Using agents to simulate a tourist market in an educational game

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Abstract—The full implementation of European policies on Entrepreneurship Education requires an effective change in teaching programmes at the different educational levels. Recent developments in the serious game sectorshow how simulation games allow studentsto tacklecomplex situations through learning by doing.

In the last few years,some researchers have suggested simulatingmarket dynamics by using the agent based approach. Consequently, a serious game has been designed and implemented within the framework of the European project "Posso … Non Posso … Vado! PNPV Project Rev.2 (I can ... I cannot ... I go!), whichaims to introduce and foster an entrepreneurial mindset among young people.

After a brief overview ofthe blended learning model and the layered structure of the game,the paper describes the interactions between the agents and their behavior, these being the key elements in the design of the market simulation model.

Keywords—EducationalGames, Soft -Agent, Business Games, Entrepreneurship Education, Tourism Market

I. INTRODUCTION

The full implementation of European policies regarding entrepreneurship education[1] requires an effective change in teaching programs at the different educational levels.
As demonstrated by several studies [2,3], serious and simulation games increase the learner's motivation[4,5], enabling him to embark on engaging and challenging paths through educational material and activities. These aspects have an impact on classroom education as well as on training programs, making the learning experiences more effective[6,7].

Serious and simulation games allow students to develop skills and attitudes in keeping withwhat the European policies call an entrepreneurial mindset (e.g. taking theinitiativeandrisk taking, criticalthinking, creativityandproblem solving, communication andpresentation and planningskills) [8].

Simulation provides useful and often essential insights into a large number of scientific and application sectors[9]. Several studies use the simulation approach to analyze the economic sector [10]. From atheoretical point of view, two main approaches tothe implementation of a simulated market are compared in the literature:

- the definition of a system regulated by macro-economic laws in which the aim is to model the behavior not of one particular unit, but of all the units combined;
- the definition of a system in which a multitude of actors, each with their own particular behaviors, interact with and generate the market dynamics. This approach is based on the study of one particular unit rather than all the units combined.

The dualism between the two paradigms (Macro Economics paradigm vs Micro Economics paradigm), has been a subject of analysisin the field of economics since the last century, and even today, it remains at the center of scientific debate.

In the last few decades some researchers have suggested analyzing the market dynamics with the same techniques used for studying complex systems [11].

A complex system is a system composed of a series of distinct elements that interact with each other; the complex system, as a whole, exhibits one or more properties not clearly derivedfrom the properties of the individual parts.

The main aim of this approach is to overcome the distinction between the two classical approaches by trying to explain the dynamics of the market at a macro level as

Fig. 1. PNPVillage Student Interface

emerging properties of a complex system in which individual actors in theeconomics sector operate at the micro level. In this way, the theories at both micro and macro levels can find empirical validation. In this context, according to Flake [12], it is possible to consider the tourist market sector as a complex, adaptive system. A complex system is adaptive if it consists of reactive elements, namely elements capable of varying their own attributes in reaction to changes in surrounding conditions.

The evolution of information technology has led to the emergence of a field of research known as the agent-based system. Multi-agent systems are software systems consisting of independent entities, called agents, each of which is able to interact with the surrounding environment according to a predetermined behavior.

The agent-based systems are now considered to be a useful tool, allowing researchers in the economics field to simulate market dynamics and thus validate economic models. In fact, the computational study of economies modeled as evolving systems of autonomous interacting agents has given rise to a research sector known as Agent-based Computational Economics (ACE). ACE is a specialization of economics of the basic complex adaptive systems paradigm [13].

From an educational perspective the multi-agent approach allows the teacher to customize the behavior of each agent without having to change the entire system [14]; the complexity of these behaviors can be increasedin order to gradually make the students aware of the real behaviors of each agent.In this manner the students can analyze the appropriateness of their decisions in the light of these agent models and then recognize the strengths and weaknesses of the strategies adopted.

This methodology was the theoretical basis for the simulation of the tourism market in the PNPVillage game. PNPVillage is a serious game developed within the framework of the EU-funded project "I can ... I cannot ... I go!" Rev. 2 (PNPV project) that aims tocreate a training model and tools for the acquisition of knowledge and entrepreneurial skills [15].

According to Allegra [16], different types of agents, both autonomous and semi-autonomous, have been defined. The behavior of semi-autonomous agents is customized by the user by means of the game interface. In particular, economics experts identified the agents, defined their behavior and guided the development of the simulation; they also supported the tuning phase and the validation of the overall model.

In the next sections the blended learning model and the layered structure of the game arebriefly introduced. Finally, we focus on the analysis of the interactions between the agents and their behaviors that are the key elements in the design of themarket simulation model.

II. PNPVillage

PNPVillage is a web-based game, developed to achieve the following general aims:

- to create a simulated environment closely resembling the real world, allowing students to understand elements of complex situations;
- to encourage competitive dynamics among students;

- to promote self-monitoring and teacher monitoring activities, by means of indexes that summarize market trends and aid/facilitate interpretation;

This serious game tests the skills of students in the management of a tourist resort. The tourism sectorwas selected because it isrelated to the students' experience/life; thus, the students are trained in the management of a businessfamiliar to them.The serious game is integrated into a blended educational path that combines both face to face learning and distance learning, in a formal and informal way. It includes:

- Classroom activities, centered on the teacher's explanations and collective analysis of the results of the last game/simulation phase;
- Laboratory activity, centered on the serious game and aimed at experiential learning and transfer of knowledge and skills;
- Online learning activity, in which students can study the educational content in depth by means of anLMS.

The game engine was integrated with a Learning Management System (LMS) in an attempt to exploit the potential of two different environments [17]. At the design phase it was important to strike a balance between an absorbing game and the educational aims, integrating the educational contents with the activities and objectives of the game [18].

The students are invited to compete in groups to manage their virtual companies efficiently, getting the necessary information in the educational forms of the LMS. Thus a scaffolding approach was adopted where students can enjoy the game as well as studying some topics in depth to improve their educational results and game scores. The help provided by both the educational contents and the face-to-face activities with teachers is intended to ensure the achievement of the educational targets.

All groups operate competitively in a single simulated market. In this way, the results obtained by a single group do not depend just on theirown choices but also on those made by all the other groups. This leads groups to compete in an environment closely resembling the real world, where the success or failure of a business is determined not only by personal ability and entrepreneurial skills but also by the behavior of its competitors.In order to promote competition and business diversification, the market was segmented into five standard types of customers: VIPs, Professionals, Middle class families, Young peopleand Workingclass (Pop) families. Each category of customers is characterized by a different propensity to spend and by different "needs". These differences are crucial in the process of negotiation and purchase of tourist packages by an individual customer.

The following simplifications have been made to reduce the complexity of the game andenhance theeducationalvalueof the game:

- Accommodation at the village can be occupied for the virtual duration of one week(it is not possible for the customer to buy portions or multiples of one week);
- the customer purchases the package at the beginning of the week and immediately occupies the corresponding accommodation (a reservation mechanism has not been implemented);
- the customer is an individual customer (not considering the number of family members and consequently the "capacity" of the accommodation);
- seasonal differences have not been taken into account (there is no high/low seasonal difference for the consumer).

III. PNPVillage Structure

PNPVillage is divided into 7 levels. At each level, the students will facenew entrepreneurial concepts related to the management of the village through the activation of specific decision-making levers.

The number and complexity of the concepts and their related levers will increase during the game.Decision-making levers can be divided into strategic and operating levers.

The strategic levers represent the management goal in terms of marketing strategy over a long period of time and are:

- Business Strategy
- Market Segment

Theoperating levers represent operative choicesand are:

- Accommodation Units
- Communication
- Price
- Staff for the Accommodation Units
- Food services and related staff
- Corporate Social Responsibility
- Sports and wellness services and related staff.

A Non Player Character (NPC) called Candy,will present the level's goals and teaching materials to the students. Candy will support the students throughout the entire game with tips and information to overcome the problems that arise. At every level, new concepts related to decision-making levers, will be developedthrough the study of teaching material directly accessible from the game.

Ateach level, players will have to manage the village for one virtual year, which has been split into quarters. In such a way, students can analyze the results of their decisions after each quarter, and apply the necessary changes to their management strategy.

The gameprovidesthe students witha set of tools, accessible throughthe user interface(Fig. 1), that canhelp him when making operational decisions. The user interfaceprovidesthe following tools:

- Village Revenue Status (it offers an overview of the financialresults).
- Staff Status (it provides an overview of the staffemployed in the village).
- Real Estate (it allows students to check the units and services in the village with the related selling costsand maintenance).
- Market Research (it givesthe students a more detailed view of the market).
- Charts (it displays trends of growth/decline in sales, revenues).
- Reports (it shows the players'business results at eachlevel).

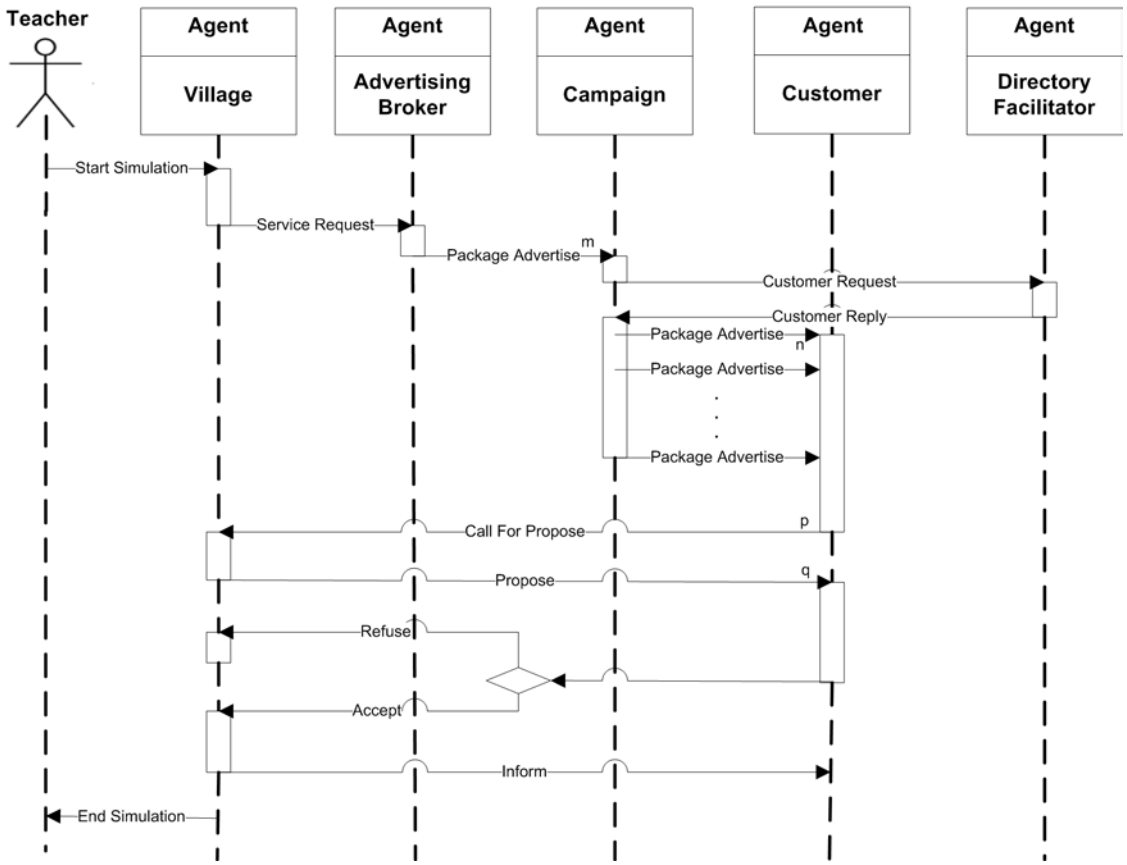

Fig. 2. Contracting Protocol

- Construction (summary of all the accommodation and service modules that can be inserted into the village).

Moreover, the user interface shows an overviewof the village andan instrument panel (dashboard)that informs theplayer on the evaluable budget,the maintenance costsof accommodationand its services, the staff costs, the year and the quarterin progress.

The 7levels of the gameare presented below. It should be bornein mindthat at eachnew levelthe student can goback on thedecision-making levers of the previous levels.The levels are as follows:

- Level 1: the student has to choose the marketing strategy, the market segment, aname and aslogan forthe village. Finallythe student will be able to build his own village inserting accommodation units and beachservices.
- Level 2: the student can select the most appropriate communication tools for the chosen market segment pursuing an effective advertising policy.
- Level 3: the student can change the selling prices of his tourist packages.
- Level 4: the student can recruit/dismissthe reception staff.
- Level 5: the student can create a catering service in the village and recruit/dismiss its staff.
- Level 6: the student has to face corporate social responsibility issues. He can also decide to create green areas, to eliminate architectural barriers.as well as to ensurehis employees follow refresher training courses.
- Level 7: the student can build sports facilities in the village and recruit/dismiss its staff.

The design of the game gives an important role to the teacher. Teachers will manage the game activities and help students, highlighting the strengths and weaknesses of their choices. For this reason, we have developed a teacher interface that provides a set of tools to monitor and manage the simulation and the player results.

IV. THE CONTRATRACTING OF THE VACATION PACKAGES

Figure 2 shows the vacation package bargaining process. The contracting model developed is ahybrid-programmingmodel consisting of an event driven programming model and a time driven programming model.

The agent's behavior and the negotiation protocol developed are describedbelow.

The teacher starts the contracting protocol by clicking the start simulation buttonfrom the teacher interface. The start-up phase is communicated to all the village agentswiththe message *start simulation*.

The players usethe student interface to customize the behavior of the village agent. The village agent sends a typed

message *service request*to the Advertising Broker agent. The service request contains all the information to instruct the Advertising Broker on how to advertise the vacation packages.

After the Advertising Broker agent has receivedthe service request,it contacts the Campaign Agents through the *Package Advertise*message that contains information about the quantity of advertising to carry out.

Each Campaign Agent is responsible for a communication channel on which to advertisethevacationpackage.

In order to contact the Customers, the Campaign Agent calls the Directory Facilitator agent. The Directory Facilitator is responsible for the registration of all agents in the system and has the function of "yellow pages". The Directory facilitator is able to give the list of all the agents of a specific type to anyone who requests it.

A campaign agent contacts the Directory Facilitator and through the *Customer Request* message requests the list of all customers present in the market. On receipt of the list, contained in the *Customer Reply*, the campaign manager will contact all customers to promote the vacation package by sending Advertise Package messages.

The likelihood that the advertising convinces the customer agent tobuy a vacation package depends on:

- customer type,
- communication channel,
- amountof advertising messages.

The numberof messages depends on how much money a player has invested in advertising.

After receiving the first Package Advertise, the customer agent will start a timer and a certain amount of time is allowed to elapse in whichpackage advertisementsfrom the other villages can be received. When this time is up, the customer agent will start the decision making process and choose whichvillage to contact tobuy the vacation package. In the event of a willingness to purchase, the customer agent will send a *Call for Proposal*message to the village. After the village agent receives the Call for Proposal, it will respond with a *Proposal* detailing the specifications of the vacation package (quality of service, price, type of housing, etc.). Finally, all the village agents' proposalswill be collected. The customer agentwill accept or reject the proposals by sending the messages Accept or Refuse.

After receivinga proposal acceptance message, the village agent will send an*Inform*message, to inform the customer that the holidayis confirmed.

V. THE MARKET

The detailed algorithm for generating the customers in the market is described as follows. Suppose that *n* is the number of customers to generate (this number can vary and is determined by the number of players in the game) at each simulation cycle.Then thepercentage of customers generatedin a specific category correspondsto a discrete,non-uniform probability distribution defined as:

- Vip 10%
- Prof 15%
- Middle Family 20%
- Young people25 %
- Pop Family 30%

For this probability the following relationshipmust be true:

$$\sum_{i=1}^{5} p_i = 1$$

wherep_i is the probability of generating a customer of type *i*.

We suppose, then, that *n* customers have been generated, and in the end we will have:

$$\sum_{i=1}^{5} c_i = n$$

wherec_i is the number of customers in category*i* present in a single simulation cycle.

Starting from the preferences indicated in Table I, it is possible to define a discrete probability distribution for each type of customer. The single customer who enters the market according to the above preferences probability distribution regarding accommodation, can "choose" what type of accommodation he would prefer and verify the availability of a holiday package in the marketmatching his preferences.

TABLE I. CUSTOMERACCOMMODATIONPREFERENCES

Accommodation Type	Vip	Prof	Middle	Young	Pop
Suite A	35%	25%	0%	0%	0%
Suite B	15%	20%	10%	5%	0%
Suite C	0%	5%	30%	25%	15%
Bungalow A	35%	25%	0%	0%	0%
Bungalow B	15%	20%	15%	10%	0%
Bungalow C	0%	5%	30%	30%	25%
CampgroundA	0%	0%	10%	10%	15%
CampgroundB	0%	0%	5%	20%	45%

The procedure requires the customer to send a request for a cost estimate only to villages that have posted advertising packages that meet hisaccommodationpreferences.

We have created aCampaign Agentfor each communication channel (flyers, the Internet, commercial posters, newspapers, TV). The behavior of the agent is definedby a vector representing the probability that a specific media channel reaches the different typesof client ($p_{c,k}$, see Table II), and by a parameter t_c that represents the gap in time between two advertising messages. Channels with a lower t_c parameter are characterized by greater activity and by a largernumber of messages per time units.

TABLE II. CHANNEL PROBABILITY

	Vip	Prof	Middle	Young	Pop
Flyer	30%	0%	60%	0%	10%
Internet	10%	60%	30%	5%	0%
Poster	0%	10%	0%	60%	30%
Newspaper	60%	30%	0%	10%	0%
TV	0%	0%	10%	30%	60%

In the first part of the simulation, the Advertising Broker agent collects the data of relating to the investment made by the villages in the different communication channels. After this phase, the Advertising Broker Agent communicatesthe investmentsto theCampaign Agents. For each village, Campaign Agents calculate the investmentin the different channels starting with the investments of all the villages:

$$relative\_investment_{c,t} = \frac{investment_{c,i}}{\sum_{j=1}^{N} investment_{c,i}}$$

where$relative_investiment_{c,t}$ is the investment for quarter t relative to channel c, and $investment_{c,i}$ is the investment for village i and channel c.

The probability $p_{c,k}$ also affects the "frequency" of the advertising campaign because it intervenes as a factor in parameter t_c.

Finally, each Campaign Agent, is identifiedby the parameter $t_c$and by the probability $p_{c,k}$. This agent will generate an advertisement every t seconds (where $t = f\ (t_c, p_c, k)$) for each type of customer.

The village to advertise will be chosen on the basis of a function of discrete probability, defined according to specific related investments. So every t seconds only one village will be promoted by the Campaign Agent.

In the first phase of its life cycle, a Customer Agent waits for advertisements.

If we consider that V is the collection of all the villages taking part in the game, the customer first choosesthe type of accommodation and then sends a request for a proposal only to the subset $S \subseteq V$ of villages that have contactedthe customer through advertising campaigns. Moreover, not all villages have a package ofthe type required by customer i.The village agents that have a suitableholiday package,in their "portfolio" respond with a proposal. Customer $i$will receive an offer, fromthe subset $S' \subseteq S$. Each proposal will be identified by a price $p_j \forall j \in S'$. Finally the village agent will accept the proposal which most closely matches his needs.

VI. Behind the Game: the Succes Indexesand Market Dynamics

In PNPVillage, the dynamics of the market are regulated by two main indexes: Market Visibility and Value For Money.

The Market Visibility Index (MVI) measures the market visibility of a business, in relation to a particular market segment. The level of visibility of a firm is calculated as a function of the investments in communication made by all the firms, for each communication channel. Value For Money (VfM) is a parameter expressing the quality of the operational choices made by a single firm in relation to the different types of customers. From the customer's point of view, it is the main element for evaluating and comparing the offers from the various firms.

Success is determined by the consistency of the choices made by the villages (i.e. by the group of students) of the various levers that have an impact on these three variables.In fact, the student manages these three variables generally indirectly through the operating levers.The manner in which the various operating levers impact on the three variables also varies from level to level.

Value for Money is a parameter whose value varies from 0 to 1. The factors that contribute to determining its value are:

- Accommodation Units (AU)
- Beach services (BS)
- Staff (STAFF)
- Food and catering services and related staff (FOOD)
- Corporate policies about Social Responsibility (CPSR)
- Sports and wellness services and related staff (SPORT)

Table III reports the weights with which the different components affect the total VfM; these values are a function of the level and take into account the progressive activation of the levers from level to level.

TABLE III. VfM factors by level

LEVEL	AU	BS	STAFF	FOOD	CPSR	SPORT
1	70%	10%	20%	0%	0%	0%
2	70%	10%	20%	0%	0%	0%
3	70%	10%	20%	0%	0%	0%
4	50%	10%	40%	0%	0%	0%
5	30%	10%	30%	30%	0%	0%
6	30%	10%	20%	20%	20%	0%
7	30%	10%	20%	20%	20%	20%

The evaluation of the proposals made by the villages for a specific type of accommodation, is based precisely on the VfM.

The choice of VfM component weight depends on the level, and highlights the effect of the decision-making lever introduced atthe new level. From an educational point of view, thischoicewill help studentsto understand how the new decision-making leverinfluences thegame outcomeand what the bestway of usingit is.

In comparing the offers of several villages fora specific type of accommodation unit, the VfM parameters are multiplied by a factor to simulate the elasticity of demand with respect to price.

For each village, the VfM is multiplied by a factor that depends on the ratio of the selling price of the accommodation unit required by the customer to the average prices proposed by the other villages for the same type of accommodation.

Starting from this ratio we have a different multiplication factor for each consumer category in order to introduce the elasticity of demand with respect to price (actually some categories are much more sensitive to price compared to others).

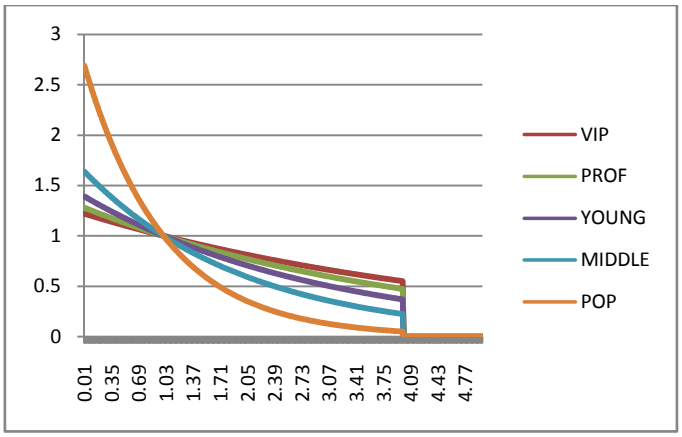

Fig. 3. Multiplication factor for consumer category

Figure3shows the trends of the multiplication factor by the ratio for each consumer category.If the ratio exceeds a factor of 4, the value of this component VfM is 0.

In the next sections, we will see how each component of the VfM is actually related to operating levers.

A. *AU- Accomodation Units*

In PNPVillage we have definedthree main types of accommodation units: suites, bungalows and **c**ampground. For each type of accommodation unit we have definedthree different categories of service: categories A, B and C. The followingtabledescribes customer preferencesby typeofcustomer andtype ofaccommodation.

The VfM, for the accommodation unit component, is determinedby the composition of the village in terms of types of accommodation available.Considering the composition of the village (the percentage of units of a certain type in the village compared to the total number of available accommodation units), we obtain a measure of how a village matches the characteristics of individual market segments. These measures are then normalized to get a value of VfM from 0 to 1.

B. *Beach Service*

The value of this component of the VfM is calculated by comparing the average selling price of the beach services of all the villages advertised.

The beach services are associated to a sales price that can be varied by the player and which reflectsthe quality. Higher prices involve higher maintenance costs and services of a higher quality.

A village with a higher selling price will benefit in consumer categorieslookingfor highquality servicesbut will bepenalizedin thosewho wantcompetitiveprices. Of course,the effect will bethe opposite for villages offering lowerbeach service prices.

The highest value of the average selling prices of beach services ($AvBeachSelling_{max}$) is chosen to obtain a value of the VfM component between 0 and 1. The component VfM for village *i*will be given by the ratio between thevalue of itsaverage selling price and$AvBeachSelling_{max}$.

C. *Staff*

The value of this component of the VfM is calculated through the weighted sum of different factors.

This weighted sum is then compared to the maximum of the calculated value in the advertised villages in order to have a normalized value to 1.

The factors of the weighted sum are:

- Director's Salary .
- Number of receptionists with knowledge of two foreign languages.
- Number of receptionistswith knowledge of one foreign language.
- Number of cleaning staff per Suite.
- Number of floor waiters per Suite.
- Number of staff for spring cleaning per suite.
- Number of staff for spring cleaning per bungalow.
- Number of entertainmentstaff for beach services.
- Number of lifeguards for beach services.

This weighted sum is then compared to the maximum of the calculated value in the advertised villages in order to have a normalized value to 1. The weight of each of these factors varies depending on the consumer category being considered. For example, the presence of qualified personnel has a relevant weight for VIP and Professional categories. For Young and Pop categories, factors with a relevant weight are entertainment services and beach services.

D. *Food and Catering Services*

The value of this component of the VfM is calculated through the weighted sum that takes into account the amount and quality of the food services.

This weighted sum is then compared to the maximum of the calculated value in the advertised villages in order to have a normalized value to 1.

The possible services that a village may include are:

- Food shop.
- Market.
- Self-servicerestaurant.
- Restaurant.
- Organic food restaurant (Bio-Restaurant),

in three different dimensions (Small,Medium and Large).

Professional and VIP categories prefer restaurants, in particular organic restaurants, while the other categories prefer other types of food services.

The value thus obtained is multiplied by a factor that indicates the adequacy of the village staff - in terms of numbers and professional skills to the newly added services.

In fact, each service needs staff, which must be appropriate both in numerical and professional terms, as indicated in table IV. The relationship between the optimal staff for the village and the current staff indicates how close the group is to the optimum.Adding personnel beyond those strictly required does not improve this component of VfM while it penalizes the village from the point of view of costs.

TABLE IV. OPTIMAL FOOD AND CATERING STAFF

Food Services	Chef	Waiter	Assistant chef	Cashier	ShopAssistant
Shop S				1	1
Shop M				1	2
Shop L				1	3
Market S				1	1
Market M				1	2
Market L				1	3
Self Service S			1	1	
Self Service M			2	1	
Self Service L			3	1	
Restaurant S	1	1		1	
Restaurant M	2	2		1	
Restaurant L	3	3		1	
Bio-Restaurant S	1	1		1	
Bio-Restaurant M	2	2		1	
Bio-Restaurant L	3	3		1	

E. Sports and Wellness

The value of this component of the VfM is calculated through the weighted sum that takes into account the number and quality of the sports and wellness services.

This weighted sum is then compared to the maximum of the calculated value in the advertised villages in order to have a normalized value to 1.

The possible services that a village may include are:

- Children's swimming pool.
- Adult swimming pool.
- Tennis court.
- Soccer field.
- Bowling green.
- Beach volleyball court.

TABLE V. OPTIMAL SPORTS STAFF

Sports Services	Pool Maintainance staff	Swimming Instructor	Tennis Instructor	General Maintainance staff
Baby Pool	1	1		
Adult Pool	1	1		
Tennis			1	
Bowling				1
Soccer				1
Beach Volleyball				1

This weighted sum is then compared to the maximum of the calculated value in the advertised villages in order to have a normalized value to 1.

Similarly to what happens for the food services, different types of customers prefer different type of sports and wellness services. For example, VIP and Professional categories prefer tennis courts while Young Families prefer soccer pitches and beach volleyballcourts.

As in the case of food and catering services, each sports and wellness service needs professional staff. Table V shows the optimal staff for each service.

Naturally, adding personnel beyond the number strictly required does not provide any advantage to this component of VfM while it penalizes the village from the point of view of costs.

F. Corporate Social Responsibility

The value of this component of VfM is calculated through the weighted sum of the following factors:

- Staff training
- Recycling
- Renovation of kitchen ventilation systems
- Elimination of architectural barriers
- Adoption of an ethical code.In addition, the player can add green areas in the village that will be evaluated quantitatively.

This weighted sum is then compared to the maximum of the calculated value in the advertised villages in order to have a normalized value to 1.

VII. CONCLUSIONS

The paper illustrates the agent based approach applied in the design of a serious game implemented within the framework of the European project "Posso … Non Posso … Vado! PNPV Project Rev.2 (I can ... I cannot ... I go!).

The methodological approach described in the paper makes it possible to simulate reality at different levels of abstraction in order to enhance the educational value of the game.

In fact, the step by step approach proposed allows students to deal progressively with the main concepts of company management, reflecting on the decision making processesand thus improving entrepreneurial competences and skills.

This innovative approach is consistent with the requirements of entrepreneurship education and provides a means of unleashing the creative and innovative potential of young people.

Finally, this approach can be successfully applied to any given discipline, helping students to develop their competences, knowledge and skills.

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