THE VALUATION OF FOODTECH AND AGRI TECH STARTUPS

Roberto Moro Visconti – dept. of Business Management, Università Cattolica del Sacro Cuore, Milan, Italy, roberto.moro@unicatt.it; www.morovisconti.com

Abstract
Food technology (FoodTech) is a branch of food science that deals with the production processes that make foods. AgriTech (AgTech) is the use of technology in agriculture, horticulture, and aquaculture with the aim to improve yield, efficiency, and profitability. AgriTech can be products, services, or applications derived from agriculture that improve various input/output processes. Investments in FoodTech and AgriTech will continue to increase to help deliver on the promise of healthier, more sustainable food systems and more efficient supply / value chains. Startups challenge incumbent food producers and offer digital solutions or other innovative results. The analysis of the innovative business model of a FoodTech or AgriTech startup is a pre-requisite for its appraisal. The evaluation depends on the prioritizing identification of the crucial value drivers.

Keywords: BioTech; Precision Farming; Geographic Information Systems; Digital Platforms; Crowdfunding; P2P lending; Circular economy; Sustainable Development Goals (SDG); Food-chain; Food waste reduction; Discounted Cash Flows.

1. Introduction

There is no bigger industry on our planet than food and agriculture, with a consistent, loyal customer base of more than 7 billion. In fact, the World Bank estimates that food and agriculture comprise about 10% of the global GDP, meaning that food and agriculture would be valued at about $8 trillion globally based on the projected global GDP of $88 trillion for 2019. However, despite a stalwart customer base, the food industry is facing unprecedented challenges in production, demand, and regulations stemming from consumer trends. Consumer demands and focus have changed in recent years. An increasing focus by consumers on sustainability, health, and freshness has placed significant pressure on the food industry to innovate. FoodTech is an ecosystem made of all the agrifood entrepreneurs and startups (from production to distribution) innovating on the products, distribution, marketing, or business model.

FoodTech can be defined as “the intersection between food and technology; the application of technology to improve agriculture and food production, the supply chain and the distribution channel.” ([http://digital-me-up.com/2016/11/27/foodtech/](http://digital-me-up.com/2016/11/27/foodtech/)).

Agritech is the use of technology in agriculture, horticulture, and aquaculture with the aim of improving yield, efficiency, and profitability. Agritech can be products, services, or applications derived from agriculture that improve various input/output processes ([https://web.archive.org/web/20151230102045/http://www.sproutagritech.com/what-is-agritech](https://web.archive.org/web/20151230102045/http://www.sproutagritech.com/what-is-agritech)).

The Ag(ri)Tech industry is concerned with startups that disrupt agriculture. They come up with solutions to improve farming output and quality using drones, sensors, and farm management software. AgTech is also about new farm products, next-generation farms, and urban farming.

2. The FoodTech Ecosystem (From the Farm to the Fork): Digital Platforms and the Circular Economy

The digital ecosystem is a pre-requisite for the evaluation of any FoodTech startup. Within this ecosystem, platforms are digital enablers and facilitators of exchange (of goods, services, and information) between different types of stakeholders that could not otherwise interact with each other. Transactions are mediated through complementary players that share a network ecosystem (Rochet and Tirole, 2003; Armstrong, 2006). Due to their digital characteristics, they have a global outreach that gives them the potential to scale.

FoodTechs find their rationale and natural habitat in a digital ecosystem where they act as an intermediating platform among networked stakeholders.

Digital platforms are at the basis of technology-enabled business models that facilitate exchanges between multiple groups – such as end-users and producers – who do not necessarily know each other.

The continuous upgrade of the technological environment creates new possibilities, and reshapes the value and supply chain of financial intermediation, disrupting the existing business models. Whereas traditional firms create value within the boundaries of a company or a supply chain, digital platforms utilize an ecosystem of autonomous agents to co-create value (Hein et al., 2019).

Digital platforms can be represented by FoodTechs, and they act as a bridging node that connects digital clients to traditional or innovative food producers. Whenever platforms connect different layers (each representing a network sub-system), they can increase the overall systemic value. Digital platforms are multisided digital frameworks that shape the terms on which participants interact.

Digitalization is defined as the concept of “going paperless”, namely as the technical process of transforming analog information or physical products into digital form. The term ‘digital transformation’ refers, therefore, to the application of digital technology as an alternative to solve traditional problems. As a result of digital solutions, new forms of innovation and creativity are conceived, while conventional methods are revised and enhanced.

Digitally born startups or similar tech-businesses are not the only ones interested in adopting digital processes. Traditional businesses may be digitalized as well (e.g., a simple farmer willing to increase exponentially his/her production of tomatoes may digitalize the production activities through new systems or machines). In practice, with digitalization, traditional firms improve their crucial economic and financial parameters, as the EBITDA, which increases, while the WACC reduces, so improving the DCF and the overall enterprise value (EV):

\[
\frac{OCF}{WACC} \approx Enterprise \ Value \uparrow \uparrow \quad [1]
\]

In synthesis, digitalization brings speed and quality at low cost, thus representing a crucial driver for scalability itself. Digitalization enables a business process reengineering of traditional firms, which may presuppose an incremental growth in production.
Figure 1. (adapted from Moro Visconti, 2020, chapter 3) shows the link between digital transformation and scalability.

Digital platforms can be interpreted in terms of network theory (see Barabási (2016), the study of graphs as a representation of either symmetric or asymmetric relations between discrete objects. In computer science and network science, network theory is a part of graph theory: a network can be defined as a graph in which nodes and/or edges have attributes (e.g., names). Digital platforms are intrinsically networked, and within networks, they represent a bridging node that connects users (stakeholders).

The properties of networked platforms are intrinsically consistent with the FoodTech ecosystem. Digital platform analysis can give an interpretation of FoodTechs that considers from an unconventional perspective their properties and potential. FoodTech and AgriTech businesses are increasingly consistent with the circular economy patterns. A circular economy is an economic system aimed at eliminating waste and the continual use of resources. Circular systems employ reuse, sharing, repair, refurbishment, remanufacturing, and recycling to create a closed-loop system, minimizing the use of resource inputs and the creation of waste, pollution, and carbon emissions (Geissdoerfer et al., 2017).

The circular economy aims to keep products, equipment, and infrastructure in use for longer, thus improving the productivity of these resources. All ‘waste’ should become ‘food’ for another process: either a by-product or recovered resource for another industrial process, or as regenerative resources for nature, e.g., compost. This regenerative approach is in contrast to the traditional linear economy, which has a “take, make, dispose of” model of production (https://web.archive.org/web/20130110100128/http://www.thecirculareconomy.org/).
3. Foodchains

A food chain is a linear network of links in a food web starting from producer organisms and ending at apex predator species. Figure 2 illustrates an example of a food chain.

Figure 2 – Food Chain

If this is the original meaning of “food chain”, there is a complementary technological interpretation. The foodchain provides a blockchain technology to trace and digitally authenticate food products, enabling a transparent, safe, and reliable supply chain ecosystem.

In more general terms, a food chain is a linear network of links in a food web starting from producer organisms (such as grass or trees which use radiation from the Sun to make their food) and ending at apex predator species (like grizzly bears or killer whales), detritivores (like earthworms or woodlice), or decomposer species (such as fungi or bacteria).

Visibility and traceability (of food provenance) are a crucial characteristic of food supply chains and may prevent frauds, favoring the immediate localization of intoxication threats.

Data validation is a key characteristic of blockchains, and it may add great value to the food chain that ignites FoodTech or AgriTech applications, as shown in Figure 3.
The food supply chain is exemplified in Figure 4. Each link can be optimized, reducing the time to delivery, improving the resilience to external shocks. A short food supply chain, made possible by digitization and optimization of the process, reduces the intermediation chains, and so the costs for the end-consumer. For example, if a tomato can be sold by the producer directly to the final consumer, the product is cheaper, fresher, and more easily traceable.
4. Business Models

B2C FoodTech is targeted towards consumers and may concern plant-based (meatless) meals, novel distribution systems, or nutrition-based tech.

Industrial food tech is the sub-segment of food tech that focuses on addressing the fundamental business models and B2B pain points within the food industry. The companies include innovators in novel processing and packaging technology and new/functional ingredients that have improved nutritional, labelling or formulation characteristics.

A taxonomy of the main FoodTech & AgriTech business models (synthesized in Table 1) is propaedeutic to the evaluation assessment of the startup.

Table 1 – Food Tech and AgriTech business models

<table>
<thead>
<tr>
<th>Typology</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ag(ri)Tech</td>
<td><strong>FARM MANAGEMENT SOFTWARE</strong>&lt;br&gt;Startups are assisting farmers in managing, organizing and optimizing all the tasks on their farm.</td>
</tr>
<tr>
<td></td>
<td><strong>DRONES &amp; ROBOTS</strong>&lt;br&gt;Startups provide farmers with robots and drones. These tools are used to collect data or directly to replace human tasks.</td>
</tr>
<tr>
<td></td>
<td><strong>URBAN AND NOVEL FARMS</strong>&lt;br&gt;Startups developing urban farms to reduce the distance between production and consumption or developing new-generation farms to increase yields, quality, and sustainability.</td>
</tr>
<tr>
<td></td>
<td><strong>AGRICULTURE MARKETPLACES</strong>&lt;br&gt;Startups working on B2B e-commerce marketplaces for farmers (with products ranging from seeds to equipment).</td>
</tr>
<tr>
<td></td>
<td><strong>AG-BIOTECH</strong>&lt;br&gt;Research and development-oriented startups with a focus on living systems and organisms for agriculture and food.</td>
</tr>
<tr>
<td></td>
<td><strong>PRECISION FARMING</strong>&lt;br&gt;Precision agriculture, satellite farming or site-specific crop management is a farming management concept based on observing, measuring, and responding to inter and intra-field variability in crops.</td>
</tr>
<tr>
<td>Food-science</td>
<td><strong>FUTURE FOODS</strong>&lt;br&gt;Startups working on breakthrough food products, mostly to replace those currently in use with more sustainable and healthier alternatives.</td>
</tr>
<tr>
<td></td>
<td><strong>MEAL SUBSTITUTES</strong>&lt;br&gt;Startups reinvent the meal. Their bars, drinks or powders replace the traditional meal with highly nutritious alternatives.</td>
</tr>
<tr>
<td>Category</td>
<td>Description</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>PACKAGING</td>
<td>Startups develop smarter and more sustainable food and beverage packagings.</td>
</tr>
<tr>
<td>PRODUCT INNOVATION</td>
<td>Startups work on already well-established ingredients or markets (such as chocolate or baby food). The innovation is either in the product itself, the transparency of its composition, the means of distribution or greater customization of the products.</td>
</tr>
<tr>
<td>DRINKS</td>
<td>Startups work on new forms of drinks, to promote new ingredients or a healthier lifestyle.</td>
</tr>
<tr>
<td>APPLIANCES AND COOKWARE</td>
<td>Startups develop a new generation of appliances or cookware. They provide more technology, new distribution channels, or more personalization.</td>
</tr>
<tr>
<td>Foodservice:</td>
<td>Startups reinvent the restaurant industry. It means improving the management of restaurants and institutional catering, connecting customers and businesses directly to local chefs for catering and new experiences.</td>
</tr>
<tr>
<td>RESERVATION PLATFORMS</td>
<td>Services to book a restaurant table, generally with a discount. These startups can specialize by focusing on unsold food, high-end restaurants, etc.</td>
</tr>
<tr>
<td>FOODSERVICE MANAGEMENT</td>
<td>Services to improve restaurant management. These startups help with online presence, cash management, marketing, customer feedback, order taking, inventory management, traceability, recipes, etc.</td>
</tr>
<tr>
<td>CATERING</td>
<td>Startups enable anyone to hire the services of a local chef to organize a dinner or cocktail party based on their tastes and budget.</td>
</tr>
<tr>
<td>STAFFING SERVICES</td>
<td>Startups help restaurants for hiring additional staff for rush hours. These “go-between” platforms enable restaurants to expand their workforce with a few clicks by managing administrative procedures.</td>
</tr>
<tr>
<td>COOKING ROBOTS</td>
<td>Startups develop cooking robots to help or replace human tasks. This also includes 3D printers, automated kiosks, and bartending robots.</td>
</tr>
<tr>
<td>Coaching:</td>
<td>Startups answering the questions, “is my food good for me?” and “what should I eat?” These services target the final customer and help him to have a better view of his food</td>
</tr>
<tr>
<td>NUTRIGENOMICS</td>
<td>Startups work on the genome or microbiota-based tests to establish the personalized nutritional needs of each customer.</td>
</tr>
<tr>
<td>RECOMMENDATION</td>
<td></td>
</tr>
</tbody>
</table>
purchases and intakes to reach his personal goals.

<table>
<thead>
<tr>
<th>Startups</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RECIPIES</td>
<td>Startups reinvent the recipe as we know it with new formats such as interactive games or addictive videos broadcast on social networks.</td>
</tr>
<tr>
<td>TRANSPARENCY</td>
<td>Startups enable consumers to access quality information on food products. They aim to create standardized content that is easily accessible by everyone and potentially exchangeable between different services.</td>
</tr>
<tr>
<td>FOOD EXPERIENCES</td>
<td>Startups create tourist experiences around the food-related points of interest (brewery, vineyard, …) or reinventing access to cooking classes.</td>
</tr>
<tr>
<td>RECIPES</td>
<td>Startups answer the question “what should I eat (or drink)?” with recommendations of meals, recipes, shopping lists, or wines based on each customer’s expectations. These startups use manual recommendations from specialists or algorithms based on artificial intelligence.</td>
</tr>
</tbody>
</table>

**Delivery:** startups answering the delivery challenges in the food industry, with home delivery of groceries, restaurant meals, or meals prepared in their kitchens.

<table>
<thead>
<tr>
<th>Startups</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEAL KITS</td>
<td>Startups regularly deliver to their customers all the ingredients to make meals by adapting quantities to the home.</td>
</tr>
<tr>
<td>MARKETPLACES</td>
<td>Startups develop food e-commerce platforms, including farm-to-home solutions and store delivery.</td>
</tr>
<tr>
<td>DISCOVERY BOX</td>
<td>Delivery services to receive products selected by experts every month. Wine, tea, coffee, and exotic new products from around the world are among the most popular themes.</td>
</tr>
<tr>
<td>RESTAURANT DELIVERY</td>
<td>Startups enable their customers to be delivered with prepared meals from nearby restaurants, mostly through independent drivers.</td>
</tr>
<tr>
<td>FULL STACK DELIVERY</td>
<td>Startups deliver meals prepared in their own kitchens.</td>
</tr>
<tr>
<td>DELIVERY ROBOTS</td>
<td>Startups develop food delivery drones or robots.</td>
</tr>
<tr>
<td>VENDING MACHINES</td>
<td>New generation of the automated machines providing food groceries, meals, and snack.</td>
</tr>
</tbody>
</table>

**Retail:** startups developing solutions for the retail food industry, from the digitalization of the supply chain to a better in-store shopper experience.

<table>
<thead>
<tr>
<th>Startups</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATA FOR SUPPLY CHAIN</td>
<td>Startups address the issues of the food supply chain with tools to improve data management.</td>
</tr>
<tr>
<td>LOYALTY</td>
<td></td>
</tr>
</tbody>
</table>
Startups work to (re)build a bond between brands and their customers while providing food corporates with more in-store data on consumers behaviours.

OMNICHANNEL SERVICES
Startup providing brands with solutions to digitalize, integrate, and manage all the channels to sell their products in-store and online.

Source: https://www.digitalfoodlab.com/

4. The Accounting Background for Valuation

The evaluation is sensitive to forward-looking data that can be used to build up a sound business plan with a time horizon coherent with the average life cycle of the products and services of the FoodTech. A business plan is a formal accounting statement that numerically describes a set of business goals, the reasons why they are believed attainable, and the strategic plan and managerial steps for reaching those goals. Hypotheses and visionary ideas of game-changers must be transformed into numbers and need to be backed by reasonable and verifiable assumptions about future events and milestones (Moro Visconti, 2019).

The accounting background is composed of pro forma balance sheets (of some 3-5 years) and perspective income statements. The matching of these two documents produces expected cash flow statements. Economic and financial margins are the crucial accounting parameters for valuation that are represented by the EBITDA, the EBIT, the operating and Net Cash Flows, and the Net Financial Position, as it will be shown in the formulation of the appraisal approaches.

The appraisal methodology may conveniently start from a strategic interpretation of the business model (that derives from accounting data) to extract the key evaluation parameters to insert in the model, as shown in Figure 4.

Figure 4 – Evaluation Methodology

An analysis of the business model may conveniently consider:
1. The revenue model;
2. The strategic goals;
3. The growth drivers;
4. The expected investments;
5. The market trends.
5. Valuation Methods

The evaluation criteria typically follow the (actual and prospective) business model of the target company.

A comparison of the primary evaluation criteria in traditional firms versus high-tech firms (startups) is reported in Table 2.
Table 2 – Comparison of the main evaluation approaches of traditional firms, technological startups, and banks

<table>
<thead>
<tr>
<th>Traditional Firm</th>
<th>Technological Startup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balance-sheet based (Fernandez, 2001)</td>
<td>Venture Capital method</td>
</tr>
<tr>
<td>Income</td>
<td>Binomial trees</td>
</tr>
<tr>
<td>Mixed capital-income</td>
<td>Financial approach (Discounted Cash Flows)</td>
</tr>
<tr>
<td></td>
<td>Market multiples (comparable firms)</td>
</tr>
</tbody>
</table>

In this case, the value may be inferred even with differential income methodologies, traditionally used in the evaluation of intangible assets (within the income approaches).

According to the International Valuation Standard IVS 210, § 80:

80. Premium Profit Method or With-and-Without Method
80.1 The premium profit method, sometimes referred to as the with-and-without method, indicates the value of an intangible asset by comparing two scenarios: one in which the business uses the subject intangible asset and one in which the business does not use the subject intangible asset (but all other factors are kept constant). (...) 80.2 The comparison of the two scenarios can be done in two ways:
   a) calculating the value of the business under each scenario with the difference in the business values being the value of the subject intangible asset, and
   b) calculating for each future period the difference between the profits in the two scenarios. The present value of those amounts is then used to reach the value of the subject intangible asset.

Among the main evaluation methodologies of FoodTech companies, the following are the most relevant:

1. Financial approach (Discounted Cash Flows – DCF);

6.1. The Financial approach

The financial approach is based on the principle that the market value of the company is equal to the discounted value of the cash flows that the company can generate (“cash is king”). The determination of the cash flows is of primary importance in the application of the approach, as is the consistency of the discount rates adopted.

The doctrine (especially the Anglo-Saxon one) believes that the financial approach is the "ideal" solution for estimating the market value for limited periods. It is not possible to make reliable estimates of cash flows for longer periods. “The conceptually correct methods are those based on cash flow discounting. I briefly comment on other methods since - even though they are conceptually incorrect - they continue to be used frequently” (Fernandez, 2001).

This approach is of practical importance if the individual investor or company with high cash flows (leasing companies, retail trade, public and motorway services, financial trading, project financing SPVs, etc.) are valued.

Financial evaluation can be particularly appropriate when the company's ability to generate cash flow for investors is significantly different from its ability to generate income, and forecasts can be formulated with a sufficient degree of credibility and are demonstrable.

There are two complementary criteria for determining the cash flows:
a.1. The cash flow available to the company (Free cash flow to the firm)
This configuration of expected flows is the one most used in the practice of company valuations, given its greater simplicity of application compared to the methodology based on flows to partners. It is a measure of cash flows independent of the financial structure of the company (unlevered cash flows) that is particularly suitable to evaluate companies with high levels of indebtedness, or that do not have a debt plan. In these cases, the calculation of the cash flow available to shareholders is more difficult because of the volatility resulting from the forecast of how to repay debts. This methodology is based on the operating flows generated by the typical management of the company, based on the operating income available for the remuneration of own and third-party means net of the relative tax effect. Unlevered cash flows are determined by using operating income before taxes and financial charges.

\[
\text{Net operating income} - \text{taxes on operating income} + \text{amortization/depreciation and provisions (non-monetary operating costs)} + \text{technical divestments (-investments)} + \text{divestments (-investments) in other assets} + \text{decrease (-increase) in operating net working capital} = \text{Cash flow available to shareholders and lenders (operating cash flow)}
\]

The cash flow available to the company is, therefore, determined as the cash flow available to shareholders, plus financial charges after tax, plus loan repayments and equity repayments, minus new borrowings and flows arising from equity increases. The difference between the two approaches is, therefore, given by the different meanings of cash flows associated with debt and equity repayments. Cash flows from operating activities are discounted to present value at the weighted average cost of capital.

This configuration of flows offers an evaluation of the whole company, independently from its financial structure. The value of the debt must be subtracted from the value of the company to rejoin the value of the market value, obtained through the cash flows for the shareholders. The relationship between the two concepts of cash flow is as follows:

\[
\text{cash flow available to the company} = \text{cash flow available to shareholders} + \text{financial charges (net of taxes)} + \text{loan repayments} - \text{new loans} \quad [2]
\]

a.2. The (residual) cash flow available to shareholders
This configuration considers the only expected flow available for members' remuneration. It is a measure of cash flow that considers the financial structure of the company (levered cash flow). It is the cash flow that remains after the payment of interest and the repayment of equity shares and after the coverage of equity expenditures necessary to maintain existing assets and to create the conditions for business growth.

In M&A operations, the Free Cash Flow to the Firm (operating cash flow) is normally calculated to estimate the Enterprise Value (comprehensive of debt). The residual Equity Value is then derived subtracting the Net Financial Position. The cash flow for the shareholders is determined, starting from the net profit:

\[
\]
Net profit (loss) 
+ amortization/depreciation and provisions 
+ divestments (- investments) in technical equipment 
+ divestments (- investments) in other assets 
+ decrease (- increase) in net operating working capital 
+ increases (- decreases) in loans 
+ equity increases (- decreases) 
= **Cash flows available to shareholders (Free cash flow to equity)**

The discounting of the free cash flow for the shareholders takes place at a rate equal to the cost of the shareholders’ equity. This flow identifies the theoretical measure of the company's ability to distribute dividends, even if it does not coincide with the dividend paid.

Cash flow estimates can be applied to any type of asset. The differential element is represented by their duration. Many assets have a defined time horizon, while others assume a perpetual time horizon, such as shares.

Cash flows (CF) can, therefore, be estimated using a normalized projection of cash flows that it uses, alternatively:

- unlimited capitalization: \[ W_1 = \frac{CF}{i} \] [3]
- limited capitalization: \[ W_2 = CF \times \frac{1}{1+i} \] [4]

where \( W_1 \) and \( W_2 \) represent the present value of future cash flows.

The discount rate to be applied to expected cash flows is determined as the sum of the cost of equity and the cost of debt, appropriately weighted according to the leverage of the company (the ratio between financial debt and equity). This produces the Weighted Average Cost of Capital (WACC):

\[
WACC = k_i (1 - t) \frac{D}{D+E} + k_e \frac{E}{D+E} \] [5]

Where:
\( k_i \) = cost of debt;  
\( t \) = corporate tax rate;  
\( D \) = market value of debt;  
\( E \) = market value of equity;  
\( D+E \) = raised capital;  
\( k_e \) = cost of equity (to be estimated with the Capital Asset Pricing Model - CAPM or the Dividend Discount Model).

The cost of debt capital is easy to determine, as it can be inferred from the financial statements of the company. The cost of equity or share capital, which represents the minimum rate of return required by investors for equity investments, is instead more complex and may use the CAPM or the Dividend Discount Model (a method of valuing a company's stock price considering the sum of all its future dividend payments, discounted back to their present value. It is used to value stocks based on the net present value of future dividends).

The formula of the CAPM is the following:

\[
E(r)_{FoodTech} = r_{free} + \beta_{FoodTech}[(E(r)_{market} - r_{free})] \] [6]

Where:
A central element is represented by the beta (β) of the FoodTech to be evaluated that consists of the ratio between the covariance of the FoodTech security with its stock market, divided by the variance of the market. Market betas, subdivided by industry, may be detected from the dataset of A. Damodaran (see, for instance, http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/Betas.html).

Once the present value of the cash flows has been determined, the calculation of the market value W of the company may correspond to:

(a) the unlevered cash flow approach:

\[ W = \sum \frac{CF_0}{WACC} + VR - D \quad [7] \]

(b) the levered cash flow approach:

\[ W = \sum \frac{CF_n}{K_e} + VR \quad [8] \]

where:

- \( \sum \frac{CF_0}{WACC} \) = present value of operating cash flows
- \( \sum \frac{CF_n}{K_e} \) = present value of net cash flows
- VR = terminal (residual) value
- D = initial net financial position (financial debt - liquidity)

The residual value is the result of discounting the value at the time n (before which the cash flows are estimated analytically). It is often the greatest component of the global value W (above all in intangible-intensive companies) and tends to zero if the time horizon of the capitalization is infinite (VR / \( \infty \) = 0).

The two variants (levered versus unlevered) give the same result if the value of the firm, determined through the cash flows available to the lenders, is deducted from the value of the net financial debts. Operating cash flows (unlevered) and net cash flows for shareholders (levered) are determined by comparing the last two balance sheets (to dispose of changes in operating Net Working Capital, fixed assets, financial liabilities, and shareholders’ equity) with the income statement of the last year.

The accounting derivation of the cash flow and its link to the cost of capital (to get DCF – Discounted Cash Flows) is illustrated in Table 3.
Table 3. *Cash flow statement and link with the cost of capital*

<table>
<thead>
<tr>
<th>Cash flow statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBIT + Depreciation and amortization</td>
</tr>
<tr>
<td>= EBITDA (A)</td>
</tr>
<tr>
<td>± Δ Operating Net Working Capital</td>
</tr>
<tr>
<td>± Δ fixed assets (CAPEX)</td>
</tr>
<tr>
<td>= Operating cash flow (unlevered cash flow to the firm) (B)</td>
</tr>
<tr>
<td>- Financial charges</td>
</tr>
<tr>
<td>± Δ net financial liabilities</td>
</tr>
<tr>
<td>± Extraordinary income and charges</td>
</tr>
<tr>
<td>- Taxes</td>
</tr>
<tr>
<td>± Δ Equity</td>
</tr>
<tr>
<td>= Net (free) cash flow to the shareholders (levered cash flow) (C)</td>
</tr>
</tbody>
</table>

Reconciliation statement:

Closing cash and cash equivalents
- Opening cash and cash equivalents

= Change in net cash flow = liquidity (D) = (C)

The net cash flow for the shareholders coincides with the free cash flow to equity and, therefore, with the dividends that can be paid out, once it has been verified that enough internal liquidity resources remain in the company. This feature, associated with the ability to raise equity from third parties and shareholders, are such as to allow the company to find adequate financial coverage for the investments deemed necessary to maintain the company's continuity and remain on the market in economic conditions (minimum objectives). They should allow for the creation of incremental value in favor of shareholders, who are the residual claimants (being, as subscribers of risky capital, the only beneficiaries of the variable net returns, which, as such, are residual and subordinate to the fixed remuneration of the other stakeholders).

The estimate of cash flows can be applied to any activity. The differential element is service life. Many activities have a defined time horizon, while others assume a perpetual time horizon, such as company shares. The discounted cash flow (DCF) approach can be complemented with real options that incorporate intangible-driven flexibility in the forecasts.

DCF is ubiquitous in financial valuation and constitutes the cornerstone of contemporary valuation theory (Singh, 2013). The robustness of the model, as well as its compatibility with the conventional two-dimensional risk-return structure of investment appraisal, makes it suited to a multitude of valuations. Accounting standards across the globe recognize the efficacy of this model and advocate...
its use wherever practicable. FAS 141 and 142 of the United States and IAS 39 that relate to the accounting of intangible assets, recommend the use of DCF methodology for attributing a value to such assets.

Some caveats should be considered. According to OECD (2017):

- “Valuation techniques that estimate the discounted value of projected future cash flows derived from the exploitation of the transferred intangible or intangibles can be particularly useful when properly applied. There are many variations of these valuation techniques. In general terms, such techniques measure the value of an intangible by the estimated value of future cash flows it may generate over its expected remaining lifetime. The value can be calculated by discounting the expected future cash flows to present value. Under this approach valuation requires, among other things, defining realistic and reliable financial projections, growth rates, discount rates, the useful life of intangibles, and the tax effects of the transaction. Moreover, it entails consideration of terminal values when appropriate” (par. 6.157).
- “When applying valuation techniques, including valuation techniques based on projected cash flows, it is important to recognize that the estimates of value based on such techniques can be volatile. Small changes in one or another of the assumptions underlying the valuation approach or in one or more of the valuation parameters can lead to large differences in the intangible value the approach produces. A small percentage change in the discount rate, a small percentage change in the growth rates assumed in producing financial projections, or a small change in the assumptions regarding the useful life of the intangible can each have a profound effect on the ultimate valuation. Moreover, this volatility is often compounded when changes are made simultaneously to two or more valuation assumptions or parameters” (par. 6.158).
- “The reliability of a valuation of a transferred intangible using discounted cash flow valuation techniques is dependent on the accuracy of the projections of future cash flows or income on which the valuation is based” (par. 6.163).
- “The discount rate or rates used in converting a stream of projected cash flows into a present value is a critical element of a valuation approach. The discount rate considers the time value of money and the risk or uncertainty of the anticipated cash flows. As small variations in selected discount rates can generate large variations in the calculated value of intangibles using these techniques” (par. 6.170).
- “It should be recognized in determining and evaluating discount rates that in some instances, particularly those associated with the valuation of intangibles still in development, intangibles may be among the riskiest components” (par. 6.172).

6.2. Empirical approaches (Market multipliers)

The market value identifies:

(a) The value attributable to a share of the equity expressed at stock exchange prices;
(b) The price of the controlling interest or the entire share equity;
(c) The traded value for the controlling equity of comparable undertakings;
(d) The value derived from the stock exchange quotations of comparable undertakings.

Sometimes comparable trades of companies belonging to the same product sector with similar characteristics (in terms of cash flows, sales, costs, etc.) are used. In practice, an examination of the prices used in negotiations with companies in the same sector leads to quantifying average parameters:

- **Price / EBIT**
These ratios seek to estimate the average rate to be applied to the company being assessed. However, there may be distorting effects of prices based on special interest rates, in a historical context, on difficulties of comparison, etc.

In financial market practice, the multiples methodology is frequently applied. Based on multiples, the company's value is derived from the market price profit referring to comparable listed companies, such as net profit, before tax or operating profit, cash flow, equity, or turnover.

The attractiveness of the multiples approach stems from its ease of use: multiples can be used to obtain quick but dirty estimates of the company's value and are useful when there are many comparable companies listed on the financial markets and the market sets correct prices for them on average.

Because of the simplicity of the calculation, these indicators are easily manipulated and susceptible to misuse, especially if they refer to companies that are not entirely similar. Since there are no identical companies in terms of entrepreneurial risk and growth rate, the assumption of multiples for the processing of the valuation can be misleading, bringing to “fake multipliers”.

The use of multiples can be implemented through:

A. Use of fundamentals;
B. Use of comparable data:
   B.1. Comparable companies;
   B.2. Comparable transactions.

The first approach links multiples to the fundamentals of the company being assessed: profit growth and cash flow, dividend distribution ratio, and risk. It is equivalent to the use of cash flow discounting approaches.

Discount factors incorporate risk. According to OECD (2017):

- “When identifying risks in relation to an investment with specificity, it is important to distinguish between the financial risks that are linked to the funding provided for the investments and the operational risks that are linked to the operational activities for which the funding is used, such as for example the development risk when the funding is used for developing a new intangible” (par. 6.61).
- “Particular types of risk that may have importance in a functional analysis relating to transactions involving intangibles include:
  (i) risks related to development of intangibles, including the risk that costly research and development or marketing activities will prove to be unsuccessful, and considering the timing of the investment (for example, whether the investment is made at an early stage, mid-way through the development process, or at a late stage will impact the level of the underlying investment risk);
  (ii) the risk of product obsolescence, including the possibility that technological advances of competitors will adversely affect the value of the intangibles;
  (iii) infringement risk, including the risk that defense of intangible rights or defense against other persons’ claims of infringement may prove to be time-consuming, costly and/or unavailing;
  (iv) product liability and similar risks related to products and services based on the intangibles;
(v) exploitation risks, uncertainties in relation to the returns to be generated by the intangible” (par. 6.65).

For the second approach, it is necessary to distinguish whether it is a valuation of comparable companies or comparable transactions.

The comparability concerns different firms but is also related to their contents.

In the case of comparable companies, the approach estimates multiples by observing similar companies. The problem is to determine what is meant by similar companies. In theory, the analyst should check all the variables that influence the multiple.

In practice, companies should estimate the most likely price for a non-listed company, taking as a reference some listed companies, operating in the same sector, and considered homogeneous. Two companies can be defined as homogeneous when they present, for the same risk, similar characteristics, and expectations.

The calculation is:

- A company whose price is known \( P_1 \).
- A variable closely related to its value \( X_1 \)

the ratio \( P_1/X_1 \) is assumed to apply to the company to be valued, for which the size of the reference variable \( X_2 \) is known.

Therefore:

\[
\frac{P_1}{X_1} = \frac{P_2}{X_2} \tag{9}
\]

so that the desired value \( P_2 \) will be:

\[
P_2 = X_2 \left[ \frac{P_1}{X_1} \right] \tag{10}
\]

According to widespread estimates, the main factors in establishing whether a company is comparable are:

- Size;
- Belonging to the same sector (see for instance the Statistical Classification of Economic Activities in the European Community, commonly referred to as NACE);
- Financial risks (leverage);
- Historical trends and prospects for the development of results and markets;
- Geographical diversification;
- Degree of reputation and credibility;
- Management skills;
- Ability to pay dividends.

Founded on comparable transactions, the basis of valuation is information about actual negotiations (or mergers) of similar - i.e., comparable - companies.

The use of profitability parameters is usually considered to be the most representative of company dynamics.

Comparables may be looked for consulting databases like Orbis (https://www.bvdinfo.com/en-gb/our-products/data/international/orbis).

Among the empirical criteria, the approach of the multiplier of the EBITDA (Earnings Before Interest, Taxes, Depreciation, and Amortization) is widely diffused. The net financial position must be added algebraically to the EBITDA, to pass from the estimate of the enterprise value (total value of the company) to that of the equity value (value of the net assets). The formulation is as follows:
W = average perspective EBITDA * Enterprise Value / sector EBITDA = \[11\]

Enterprise Value of the company

And then:

Equity Value = Enterprise Value ± Net Financial Position \[12\]

The DCF approach can be linked to the market approach since they both share as a starting parameter the EBITDA.

REFERENCES