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## Understanding the Dynamics of Multi-level Marketing using Agents-Based Simulation

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### ABSTRACT

Multi-level marketing (MLM) companies rely on independent distributors whose revenues depend on their sales and the sales of their chain of recruits. Even though MLM companies have experienced tremendous growth during the last two decades and have reached many markets and countries, the MLM business model is still very controversial from legal and ethical standpoints. The controversy stems from the confusion with pyramidal schemes in which distributors' income depends solely on the ability of the company to recruit new distributors. Using Agents based simulation; this paper seeks to explore the dynamic of the MLM business model versus pyramidal schemes and addresses specifically the impact of compensation choices on metrics such as distributors' numbers, turnover and income. Simulation results show that the business model gets closer to pyramidal practices when the number of levels in the organization is high.

**Keywords:** Multi-Agent Simulation; Multi-level marketing, Pyramidal schemes.

### 1. INTRODUCTION

According to Zábaj (2014) "Multi-Level Marketing (MLM) is a business model, which utilizes a combination of direct marketing and franchising. Typically, individuals become associated with a parent company in an independent contractor relationship". More specifically, MLM, also known as "Network Marketing" or "Multilevel Direct Selling" is a direct selling channel that focuses heavily on its compensation plan structure. Members of the network (distributors) earn compensation not only from their personal sales of goods and services to consumers (non-members of the network) but also from sales and hiring activity from the members they have personally recruited into the network, described as down lines (Choudhary and Kamal, 2013).

It is quite challenging to collect reliable statistics about Multi-Level Marketing. In United States, based on figures of the American Direct Selling Association (DSA), direct selling reached a turnover of almost USD 36.12 billion in 2015 through 20.2 million members. According to the Economist (2013), the vast majority of direct selling in the United States is conducted through Multi-Level Marketing.

MLM companies strive to distance their business model from pyramidal sales, which are illegal in many jurisdictions. The controversy about MLM stems from the association with pyramidal schemes (Constantin, 2009) which explains why MLM companies have rather a negative image among consumers (Muncy, 2004). Pyramidal schemes are defined as organizations that rely on the continual recruitment of new members, all of whom need to recruit others to recover their own investment (W. Keep and J. Vander Nat, 2014). That is, pyramidal scheme member's compensation depends exclusively on their ongoing ability to recruit others into the same network. Because of the exponential growth of the network structure, the majority of members in pyramidal schemes will end-up losing money unless recruitment continues forever. Hence, a pyramidal scheme is a money-transfer scheme from the vast majority at the bottom to a small minority at the top of the recruitment structure (W. Keep and J. Vander Nat, 2014).

Nevertheless, a company relying on a pyramid scheme can create confusion by introducing products or services to market itself as genuinely involved in real business activities and distance itself from illegal practices. In such cases, members seldom focus on selling products but rather on getting rewards from recruiting others (Emek et. al., 2011).

To distinguish real marketing plans from pyramidal sales, the DSA included in its code of ethics a section regarding pyramidal sales. This section specifies that "member companies shall remunerate direct distributors primarily on the basis of sales of products, including services, purchased by any person for actual use or consumption. Such remuneration may include compensation based on sales to individual direct distributors for their own actual use or consumption, sometimes referred to as internal consumption" (DSA, 2015)

The simulation in the present paper will we focus on the use of Agents Based Simulation (ABM) to understand the dynamics of network marketing especially to analyze the impact of compensation choices on the MLM company and on its distributors and draw a comparison with pyramidal schemes.

This paper is organized as follows: In **Section 2**, we describe the problem, and then we detail in **Section 3** our model conception. Implementation results are discussed in **Section 4**, followed in **Section 5** by conclusions and research perspectives.

## **2. PROBLEM DESCRIPTION**

There are several cases of famous Multi-Level Marketing companies convicted for pyramid practices. One of the examples is the American "Burn Lounge", an online music retailer. In 2014, the U.S. Court of Appeals declared Burn Lounge to be an illegal pyramid scheme. In 2015, the US Federal Trade Commission (FTC) began returning USD 1.6 Million to distributors that lost money in the scheme (FTC, 2015).

However, not all cases are "clear-cut" as in the example of Herbalife, one of the world leading MLM companies with net sales of USD 4.5 billion and 655 000 sales leaders in 93 countries in 2015 (Herbalife, 2015). In 2012, the Brussels (Belgium) Commercial Court stated that "the company was establishing,

operating or promoting a pyramid scheme where a consumer gives consideration for the opportunity to receive compensation that is derived primarily from the introduction of other consumers into the scheme rather than from the sale or consumption of products”. In 2013, the Brussels Court of Appeal invalidated the Commercial Court’s decision (Herbalife, 2013a). In the United States, the FTC forced the company in 2016 to pay USD 200 million to participants and to “fundamentally restructure its business so that participants are rewarded for what they sell not how many people they recruit” (FTC, 2016). The amalgam between legitimate direct sales and pyramid practice contribute to the generally negative image of MLM (Albaum and Peterson, 2011).

This confusion between legal MLM and pyramidal schemes stems from the complexity of compensation plans. As mentioned earlier, distributors are compensated not only for the sales they personally make but also for the sales made by multiple levels of their recruits (Muncy, 2004). Hence, compensation schemes are strongly tied to the MLM organizational structure.

Taylor (2000) defines four typical MLM organizational structures.

- **Unilevel systems:** Allow an unlimited number of recruits on the front line. However, there is a limit on the number of levels that can qualify for commissions;
- **Matrix systems:** Have limits on how many distributors can be recruited into one’s front line ;
- **Binary systems:** Recruiting is conducted in a downline of two legs, with incentives to maintain matching volume, or a balance, between the two legs. Distributors are paid commissions whenever both legs achieve a defined number of sales units ;
- **Stairstep/Breakaway systems:** Allow distributors to ascend a stairstep of levels in a hierarchy of distributor breakaways. Each breakaway is a separate organization tied to one distributor who draws overrides from the entire breakaway organization.

As far as compensation is concerned, the FTC sets guidelines for MLM companies (**Table 1**). However, these qualitative guidelines might not always be enough to help making a decision regarding the legitimacy of a company’s practices.

**Table 1**  
**FTC compensation guidelines for MLM companies (Adapted from (Grayson, 1996))**

<i>Guidelines</i>	<i>Details</i>
Direct retail sales by distributors	Compensation plans should strongly encourage each and every distributor, regardless of level, to personally generate significant retail sales
Overbuying inventory	Distributors should be protected from overbuying inventory for example via recourse to a company buy-back policy
Recruitment of new members	Distributors should not be compensated for recruiting new members per se. They can be compensated for the products sales of these distributors and their networks
Joining as a distributor	Nothing more than a nominal fee should be required for becoming a distributor and distributors should not be allowed to purchase status or any given network level
Advertising of extraordinary income	Extraordinary income or unrealistic incomes should not be promised

What is more, MLM companies are criticized on ethical grounds for skewed distribution of distributors' income and for their turnover ratios (W. Keep and J. Vander Nat, 2014). To illustrate, only 2.8% of Herbalife's "Sales Leaders" earned more than USD 25 000 annually and their turnover rate was 48 % in 2012 (Herbalife, 2013b).

Consequently, given the impact of compensation systems on MLM companies from ethical and regulatory standpoints; how can Agents-based Simulation support decision making about MLM compensation choices?

### 3. MODEL CONCEPTION

In our paper, we build a model that allows simulating the dynamics of Multi-level marketing and the impacts of compensation choices through a selection of metrics. Our simulation model features a MLM company relying on network marketing to distribute a service in a given market. Our proposed model has underlying assumptions in relation with the company's organizational structure, the market supply and demand for the company's services as well as for distributors. The model captures also distributors learning through time.

#### 3.1. Agent Based Modeling

##### 3.1.1. The Concept

Agent-based modeling (ABM) is the computational study of social agents as evolving systems of autonomous interacting agents (Janssen and Ostrom, 2006). The key feature of ABM is that it involves a bottom-up approach to understanding a system's behavior. According to Macal and North (2010), an agent based model comprises the Agents, the Environment, and the Interactions. Agents are self-contained and uniquely identifiable that can function independently and have attributes (e.g. age, gender, preferences) and a decision making process (e.g. utility maximization). The Environment represents the setting in which the modeling occurs (e.g. market or a geographic area). Finally, Interactions take place among the different agents, and between the agents and the environment. Agent-based modeling can be coded through general, generic software, or programming languages (Java, C++, Matlab...), or dedicated software and toolkits that address the special requirements of multi agent modeling such as Netlogo, Repast, and Swarm.

##### 3.1.2. The Application

- **The agents:** Two types of agents are defined in this simulation. The MLM company and the distributors:

First, the MLM Company sets the commissions' schemes of both the distributors' recruitment and selling activities. The company adopts a unilevel structure where a distributor can hire an unlimited numbers of peers.

The compensation system comprises three commissions:

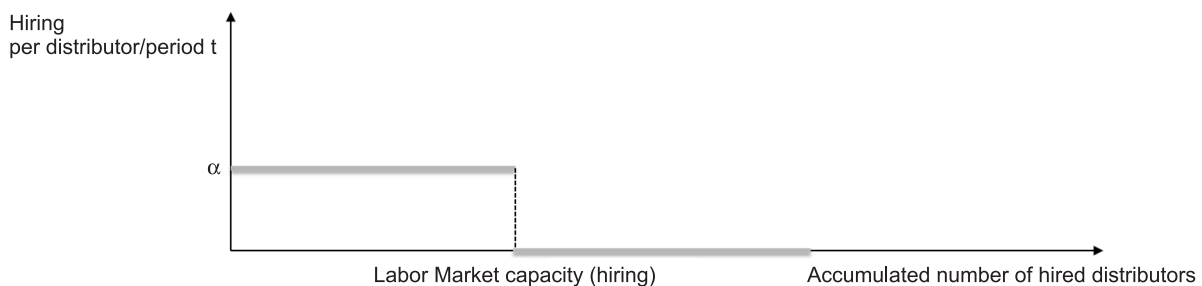
- Direct selling commissions: A percentage of a distributor's sales revenue in a given period
- Hiring commissions: Commissions for a distributor's direct recruitments in a given period
- Indirect selling commissions : A percentage of a distributor's downline sales revenue in a given period (sales made by recruits or by recruits of recruits)

For the purpose of the simulation, we define the following matrices:

- SALES ( $n, m$ ): The distributor  $n$  sales during the simulation period  $m$
- HIRING ( $n, m$ ): The distributor  $n$  recruitments during the simulation period  $m$
- HIERARCHY ( $1, m$ ): The recruiter of distributor  $m$
- SALES\_COMMISSIONS\_RATES ( $1, l$ ): The sales commission rates on sales made by a distributor applied to the  $l^{th}$  level distributor in the upline. Hence, SALES\_COMMISSIONS\_RATES ( $1,1$ ) represent a distributor's commission rate on its own sales.
- HIRING\_COMMISSIONS\_RATES ( $1, 1$ ): The distributor recruitment commission's rate
- DIRECT\_SELLING\_REVENUES ( $n, m$ ): The distributor  $n$  sales commissions during the simulation period  $m$  on the sales directly made
- INDIRECT\_SELLING\_REVENUES ( $n, m$ ): The sales commissions of a distributor  $n$  during the simulation period  $m$  on the sales made by her/his downline
- HIRING\_COMMISSIONS ( $n, m$ ): The total recruitment commissions of a distributor  $n$  during the simulation period  $m$
- SELLING\_REVENUES ( $n, m$ ): The total revenues generated by a distributor  $n$  direct sales efforts during the simulation period  $m$
- HIRING\_REVENUES ( $n, m$ ): The total revenues generated by a distributor  $n$  hiring efforts in the simulation period  $m$ . It corresponds to sum of HIRING\_COMMISSIONS ( $n, m$ ) + INDIRECT\_SELLING\_REVENUES ( $n, m$ )

Second, the distributors allocate their time between hiring new agents and selling the MLM company products and seek to maximize their income. If a distributor's revenue falls below the opportunity cost, the distributor leaves the company and never returns.

- **The interactions with the environment:** Agents' interactions with the environment are defined through the following decision functions:
  - For every period, we assume that every distributor has the ability to hire  $\beta$  distributors (recruits) if 100% of the time is dedicated to hiring provided labor market capacity is not reached. Beyond this threshold, hiring capacity per distributor is zero as there are no available distributors to hire in the market. We further assume that labor market capacity grows over time following a given distribution



**Figure 1.1: Modeling the hiring capacity per distributor**

For every period, we assume that every distributor has the ability to sell  $\beta$  units of the service if the distributor dedicates 100% of his time this activity provided the maximum number of units sold for the current period is not reached. Beyond this threshold, selling capacity per distributor is zero. We further assume that sales market capacity grows over time following a given distribution.

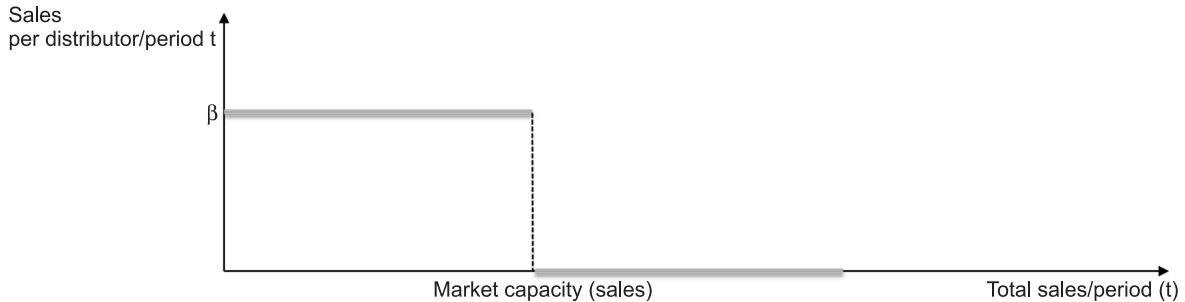


Figure 1.2: Modeling the selling capacity per distributor

### 3.2. Distributors Decision Making and Learning

#### 3.2.1. The Concept

To model learning, we use the strategy of adaptive proportions described by Freeland and Stabell (1978). It consists of a discrete multi-period decision-making function that allocates an activity effort proportionally to its accumulated performance.

The allocation of the effort between different activities is defined by Freeland and Stabell (1978) as:

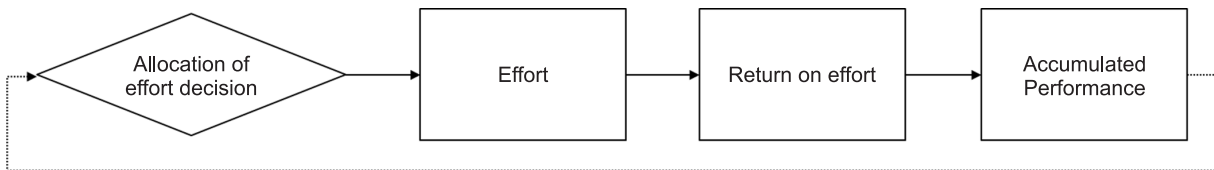


Figure 1.3: Learning process per agent

$$a(i, t) = 1 - \frac{\frac{1}{u(i, t-1) + 1 - \min u(t-1)}}{\sum_1^n \frac{1}{u(i, t-1) + 1 - \min u(t-1)}}$$

Where,

- $a(i, t)$  is the allocation of effort to activity  $i$  during the period  $t$
- $u(i, t-1)$  is the accumulated performance of activity  $i$  until period  $t-1$
- $\min u(t-1)$  is the minimum of accumulated performance for all activities until period  $t-1$

#### 3.2.2. The Application

In our model, we suppose that there are two possible activities: Hiring and selling. In our model, we further assume that, at the beginning of the simulation sharing ratio is random. This sharing ratio will change over time through the learning process.

The performance of the selling activity is defined as the commissions on sales for a period  $t$ . The performance of the recruitment activity for an agent is computed through the distributor's commissions from the hiring activity, that is, hiring and indirect selling revenues (cf. **Section 3.1.2**).

Hence, for every period and for every agent the allocation of effort as follows:

$$a(\text{hiring}, t) = 1 - \frac{\frac{1}{u(\text{hiring}, t-1) + 1 - \min u(t-1)}}{\frac{1}{u(\text{hiring}, t-1) + 1 - \min u(t-1)} + \frac{1}{u(\text{selling}, t-1) + 1 - \min u(t-1)}}$$

$$a(\text{selling}, t) = 1 - \frac{\frac{1}{u(\text{selling}, t-1) + 1 - \min u(t-1)}}{\frac{1}{u(\text{hiring}, t-1) + 1 - \min u(t-1)} + \frac{1}{u(\text{selling}, t-1) + 1 - \min u(t-1)}}$$

The simulation algorithm

The general simulation algorithm is presented in the flow chart hereafter (**Figure 1.4**):

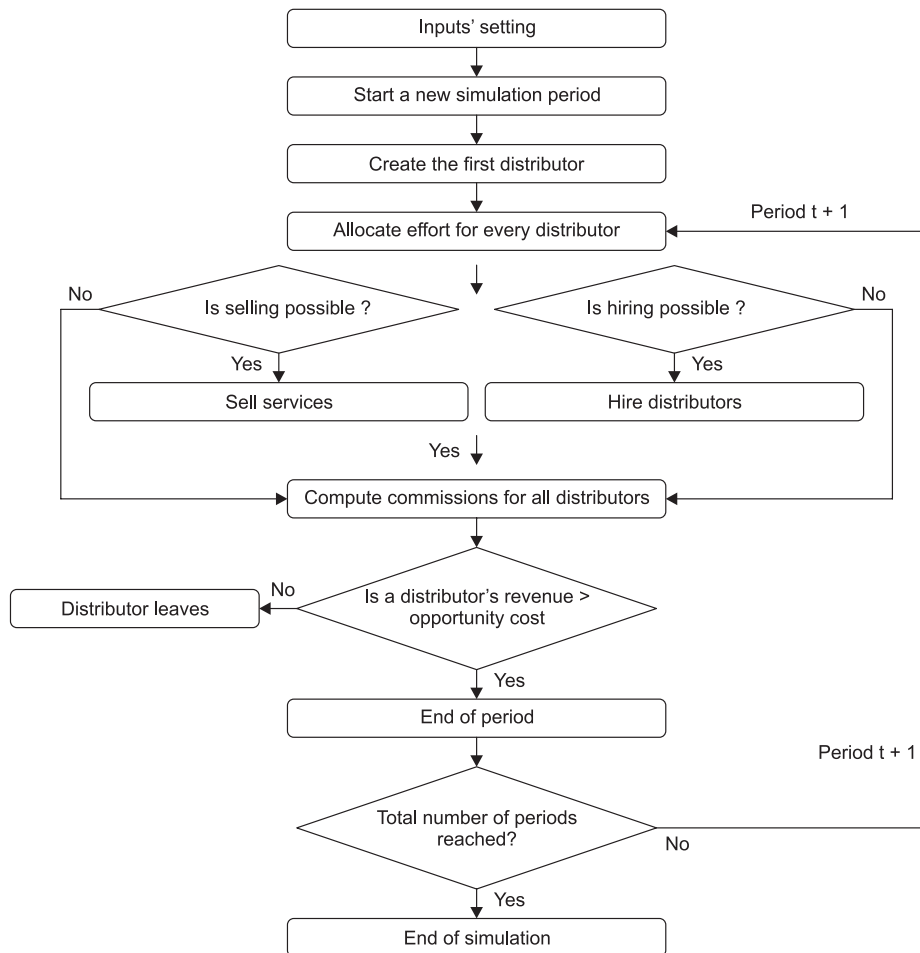


Figure 1.4: The algorithm flow chart

## 4. RESULTS

The simulation interface is as follows (Figure 1.5)

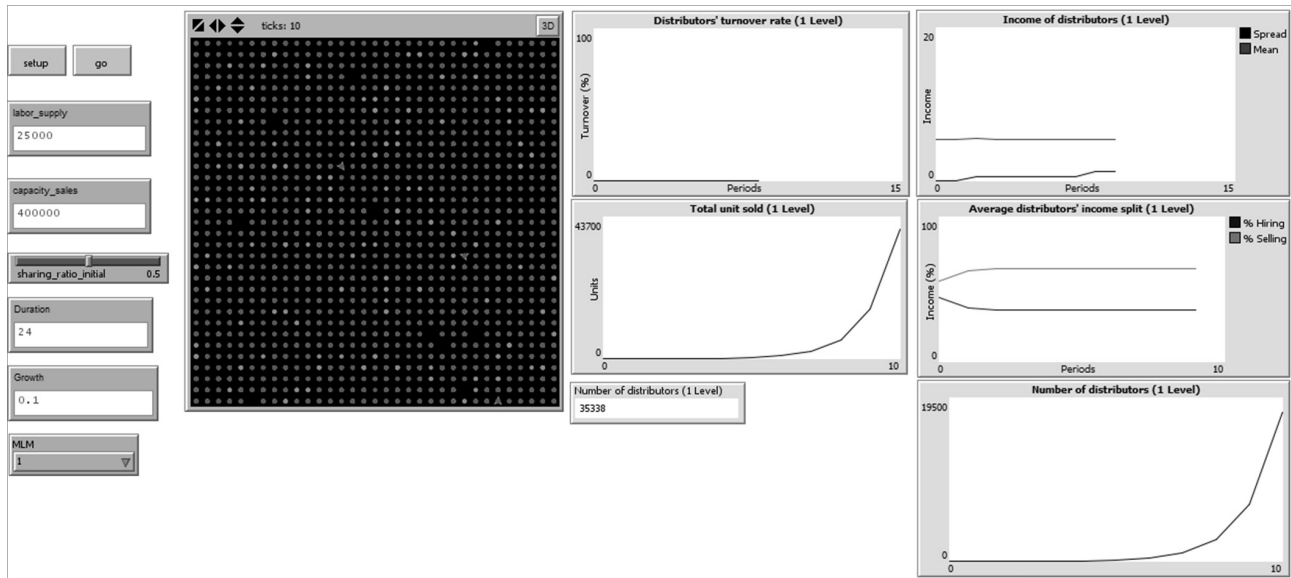


Figure 1.5: Simulation interface

Table 1.2 Presents the Inputs, the Grid and Results of the Simulation

Table 1.2  
Simulation inputs, grid and outputs

<i>Details</i>	
<p>The inputs (the base case scenario values are between brackets)</p>	<ul style="list-style-type: none"> <li>• Capacity hiring: The maximum number of distributors than can be hired at the beginning of the simulation (25 000)</li> <li>• Capacity hiring growth rate: The growth rate of distributors supply (uniform distribution between 0 and 10 %)</li> <li>• Capacity sales: The total maximum number of units that can be sold per period (300 000)</li> <li>• Sales per distributor: The maximum number of units that can be sold per distributor and per period if the distributor dedicate 100 % of the effort to selling provided capacity sales is not reached (10)</li> <li>• Recruits per distributor: The maximum number of recruitments per distributor and per period if the distributor dedicate 100 % of the effort to this activity provided capacity hiring is not reached (6)</li> <li>• Number of levels in the organization (one, two, three and six): For the value of two for instance, a distributor gets indirect sales commissions only from direct recruits' sales. For the value of three, a distributor gets indirect sales commissions from his/her downline until the second level and so one. A value of one means that the distributor does not get indirect sales commissions. In all cases, total sales' commissions are 60% in order to make comparisons relevant (cf. below).</li> <li>• Sales commissions:                         <ul style="list-style-type: none"> <li>◦ One-level organization <math>\Rightarrow</math> 60 % (level 1)</li> <li>◦ Two-level organization <math>\Rightarrow</math> 40% (level 1) and 20 % (level 2)</li> </ul> </li> </ul>



<i>Details</i>	
	<ul style="list-style-type: none"> <li>◦ Three-level organization <math>\Rightarrow</math> 30% (level 1), 20 % (level 2) and 10% (level 3)</li> <li>◦ Six-level organization <math>\Rightarrow</math> 24% (level 1), 17 % (level 2), 8% (level 3), 5% (level 4), 4 % (level 5) and 2% (level 6)</li> </ul>
	<ul style="list-style-type: none"> <li>• Hiring commissions: (1.2)</li> <li>• The initial selling effort allocation (50%). It changes in the simulation through learning</li> <li>• The opportunity cost (4): If a distributor's revenue falls below the opportunity cost, the distributor leaves the company</li> </ul>
The grid	<ul style="list-style-type: none"> <li>• Up to 500 000 agents that allocate their efforts between selling and hiring every period</li> <li>• When the effort allocation is geared towards selling, a distributor is represented as a green dot. A distributor is represented in blue otherwise.</li> </ul>
The outputs	<ul style="list-style-type: none"> <li>• Breakdown of average distributors' income: Income from the selling activity and hiring activity (includes indirect selling commissions)</li> <li>• Distributors' turnover: The percentage of distributors leaving the company</li> <li>• Income of distributors: Mean and spread</li> <li>• Number of distributors</li> <li>• Number of units of service sold</li> </ul>

In the following sections, we analyze the simulation outputs across four MLM models with one, two, three and six levels for the base case scenario.

#### 4.1. Breakdown of Average Distributors' Income

The effort allocation at the beginning of the simulation is 50% for both selling and hiring. In **Figure 1.6**, we see clearly that the more levels in the organization, the higher the allocation toward hiring. The higher hiring revenue is a direct consequence of the allocation of effort towards this activity. In all organizations, we observe the same pattern. During the first phase, the allocation towards sales and hiring change smoothly until the maximum number of distributors is reached (cf. **Section 4.2**). After that, the market becomes unstable because distributors vary their allocation as frequently as market conditions change. In all cases but in the one level organization, hiring remains the dominant activity. Actually in this latter case, there are no incentives to recruit distributors other than getting one time hiring commission and the revenue allocation follows a different pattern with selling more favored especially when the labor market is saturated. To sum up, the higher the number of levels in the organization, the closer the income profile to pyramidal schemes.

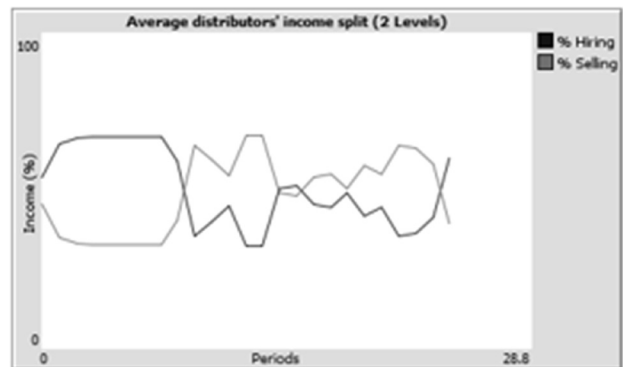
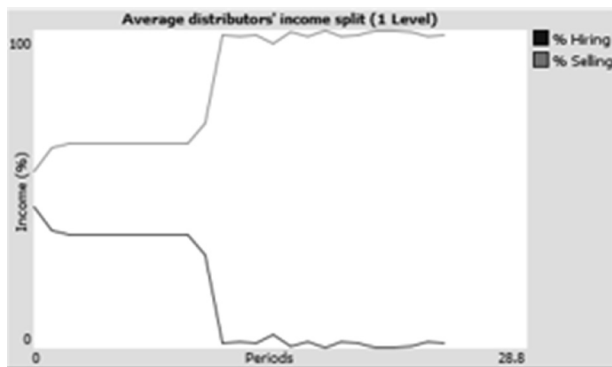




Figure 1.6: Breakdown of average distributors' income per organization

#### 4.2. Distributors' Turnover Rate

In **Figure 1.7**, the turnover rate follows roughly the same pattern to varying degrees across the different organizations. At the beginning of the simulation, its value is at 0% and stays at that level as long as the distributors' revenue exceeds the opportunity cost. When the labor and service markets reach maximum capacity, recruiting and selling slow down which affect negatively the distributors' revenue and make a group of them to leave the company. After this inflexion point, turnover fluctuates driven by distributors' opportunity cost and by their supply in the market. The simulation shows that the more levels in the

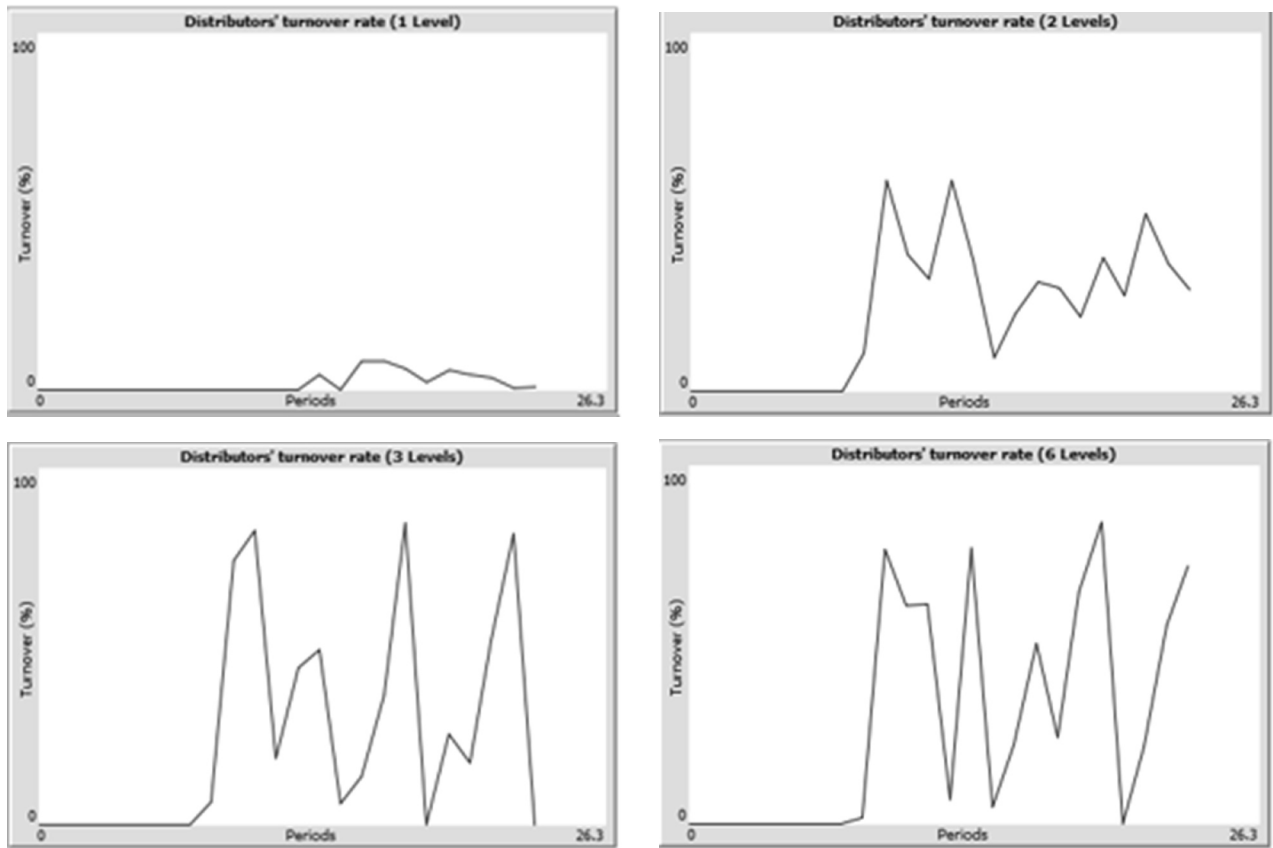


Figure 1.7: Distributors' turnover rate per organization

organization, the higher the turnover rate and the sooner the turnover begins. As explained in **Section 1**, pyramidal structures feature very high turnover rates in periods of market saturation as the distributors' income depend exclusively on the downline recruiting performance.

### 4.3. Income of Distributors: Mean and Spread

In **Figure 1.8**, the income spread grows until the labor market is saturated for the first time. Then, the spread fluctuates through time. It is very clear that the more compensation levels in the organization, the higher the spread, the higher the income inequalities (mean versus spread) and the sharpest the spread decline after the labor market saturation. For instance, in our simulation, the spread reaches 1 680 for the six-level organization after 10 periods to decline sharply to almost zero at the end of the simulation. Whereas, in the one-level organization, it reaches only 11 after 12 periods and stays more or less stable afterwards. Large income spreads is a feature of pyramidal schemes.

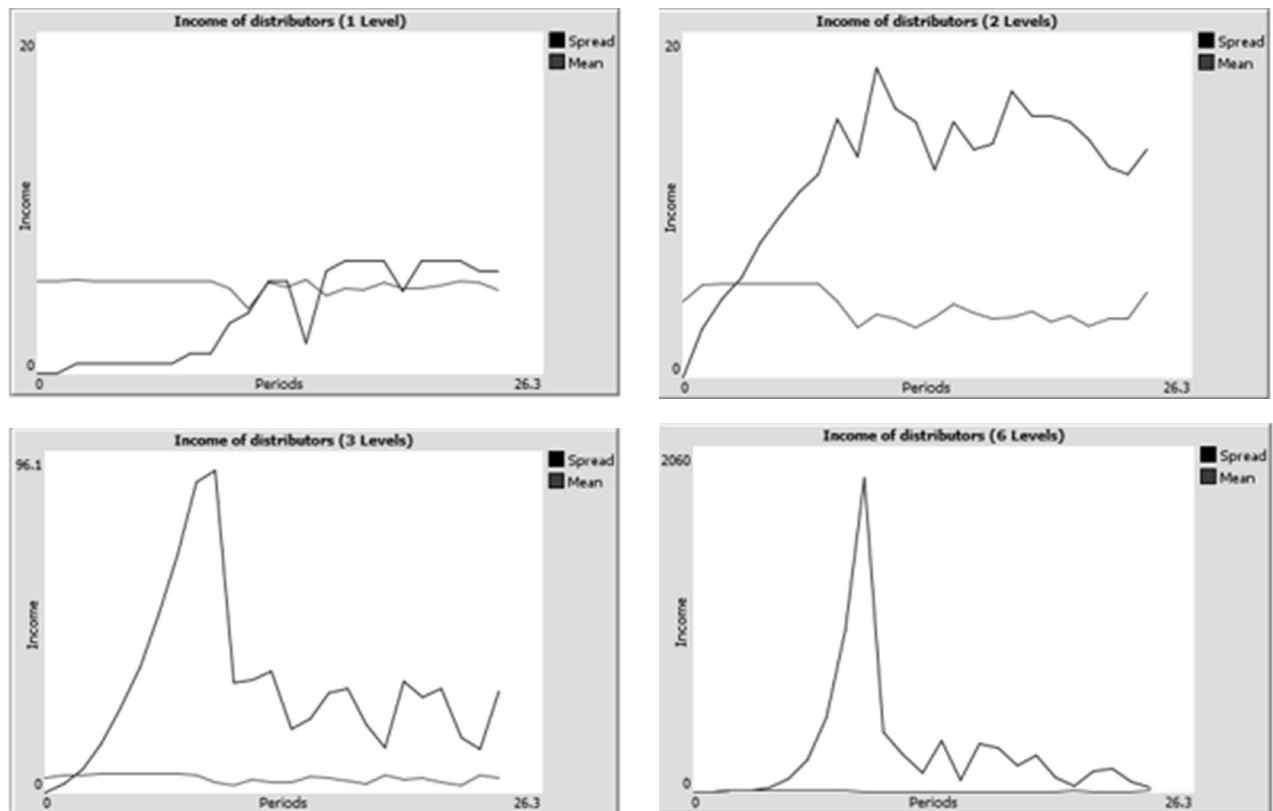


Figure 1.8: Mean and Spread of the distributors' income per organization

### 4.4. Number of Distributors

The increase and the decline in the number of distributors are sharp for organizations with higher number of levels. For instance, with six levels, the organization virtually loses all the distributors in period 24. When distributors' supply growth nears 0 %, there are no distributors in the company. In a pyramidal scheme, the number of distributors should grow and decline swiftly, after market saturation, because distributors dedicate their effort entirely to hire peers.

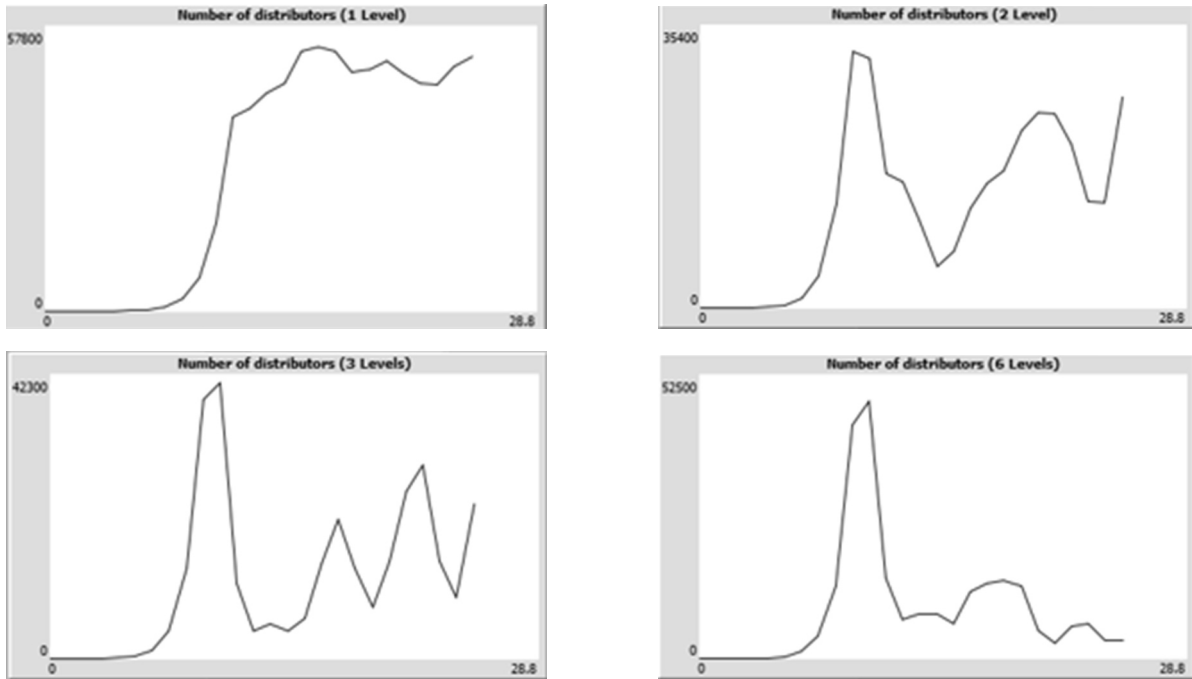


Figure 1.9: Number of distributors per organization

#### 4.5. Number of Units of Service Sold

The service market reaches its full capacity only in the case of the one-level organization. The focus of other organizations on recruitment (proportionally to the number of level) and the lower number of distributors (because of high turnover rates), significantly reduce the number of units sold per period.

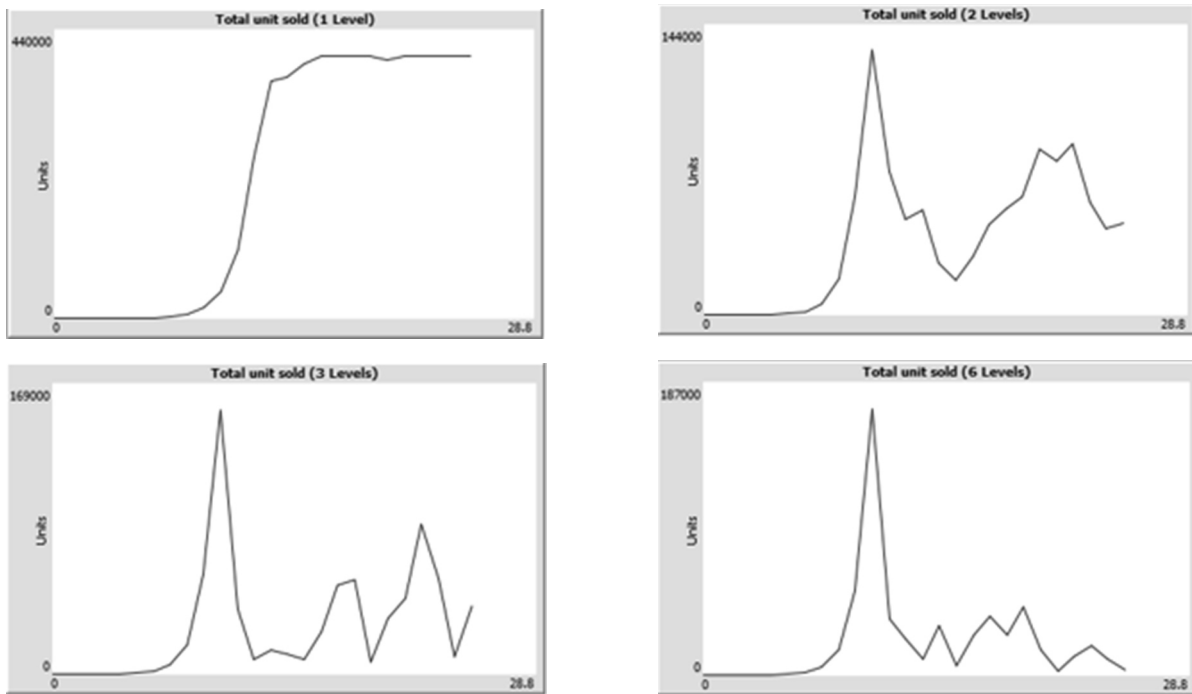


Figure 1.10: Number of units sold per organization

## 5. CONCLUSION, LIMITS AND PERSPECTIVES

This paper aims at modeling the dynamics of a market where a Multi-Level Marketing company operates and at understanding the impacts of compensation schemes on distributors' incentives and behavior and, therefore, on the company overall.

In order to capture the endogenous and exogenous factors affecting such a company, we modeled first, the supply and demand of the service sold and of the distributors, second, the organizational structure and finally, the distributors' effort allocation depending on their personal historical performance of hiring and selling activities. Results show the importance of compensation schemes on the company and on the distributors. More specifically, the number of levels in the organization affects in a significant manner the number of distributors, the number of services sold, the turnover and the effort allocation. When the number of levels is important, the allocation of efforts is geared towards hiring rather than selling which lead to relatively higher revenues with large discrepancies as long as the distributors are incentivized to join the company. When the latter condition is no longer respected, companies with a large number of levels tend to be very unstable as they face high turnover rates and a constantly changing distributors behavior. Although, MLM companies with a large number of levels do not follow pyramidal practices per se, their turnover rates, income spread, and reliance on hiring and instability raise serious concerns from ethical standpoint. In fact, compensation schemes and organizational structures affect the closeness of MLM companies to pyramidal practices. Finally, the ability to tap into a large available supply of potential distributors allows MLM companies to survive or at least delay their decline especially when the number of levels is important. Consequently, market regulators should examine closely the compensation and organizational structures of MLM companies and their impact on the business model.

As in every simulation, our methodology presents several limits. Firstly, our model of potential distributors' supply in the market could be more sophisticated to include other parameters such as seasonality and heterogeneity of distributors' preferences. Secondly, when turnover grows, distributors might influence their peers to leave the company as well; this contagion effect was not captured in the simulation. Thirdly, numerical data used in the simulation should be calibrated using real market data. Lastly, we run the simulation with only one MLM company; the dynamic might change in the presence of many competing companies. These limits open the door to many perspectives to this research.

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