangle to analyze. This work is then shared amongst the class using group presentations or questioning by the instructor. The instructor can critique or facilitate a class critique of a synthesis of the class' analysis, and guide a further analysis of the fit between elements. A final step is to draw formal conclusions from the analysis and make appropriate recommendations.

The framework itself is comprised of three main elements (Figure 1): Opportunity (O), Resource Requirements (RR) and Entrepreneur(s) (E). Of the three elements, Opportunity is usually considered first because if the outcome indicates there is no opportunity, it makes little sense to continue. We suggest to students that they think of the evaluation as a two-step process addressing the questions:

1. How attractive is this opportunity?
2. How attractive is this opportunity to me?

Question 1, considered in isolation, reflects an economic/market perspective and focuses on the Opportunity element at the top of the triangle. Students must first determine whether people "should" want this particular product or service by considering what need or want is satisfied by the product. A clear understanding of this should provide students with insights as to the value of the product and potential pricing strategies. If it is concluded there is indeed a market for the product then the opportunity can be said to exist. The remaining criteria in this section establish the size or attractiveness of the opportunity. Two questions (who is the market and where are they located?) address market characteristics explicitly and enable students to draw a conclusion regarding market size. In our experience, students need to be reminded regularly to develop a profile of the target market using concrete demographic characteristics. We encourage students to work down the list of criteria in a systematic fashion, examining growth potential, the opportunity's duration, competitive advantage (is there one; if yes, is it sustainable?), and the industry structure and stage of development. After completing this part of the assessment it is important for students to draw a conclusion about the opportunity's overall attractiveness or potential associated with the opportunity. We suggest one helpful way of rating the attractiveness is to rank it using one of three venture classifications i.e., lifestyle venture, small-to-medium sized stable and profitable firm, or a firm with high growth potential.

Once the attractiveness or size of the opportunity has been established, students are ready to tackle the second question: How attractive is this opportunity for me? However, this is ultimately a question of fit between all three elements and can only be answered after considering the other two elements of the framework, RR (resource requirements) and E (entrepreneur). In RR the aim is to identify the amount and/or quality of resources that the opportunity seems to require. If the business being assessed does not include financial projections, it may be difficult to make accurate estimates of financial needs here. Nevertheless, students can still provide rough yet useful indications of the scale of resources needed by identifying the key assets that will be required to start the business and by differentiating between ventures needing thousands versus hundreds of thousands versus millions of dollars. Such basic categorizations not only provide an indication of scale, but also enable insights later in the process about the types of financing sources that may be appropriate, and the likelihood of success in accessing these sources. Students also examine commitment in terms of the demands the opportunity will make on the entrepreneur's time, energy and lifestyle. In addition, human capital needs (i.e. the depth of knowledge and skills needed to operate the business) are examined. Students should be cautioned to avoid oversimplifying here, as Yes/No answers are not typically helpful. We remind students that all businesses will require some business knowledge but the reality is that many entrepreneurs are able to start without any business background, learning what they need from the school of "hard knocks". It can be helpful to ask students to consider how many years of education or experience would constitute satisfactory preparation to operate the business. It is also useful to consider business and technical knowledge separately and to break the business component of human capital into functional areas such as Leadership/Strategy, Marketing, Operations, HR, and Accounting/Finance. At a minimum, students should try to categorize each area of required knowledge as Low, Moderate or High and justify their choices.

Turning to the E (entrepreneur(s)) in the framework, under this heading students are asked to evaluate the entrepreneur in seven areas. Firstly, they need to identify the prospective entrepreneur's personal characteristics that could help or hinder his/her ability to function effectively as an entrepreneur. Secondly, they examine the entrepreneur's motives or goals for starting the business. This is important because it cannot always be assumed that financial gain is the main motive. The next area is an evaluation of how much time the entrepreneur can commit to the venture. Fourthly, students look at the entrepreneur's ability to handle the venture's risk. It is worth noting that this is not the same as someone's willingness to take risk, as that will already have been considered under personal characteristics. Instead, students here should try to evaluate the entrepreneur's risk-taking ability based on such factors as age, number and age of any dependents, amount of personal indebtedness, personal net worth, etc. Next is the evaluation of "human capital", or any relevant knowledge and skills the entrepreneur has acquired through education or experience. As was the case in the resource requirements element, we ask students to distinguish between businesses versus technical knowledge/skills. "Technical" background refers to any industry-specific or product-specific knowledge or skills that may be useful in a particular firm. Physicians and software programmers, for example, often possess a great deal of technical knowledge but may have little knowledge about how to run a business. In the sixth area the students evaluate the availability of financial capital or how much the entrepreneur is able to personally invest in the venture. Finally, the entrepreneur's social capital - who they know - is evaluated. Here students pay particular attention to the entrepreneur's access to individuals able to help their venture.

The final part of answering the second question involves examining the "fit" among the three elements of the framework. As Figure 1 shows, there are three potential areas of fit: students must evaluate the fit between O and RR, O and E, and finally RR and E. The fit between O and RR is largely a question of economics, the main issue being the extent to which the investment required aligns with the size and profitability of the opportunity. In many of our introductory cases there is often insufficient financial information to make a detailed evaluation, so this aspect of fit tends to receive less emphasis. The fit between O and E involves a consideration of the extent to which the opportunity is consistent with the motivation, goals and aspirations of the entrepreneur. A good fit here can be key to happiness, personal fulfillment, and wellbeing, and may have less to do with economics. Next the fit between RR and E compares the resources needed to properly pursue this opportunity to what the entrepreneur has available.

If the evaluation has been done well, the student is now in a position to identify where the gaps and mismatches are, and assess their severity. Students need to be reminded that they will seldom see a perfect match in the real world, but by applying the framework they should be in a position to report the overall level of fit, identify potential strategies for mitigating or reducing gaps, and draw a conclusion as to the overall suitability or attractiveness of the opportunity for the entrepreneur.

REFLECTIONS ON IMPLEMENTING THE FRAMEWORK

In use, the framework addresses EE challenges in a number of ways. We use the framework because it conceptualizes entrepreneurial activity as a dynamic process influenced by multiple factors. Using the framework requires the students to come to a conclusion - they must make decisions and judgments - about the opportunity. We think it encourages, at the same time, a balanced and realistic appraisal of the opportunity and for the student entrepreneurs in the course the framework provides a rigor to temper, but not kill, their enthusiasm for an opportunity. The framework develops the student's risk-taking abilities, albeit in a low risk educational environment, by requiring them to employ the framework in a systematic manner. Students must examine questions, whether they think they have the correct (or good) answer or not. In our experience many students try to avoid this situation but this aspect of the evaluation takes them out of their comfort zone and asks them to take a small personal risk. Ultimately they must answer all the questions and defend their judgments. They also develop their critical thinking and ability to deal with unstructured entrepreneurial situations, skills which are transferable to other areas and settings. The framework provides a comprehensive yet simple structure, but not too simplistic. It facilitates identification of key issues without getting bogged down in financial and operational details and works well with a wide variety of opportunities and industries, as well as cases differing in length and complexity. In addition, the framework highlights the human dimension; it is one of the few frameworks that explicitly recognize the non-economic motives of entrepreneurs, despite overwhelming evidence that these motives are important. A business plan does address the availability of human capital in the management team, but is not normally used in introductory courses and is not suitable for preliminary screening of opportunities. We have also found, pragmatically, that the framework can be used in a 60-90 minute class time frame, with multiple case types from newspaper articles to guest speakers to videos. It can be used at just about any stage of the course or even the academic program. Finally, the framework is perceived as useful by both instructors and students.

Accredited schools and those planning to become accredited can take some comfort in the fact that implementation of the framework can be quite compatible with AACSB principles (Table 1). Memorial's Faculty of Business, for example, is an accredited school where the ability to evaluate opportunities is a program-level goal. As Table 1 demonstrates, AACSB's expectations regarding a school's ability to demonstrate learning achievement are quite high, requiring considerable effort to demonstrate the school is meeting its learning goals through systematically measuring outcomes and continuous improvement. Nevertheless, accommodating AACSB's assessment of learning (AOL) requirements occurred quite seamlessly here, requiring almost no changes to prior practice, and according to the Faculty's AOL coordinator, the practices employed by the entrepreneurship area were well-suited to be used as a model for the other area groups. It seems likely the smooth accommodation of AOL in the entrepreneurship area was facilitated by the prior existence of clear learning goals (no doubt necessitated, in part, by the absence of a textbook), a strong emphasis on skill development through repeated practice in applying the framework, and multiple measures of student learning across the semester to capture student progress and provide diagnostic feedback for both students and instructor.

Learning assessments in Memorial's Introduction to Entrepreneurship course suggest that students improve significantly in their ability to apply the framework as the semester progresses, despite the fact that the examinations increase in complexity. Grades are assigned for the comprehensiveness of the analysis (i.e. systematic and thorough scope of framework coverage, with explicit effort to identify both positive and negative aspects) and quality of thought (e.g. the use of evidence and examples to support claims, creativity, and integrative thinking). These simple criteria are transparent to students and are assessed using broad strokes (e.g. 70 versus 75, rather than trying to make fine distinctions, such as 72 versus 74). Students have responded well. Not only is this, arguably, a more efficient way to measure student performance, but it is a more reliable indication of student progress, as distinctions involving one or two marks in a qualitative analysis can be quite random.

Students in the Introduction to Entrepreneurship course are formally assessed on their ability to evaluate opportunities on four occasions across the semester, typically in weeks four, five, nine and eleven. The first assessment (Week 4) is an individual assignment where students evaluate opportunities that they have identified themselves in preparation for a term-long project. The three subsequent assessments all consist of midterm examinations based on the analysis of written cases. The first midterm exam (Week 5) requires students to assess one case-based opportunity using the framework. Two cohorts of students were analyzed separately (Figure 3) due to changes in the recording of grades for Midterm 2. Midterm 2 normally includes one major question directed at evaluating the case-based opportunity and another major question addressing start-up issues. Because separate marks for the two questions were only retained for storage to meet the more recent administrative needs of AOL, Cohort 1 includes five classes of students enrolled over five semesters from Fall 2012 to Fall 2014; in this instance the second (Week 9) grade is based on a specific question directed at opportunity evaluation. In contrast, the midterm 2 result for Cohort 2 students (five classes enrolled over four semesters from Fall 2010 to Winter 2012) represents the overall examination score (no separate score was available for question 1), only half of which was based on opportunity evaluation. The latter must therefore be regarded as a more indirect measure of student ability to evaluate opportunities. Finally, the last midterm examination (Week 11) consists of a case requiring students to evaluate three opportunities (start-up, franchise, and a purchase decision) and select the most appropriate one.

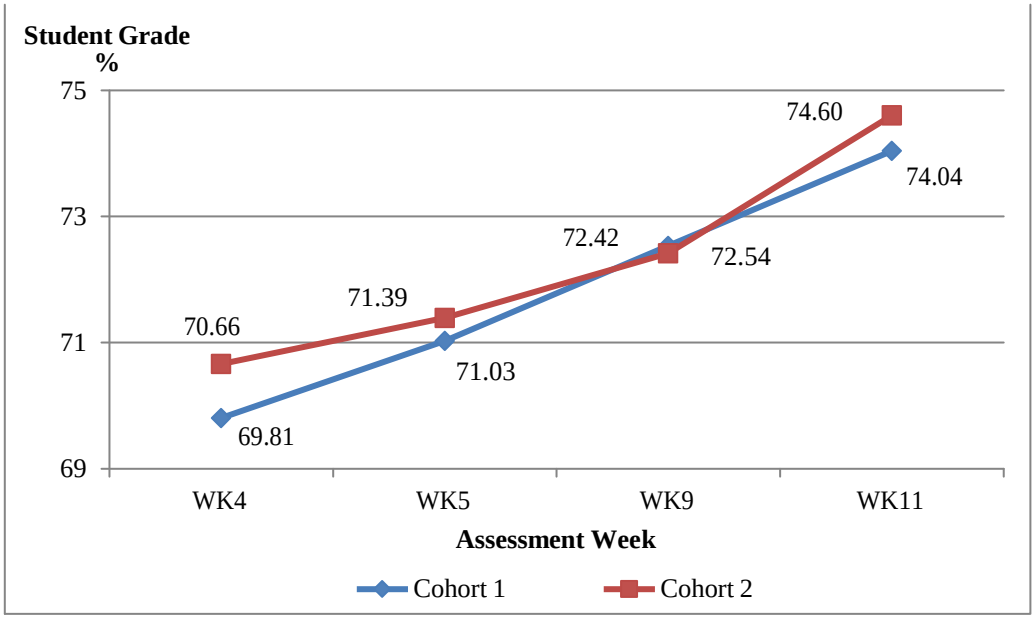
Table 1
FRAMEWORK COMPATIBILITY WITH AACSB PHILOSOPHY & IMPLEMENTATION

Source	AACSB Dictums	Comment
1, 2	Learning goals are established at different levels.	The ability to assess opportunities is a learning goal at both the course level and undergraduate program level at Memorial.
1, 3	Goals express expectations concerning the depth & breadth of student knowledge & skills.	Student analyses are evaluated for both quality and comprehensiveness. E.g.: making inferences and providing examples to support claims versus systematic coverage of the framework criteria.
2, 3	Learning goals should address two types of learning: general knowledge/skills and management-specific knowledge/skills.	Application of the framework requires analytical skills, problem solving and integrative thinking. Understanding the framework's theoretical foundations requires management-specific knowledge of entrepreneurship, marketing, strategy, accounting and organizational theory concepts.
2, 3, 4	Measures to assess achievement of the learning goals must be specified or developed to support the principle of accountability (Standard 8, Assurance of Learning).	At Memorial existing assessment formats were easily specified to assess student learning on the program's AOL rubric for opportunity evaluation. No new measures needed development and no stand-alone (i.e. outside of the normal classroom experience) measures were required.
2	Course-embedded measures of learning achievement can be used when required courses expose students to systematic experiences designed to produce the school's learning goals.	Course-embedded measures involving the framework are employed at Memorial to assess learning on the program's opportunity evaluation rubric.
3, 4	Assessment information should be used for continuous improvement.	Continuous improvement can be facilitated throug the use of multiple assessments (including informal measures) throughout the course, providing separate feedback on the comprehensiveness and quality of student analyses, and decomposing the framework to focus on one or more parts, etc.
3	Assessment of learning goal achievement should include both direct and indirect measures.	Memorial used a variety of assessment tools, including instructor review of group discussion notes, exercises and formal assignments requiring students to screen/select opportunities they have identified, the use of specific questions directing attention to one or more parts of the framework on examination cases, written holistic case analyses, and instructor reflection on in-class case discussions.
3	Ideally curriculum addresses a (program-level) learning goal in a number of courses.	The framework is flexible and adaptable. It has been used successfully in two undergraduate courses (Intro to Entrepreneurship & New Venture Creation - NVC) and the MBA NVC course. In NVC courses it is used early for Opportunity Screening. It is also suitable for strategy courses and was used to ground the analysis in an advanced- level case on growth intentions and goal-setting where no other framework was available to guide the analysis (Hanlon, Walker & Stapleton, 2015).

4	Students should engage in experiential and active learning.	The framework can be applied to cases, opportunities that the students themselves have identified, and other real-world contexts such as might be found in small business centres and student consulting situations.
4	Curricula should facilitate frequent student-student and student-faculty interaction.	The framework's suitability for case analysis is strength. The class can be divided into groups assigned to discuss one piece of the framework before presenting their results to the whole class. The instructor can facilitate the discussion of FIT, which cannot be considered until each of the framework dimensions has been analyzed individually.
4	Although skill areas tend to remain consistent, knowledge areas are likely to be more dynamic.	The specific evaluation criteria comprising the framework can be easily revised to incorporate new knowledge.
Sources for AACSB Dictums: (1) AACSB 2009; (2) AACSB 2012; (3) AACSB 2013; (4) AACSB 2016		

Figure 3 provides a summary of student grades on the four assessments. All classes in the sample had the same instructor and were taught by one of the authors; it was not possible to include classes of other instructors because grades on individual assessment instruments were only recorded in instructor spreadsheets that were no longer available due to staffing changes. It can be seen that for each cohort the marks get progressively better across the semester. Repeated measures ANOVA results indicate that the difference in grades is statistically significant for both cohorts (Cohort 1 n=200, F=7.001, p<.001; Cohort 2 n=208, F=9.573, p<.001) (the Huynh-Feldt version of the test was applied in both instances).

Figure 3
OPPORTUNITY EVALUATION GRADES ACROSS SEMESTER



It is noteworthy that Cohort 2 scores dip below those of Cohort 1 in Week 9. This can likely be attributed to the fact that (as mentioned earlier) the Week 9 Cohort 2 grade included the results from a second question dealing with start-up. Because Cohort 2 scores include the evaluation of other, more recently introduced knowledge (i.e. start-up, in addition to the opportunity framework) this drop in performance is not unexpected. On another note, one might surmise that the lowest score occurs in Week 4 because students have not yet become accustomed to the assessment methods and standards employed in the course. We were not able to rule this alternative explanation out, but we were able to compare the grade on the Week 4 assignment with an alternative individual assignment. In earlier years the Week 4 assignment was a research proposal for the term project; an analysis of a sample of another four classes (n=173) for this assignment revealed an average grade of 80.4 percent, which was significantly higher than the opportunity evaluation grade of 70.66 percent ($t=-7.204$, $p<.000$). Overall, our results are consistent with the expectation that students are improving their opportunity evaluation skills as the semester progresses, but the results cannot be considered conclusive without a control group for comparison.

CONCLUSIONS

We have provided an account of the evolution of our framework and its efficacy as a tool for introducing students to opportunity evaluation. The main contribution of this paper is the sharing of a practical entrepreneurship teaching tool that aligns well with current EE theory. The practicality of the framework is crucial. It is important to remember that our audience of first-year undergraduate business students is required to take the course and unlikely to become entrepreneurs, though they are likely to become managers. Using Gibb's (2002) description of audiences they are, then, mainly managers who will need to use entrepreneurial tools and behaviours and/or will, in the future, are in a position to assist entrepreneurs. Fortunately, the framework is well suited for this audience and future entrepreneurs who can apply it in their future student and work lives.

Not only is it practical for student learning, it is also practical for instructors. The framework is adaptable to a variety of materials (i.e. short/long, complex/simple, or videos cases etc.) and student audiences (i.e. introductory or more senior level courses) and its elements - opportunity, resource requirements and entrepreneurs - are easily recognizable to business students and can also be broadly understood by a lay person. Furthermore, instructors can adapt their use of the framework to the needs of their audience. If an industry analysis is thought to be too complex, for example, it can be simplified to focus on entry barriers alone.

The framework reflects contemporary EE philosophy by enhancing our student's capacity for action based on a number of the main entrepreneurial behaviors and enables them to apply an entrepreneurial heuristic valuable in a start-up and other contexts where an opportunity evaluation is needed, such as screening a number of opportunities. The strength of learning comes from applying the framework in numerous instances over the course. Although some knowledge of entrepreneurship concepts is needed to understand the framework, it is the ability to apply the framework that is emphasized. In other words, knowledge becomes the means to an end rather than the end in itself.

In the future we hope to extend the use of the framework to all students in our university. We have also been discussing the use of the framework by local incubators/accelerators, as we have used the framework successfully with a number of local entrepreneurs on an individual basis. Future research could usefully examine the framework's application to these non-academic environments and to test its usefulness in other universities. In addition, an experimental design

that includes a control group would permit a more definitive conclusion regarding the efficacy of the framework.

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DEVELOPMENT OF ENTREPRENEURSHIP EDUCATION PROGRAMMES FOR HEI STUDENTS: THE LEAN START-UP APPROACH

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ABSTRACT

In recent times the relevance of the business model design overlapped the business plan conception, having the lean start-up approach contributed to this situation. This approach consists in a methodology that focuses on agile testing and learning cycle to validate hypotheses in the business idea. It can be taught in higher education institutions being an interesting approach in the development of entrepreneurship educational programmes for university students. Thus, this research intends to make clear how a lean start-up approach can be useful for the development of entrepreneurship educational programmes, presenting two European projects – ICT Entrepreneur and SCIENT, that evidence that is possible to integrate the lean start-up approach in the design of entrepreneurship training courses. The integration of the "build-measure-learn" approach, supported by these two European educational projects is explained and discussed.

Key Words: *Entrepreneurship Education, Lean Start-Up, Higher Education Institutions, Entrepreneurship Programs*

INTRODUCTION

The rapid growth of the claim and supply of Entrepreneurship Education Programmes (EEP) demands for more examination in design, delivery and assessment of these programmes (Fayolle et al., 2006). Studies investigating European Union vs. Units States experiences in entrepreneurship education (EE) have been well recognized so far (Fiet, 2001). Nevertheless, there is no common paradigm in literature for the design, delivery and assessment of EEP. As Fayolle et al. state (2006: 702):

> "*There is therefore a need to develop a common framework to evaluate, compare and improve the design of those programmes, which goes beyond the estimation of their short-term microeconomic impact*". In addition, there is a lack of comparisons and analyses discussing problems of development of EEP.

Despite the relevance of business models for academics and practitioners, there is an absence of literature and research on this topic. Perhaps, an explanation behind the inexistence of specific literature lies in the lack of consensus on the conceptualisation and definition of what a business model is (Teece 2010; Zott et al. 2011). Morris et al. (2005) refer that there is not a generally accepted definition of "business model", instead a diversity of terminology is being used (e.g. business model, business strategy, economic model). Another possible explanation is related with the fact that the business model design within the entrepreneurship field is a recent topic (Trimi and Berbegal-Mirabent, 2012).

Nevertheless, it is gaining a growing attention in the literature. The usefulness and predictable power of business models are expected to help entrepreneurs making more informed decisions, thus increasing the chances of success (Trimi and Berbegal-Mirabent, 2012). This new approach can be more useful, than the conventional one based mainly on the business plan, to entrepreneurs out of the business language, as is the case of scientists, engineers or informatics.

Recently the relevance of the business model design overlapped the business plan conception (Nirwan and Dhewantob, 2015). Blank (2013:5) argues that "a research exercise written in isolation at a desk before an entrepreneur has even begun to build a product", and the Lean Start-up approach hardly contributed to this situation. But what is a Lean start-up approach? This is a methodology that focuses on agile testing and learning cycle to validate hypotheses in the business idea. This methodology allowed a lot of enterprises in the United States to achieve success.

The lean start-up approach is, for some authors, a practical methodology rather than an academic subject (Nientied, 2015). Whereas Patz (2013:61) defends that the lean start-up concept does have an academic contribution

> *"… to existing theories of entrepreneurial action like Effectuation and Bricolage, adding the element of running experiments and stressing the learning aspect of the entrepreneur during the journey of starting a company".*

Since the lean start-up is progress in an intellectual and practice development (Ries, 2011), it can be taught in Higher Education Institutions (HEI) and it could be an interesting approach in the development of entrepreneurship educational programmes for HEI students. This is what this research aims to show: how a lean start-up approach can be useful for the development of entrepreneurship educational programmes (EEP). Thus, this paper intends to illustrate through two European projects – ICT Entrepreneur and SCIENT, how it is possible to integrate the lean start-up approach in the design of entrepreneurship training courses. Furthermore, an integration of the "build-measure-learn" approach, supported by these two European educational projects, was carried out and discussed.

THEORETICAL BACKGROUND

Entrepreneurship Education

Entrepreneurial pedagogy and entrepreneurial learning have become issues of growing importance in several educational systems all over the world. According to Harms (2015), entrepreneurship education (EE) became an effective way to increase the "amount" of entrepreneurs. The growing number of HEI providing EEP and carrying out academic research in the area reflects its popularity (West et al., 2009).

It is consensual that EE plays a critical role in guiding and developing future entrepreneurs, since this type of education can provide them with the necessary knowledge and skills to create their own business or to be entrepreneurs in their job (Dutta et al., 2011). Thus, EE is crucial to the development of enterprising citizens, by identifying and activating vocations in individuals, promoting entrepreneurial attitudes and entrepreneurial intentions and behaviours (Oosterbeek et al., 2010). Education and training, based on a solid educational programme, can contribute to increased management knowledge and to developing the psychological attributes and behaviours associated with entrepreneurship (Lee et al., 2006). Moreover, EE prepares students for the job market that is complex and uncertain, endowing future leaders in

entrepreneurship, innovation, and management of technology with a set of knowledge, skills and attitudes that empower them to address global challenges (Harms, 2015).

Hytti and O'Gorman (2004) consider that EE can be described in terms of three aims: learning to understand entrepreneurship, learning to become entrepreneurial, and learning to become an entrepreneur. In this scope it is necessary to distinguish entrepreneurial and enterprising behaviour (internal entrepreneurship) and doing business (external entrepreneurship).

In the perspective of authors as Gibb (2011), the pedagogy applied to EE should be built on the active role of students, in the learning process, instead of being based on traditional teaching methods. Sherman et al. (2008) noticed that some educators increased the use of experiential learning in the classroom, reflecting a desire to move away from traditional teaching methods. Their study showed that activities that are more experiential in nature have a greater impact on the decision to become an entrepreneur and that those activities make the students more attracted to become entrepreneurs.

In this new learning entrepreneurship methodology, the information should be created collaboratively, using an approach of trial-and-error as a part of the learning process. Methods used can include cooperative learning, team learning, project work, learning by doing, drama pedagogy, practice enterprises, workplace guidance and company visits (Gibb, 2011). Additionally, Gartner (2008) refers the stories of entrepreneurship and suggests that more attention should be paid to the stories that entrepreneurs tell about themselves. In turn has identified a wide range of teaching methods, including role-play, learning diaries, guest speakers, case studies and simulations. Neck and Greene (2011) emphasise the importance of learning games and simulations because they allow students to play in virtual scenarios that reflect reality playing, observing, creating and thinking about entrepreneurship.

Caseiro and Alberto (2013) defend that lectures should be reduced to the minimum necessary and teaching should be oriented to the resolution of practical cases, preferably real cases to be discussed and resolved using a group of students; this will stimulate the abilities of cooperation and communication. That way it will be possible to engage students in a business context, to provide them with a vision of the kind of problems that may happen and to call their attention to the multidisciplinary nature of the situations.

Teaching methodologies employed outside the classroom should be more explored. As has been stated by some researchers (e.g. Cooper et al., 2004; Pittaway and Cope, 2007) projects carried out in connection with businesses have resulted in positive learning outcomes and teaching experiences because these practices are related to real life and are prepared in collaboration with the staff of the enterprises.

HEI and its programs have been questioned to provide more extensive impact on development and encouraging entrepreneurial skills, knowledge and attitudes. EEP began to appear during the 1960s, mainly in the US. Brush et al. (2003) argues that 1600 HEI offer 2200 courses in entrepreneurship worldwide. The evaluation of EEP began after 1980s (Kao and Stevenson, 1984; Vesper and Gartner, 1997) and after this date, this topic turned out to be one of the fascinating signs about entrepreneurship research since of the complexity of the definition, objectives, processes, activities and results of the EEP. Literature of the most recent EEP studies shows the scope of the conceptual and methodological challenges in the designing and monitoring of EEP (Fayolle et al., 2006). Garavan and O'Cinneide (1994) recommended a set of evaluation criteria for EEP evaluation such as philosophy of the program; targeted population;

objectives and program content; learning strategies and methods; and outcomes and impact of programs.

Twaalfhoven and Wilson (2004) compared the US and EU path for EE design and delivery. The results show that European HEI and business schools offer a variety of entrepreneurship or SME oriented courses as primarily elective that have not being integrated into all the curriculum or across the HEI. The curriculum is mainly focused on business start-up phase and neglect the growth phase. Entrepreneurship programs are delivered with participative pedagogy; however, the innovativeness of the teaching methods is still an issue for most programs. European entrepreneurship studies have on average 9.5 years of tradition and significantly less specialized courses or teachers in entrepreneurship. The lack of critical mass of the educational materials and innovative approaches have been described. Given this context new methodological approaches to EE are needed.

Lean Start-Up Approach

During the start-up process, entrepreneurs need to set up the frontiers of the business and define the offer. In the initial stages efforts are very focused on building the product that can be commercialised. This is a very difficult task, especially for new technology-based firms which usually require great investments, have very short product life cycle and have a limited time span to turn the idea into a business. But even in these cases it is necessary to spend some time maturing the business model (Trimi and Berbegal-Mirabent, 2012).

All of the essential features regarding the product, operations and the structure of the new firm are embedded in the business model. According to Teece (2010), the business models reflect what the clients' needs are, and how a company can organise its processes in order to best meet those needs, and have profits for that, this is, a business model evidences how to deliver value to customers and how to manage the organisation. As such, the relevance of the business model seems to be unquestionable and the lean start-up approach hardly contributed to this fact (Nirwan and Dhewantob, 2015).

The introduction of the customer development process by Steve Blank launched definitively the lean start-up movement. Blank (2005) defends a step-by-step process for managing the search for a new business model, and provides entrepreneurs with a route from idea to a feasible business model. Some years later, in 2011, after refining and developing further this initial methodology in collaboration with entrepreneurs, academics and other thinkers, Eric Ries published the book The Lean Start-up, thus contributing to the establishment of a lean start-up terminology including new several terms. This theory, initiated by Blank (2005) and popularised by Ries (2011), focuses on the importance of learning from the customer (market) to produce the adequate products. This is done throughout an iterative process where problem, product, and customer hypotheses are developed and validated, and prototypes are built when is necessary in order to minimize waste, time, and money during the new product development process (Blank, 2005; Ries, 2011).

According to Nientied (2015), lean start-up is a system for developing a business (or product) in the most efficient way possible to decrease the risk of failure, by treating all business ideas as assumptions (or hypotheses) that must be validated through a quick test or experimentation in the marketplace. Thus, the premise of lean is precisely to avoid waste, rather than reducing costs, by settling on structured experimentation, iterative product releases, and clients' feedback to generate validated learning. This approach pursues to reduce or even eliminate wasteful practices and add value generating practices, during the product development

process, so that start-ups can have better probabilities to succeed without the need of large amounts of funds, or elaborated business plans. In other words, the idea behind this approach is that the real product of an early stage start-up is an experiment that contributes to reducing the initial extreme uncertainty. The progress of a certain business can be assessed by the learning that is gained from these experiments (Moogk, 2012).

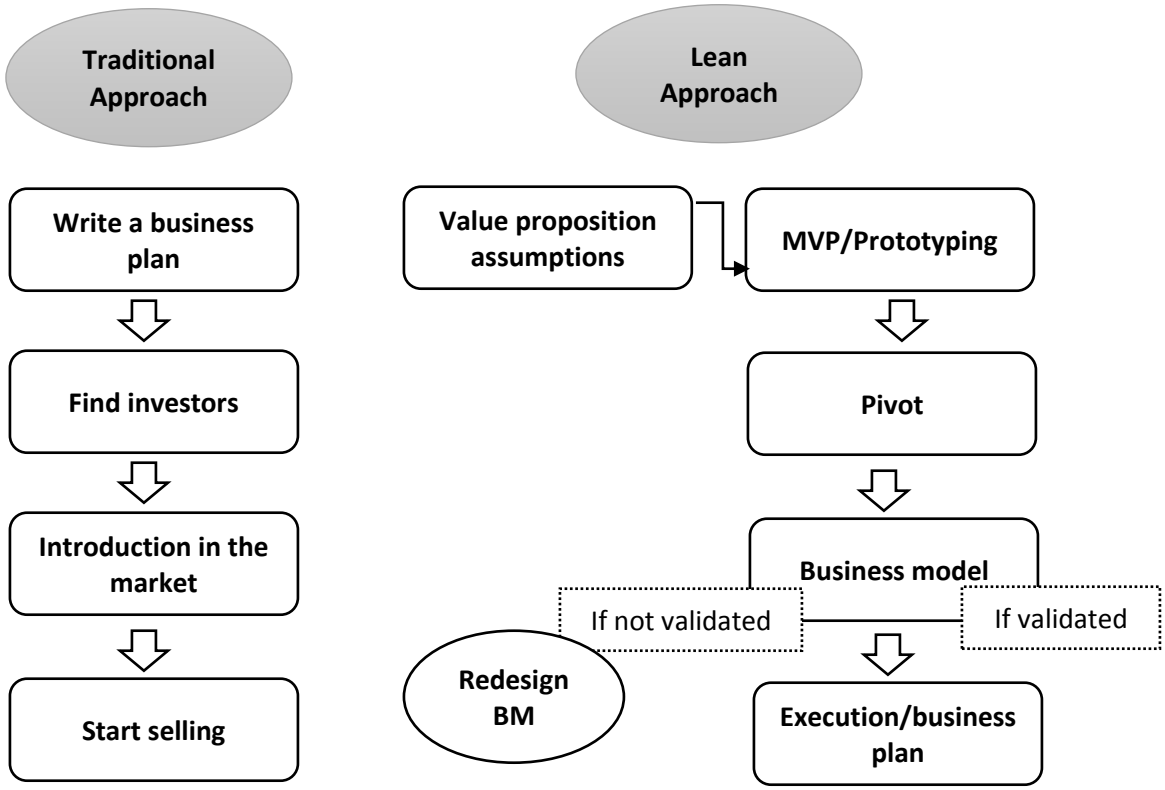
Following the works of Blank (2005) and Ries (2011), Eisenmann et al. (2012) introduced the concept of "lean start-up", defined as a firm that follows a hypothesis-driven approach to the assessment of an opportunity and the development of a new product for a specific market. This methodology focuses on translating a specific point of view or idea into verifiable hypotheses regarding a new product, associating to the process a business model. The hypotheses are then tested using prototypes that are planned to validate specific product features or business model specifications.

In this context, the entrepreneurial opportunity is based on modelling the new solution in a way that could solve a specific market need or problem. Ries (2011) presents the main principles of start-up methodology:

1. Get out of the building. Initially start-ups should formulate hypotheses that will be validated (or not) by customers in real world, needing to reflect about "the conversation" with the customers to help eliminate most of the uncertainty. Usually entrepreneurs formalise their hypotheses in a framework designated as business model canvas (a diagram of how a firm crates value for itself and for its costumers - Blank, 2013).
2. Minimum Viable Product (MVP). This is the version of the product that enables to test the "build-measure-learn approach" with a minimum amount of effort and development time (it has just those features that allow the product to be deployed and showed for a group of possible customers). According to Blank (2013), this is related with the agile development, a work carried out with the customer, in order to develop a product iteratively and incrementally.
3. Validated Learning. This is a method for demonstrating progress very useful mostly when one is embedded contexts of extreme uncertainty (it is based on the voice of the customer).
4. Pivot if necessary. If after customer feedback, the entrepreneur's assumption turned out to be invalid, the entrepreneur should consider a pivot, this is, to carry out a structured correction designed to test a new hypothesis about the product (it results from a better understanding of the customer's problem).
5. Iterate rapidly. The cycle of evolution: build-measure-learn should be as faster and lighter as possible. This process will provide the orientation that start-up needs to be successful. Note that ideas and products are thus based on learning derived from this cycle.

Figure 1 illustrates the approaches to start up. "According to the decades-old formula, you write a business plan, pitch it to investors, assemble a team, introduce a product, and start selling as hard as you can" (Blank, 2013:4). However, as is possible to infer from the scheme, contrary to the traditional approach, lean start up approach allows to make experiments and test the value proposition and market traction before making a significant investment. Once the entrepreneur gets a validated value proposition, and the value proposition is embedded in a sustainable business model, then the strategy can be set and the business plan can be written.

Figure 1
FROM TRADITIONAL APPROACH TO LEAN APPROACH



HOW TO USE THE LEAN START-UP APPROACH TO DEVELOP ENTREPRENEURSHIP TRAINING - EVIDENCE FROM TWO CASE STUDIES: ICT ENTREPRENEUR AND SCIENT PROJECTS

Two case studies will be explored based in the projects Erasmus+: ICT Entrepreneur and SCIENT, whose final aim is to develop a pilot training test in the European countries of the consortiums. Both entrepreneurship programmes here presented aimed to develop/test a complete pre-accelerator programme that could be offered in universities, research and entrepreneurship centres, accelerators and incubators, across Europe, once the project is completed. This task involves several phases. The first phase of this project was to make a diagnosis aiming to evaluate the national entrepreneurship ecosystem and the relevance of the existing entrepreneurship courses in each country of the consortium. Thus, an intensive search for the courses/seminars/lessons related with entrepreneurship education was carried out and several organisations were selected to be visited and interviewed (note that each partner visited and interviewed about six national entities and two foreign institutions chosen outside the countries of the consortium). The information collected helped us in the identification of the gaps, strengths and weaknesses in the current EE. This analysis also allowed us to identify specific entrepreneurial training needs of both STEM (Science, Technology, Engineering and Mathematics) and ICT students. Then questionnaires directed to the students were also developed and the data was carefully analysed (these instruments included skills, motivations, support from the HEI, barriers, difficulties and sociodemographic traits as variables).

Taking into account the results of the interviews and questionnaires, there is some consensus regarding the inclusion of the following subjects in an entrepreneurship programme directed to these students: entrepreneurial culture, communication and negotiation techniques, finances, basic management tools, logistics for manufacture/delivery of product, setting prices, selling products, internationalisation, business models, marketing and market research, and soft skills in general. This is in line with Mwasalwiba (2010) findings, who concluded that the most taught subjects or course contents in a typical entrepreneurship programme were: resources rationalising and finance, marketing, idea generation and opportunity discovery, business planning, managing growth, organisation and team building, new venture creation, SME management and risk and rationality. Other subjects, less common, were legal issues, management of innovations and technology, franchising, family business, negotiation skills, communication skills, and problem solving.

As such we tried to include in the courses some of these contents as well as practical activities, using an approach based on the lean start-up. Before the dissemination between the students, a "Train the Trainers" was carried out (for ICT in January in Nicosia, Cyprus, and for SCIENT in April in Bologna, Italy). All the participants of both projects were represented in these two-day trainings in order to criticise, make adjustments, recommendations and improvements. All didactic materials were uploaded in Trello (it is a web-based project management application) and distributed to trainers in all countries of the consortium.

In order to complement the theoretical training, the participants will be involved in job shadowing, working in interdisciplinary teams under the guidance of academics, managers, investors and entrepreneurs, having thus the opportunity to understand business needs and how their research can be applied in real business settings. Internships and visits to companies, as well as the presence of guest speakers in the training sessions, and mentoring and coaching activities, were also included in the pack. Additionally, the top five ICT participants from each country will participate in the final competition that will be held in Cyprus. For SCIENT, an internship in Germany will be offered for the best team.

Next we present the projects contexts, followed by the proposal for contents and functioning of each training course.

SCIENT

There are more than 180,000 STEM (Science, Technology, Engineering and Mathematics) students (about 36%) in EU universities (European Union, 2010). Not all of these students will get an academic/research position and sign a contract with a research unit. They will most probably have to go abroad or start to think about creating their own job (Ferreira et. al., 2016). This particular target group should be provided with "entrepreneurship experiential elements", which have potential to complement the research, thus an adequate entrepreneurship training programme should cover the whole life-cycle of business and is sensitive towards to PhD process of doctoral students to whom the programme is directed (Thursby et al., 2009).

Given the importance of entrepreneurship to surpass the problem of unemployment of this target (STEM students), the project SCIENT, an EU-funded project designated "A European University-Business Alliance aiming to foster young SCIEntists ENTrepreneurial spirit" (in the cope of Erasmus^{+}) will be implemented in order to develop an innovative entrepreneurship programme for PhD STEM students/graduates, developing their transversal skills and providing them with a new professional path.

SCIENT will enhance scientific entrepreneurship by focusing on young researchers. The goal is to make doctoral students and graduates aware of their career options and aware about the possibility of using their research findings and starting their own company, avoiding that they limit their prospects by considering only an academic/researcher career. The SCIENT Project has the following objectives:

i) Develop transversal skills (both hard and soft skills) for PhD STEM students/graduates and creating new professional paths for these individuals;
ii) Identify the obstacles that PhD students/graduates face in transferring their research findings into business ideas;
iii) Support and stimulate the exchange of knowledge between HEI and enterprises across the countries involved;
iv) Develop and test of a pre-accelerator programme for universities, research and entrepreneurship centres, accelerators and incubators;
v) Transfer best practices from North EU countries to South EU countries;
vi) Open up new learning opportunities through the practical application of entrepreneurial skills (start-ups, spin-offs, products, prototypes).

To put in progress such an ambitious programme, a consortium of 15 organisations from 8 countries: Cyprus, Malta, Italy, Portugal, Spain, Lithuania, Germany and United Kingdom was created. The project includes: Universities with relevant experience on entrepreneurship education field for higher education students (European University Cyprus, University of Beira Interior, Kaunas University of Technology, and University of Gloucestershire); SMEs with experience in research and consulting work on entrepreneurship (GrantXpert, Paragon); a Science and technological park (Parkurbis) and an accelerator (Chrysalis Leap) providing vital input during the development of our training content; two Northern EU partners (despite UoG in UK), from Germany (ISOB, responsible for the Evaluation and Quality Assurance), a cluster of companies (SPS, which provided support and development to start-ups on a daily level), aiming to transfer best practices from these countries to Southern EU partners; one media partner (SigmaLive), responsible for the dissemination and exploitation activities; and a Business Angel Network, (CYBAN) to understand the perspective of the investor.

In line with the recent developments in the literature on start-up and business idea support the learning units have been identified and organized following a lean approach. Thus, SCIENT training course is composed of only 40 training hours during which it is necessary to give a framework on how to transform a business idea into a business plan. It this context it is necessary to:

1. Realize a "lean" training package, able to be easily adopted and mainstreamed into different University courses;
2. Give some inputs to evaluate the feasibility and the market potential of business ideas, in order to decide whether or not these can be turned into proper business plans;
3. Give students handy tools to let them work individually;
4. Provide PhDs with methodological instruments to be able to deepen knowledge acquired by them.
5. Provide each participant with instruments and concepts that could support the development of his/her business idea;
6. Have a large part of the courses (12 hours) dedicated to practical exercises.

The didactic approach SCIENT is based on a multiple set of instruments, tools and trainers that will closely follow the participants both in class (front lessons, class work etc.) and remotely (skype meetings or similar). Furthermore, each participant will be assisted and, in a way, "mentored" by the respective SCIENT partner by whom he/she has been selected, having a

small group of mentors involved in this process (successful entrepreneurs, business consultants, start-up experts, ICT experts, etc.).

Each SCIENT learning unit will be technically developed (main outlines for setting the framework of each lesson, tools as presentations and instruments for working sessions) by the organization that, within the consortium, is more expertise and competence for the particular subject.

Table 1 shows the structure defined for the SCIENT training.

Table 1
SCIENT TRAINING OUTLINE

Modules	Learning units
Innovation starts with you	▪ Self-assessment and how to model your personal skills ▪ Building a cross-disciplinary team and organisational behaviour issues/growth aspects
Innovation, research, technology transfer and entrepreneurship	▪ Value proposition ▪ Test your traction: minimum viable product; pretotyping; pivot or persevere
Get out of the building and test your customers	▪ Business model Canvas ▪ Development and commercialization
Plan business idea	▪ From business model Canvas to business plan ▪ Start to prepare a real business plan
Protect your business idea	▪ Handling IPR ▪ Open innovation
How to pitch: insights and common mistakes	▪ Pitching and finding investors

ICT Entrepreneur

Through an in-depth analysis of existing entrepreneurship programmes, accelerators and incubators in the EU, the project ICT ENTREPRENEUR aims to identify the existing gap in South EU countries and the best practices from North EU countries and develop a new, top-quality pre-accelerator programme for ICT students/graduates. Although the number of new starts ups have increased dramatically in the past few years, the percentage of youth participating in these programmes is small. Thus there is still a need to develop new, more targeted training programmes for those groups of the population that have the highest potential to propose innovative products and services to the market. ICT students/graduates are considered among the brightest minds, however they fail when turning their findings into marketable products, or considering entrepreneurship as an attractive career option. In fact, there's a deep concern about the specific obstacles ICT students/graduates face in transferring their project findings from university assignments into business ideas and that will be taken into account in the construction of the new programme.

Thus, ICT Entrepreneur is an innovative project, aiming to have a practical application once it is completed. This EU-funded project, entitled "A European University-Business Alliance aiming to foster the entrepreneurial spirit of ICT students" (in the cope of Erasmus^{+}) aims to develop an innovative training package that will help ICT students and graduates to enhance their entrepreneurial skills and put their knowledge into practice.

The ICT Project has the following objectives:

i) Foster the entrepreneurial spirit and develop transversal skills (hard/soft) for ICT students/graduates helping them to create new professional paths;
ii) Through an in-depth needs' analysis, identify the obstacles that ICT students/graduates face in transferring their findings into business ideas;
iii) Enhance scientific entrepreneurship levels within EU Universities, decreasing thus youth unemployment and boosting job creation and growth;
iv) Transfer best practices from North EU countries that have long-term experience in entrepreneurship and accelerator programmes to South EU countries;
v) Opening up new learning opportunities through the practical application of entrepreneurial skills, for the creation of start-ups and spin-offs, commercialisation of new services, products and prototypes.

The project partnership, involving 7 partners from 5 countries (University of Beira Interior from Portugal, European University Cyprus and GrantXpert from Cyprus, University of Gloucestershire from UK, Institut für sozialwissenschaftliche Beratung GmbH (ISOB) and Strategische Partnerschaft Sensorik (SPS) from Germany and FUNDEUN from Spain), has taken this EU initiative in an effort to open up new learning opportunities for the creation of start-ups and spin-offs and the commercialisation of new services, products and prototypes. Furthermore, the partners' aim is to enhance entrepreneurship levels within European universities, thus boosting job creation and growth.

A training programme will be created in order to open up new possibilities through practical application of entrepreneurial skills. Many people will be involved in the co-creation of the training content, such as academics and industry people.

In ICT the business loop "Build-Measure-Learn" is at the core of the approach - the ideas are turned into products, data about how the product is actually used by customers is gathered and analysed, and ideas for improvement are fed back into the product development process.

Based on the model concepts and ideas are grouped together to form a set of modules that follow a logical sequence and comprise all the following aspects: (i) design of the product/service: a start-up could only succeed if it will produce something (good or service) that will address specific consumer needs, either by enhancing a current product or service or by introducing something new; (ii) the lean start-up approach, that is, satisfying consumer needs with the minimum possible resources (this approach will be at the epicentre of the whole training programme and a cornerstone methodology); (iii) intellectual property protection; (iv) finance and marketing concepts; (v) personal skills, leadership and effective building of multidisciplinary teams; (vi) pitching techniques and funding.

The programme of 50 hours of training sessions will generally follow an original and practical approach. For instance, complicated concepts and ideas will be presented with visual tools as is that of the 'mind map' and simple charts which can instantly communicate a concept.

Table 2 shows the structure defined for the ICT Entrepreneur training.

Table 2
ICT TRAINING OUTLINE

Topic	Module
Who am I?	▪ Assessing your entrepreneurial mindset
Soft skills	▪ Developing your entrepreneurial skills
Team building and grow aspects	▪ Moving from "myself" to the "team": from your individual behaviour to team building
Idea generation and entry in the market	▪ From idea generation to commercialisation
Legal aspects and intellectual property	▪ IPR +Technology management: protecting your work handling IPR
Research, start up, market needs	▪ Business model canvas
How to prepare the business plan	▪ Lean business plan
How to sell your idea and get financing	▪ Pitching and finding investors
EU/other funding	▪ From bootstrapping to accelerating your business

CONCLUSIONS AND IMPLICATIONS

This study aimed to show how a lean start-up approach can be useful for development of EEP, presenting two European projects – ICT Entrepreneur and SCIENT - that evidenced that it was possible to integrate the lean start-up approach in the design of entrepreneurship training courses. The integration of the "build-measure-learn" approach, supported by these two European educational projects was explained and discussed. The implementation and assessment of EEP is valuable for variety of stakeholders. Thus, there are a number of players that might find this study useful and interesting.

A diversity of the entrepreneurship programs with broad range of goals, designs and philosophies arise in the HEI. However, while the general path of launching entrepreneurship programs seems to be established, further adjustment of the EEP is needed in order to fulfil the conceptual, operational, monitoring, or system gaps. Challenged with a variety of the EEP individuals, students, policy makers and other stakeholders claim better assessment criteria for recognizing an effective EEP. Thus, later, we intend to link our framework to other existing theories, as well as to follow the participants in the programs analysing the ones that create their own business and observing in loco the applicability of the lean start-up methodology in their enterprise daily routine.

HEI with their core missions of creating, adopting and disseminating knowledge are predictable to offer more and better educated individuals with better professional and entrepreneurial skills and preparedness to make things happen as active citizens. EEP have seminal effect on the attitudes and behaviour and have an impact to accommodate these goals. However, the conceptualization of the EEP is still in the early stage of development and future research areas relating to delivering knowledge, skill, as well as culture and philosophy of EEP are required.

In future, these kinds of Erasmus + programmes should be directed to modernise education and training and to promote innovation, entrepreneurship and employability, in a systematic and monitored way. A huge effort should be done in order to direct Erasmus+

programmes to fighting youth unemployment by helping young people to improve key skills such as proficiency in a foreign language, communication, adaptability or in learning how to live and work with people of different nationalities and cultures. Thus, on the policy level, there is essential to foster EE through benchmarking and best practice identification in different contexts. On the HEI level there is a cumulative stress to adapt the traditional educational programmes to the new complexities of the real and globalised world.

The lean start-up approach here explored could be a way in order to develop an EEP in HEI context. The lean approach reduces constraints by helping new start-ups launching products that clients really want, more quickly and cheaply than traditional methods and with less risk. Despite the importance of the use of the lean start-up approach, business model design should not be forgotten; it stands as a key issue for any individual willing to create a new business. What is necessary to have in mind is the dynamic of the business models that integrate basic insights of innovation and business processes. The lean start-up movement has not gone totally mainstream (Blank, 2013) and it has been associated with the technology industry but this approach is not confined to any specific sector (Ries, 2011). Thus, future work could focus on the effectiveness of the lean start-up methodology by making use of a quantitative research approach and eventually, a study concerning decision making process from a managerial point of view could be of interest for theory and practice.

EEP should care more about which pedagogy develops skills, and what is best appropriate to develop attitudes and entrepreneurial values and be more careful about adjusting the appropriate teaching, learning strategies, and pedagogy.

On the institutional level, the quality of the programs should be rewarded and encouraged to ensure that the incentives advanced will be used to promote a fair and professional conduct of all competing in this field. Collaboration and better use of partnerships with business sector and academic community would be desirable. Additionally, future analysis of European educational entrepreneurship based programs should be carried out aiming the improvement of the process of teaching entrepreneurship to new entrepreneurs.

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WHEN SCIENCE MEETS ENTREPRENEURSHIP: ENSURING BIOBUSINESS GRADUATE STUDENTS UNDERSTAND THE BUSINESS OF BIOTECHNOLOGY

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ABSTRACT

Bioentrepreneurship is considered by many to be more than simply entrepreneurship principles applied to the business value propositions of the biotechnology industry. This stems from the inescapable integration of science and business. In biopharmaceuticals, its most challenging sector, the entrepreneurial effort needed to reach product approval is scientifically complex, takes some ten-to-fifteen years to attain U.S. government registration, and requires over $2 billion of successive capitalization over that period, while only 12% of the drug candidates entering human clinical trials complete all phases and are ultimately approved. This entrepreneurial effort is framed by the BIEM 2.0 (Bioenterprise Innovation Expertise Model) model, which describes the essential expertise needed throughout the innovation phase, i.e., from scientific breakthrough to market-ready product.

This paper describes the global biotechnology industry and its entrepreneurial nature, the application of general entrepreneurship education principles to bioentrepreneurship education, and an overview of global bioentrepreneurship education programs. It further describes the goal of the University of San Francisco's Business of Biotechnology (BoB) program to enable students to easily apply the BIEM 2.0 model to every bioenterprise-related situation. The resulting automaticity-building "engaged analysis" pedagogy is presented, along with its cognitive psychology underpinnings, how traditional mainstream science-business media may be utilized to implement these assignments, the peer-reviewed literature basis for certifying these information sources for entrepreneurship education purposes, and how the "engaged analysis" pedagogy may be applied to general entrepreneurship education. Future research possibilities are also discussed.

INTRODUCTION

One challenge is present in every university course: While the lecturer lectures, the in-class activities are structured, the students are present, presumably listening and participating, and the assignments are assigned and completed, along with midterm and final exams, the question remains: Do the students actually internalize the material? Are they able to apply it with facility? This can be even more challenging when a portion of the subject matter being taught is in a discipline not the students' own. In the field of bioentrepreneurship education, science graduate students are unfamiliar with the discipline of business, while business graduate students are frequently unfamiliar with the levels of science needed for product breakthrough. This is the de facto challenge found in teaching entrepreneurship to graduate students seeking to enter the global biotechnology industry, a place where entrepreneurship is central, and science and business are inextricably linked.

This paper describes the global biotechnology industry and what entrepreneurship means in that context, a view of general entrepreneurship education vs. bioentrepreneurship education,

an overview of bioentrepreneurship education programs, the driving pedagogy of the University of San Francisco's Business of Biotechnology (BoB) program, including the design of its automaticity-building "engaged analysis" pedagogy, the cognitive psychology underpinnings which support its efficacy, and how this "engaged analysis" approach may be applied to general entrepreneurship education. Future research possibilities are also discussed.

THE GLOBAL BIOTECHNOLOGY INDUSTRY

Like any industry, the global biotechnology industry is often viewed in terms of its major, revenue-ranked market sectors: biopharmaceuticals, agricultural biotechnology, alternative fuels, and genetically-engineered industrial enzymes. In 2015, consolidated industry revenues were estimated at $323B, reflecting 564,000 employees and nearly 7,000 businesses worldwide (IBISWorld, 2016).

Of its various market sectors, the biopharmaceuticals sector is the largest and most closely followed in the business media. P&S Market Research reports $160B in global biopharmaceutical revenues for 2014 (P&S Market Research Report [P&S], 2015), currently accounting for some 20 percent of the traditional global pharmaceuticals market, while the market share for biopharmaceuticals is projected to grow (P&S, 2015). The agricultural biotechnology sector is more difficult to quantify as it contributes to multiple areas of the bioeconomy through the sectors of food, animal feed, and alternative energy, among others. In 2015, 450M acres (180M hectares) of bio-engineered crops were planted in 28 countries, representing some 12% of the land surface utilized in crop production worldwide (James, 2016; Bruinsma, 2005). The more cohesive industrial enzymes market sustained 2015 global revenues of $8.8B (Grand View Research, 2016).

This, however, is a picture of the biotechnology industry based solely on revenue, and does not begin to account for its substantive and independent entrepreneurial activities. Many biotechnology firms generate no revenue whatsoever, and are funded variously by venture capital, private equity, corporation partnerships, initial public offerings, and substantial loans, among other emergent investment instruments. While not all investment capital can be tracked, bioenterprise "raised $110 billion in 2015" from venture capital investment, IPOs, and debt sources, additionally receiving another $70B in partnership funding (Yang, 2016). This total, some $180B, is more than half of current $331B global industry revenues, and lends credence to the entrepreneurial profile of the biotechnology industry, where the goal of a bioenterprise can simply be to head toward commercialization, and exit at the first good opportunity. Exiting may take many forms, from licensing or selling outright to other companies in a position to market, manufacture, sell, and distribute, and it may occur at any stage from scientific discovery through to approved product, and for proactive and/or reactive reasons.

In terms of how the investment monies raised are distributed, the high cost and high risk of developing biopharmaceuticals are the most consuming. Once a drug compound has demonstrated promise and passed all animal and other preclinical studies, three successively more expensive human clinical trial phases (I, II & III) are required before FDA approval. For the successful drug, this typically takes over ten-fifteen years while "fewer than 12% of the candidate medicines that make it into phase I clinical trials will be approved by the FDA" (PhRMA - Pharmaceutical Research and Manufacturers of America, 2016). Since roughly nine out of ten compounds are abandoned at various stages in the clinical trials process, the investment into abandoned compounds is frequently weighted into the total cost profile, as solely considering the cost to develop the individual drugs that were successful would be misleading.

The Tufts Center for the Study of Drug Development examined some 106 new drugs from 10 pharmaceutical companies, including the costs of abandoned compounds during that period. The result assigned a cost of some $2.6B per drug at the time of market approval, with an increase to nearly $2.9B when all post-approval R&D costs are factored in (DiMasi, Grabowski & Hansen, 2016). All of this entrepreneurial activity is pre-manufacturing, and most notably, pre-revenue.

While entrepreneurial activity is present in all sectors, the scope of the biotechnology industry itself is changing. There is a growing biomedical devices marketplace, which, when it utilizes genetic tools or information, can be considered a part of the biotechnology industry. Its time-to-market and capital requirements are usually significantly less; however, problematic new technologies can take an undetermined period of time and investment, reflective of the experience of Theranos, Inc. with over $700M invested since 2003 (Siconolfi, Weaver & Carreyou, 2016, June 13).

Other emergent markets center around information. Whether tied to biomedical devices, diagnostics, or patient test results, there is also clinical trials data, health care management, consumer health, and more. With the rapid expansion of mobile devices, inexpensive communications technologies, and the seemingly limitless data storage in the Cloud, the move to mobile cannot to be considered separately, but rather as a potential part of every entrepreneurial play, biotech or otherwise (Kelly, 2016). McKinsey & Company reported that "digital healthcare attracted $4.2 billion in venture capital funding in 2014 alone (up 125 percent over 2013)" (Atluri, et al., 2015), while the TEConomy 2016 report also noted "rapid growth in investment made to IT-related companies". It went further to state: "This has caused the bioscience-related share of overall venture funding to decline during this period" (TEConomy, 2016). The idea that IT investments are somehow bleeding off bioscience venture capital misses the fact that the biotechnology entrepreneurial space is changing, and previous market sectors may not be completely relevant. Case in point is 23andMe, whose stated mission is "To help people access, understand and benefit from the human genome" (23andMe, 2016). Since its founding in 2006, it has collected the genetic material of over 850,000 humans, it is now monetizing access to it in deals with such biopharmaceutical firms as Genentech, and it has reportedly built an in-house therapeutics development team (Regalado, 2016, June 21; Zeleski, 2016, June 22). Is 23andMe, which started as a direct-to-consumer information company, transforming itself into a pharmaceutical feeder company? In which market sector should be it placed? Or will we need to draw the industry sector lines differently?

This is the entrepreneurial space of the biotechnology industry, where even today, its employment needs are growing. In the United States alone, the TEConomy 2016 report, using a definition of biobusiness which includes the entrepreneurial sector, reports that "[t]he bioscience industry employed 1.66 million in 2014 across more than 77,000 U.S. business establishments", adding "an additional 7.53 million jobs", either indirect or induced (TEConomy, 2016). This is the expanded view to which bioentrepreneurship education must be responsive.

ENTREPRENEURSHIP EDUCATION

Entrepreneurship education has its roots in the last century. In the United States, the University of Michigan offered its first course in 1927, Harvard Business School in 1947, and Babson College in 1964, while all three secured the highest three rankings in the 2016 Princeton Review of graduate entrepreneurship programs, in the order, Harvard, Babson and Michigan. (Princeton Review, 2016) By 2006, there were over 600 entrepreneurship degrees in the United States, and by 2008, there were 5,000 courses (Torrance, W.E.F., et al., 2013).

Still, there is, if not, controversy, a lack of cohesion among these programs. As recently as 2013, Steven A. Gedeon expressed: "It would appear that the current 'state-of-the-art' in entrepreneurship education may leave a lot to be desired. There is no common framework or acknowledged best practices" (Gedeon, 2013). Following a detailed analysis, he cites many options for educational goals, but ultimately proposes a new definition:

> *"Entrepreneurship education encompasses holistic personal growth and transformation that provides students with knowledge, skills, and attitudinal learning outcomes. This empowers students with a philosophy of entrepreneurial thinking, passion, and action-orientation that they can apply to their lives, their jobs, their communities, and/or their own new ventures" (Gedeon, 2013).*

While expansive, Gedeon's definition identifies "knowledge, skills, and attitudinal learning outcomes" for good reason. This specifically calls out the three categories of learning described in the Kirkpatrick framework, "the most accepted and influential in terms of educational evaluation", which in turn can be used for assessment of learning, required by business school accrediting agencies, including EFMD (European Foundation for Management Development) and AACSB (Association to Advance Collegiate Schools of Business) (Gedeon, 2013; Eseryel, 2002; Kirkpatrick, 2006). There is no distinction between starting up a business vs. working entrepreneurially in a large company, or being innovative vs. acting as a leader, or intentionally causing "creative disruption" vs. observing a small opportunity in a stable market. This dovetails with Donald F. Kuratko's perspective, noting similar sentiments with his definitions of entrepreneurship, focusing on the entrepreneurial firm, and "seeing entrepreneurship as more than the mere creation of business" (Kuratko, 2005). Rather, "entrepreneurship is a dynamic process of vision, change, and creation" (Kuratko, 2016).

With disagreement about the definition and goals of entrepreneurship education, it is not surprising to find similar disagreement on content. Solomon asserts, also quoted by Gedeon, "there is little consensus on just what exactly entrepreneurship students should be taught" (Solomon, 2007, p. 169; Gedeon, 2013). So the basic decision for any program is "What should be taught and how should it be taught?" (Kuratko, 2005).

Still, "who" might be taught entrepreneurial skills is also interesting. Curiously, while making no mention of qualifications in his design of a new MBA program, Gedeon makes the assessment that the likely pool of candidates will be "mostly engineering, science and technology students" (Gedeon, 2013, Table I, p. 235).

IS "BIOENTREPRENEURSHIP EDUCATION" NECESSARILY DIFFERENT?

It is tempting to suggest that a bioentrepreneur is simply someone who is an entrepreneur in the biotechnology industry, but it is more than that. The bioentrepreneur, and bioentrepreneurship itself, cannot extract itself from the science, most especially in the biopharmaceuticals sector. As Harvard Business School professor Gary Pisano contends in his seminal book, Science Business (Pisano, 2006):

> *"Perhaps in no other industry have science and business been as tightly interwoven as they have become in biotechnology. … From its conception, biotechnology was different. In biotechnology, the science is the business."*

This marriage of science and business places extraordinary pressure on both the bioenterprise, and the educational programs which seek to support it. First of all, the complexity,

cost and duration of biotechnology endeavors are significant, while the risk is relentless throughout the science-to-product life cycle. Furthermore, with the integrated challenge of both science and business, learning "about" the essential traits of bioentrepreneurship in lecture courses is one thing, being able to recognize the characteristics of the challenge in actual practice is another. Thus, we are educating students not only to be entrepreneurial, but also to be prepared for a biotechnology industry where the enterprises themselves are by definition entrepreneurial, and where the path to success is dynamic and subject to change in unexpected ways.

> *"The endeavor carries innate risk. Simply stated, the bioenterprise must drive nascent science to stable, commercially-available and ultimately profitable products and services, an exercise for which success can neither be predicted from the outset, nor at numerous points along the way. Achieving commercial success requires a multi-disciplinary and creative entrepreneurial organization, which can operate within a continually-challenging and unprecedented business context." (Gunn, 2013)*

For the remainder of this paper, the biopharmaceuticals sector shall be used as the primary reference, given its revenue contribution to the global biotechnology industry, the substantial amount of investment capital currently driving innovative efforts, the complexity of these endeavors, the length of the entrepreneurial effort necessary before a commercial product can emerge, and risk.

BIOENTREPRENEURSHIP EDUCATION PROGRAMS

A relatively new educational field, bioentrepreneurship education programs follow a complement of strategies. Given the core need for an understanding of science, as well as a capacity for innovation in scientific research, most educational programs require scientific qualifications and seek to address the business aspects of bioenterprise.

John Hopkins University offers the most diverse choices in graduate entrepreneurship programs, including an MBEE (Masters in Biotechnology Enterprise and Entrepreneurship), a dual MS in Biotechnology/MBA, and a Certificate in Biotechnology Enterprise. The Johns Hopkins' MBEE literature notes that "The curriculum is designed so that scientists can gain an understanding of the entire biotechnology enterprise and considerations that are unique to the biotechnology industry. As a result, graduates will be prepared with the tools and knowledge necessary to commercialize their product ideas and/or manage a biotechnology organization" (Johns Hopkins University, 2016). For both the MBEE and the certificate in Biotechnology Enterprise, a bachelor's degree in the life sciences is recommended or preferred.

At one viewing, the conundrum of science-business is revealed. Is it more science? Is it more business? Must you have both? Where does this fit in the science-to-product life cycle? This leaves room for other educational strategies.

Case Western Reserve University's Masters in Entrepreneurial Biotechnology requires at a minimum a bachelor's degree in biology or biology-related field (Case Western Reserve University, 2016). Karolinska Institutet's Master's Programme in Bioentrepreneurship is "tailored for students with a background in biomedicine, pharmaceutics, biotechnology, healthcare or medicine with courses addressing the central themes of how to manage and develop life science companies", and requires a complementary undergraduate degree (Karolinska Institutet, 2016).

In an entrepreneurial move itself, the Copenhagen Business School offers an MSc in Business Administration and Bioentrepreneurship, wherein the first year of its two-year program must be taken at another university, as it requires in-depth life science (biology/biotechnology).

Approved educational institutions include the University of Copenhagen, the Danish Technical University, or "any Danish or international university offering an equivalent course package" (Copenhagen Business School, 2016). In this way, the entrepreneurship portion of the program can be independent, while remaining interconnected with graduate science curriculum.

At the same time, the MPhil in Bioscience Enterprise program at the University of Cambridge, housed in the Department of Chemical Engineering and Biotechnology, receives applications "from all over the world from candidates with a first degree in life or physical sciences, medicine, law, finance, economics or an allied discipline," with further emphasis that "economics, biophysics, bio- and chemical engineering and financial or legal backgrounds are as likely to be admitted as those with a purely biological focus" (University of Cambridge, 2016).

A separate note should be made regarding bioentrepreneurship education in relation to the emergence of Professional Science Master's degree programs in the United States (Professional Science Master's, 2016). In the 1990's, a general consensus emerged that the U.S. innovation economy required its scientists and engineers to have more industry training. This was called for directly in the 1995 report "Reshaping the Graduate Education of Scientists and Engineers", published jointly by the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine (Griffiths, P., et al., 1995). In 1997, the Alfred P. Sloan Foundation took action, funding the "Sloan Foundation PSM Initiative", awarding grants to research universities in support of creating master's programs which integrated science and business into one degree. The Sloan Foundation seed funding ceased in 2002, yet new PSM programs continued to be created. Today, the Keck Graduate Institute (KGI) oversees PSM accreditation in concert with the National Professional Master's Association (NPSMA) (Professional Science Master's, 2016). There are 350 PSM accredited programs at 163 universities, primarily based in the U.S., although there are also programs in Australia, South Korea and the UK.

Of the 24 official subject areas on which a PSM degree may be based, in fields related to Biotechnology, some 34 PSM programs in the field of Biotechnology have gained accreditation. The aforementioned Case Western masters' degree is the only one which has the accreditation of PSM/Entrepreneurial Biotechnology, while others have the accreditation of PSM/Bioinnovation and PSM/Bio/Pharmaceutical Discovery and Development. Even for those PSM/Biotechnology programs not focused on the entrepreneurial start-up, they may include explicit bioentrepreneurship coursework, while all are directed toward employment in the global biotechnology industry, itself a primarily entrepreneurial endeavor.

A list of selected schools with bioentrepreneurship programs was published by Nature Biotechnology in its "Bioentrepreneur" section (Langer, 2014). Additionally, a number of universities have developed singular bioentrepreneurship courses in various science, engineering, medicine and business departments.

The University of San Francisco's multi-faceted Business of Biotechnology program is described in detail in subsequent sections.

THE BIOTECHNOLOGY INDUSTRY IN THE SAN FRANCISCO BAY AREA

Within the global biotechnology industry, San Francisco is often referred to as the birthplace of biotechnology, as well as the world's largest biocluster. The greater San Francisco Bay Area is home to such research universities as Stanford University and the University of California campuses at San Francisco, Berkeley and Santa Cruz. Add to this, the highest regional concentration of biotechnology companies nationally, its co-location with Silicon Valley, and the

numerous venture capital and private equity firms located on Sand Hill Road in Menlo Park, the San Francisco Bay Area is a significant national and global center for entrepreneurship. (Bloomberg, 2014, December 4) (SVbizLaw Venture Capital Directory, 2016)

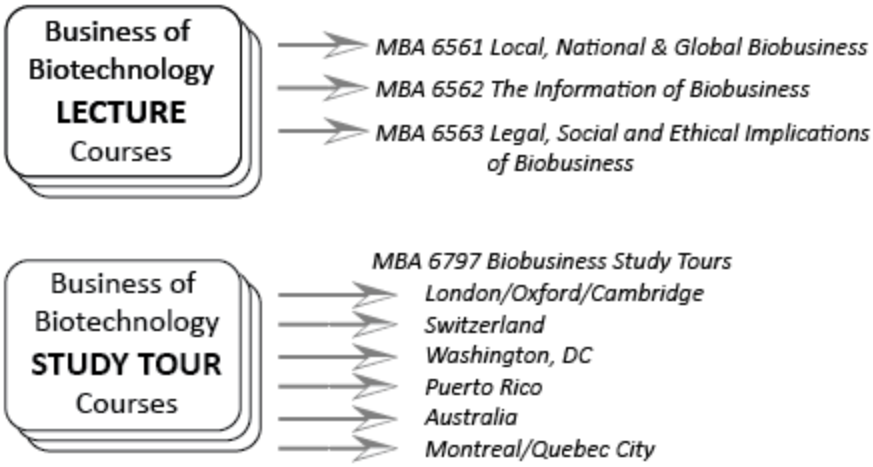
Life sciences venture capital investment directed to San Francisco area biotechnology firms in 2014 reflected over 100 deals with a combined investment in excess of $2B. (SFCED, 2015) (NVCA, 2016) With over 1,600 biotechnology firms, and direct and indirect biotechnology employment of over 250,000 employees, the San Francisco biocluster largely supports the biopharmaceuticals sector and biomedical device research and development. (TEConomy, 2016)

USF'S BUSINESS OF BIOTECHNOLOGY PROGRAM

The Business of Biotechnology (BoB) program is a part of the School of Management at the University of San Francisco, a Jesuit university founded in 1855 and located in San Francisco, California, USA. Its two campuses in San Francisco and four regional campuses in Northern California serve a total student population of approximately 10,000, including 4,000 graduate students. The Business of Biotechnology (BoB) program was originally conceived and proposed in 2006 as a concentration in the Masters in Information Systems (MSIS/Biotechnology). In 2009, the program was expanded to include MBAs, JD/MBAs, and any graduate student in the university with a subject area valuable to the biotechnology industry. The pedagogical concept was to teach all students together, as they would ultimately work together, in the biotech industry. Its goal was to give perspective to the global, national and local biotechnology industry, while introducing entrepreneurial biobusiness concepts to any graduate discipline needed by bioenterprise in its innovation stage, i.e., from scientific or science/technology breakthrough to market-ready product. In 2013, the PSM/Biotechnology was founded in the College of Arts and Science, and graduate science students began enrolling in Business of Biotechnology MBA courses.

The Business of Biotechnology courses are of two types: lecture courses and biobusiness-intensive study tours. Three lecture courses are taught each year, while two biobusiness-focused one-week study tours to a rotating set of global bioclusters are offered. All courses are designed to be taken individually, and in any order. There is no official science prerequisite, other than high school biology. For non-science students, the philosophy is one of "minimalist science", explaining enough for each student to understand the science-business value proposition and attendant risks, regardless of scientific knowledge. For science students, the presumption is that they have no business or entrepreneurship background, and that all must be taught. The Business of Biotechnology pedagogical development is described in detail in "An agile, cross-discipline model for developing bio-enterprise professionals", published in the Journal of Commercial Biotechnology. (Gunn, et al., 2013) The USF Business of Biotechnology courses are cited in Figure 1.

Figure 1
USF'S BUSINESS OF BIOTECHNOLOGY MBA COURSES



FOUNDATIONAL PEDAGOGY: THE BIEM 2.0 MODEL

While the San Francisco Bay Area is largely the targeted region for USF biobusiness graduates, the program pedagogy instills a global view. In the two years prior to conceiving the Business of Biotechnology courses, Gunn conducted one-on-one interviews with 150 national and global biotechnology industry professionals, including CEOs, Chief Scientific Officers, bioscience researchers, industry leaders, policymakers, elected officials, and educators (Gunn M., 2007). While studying various models of entrepreneurship and bioenterprise in the peer-reviewed literature, business books, and the business press, in addition to closely watching the biotechnology industry, Gunn also became interested in business failures. Looking at why biobusinesses fail, Gunn developed a twelve-point model for essential capabilities necessary in the entrepreneurial science-to-product phase of bioenterprise.

> *"When viewed from this perspective, successful bioenterprises were observed to assemble the right expertise at the right time at every turn in the biotechnology innovation life cycle. Agile organizations had an appreciation for a larger spectrum of expertise than did less flexible ones." (Gunn, et al., 2013)*

The result was the BIEM model, the Bioenterprise Innovation Expertise Model, which identified only those expertise areas which were essential to the science-to-product life cycle, and it focused on the biopharmaceuticals space. As described in its first appearance in the peer-review literature:

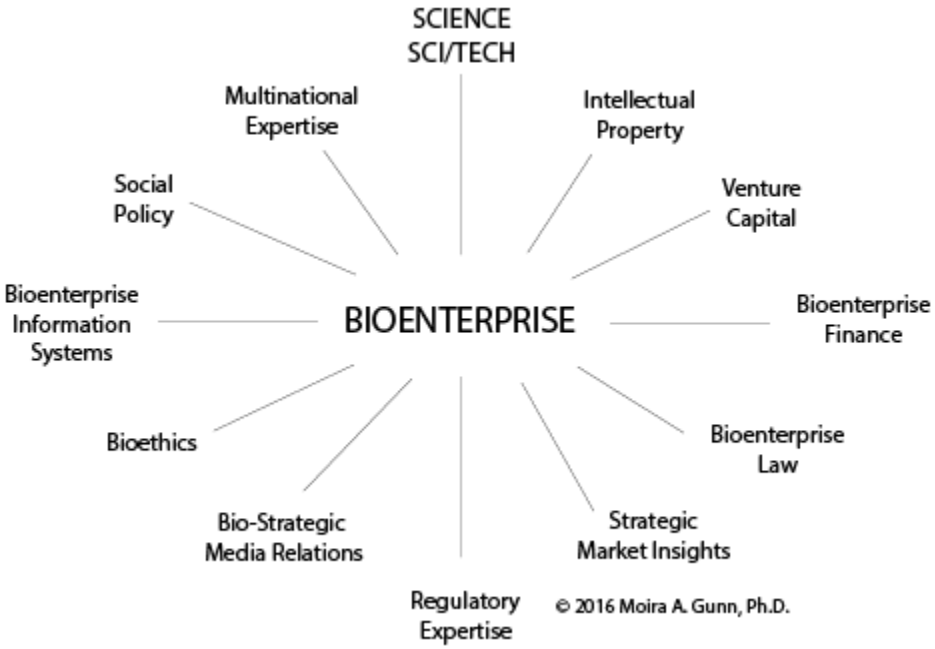
> *"The essence of this model reveals itself when considering the bioenterprise as a whole. While breakthroughs in science are expected, there are also scientific setbacks. The creativity and resilience required to ensure that investment capital is in place goes hand-in-hand with a readiness to construct previously unexplored investment vehicles … How last year's marketplace behaves may be completely different from this year's marketplace – there are competitor's products, a changing regulatory scene, negative and/or positive media, and much, much more. … The sudden perception by the public that there may be a bioethical or social problem can be made worse and/or better by the media, as well as by engaging, mishandling and/or avoiding the right and wrong players. Throughout this process, team dynamics in the science business arena takes on even greater meaning, with the need for high-functioning teams being absolutely essential.*

The Bioenterprise Innovation Expertise Model reflects a dynamic of the expertise needed to address the challenges of bioenterprise, which itself must be both robust and creative, and is frequently called upon to address situations which are arguably unprecedented. Such is the nature of science-business." (Gunn, et al., 2013)

Following this effort, work began on developing a model for biomedical devices. It became clear that the original BIEM model also applied, but with two minor differences. First, in the biomedical device sector, the product could be a standalone device, or an embeddable technology, be it hardware, software or both, which required a greater emphasis on technology. As a result, Science/Technology, or Sci/Tech, was added to the expertise area identified as "Science". The other feature which is not observable in the graphic representation of the BIEM model is that the timeline to market-ready product for biomedical devices is usually much shorter, often just a few years, and the investment capital requirements significantly less, bearing in mind the experience of Theranos, Inc (Siconolfi, Weaver & Carreyou, 2016, June 13).

The current version of the BIEM model, as presently utilized in USF's Business of Biotechnology courses, is BIEM 2.0. It is depicted in Figure 2.

Figure 2
BIEM 2.0 (BIOENTERPRISE INNOVATION EXPERTISE MODEL) – ESSENTIAL CAPABILITIES



The importance of comprehending the BIEM model in terms of bioenterprise entrepreneurship was sufficiently paramount that the model went beyond necessary knowledge for bioentrepreneurship students, and it became an overall driver of context for all subject matter. All courses were created using two sets of rubrics, one for factual knowledge and a second for contextual reference using the BIEM model. For example, factual knowledge would be the difference between biologics and traditional pharmaceuticals, and the protections and limitations of GINA, the Genetic Information Nondiscrimination Act. Contextual knowledge makes these

relevant to various aspects of bioenterprise via the BIEM 2.0 model. Its specific relevance within each of the courses is identified the original article on the program. (Gunn, et al., 2013)

Validating the BIEM Model

The original BIEM model appeared in the peer-review literature in 2013 and 2014 (Gunn, et al., 2013; Gunn & Lorton, 2014). The addition of biomedical device innovation to biopharmaceutical development was introduced in BIEM 2.0, and shared with a number of biotechnology industry professionals at many levels of the bioenterprise.

In 2016, a formal validation study for BIEM was undertaken. In the biopharmaceuticals space, twenty experienced venture capitalists were surveyed regarding the relative importance of each expertise listed in BIEM 2.0 in the science-to-product life cycle, while some in the biopharmaceutical. "Sci/Tech" was split into two disciplines: Science and Technology. Given the long lead time – some ten-fifteen years to a successful drug approval, and the fact that nine out of ten drugs attempted fall out somewhere along the way, the most senior venture capitalists were sought out. With a minimum qualifier of twenty years' experience in the biotechnology industry, their careers averaged 30 years in the biotechnology industry, all had served on numerous corporate boards, 90% had been board chairs, and 80% had been CEO's and/or presidents in the biopharmaceutical sector. All were still active venture capitalists, and while the subjects surveyed reflected a relatively small sample size, they were experts in a very small, experienced field, validating its predictive viability (Kaufman et al., 2006). In short, the findings validated the BIEM model.

> *"The experienced biopharmaceuticals venture capitalists had a very cohesive response to the importance of the innovation expertise capabilities identified by the BIEM model. The data shows an inter-rater reliability of .950 for average measures (F = 19.9; p< .001) pointing to a high level of agreement among VCs when evaluating the 13 items listed. This demonstrates that the venture capitalists are 95% in agreement." (Gunn, et al., 2016)*

The innovation expertise disciplines considered "extremely important" were intellectual property, science, regulatory expertise, venture capital and technology, in that order. The least important, although still regarded as "moderately important", were multinational expertise, social policy and media relations, this last being the lowest ranked. No expertise was eliminated, and while some rewording of definitions resulted, no new innovation expertise emerged.

Unexpected secondary findings relate to the venture capitalists' perspective of their own expertise in relation to the BIEM model. While having made investments in the biopharmaceutical area for many years, only 30% had one or more degrees in the life sciences, yet 60% had MBAs. Recognizing that expertise grows over 30-year careers, the venture capitalists were asked which parts of the BIEM model reflected a primary expertise they felt they personally possessed, and which reflected a secondary expertise for them, if at all. While venture capital was identified as the highest ranked expertise needed, only one venture capitalist (the sole attorney) listed intellectual property as a primary expertise, 75% listed intellectual property on their secondary expertise list, and 20% did not list it as a personal expertise.

The complete findings and details of the BIEM 2.0 Verification Study can be found in the Journal of Commercial Biotechnology (Gunn, et al., 2016). Its findings were introduced into the Business of Biotechnology courses in fall, 2016.

TEACHING THE BIEM MODEL IN PRACTICE

In designing both individual biobusiness courses, as well as the integration of these courses together within a total Business of Biotechnology program, "knowledge, skills, and attitudinal learning outcomes" are paramount (Gedeon, 2013). The factual "knowledge" component was clearly defined (Gunn, et al., 2013, Table 6, p. 82) and is tested directly using standard evaluation techniques, with knowledge-related objectives updated yearly depending upon changes in the biotechnology industry, e.g., the June 13, 2013 U.S. Supreme Court ruling in re: Myriad Genetics and the patenting of gene sequences (Supreme Court of the United States, 2012).

Jumping ahead to the "attitudinal" learning outcomes, differential attitudinal measures have been in place for some time, and the results have been published in the peer-reviewed literature (Gunn & Lorton, 2014). This particular extension of ongoing attitudinal research was spurred by changing biotechnology industry employment needs. As more products were reaching later stages in the science-to-product life cycle, and the biotechnology industry itself was maturing, Nugent and Kulkarni reported on an emergent complement of qualities being sought in prospective employees. In the September, 2013 issue of Nature Biotechnology, their ariticle, "An interdisciplinary shift in demand for talent within the biotech industry" cited an "orientation towards the life sciences industry", "the ability to work effectively across disciplines", and "a commercial market-based mindset versus an academic mindset" (Nugent & Kulkarni, 2013).

While working across disciplines was intrinsic to the program design, and the commercial mindset of the BIEM model was present throughout, testing for an "orientation towards the life sciences industry" was more challenging. Such evaluation clearly falls as an "attitudinal" learning outcome. As the biobusiness lecture class sessions were scheduled through the regular semester, measuring attitudinal changes could not rule out external influences over this period; however, the one-week biobusiness study tours were immersive in nature, and might well produce measurable attitudinal changes without external influences.

As a part of the ongoing GLAS (Gunn-Lorton Attitudinal Surveys) project, work was already underway to attempt to identify non-science students who had a positive and/or negative orientation to science, in general, as well as other attitudinal aspects relating to technology and mathematics. A study of students over multiple biobusiness study tours enabled attitudinal change toward the biotech industry to be measured. Prior to study tours, all students, i.e., MBA, JD/MBA, MSIS, and PSM/Biotechnology, registered high levels of confidence in their own field of study. Post-trip, "non-science students on first-time biobusiness immersive study tours, with no prior biobusiness courses, experience a statistically-significant increase in their confidence levels with respect to biobusiness, information systems, law and the federal government" (Gunn & Lorton, 2014). Additionally, since the science students had taken at least two biobusiness lecture courses prior to attending a study tour, they started the study tour already registering high comfort levels in biobusiness, presumably from their lecture course experience, and yet still gained new and statistically significant comfort levels with general business, solely from the experience of the study tour. This circularly confirmed the absence of general business knowledge on the part of science students.

The details of the study are published in the journal Technology Transfer and Entrepreneurship in "Measuring the Effectiveness of Global Immersive Study Tours to Attract Non-Scientific Working Professionals to the Bioenterprise" (Gunn & Lorton, 2014). Continued measurement of attitudinal change on subsequent study tours confirm the original results, while other attitudinal data continues to be collected.

The final category of Kuratko's learning outcomes, indeed the subject of this paper, is the acquisition of "skills", for which the goal of automatic application of the BIEM model was set (Kuratko, 2015). To that end, the Business of Biotechnology courses were designed to instill in each student the capacity to evaluate anything they read, anything they heard, anything presented to them whatsoever about bioenterprise, and to be able to quickly evaluate this information using the framework of the BIEM model. In this way, they could qualify the information they were absorbing, as well as identify what essential points might be missing. This educational goal reaches beyond a student being able to repeat back the BIEM model on a test. It, instead, seeks to address the challenge laid out in the Introduction: "Do the students internalize the material? Are they able to apply it with facility?" Could they apply the BIEM model automatically? Unconsciously? And how might the courses be structured such that this goal could be accomplished? This is the very definition of an acquired skill.

Applying the BIEM Model with "Automaticity"

"Automaticity" is defined as "expertise learned through practice", so that it becomes automatic (Anderson, 2015). Each of us has experienced this in any number of ways, whether intuitively understood or anecdotally acquired. It is the fact that repetition of process enables that process to become automatic. But how automatic? This is a matter of sliding scale, as "Automaticity is a matter of degree" (Anderson, 2015). Processes that are well and deeply experienced, in fact, permit parallel processing, i.e., enabling the process to be performed while leaving capacity to perform other, non-repetitive processes. This has been well-documented in the literature for some time, but readers will easily recall learning to drive a car for the first time, while now, years later, they are able to drive a car through a variety of situations, even while carrying on a conversation with a fellow passenger. Still, when presented with unfamiliar driving environments, such as on travel in a rental car in a new locale, perhaps with a local language unknown to them, these same drivers may well find casual conversation with a passenger at best, problematic, and at worst, impossible. It requires much more mind capacity to drive in the unfamiliar environment, then with a familiar vehicle over familiar terrain (Wikman, Nieminen & Summala, 1998; Underwood, 1974).

Similarly, both noticing and evaluating the BIEM model innovation expertise disciplines should take less time with practice, and with repetition, the process is presumed to become increasingly automatic. In fact, following a sufficient degree of practice, "participants [lose] their awareness of the automated activity" (Anderson, 2015; Spelke, Hirst, and Neisser, 1976). In its best realization, the students might apply the BIEM model unconsciously, while concentrating consciously on the effort at hand, the factual details of the information they are attempting to absorb about a bioenterprise or any biobusiness-relevant situation. All details will always have a contextual framework.

The challenge was to create "engaged analysis" assignments. How could we engage the student with the BIEM model while teaching the required bioentrepreneurship curriculum?

"Engaged Analysis" PODCAST Assignments

A typical audio podcast assignment is similar to a reading assignment, wherein the point is to extract a set of facts, but the concept of "engaged analysis" requires more. While the extraction of information while listening to the podcast is identical, the students must also place this extracted information into the larger contextual framework of the BIEM model.

The cognitive functions required for such an "engaged analysis" podcast assignment are:

1. listening to the podcast for content in terms of relevance to bioentrepreneurship
2. matching this content to expertise in the BIEM model
3. entering particular items under each BIEM expertise element as appropriate
4. writing up the BIEM analysis upon completion, noting if any elements are not present

The audio format of the material is important to engagement, as well. "Speech comes in over time, which means that the auditory information must be held long enough to determine the meaning of what is being said." (Anderson, 2015) Without going further into cognition theory, reading a written transcript of an interview engages a different set of cognitive functions. In the audio format, it requires the student's attention at a more involved level, especially with the added requirement to classify the information in the BIEM context. With the added goal of achieving automaticity, a series of these "engaged analysis" podcast assignments were designed to introduce intentional repetitive practice. The first challenge was to qualify bioenterprise-relevant podcasts suitable for university education.

Kuratko identifies three primary sources of entrepreneurial learning as providing "the background for entrepreneurship education as we know it today" (Kuratko, 2005). He lists:

1. research-based and popular publications
2. direct observation of practicing entrepreneurs
3. speeches and presentations by practicing entrepreneurs

Under "research-based and popular publications", Kuratko lists ten categories of valid entrepreneurial education information, with textbooks on entrepreneurship, academic journals, books about entrepreneurship, and news periodicals, among them. Under "news periodicals", Kuratko lists as the sole examples: "Business Week, Forbes, Fortune, and The Wall Street Journal" (Kuratko, 2005). These are all traditional mainstream media publications, which have the qualifying feature that each follows published journalistic standards. For example, The Wall Street Journal follows the Dow Jones Code of Conduct, which covers confidential information, appropriate business relationships, compliance with laws and regulations, securities transactions, and political and civic activities, among other aspects (Dow Jones, 2016). Special instructions for news department in The Wall Street Journal, Newswire and MarketWatch are also detailed (ASNE, 2016). All providers of content and all material released by traditional mainstream media are covered by comparable policies. Furthermore, traditional mainstream media requires editorial oversight ensuring that these standards are met.

In 2005, the periodicals listed by Kuratko were essentially print-on-paper publications, with a print-on-screen web presence. Since that time, mainstream media has rapidly expanded, and podcasts are regularly produced by traditional mainstream media. The Wall Street Journal issues multiple free podcasts every day, as does the Financial Times on its FT Audio site. The Washington Post has a line-up of podcasts with a subset focusing on entrepreneurship. Specialty entrepreneurship podcast series are also being created. In April, Forbes announced a new podcast network "targeting millennial women who embrace entrepreneurship" (Forbes, 2016, April 12). Independent of the form of multimedia, such as the written word, audio, video, or graphics, all materials issued by traditional mainstream media publications follow the organization's published journalistic standards.

On the topic of bioentrepreneurship, two traditional mainstream media podcast series were qualified using Kuratko's definition: The podcast version of BioTech Nation, which airs on

NPR's NPR Now SiriusXM satellite radio channel, and First Rounders, a podcast series from Nature Biotechnology (BioTech Nation, 2016; First Rounders, 2016). Both adhere to published ethical standards policies (NPR, 2016; Nature, 2016), and both are available free-of-charge on iTunes and other Internet websites (BioTech Nation iTunes, 2016; First Rounders iTunes, 2016).

BioTech Nation is a regular weekly segment of Tech Nation, which airs on a number of NPR and public radio venues. This biotechnology segment is extracted for separate podcast listening, providing 50-60 unique podcasts each year, with an available archive of just over two years (Biotech Nation, 2016). BioTech Nation interviews are usually 7-10 minutes in length, and are structured as follows:

1. What is the product you are trying to create, or problem you are trying to solve?
2. What is the science driving your product?
3. What is your science-business value proposition?
4. What/who is your competition?
5. Where are the biggest risks? Largest challenges?
6. Where are you in the science-to-product life cycle?
7. What is its status today? How far from an actual product?

Occasionally, long form interviews (up to 30 minutes) from the main Tech Nation program have bioentrepreneurship relevance, and they may also be used for "engaged analysis" assignments (NPR Now, 2016; Tech Nation, 2016). Two to five Tech Nation interviews may be relevant in any given year.

The Nature Biotechnology's First Rounders' podcasts feature a number of bioentrepreneurs discussing their first-hand experience in the biotechnology industry. Started in 2011, it is "a series of conversations with founders, financers and developers from biotech's past, present and future" (First Rounders Home, 2016). These in-depth, long form podcasts offer the insights and experience of starting and building companies, and they feature a number of recognized scientist-entrepreneurs. Not on a fixed schedule, two-to-seven podcasts are available each year.

Having validated the BIEM model and qualified bioentrepreneurship podcast information sources, the design of the "engaged analysis" assignments was straightforward. Matching the content of the podcasts to the learning objectives in each lecture course, and the sequence of lectures therein, a schedule of podcast assignments was created. As some fifty new BioTech Nation are available each year, and each are of short and focused duration, they are primary. About half of the podcast assignments are replaced on an annual basis, and occasionally long form Tech Nation interviews are utilized, as in the Tech Nation interview of Dr. Marshall Summar and Jim Powers in Table 1. The AY2015-2016 "Engaged Analysis" podcast assignments, and the specific learning objective for each assignment, can be found in Tables 1-3. The facts determined from the interview must be listed and placed under the relevant innovation expertise in the BIEM 2.0 model. Expertise which has no relevance must be clearly identified, as well.

Table 1
MBA 6561 LOCAL, NATIONAL & GLOBAL BIOBUSINESS
AY2015-2016 LECTURE COURSE PODCAST ASSIGNMENTS

A Platform Company becomes a Vaccine Company
Stan Erck, President & CEO, NovaVax
Partnering
James Sabry, Global Vice President and Head of Partnering, Genentech
Stem Cell Treatments
Martin McGlynn, Stem Cells, Inc. *
How viruses & bacteria fight disease
Dr. Rip, Ballou, Glaxo Smith Kline (GSK)
Dr. Tim Miller, Abeona Therapeutics
Dr. David Williams, Bactevo
Bioenterprise-Medical Center Partnerships
Dr. Marshall Summar, Children's National Medical Center
Jim Powers, Chair and CEO, Hemoshear Therapeutics
An Alternative Bioenterprise Start-Up Model
Darren Cunningham, CEO, Inflection Biosciences
A Venture Capitalist's View on Health and Tech Investments
Julie Papanek, Principal, Canaan Partners
A Product to Avoid Injections – Insulin/Diabetes, Juvenile Hormones/young teens
Dr. Michael Berelowitz, Chair, Scientific Advisory Board, Oramed Pharmaceuticals

* *On May 31, 2016, concurrent with its announcement that its Phase II study proved insufficiently successful, Stem Cells, Inc. further announced that its Board of Directors had "approved a plan to wind down the Company." (Stem Cells, Inc., 2016) This will be used as a case study in AY 2016/2017.*

Table 2
MBA 6562 THE INFORMATION OF BIOBUSINESS
AY2015-2016 LECTURE COURSE PODCAST ASSIGNMENTS

Patient-Centric Drug Development
Dr. Eric Topol, Director, Scripps Translational Science Institute,
& Author, "The Patient Will See You Now" *****
Dr. Paul Hastings, Chair and CEO, Oncomed Pharmaceuticals, and
Chair, BIO Patient Centric Drug Development Committee
Emergent Treatments, Medical Technology and Consumer Technology
Dr. Daniel Kraft, Founder and President, Exponential Medicine
And Chair of Medicine, Singularity University
Biomedical Devices and Device Platforms
Dr. Anita Goel, Chair and CEO, NanoBioSym
Dr. Sam Whitehouse, COO, QuantuMDx
John McDonough, CEO, T2 Biosystems
Global View of the Biotech Industry by Nation
Mike May, Editor-in-Chief, Scientific American WORLDview 2015
Dr. Yali Friedman, Head, Data Analytics, S.A. WORLDview Scorecard

* *Dr. Topol's book, "The Patient Will See You Now" is one of two texts used in this course*

Table 3
MBA 6563 LEGAL, ETHICAL & SOCIAL IMPLICATIONS OF BIOBUSINESS
AY2015-2016 LECTURE COURSE PODCAST ASSIGNMENTS

The World Trade Organization and Global Biobusiness
Keith Rockwell, Director, Information and External Relations
Antony Taubman, Director, Intellectual Property, Government Procurement, and Competition Division *
Global Intellectual Property Considerations
Gareth Williams, Intellectual Property Attorney, Marks & Clerk
Meeting Societal Need for Biopharma – New Bioenterprise Structures
Dr. Bernard Pecoul, Executive Director, DNDi (Drugs for Neglected Diseases Initiative)
Ethical Implications of Decoding Extinct Species and the Potential for De-Extinction
Dr. Svante Paabo, Director, Department of Genetics, Max Planck Institute for Evolutionary Biology, Leipzig, Germany **
Biotechnology Industry Ethics
Dr. Jennifer Miller, Founder and President, Bioethics International, and Editor, Good Pharma Scorecard
Consumer Biobusiness
Anne Wojcicki, Founder and CEO, 23andMe
Commercializing New Biotechnologies
Katrine Bosley, CEO, Editas Medicine (CRISPR-Cas9)
Government/Social Policy
Dame Sally Davies, Chief Medical Officer, England, Former Chief Scientific Advisor, Department of Health, England
Sir Andrew Dillon, COO, NICE (National Institute for Health and Care Excellence), England

* Mr. Taubman is the WTO lead, on the WTO – World Trade Organization, WIPO – World Intellectual Property Organization, and WHO – World Health Organization publication: ***Promoting Access to Medical Technologies and Innovation Intersections between public health, intellectual property and trade***. WTO ISBN 978-92-870-3839-5, WIPO ISBN 978-92-805-2308-9, WHO ISBN 978-92-415-0487-4. It *is one of two texts used in this course*

** *Dr. Paabo's book, "Neanderthal Man: In Search of Lost Genomes" is one of two texts used in this course*

The "Engaged Analysis" STUDY TOUR Assignment

Kuratko describes two other sources of information about entrepreneurial perspective besides "research-based and popular publications". These include "direct observation of practicing entrepreneurs" and "speeches and presentations (including seminars) by practicing entrepreneurs" (Kuratko, 2005). This is precisely the experiences of students attending biobusiness study tours.

The "engaged analysis" study tour assignment asks the student to synthesize the content of every business encounter, every speaker, every organizations visited during the one-week biobusiness study tour in the context of the BIEM model, and to bring that analysis together in a final report, organized by innovation expertise identified in the BIEM model. The student experience during a study tour is more closely related to presentations and introductory

engagements normative in the business sphere, and much of the information communicated is verbal.

From an instructional point of view it is important to note that the presentations have not been vetted, and so the actual content is not entirely within the instructor's control. Furthermore, different global bioclusters offer different biotechnology industry features; this total analysis enables the students to understand the biocluster from that perspective. Furthermore, the visitation schedule of the same organization may vary from one visit to the next. Thus, the final "engaged analysis" report changes with the experience of each study tour. Recent exemplar organizations visited are listed in Table 4. Clearly, the collective BIEM analysis of a study tour to Washington, DC will differ significantly from a study tour to Switzerland, while both are significant bioclusters in the global biotechnology industry.

Table 4
EXEMPLAR VENUES FOR THE 'ENGAGED ANALYSIS" STUDY TOUR ASSIGNMENT

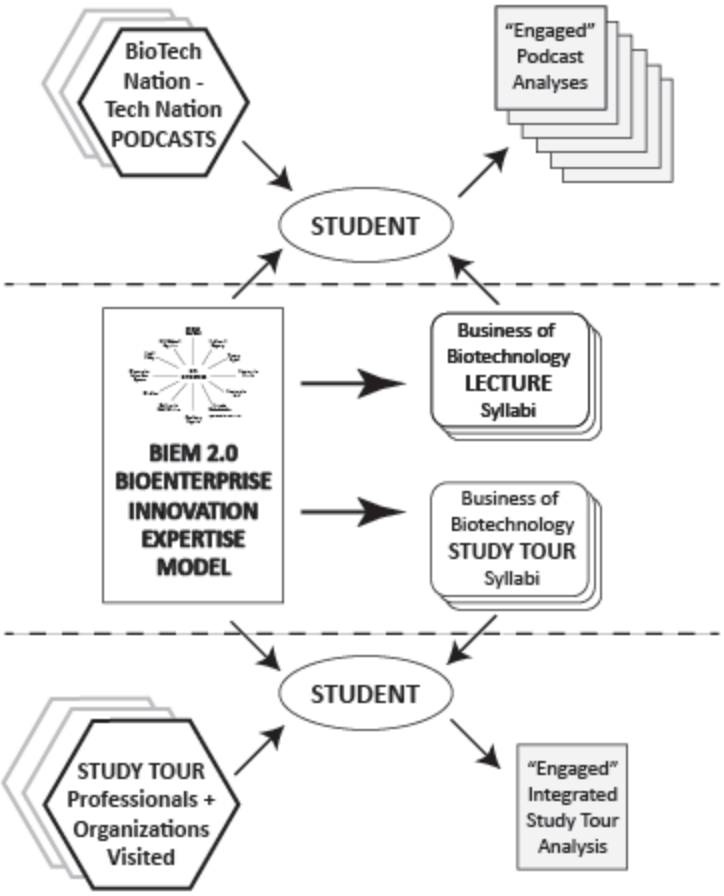
Switzerland	CelGene, DSM/ Sight and Life, EPFL MicroCity, CSEM (Swiss Center for Electronics and Microtechnology), Hoffman-La Roche (Roche), International Red Cross and Red Crescent Novartis, World Health Organization, World Trade Organization
London	EvaluatePharma, Genomics England, Imanova, Marks & Clerk (patent attys), MedCity London, NICE, OneNucleus (Seven biotech start-up presentations), PsiOxus Therapeutics
Washington, DC	FDA (Food and Drug Administration), Hemoshear Therapeutics, Motley Fool, NIH (National Institutes of Health), NSF (National Science Foundation), USPTO (US Patent and Trade Office), National Press Club, NPR, U.S. Supreme Court
Puerto Rico	PRIDCO (Puerto Rico Industrial Development Company), AbbVie Biotechnology, Amgen Manufacturing/Biological Products, INDUNIV, Johnson & Johnson (Janssen Ortho), Medtronic, Pfizer Consumer Healthcare, Pioneer Hi-Bred, University of Puerto Rico/Molecular Sciences Research Center

The Cumulative Effect of "Engaged Analysis" Assignments

Recalling that automaticity comes with repetition, and that a number of students elect to take all the lecture courses and at least one biobusiness study tour, there is a cumulative effect with regard to the "engaged analysis" assignments. A student who has completed all three lecture courses and one study tour would have had the experience of consciously applying the BIEM model 28-45 times. At some point, this will presumably become automatic.

The pedagogical structure for the incorporation of these "engaged analysis" assignments, their relation to the BIEM model, both lecture and study tour syllabi, and the BioTech Nation podcasts can be found in Figure 3.

Figure 3
THE BIEM-DRIVEN "ENGAGED ANALYSIS" PEDAGOGICAL STRUCTURE



APPLICATION OF "ENGAGED ANALYSIS" ASSIGNMENTS TO GENERAL ENTREPRENEURSHIP EDUCATION

Transforming a standard student assignment into an engaged analysis assignment is straightforward. Once basic learning outcomes are established, the elements of the enhanced "engaged analysis" assignment are:

1. a contextual framework, such as a formal model or "attributes list"
2. a qualified information source or first-hand experience

Whether a single assignment, or a series of integrated assignments, the goal for "engaged analysis" assignments is the application of a contextual framework to relevant material. When automaticity also becomes a goal, repeated assignments utilizing the same contextual framework are in order.

There are numerous generalized entrepreneurship models which can be applied, and that is the province of the institution and the instructor. With the recent popular emphasis on "agility" and "pivoting", one example of an applicable model could relate to the "lean startup." The students could be asked to consider how an enterprise or entrepreneur does and/or does not

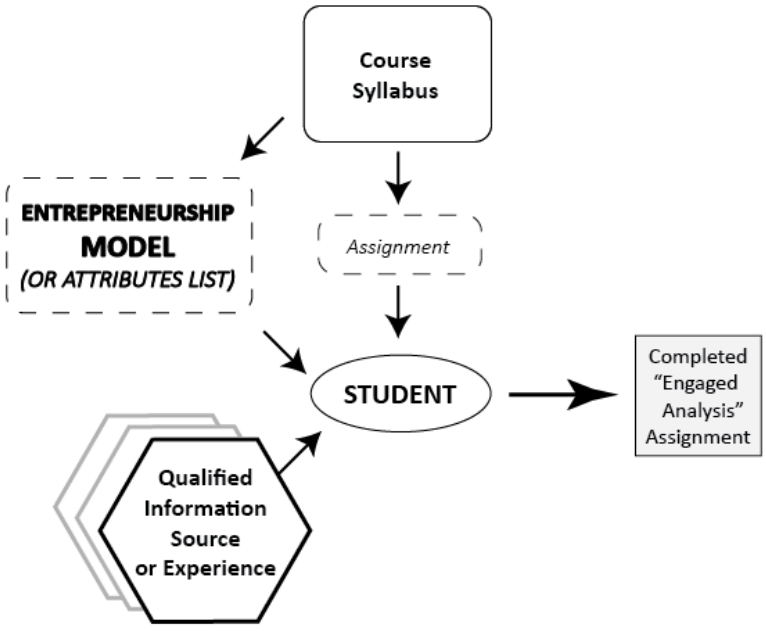
incorporate lean start-up principles. Used on its face, or translated to a list of attributes relevant to the model or course being taught, two references are helpful: Steve Blank's 2013 Harvard Business Review article "Why the Lean Start-Up Changes Everything", and Eric Ries' 2011 book, "The Lean Startup" (Blank, 2013; Ries, 2011).

The other essential characteristic of the "engaged analysis" assignment is in relation to a qualified information source or first-hand experience. With the explosion of information sources online, qualifying material to be assigned to the student remains a crucial element in constructing these assignments. According to Kuratko, suitable original materials may be obtained from academic journals, textbooks on entrepreneurship, books about entrepreneurship, biographies or autobiographies of entrepreneurs, compendiums about entrepreneurs, news periodicals, venture periodicals, newsletters, proceedings of conferences, and government publications (Kuratko, 2005). The advantage of textbook publishers, peer-reviewed journals, and traditional mainstream media is that accreditation mechanisms and editorial controls are naturally in place, ensuring that any material is both accurate and suitable.

As noted earlier, podcasts from The Wall Street Journal, FT Audio, Forbes and any traditional mainstream media may be used, as well as special podcast series produced by traditional mainstream media. Textbook publishers often provide additional instructional materials, and the source material need not be podcasts. It could be a written article, a video, or a graphic. First-hand experience is also a potential information source, so that assigning students to attend an event, listen to an in-class speaker, or participate in an activity can be a suitable source to which to apply the reference model or attributes list.

A generalized "engaged analysis" model for entrepreneurship education is depicted in Figure 4.

Figure 4
A GENERALIZED "ENGAGED ANALYSIS" MODEL FOR ENTREPRENEURSHIP EDUCATION



Creatively using the "engaged analysis" approach is not limited by the information sources listed by Kuratko. Today, some 12 years after publication, students are now equipped

with smartphones. Audio podcasts can be incorporated during tests, asking students to listen to the audio and perform their normal "engaged analysis" assignment during the testing period. Using a podcast during a test may require some 50%-100%-150% more time than the length of the actual podcast due to the engagement required. Some students listen through twice, while others do short rewinds and re-listen as they go.

This testing strategy should be viewed as distinctly different from listening to a podcast and them immediately being asked questions about it. "People can report an auditory stimulus with considerable accuracy if probed for it soon after onset." (Anderson, 2015, pp. 126-127) What this does test is the student's facility with the "process", i.e., applying what they heard with the context of the model. Care should be taken that students with learning challenges receive appropriate consideration and are accommodated.

CONSIDERATIONS FOR FUTURE RESEARCH

In considering future research, it is important to appreciate the deep and substantive research which has been ongoing in the larger framework of automaticity in the field of psychology and educational psychology. An important early reference in the literature is John A. Bargh's 1994 contributed chapter, "The Four Horsemen of Automaticity: Awareness, intention, efficiency, and control in social cognition" (Bargh, J.A., 1994). It focuses on understanding the nature of the entire automaticity process and its four essential characteristics. In simple terms, "awareness" centers on the idea that a person may or may not be aware of performing an automatic process, and similarly, unaware of its impact. "Intentionality" and "controllability" dovetail and range from recognizing that an action they are taking has been automatically instigated, to actively intending to perform an action, to controlling an action once it has started, and more. "Efficiency" anticipates that the action can, with practice, ultimately be done with little or no effort (Bargh, J.A., 1994).

The useful application of automaticity in an educational context can be found in the ubiquitous educational goal of teaching students to read. Most of us read with great facility, but it is the degree of automaticity within that capability that emphasizes its power. This is exemplified by the basic research question: Can a person who knows how to read, when presented with a word, choose not to read it? In a series of interrelated color experiments, combining the reading of words which named the actual color in which it was printed, with other words printed in a different color that the one it describes, and still other words which can intentionally avoid being read while still permitting the subject to identify its color, the results were profound: "Reading of words cannot be inhibited via voluntary intention alone" (Brown, et al., 2002). The automaticity of reading is so all-encompassing that a person cannot choose to not read; once this skill is learned, it has become "involuntary".

In contrast, the action of "engaged analysis" reflects what is considered a higher mental process then reading a single word, whose meaning is uniformly agreed upon, i.e., reading a word is a process where, for the most part, any single input has a single output. No information processing is required. "Engaged analysis", however, is a dual-level information processing task, the output of which may be different for any individual depending upon their expertise, experience and intention. At one level, the input requires some combination of reading, listening, watching and/or otherwise deriving information relative to a bioenterprise, while on another level; it requires applying the BIEM 2.0 model to the information derived. It is on this second level that automaticity is possible.

Research on automaticity with respect to higher mental processes indicates that while automaticity can also be achieved, the origins of the exercise are always "voluntary", since the individual's goals are presumed to be a result of conscious choice:

> *"Under the prevailing assumption that goals were put into place through conscious choice and decision processes, it [seems] that the limits of the extent of environmentally driven, automatic processes [have] been reached. They could determine the shape of inputs but not outputs in the form of memory storage, judgments, evaluations, and behavior" (Bargh & Ferguson, 2000).*

Bargh & Ferguson also considered the situation wherein the individual's goal was no longer conscious, but rather an automatic action was triggered by the environment itself. In the case of "engaged analysis", this could cause the individual to automatically apply the BIEM model whenever presented with information with respect to any bioenterprise.

> *"One possible route remained for higher order processes to occur completely without conscious involvement, and thus automatically. That would be if the environment itself could activate the person's goal within the situation, as part of the preconscious analysis of that situation… This became the so-called auto-motive model of environmentally driven, goal-directed behavior … That research showed that once put into motion by explicit instructions (as in a psychology experiment) or the individual's own intention to pursue the goal (as in life outside the laboratory), well-practiced information-processing and behavioral goals could operate autonomously, needing no conscious intervention to run to completion" (Bargh & Ferguson, 2000).*

Thus, the goal of applying "engaged analysis" beyond the classroom, and within bioentrepreneurship at every level, is realistic, and continued automaticity is possible. Still, is it beyond the student's control? The fact that "engaged analysis" is always, in part, a conscious activity ensures that it can be controlled.

> *"The concept of automaticity has attained a status commensurate with conscious or controlled information processing … [T]wo main developments have taken place over the past 5 years or so. First, no longer is automaticity assumed to result exclusively from a process of skill acquisition, in which a process always begins as a conscious and deliberate one, and only with experience becomes capable of automatic operation. Second … any process of sufficient complexity to be of interest … involves a complex interplay between both controlled (conscious) and automatic processes" (Bargh, J.A., et al., 2012).*

Clearly, "engaged analysis" is just such a process. The educational goal then encourages by practice that part of the process which can become automatic, while educating the student to consciously find, derive and qualify correct information with respect to a bioenterprise.

While the study of automaticity is deeply rooted in the field of psychology, and automaticity practices are present throughout education (think multiplication tables), it has not been widely applied in the entrepreneurship education space. Future research can branch in a number of directions, including:

1. Measurement of the degree of automaticity achieved with "engaged analysis"
2. Timeframe/engagement levels required to reach automaticity
3. Efficacy of different sources of material (print, audio, graphic, video, etc.) to achieve automaticity
4. Differences between different engaged analysis approaches
5. Gender differences
6. Automaticity retention characteristics
7. Identification/qualification of new models with the intention of achieving automaticity with "engaged analysis"

8. Distinguishing between failures of automaticity and failures of model to be applied
9. The ethics and standards when attempting to create automaticity in students
10. Introduction of alternative evaluation models for use in "engaged analysis"

Current specific research efforts include:

1. Completion of data collection from Biomedical Devices venture capitalists seeking verification of the BIEM 2.0 model so that it may be applied with confidence with respect to the Biomedical Devices sector.
2. Initial work to develop tools to test degrees of automaticity over time within an introductory course. A proposed example is a timed, in-class test, to be administered at intervals throughout the course. Several paragraphs describing a real or fictitious bioenterprise will be given to the students, followed by the single question: "What is missing?" The answer would be some number of the essential disciplines, while the BIEM 2.0 model would need to be recalled by the student from memory.

All of these questions, and more, may be examined in the future.

DISCUSSION AND CONCLUSIONS

Entrepreneurship education is a rich and expanding field with bioentrepreneurship education presenting additional challenges. In the biopharmaceuticals sector, the innovation phase is scientifically complex, of long duration, expensive, and risky. The need to understand the entrepreneurial effort in terms of the global biotechnology industry, as well as the science-to-market-ready-product life cycle, is essential. Thus, bioentrepreneurship education requires both content and context.

The creation of the "engaged analysis" pedagogy does just that. It incorporates a contextual framework into all bioentrepreneurship-related knowledge, while creating a specific skill: The ability to apply the BIEM 2.0 model to myriad real-life bioenterprise situations. Successfully incorporated in two ways – graduate MBA lecture courses and MBA biobusiness study tours – dual-level information processing actions within a single assignment are both possible and relevant.

The original intent of the "engaged analysis" assignments was to create a pedagogy so that the students could quickly assess the completeness of any bioenterprise value proposition before them. While the BIEM 2.0 model has been the reference of choice, the students now know that they can use *any* reference model for context. In the best case, this empowers students to create their own reference models (and/or attribute lists), reflective of their personal experience, expertise and goals, as they proceed throughout their careers. In the best case, by creating their own reference models, they may find an entrepreneurial edge, creating unique value in the innovation economy. This is the very definition of entrepreneurship.

ENDNOTES

1 Following first round acceptance of this manuscript, the author contacted Professor Donald F. Kuratko, the Jack M. Gill Distinguished Chair of Entrepreneurship, Professor of Entrepreneurship, Executive & Academic Director of the Johnson Center for Entrepreneurship & Innovation at the Kelley School of Business at Indiana University in Bloomington, Indiana. After reading the manuscript, and following discussion of a conference call, Professor Kuratko agreed with the assessment presented. He followed up with a letter, dated August 30, 2016, in which he states: "In my 2005 article entitled, 'The Emergence of Entrepreneurship Education: Development, Trends and Challenges' published in *Entrepreneurship Theory & Practice,* I spoke about the various sources of entrepreneurial learning including research-based and

popular publications. Within that category I mentioned the traditional print media (Wall Street Journal, Business Week, etc) yet the world has changed dramatically since the publication of that article with a major shift to this new digital age providing greater access to information than ever before. Please know that in developing the 10th edition of my textbook entitled, *Entrepreneurship: Theory, Process & Practice*, my publisher (Cengage/Southwestern) sought more expert interviews and digital representations for the practical applications of the entrepreneurial learning. So, it seems clear that newer forms of popular learning sources are needed and *BioTech Nation* certainly stands as one of those sources in this new age." The full argument is left within the text in order to qualify other materials as valid sources of entrepreneurial learning in future publications.

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