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### Incentive Models and PD Guidelines (Initial Version)

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#### *Abstract*

This deliverable is based on the assumption that design with specific characteristics will influence the internal motivation of users to engage in annotation projects, that is, the design can be seen as an incentive itself. In other words, designers of annotations and participation tools should take into account (and incorporate in the tools) various motivation and incentive mechanisms in order to suit emotional, cognitive, social and ethical needs of users. These motivation and incentive mechanisms depend on both user-centered design requirements and the relevant task-related variables that might affect the performance of the users of semantic annotation tools. Broadly speaking, these variables may be based on individual characteristics of users (e.g., ability, motivation) and social, technological, and environmental/contextual constraints. A rich, multidisciplinary literature has contributed to the definition of an extremely lengthy list of these factors. We propose to use a simplified set of the most prominent features that can be relevant for the kind of tasks involved in semantic annotation. Finally, this simplified set of variables will be considered in a case study developed within the INSEMTIVES project.

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## Executive Summary

The success of the INSEMTIVES project is highly dependent on motivational concepts which encourage users to get involved in the process of annotating a huge amount of unstructured information and generating valid ontologies for non-textual sources. Following Herbert Simon we can distinguish between two types of motivation: (a) the motivation to participate, that is the willingness of a subject to take part in a task, and (b) the motivation to produce, that is the intention to perform competently once he commits to the task. These types of motivations and incentives aspects are not only investigated within sociological and economical research with the aim to develop theories and experimental insights, but also within the more IT and design oriented research, including those dealing with the design of environments for online communities or cooperative works.

The outcome of this deliverable is an **initial set of incentive models** ranging from economic-based to non materialistic-based incentives. Such models are helpful in **analyzing the bottlenecks of current semantic content authoring environments** in the light of the missing incentives impeding large user participation.

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# 1 Introduction

The strategy for the design and implementation of semantic authoring tools incorporating incentive schemes for users is twofold.

As explained in D1.2.1, we propose a methodology that encompasses the ability to a) analyze any work environment of a social nature in which one aims to introduce annotating tasks; b) conduct a design process for the tools that serves as vehicle for the tasks themselves taking the analysis of the social and technological context as an input.

These two phases are mirrored in the two deliverables as follows: the deliverable D 1.2.1 contains all of the elements that can guide the design process *strictly speaking*, whereas the present deliverable D1.3.1 concentrates on the analytical steps that logically precede the design process.

As explained also in D1.2.1, this approach stresses a *value-chain outlook* on the design process, clearly distinguishing problems regarding motivation/participation in the design process *strictu sensu*, on the one hand, and motivation/participation of users once the tool is in place, on the other hand. Naturally, we expect the reader to proceed iteratively between the two layers that, as far as we are concerned, can only be analytically separated but that are carried out simultaneously in the design practice.

Whereas the deliverable D.1.2.1 provides a comprehensive methodological approach allowing for the analysis, design and testing of the tools, this deliverable outlines a general framework which aims at guiding designers with respect to which design goals or requirements to be considered as well as allowing them to map the analysis results into a possible set of solutions. This deliverable is based on the assumption that design with specific characteristics will influence the internal motivation of users to engage in annotation projects, that is, the design can be seen as an incentive itself. Therefore, the resulting product design are expected to incorporate different motivation mechanisms, mainly focusing on user-centered design requirements such as usability, sociability, design for fun etc.. These requirements aims to address emotional, cognitive, social and ethical needs of users and are viewed as design goals that designers of annotations and participation tools can take into account.

In addition, for the analysis of the situation of content annotation we need to carefully analyze the relevant task-related variables that might affect the performance of the users of semantic annotation tools. Broadly speaking, these may be based on individual characteristics of users (e.g., ability, motivation) and social, technological, and environmental/contextual constraints. A rich, multidisciplinary literature has contributed to the definition of an extremely lengthy list of these factors; however, trying to use such a list with a practical implementation goal in mind might be unwieldy, so we propose to use a simplified set of the most prominent features that can be relevant for the kind of tasks involved in semantic annotation.

Finally, all these requirements and suggested dimensions for the analysis will be considered in the case studies within the INSEMTIVES project.

## 2 Relevant Variables

### 2.1 Relevant Design Goals for Motivating Participation

The design process of user-centered tools needs to consider some general design requirements which will influence the end users' motivation to engage in annotation projects. Besides usability and sociability requirements, software designers refer to a number of additional (design) issues with respect to software *affordances* that can strengthen or support users' motivation for participation. These include including the emotional, cognitive, social and ethical dimensions. We can regard these general requirements as design goals that designers aim at achieving by designing for them purposefully. Accordingly we suggest the consideration of the following design goals:

- Designing for Usability
- Designing for Sociability
- Designing for Human Values
- Designing for Emotion and Enjoyment
- Designing for Incentives

All these listed design goals or requirements are not necessarily independent from each other, nor are they systematically distinct and complete. They represent some samples of requirements which have been suggested by different HCI scholars in the recent years. We describe some principles and guideline related to these goals. Since there are not any better and more sophisticated requirements available, the annotation and participation tools that will be developed in the INSEMTIVES project shall take these requirements into account when designing the applications. Furthermore, the evaluation of INSEMTIVES tools will follow these requirements lists as well and will include tests with users.

#### 2.1.1 Designing for Usability

*Usability* is an important consideration in the design of products. Products need to provide suitable functionalities (usefulness) and an appropriate usage of these functionalities (**usability**). Meanwhile usability emerged to an attribute of quality, what ensure that the users of products are able to work effectively, efficiently and with satisfaction (ISO 9241-11) to fulfill their tasks. These three dimensions are understood as follows:

- **Effectiveness:** Accuracy and completeness with which users achieve specified goals.
- **Efficiency:** Resources expended in relation to the accuracy and completeness with which users achieve goals.
- **Satisfaction:** Freedom from discomfort, and positive attitudes towards the use of the product.

There are a set of general principles and heuristics suggested to design usable systems, i.e. to achieve the aforementioned usability goals. In the following we provide some of well-accepted principles and heuristics. For more information we suggest the following references (Nielsen, 1994; Nielsen, Mack, 1994; Preece et al., 2002; Koyani et al., 2003; Te'eni et al., 2007; Shneiderman, et al., 2009)

Jakob Nielsen's (Nielsen, 1994) heuristics are the best known usability heuristics for user interface design: Visibility of system status; Match between system and the real world; User control and freedom; Consistency and standards; Error prevention; Recognition rather than recall; Flexibility and efficiency of use; Aesthetic and minimalist design; Help users recognize, diagnose, and recover from errors; Help and documentation. The International Standardization Organization (ISO) presents a set of usability heuristics that applies to the interaction of people and information systems. The standard (ISO 9241 part 110) refers to this interaction as a *dialogue* and describes seven general *dialogue principles*: Suitability for the task; Self-descriptiveness; Controllability; Conformity with user expectations; Error tolerance; Suitability for individualization; Suitability for learning.

In addition to these general dialog principles, there are also guidelines for specific topics. The following requirements are organized according to different topics which are most relevant to the Web context where user participation, contribution, motivation play a significant role (Preece, Shneiderman, 2009).

Usability factors that may influence reading:

- Interesting and relevant content presented in attractive, well-organized layouts.
- Frequently updated content with highlighting to encourage return visits.
- Support for newcomers through tutorials, animated demos, FAQs, help, mentors, contacts.
- Clear navigation paths so that users have a sense of mastery and control.
- Universal usability to support novice/expert, small/large display, slow/fast network, multilingual, and users with disabilities.
- Interface design features to support reading, browsing, searching, and sharing.

Usability factors that may influence contributing:

- Low threshold interfaces for easily making small contributions, e.g., no login.
- High ceiling interfaces that allow large and frequent contributions.
- Visibility for users' contributions and frequency of views; aggregated over time.
- Visibility of ratings and comments by community members.
- Tools to undo vandalism, limit malicious users, control pornography and libel.

Usability factors that may influence collaborating:

- Ways to locate relevant and competent individuals to form collaborations.
- Tools to collaborate: communicate within groups, schedule projects, assign tasks, share work products, request assistance.
- Visible recognition and rewards for collaborators, e.g., authorship, citations, links, acknowledgements.
- Ways to resolve differences (e.g., voting), mediate disputes, and deal with unhelpful collaborators.

### 2.1.2 Designing for Sociability

Besides general guidelines for usability, participation support and *sociability* design should be taken into account. As experiences from Web2.0 analyses and Open Source Software projects (OSS) show, socializing in user communities can be enhanced by respecting some general principles or guidelines. Sociality refers to the tendency to associate with or form social groups. Sociality, not functionality, is viewed as the key concept in social software systems. Bouman et al. (Bouman et al., 2007) suggested a design framework which could help designers and developers to create social software that invites and supports its users to engage in social activities online as well as offline, to associate with or form social groups, ultimately leading to seeking or enjoying companionship. They argue that designers of social software have to address in one way or the other the following issues:

- Enabling practice, i.e., supporting practice that exists or could exist within the social group that is the intended audience of the social software system.
- Mimicking reality, i.e., finding or creating metaphors that relate to the real world.
- Building identity, i.e., providing the community with the mechanisms that allow for the development of an online identity.

- Actualizing self, i.e., creating mechanisms that allow users to tap into the collective wisdom and experience and use it for their own benefit, learning process and self-actualization.

According to Preece (Preece, 2000), communities with good sociability have social policies that support the community's purpose and are understandable, socially acceptable, and practical. Success of an online community requires a blend of well-designed software (i.e., usability) and carefully crafted social policies. According to Lazar and Preece (Lazar, Preece, 2002), the following three broad categories of issues are considered as important: Registration issues; Trust and Security issues; and Governance issues. Other recommendations for the support of end user participation are listed by Preece and Shneiderman (Preece, Shneiderman, 2009) as follows:

- Reading: issues for the attraction/motivation of end users to visit web sites and applications, to use web services, to read provided information, to consume multimedia content, to "stay" on the web site, to come back and to visit again regularly.
- Contributing: design recommendations for the attraction/motivation of end users to edit web content, produce/generate own content, contribute to web communities and collective repositories, etc.
- Collaborating: issues for the attraction/motivation of end users to collaborate with others in a user community, to coordinate their contributions with other contributors and so on.

### 2.1.3 Designing for Human Values

*Human values* and ethical considerations are fundamentally part of design practice. Value Sensitive Design offers one viable principled approach to systematically considering human values throughout the design and deployment of information and other technologies (Flanagan et al., 2005; Friedman, 1997; Friedman et al., 2006). Through its theory and methods, Value Sensitive Design requires that we broaden the traditional criteria (e.g., reliability, correctness) for judging the quality of systems to include those that advance human flourishing.

Values are at play in all phases of designing, developing, deploying, and appropriating of information technology. In all these activities there exists the need for explicit consideration of values, value tensions, and value trade-offs. It is expected that Value Sensitive Design will be used in conjunction with other successful methodologies (such as Participatory Design, systematic debugging and testing practices, rapid prototyping) with a variety of practitioners including software engineers, usability engineers, interaction designers, information solution professionals, and concerned direct and indirect stakeholders.

Methodologically, at the core of Value Sensitive Design lies an iterative process that integrates conceptual, empirical, and technical investigations. *Conceptual investigations* involve philosophically informed analyses of the central constructs and issues under investigation. Questions include: How does the philosophical literature conceptualize certain values (e.g. trust, privacy, ownership)? Who is affected? How should we engage in trade-offs among competing values in the design, implementation, and use of information systems? *Empirical investigations* focus on the human response to the technical artifact, and on the larger social context in which the technology is situated. For example, how do stakeholders apprehend individual values in the interactive context? How do they prioritize competing values in design trade-offs? How organizations appropriate value considerations in the design process? Technical investigations involve analyzing current technical mechanisms and designs to assess how well they support particular values, and, conversely, identifying values, and then identifying and/or developing technical mechanisms and designs that can support those values.

In several case studies Friedman et al. (Friedman et al., 2006) demonstrate the application of the Value Sensitive Design (VSD), exploring different values such as privacy, informed consent, trust; the democratization of the planning process. There are several techniques that can be employed to understand values in context, including value card techniques (Flanagan et al., 2005) or photo-elicitation technique (Le Dantec et al., 2009) as well as techniques for dealing with value tensions (Miller et al., 2007). In addition, current literature suggests specific guidelines for specific values such as trust or issues about web credibility or security (cf. (Fogg, 2002)).

### 2.1.4 Designing for Emotion and Enjoyment

Most software development processes just focusing on the traditional principles of usability, which described before, *hedonic* quality get more and more important to increase good user experience. *Joy of Use* plays a significant role in the development of software tools. If the customer experienced the product with joy and trust, he will most likely continue with the usage or use the product again. To maximize usage, the interfaces of the tools should be designed with focus on positive emotions in addition to usability, that is, the interface should be complemented with design features that create positive experience, including *pleasure*, *enjoyment*, *fun*, which are to some extent related to user satisfaction (Agarwal, Karahanna, 2000; Tractinsky et al., 2000).

The topic of design for fun goes back to early studies of games, such as the work of Malone (Malone, 1982) on educational games. He summarized the design heuristics for enjoyable interfaces with these criteria: challenge, curiosity, and fantasy (which he tied to emotion and metaphor). The interest in pleasure and fun in relation to IT is now beginning to grow (Monk, Hassenzahl, 2002; Karat, Karat, 2003; Nielsen, 2003; Shneiderman, 2004).

Jordan (Jordan, 1999) constructs an explanatory framework and discusses four different types of pleasures; *Physio-pleasure* (derived from the sensory organs, such as quality materials to the touch); *Socio-pleasure* (derived from the product and how it affects their social identity or relationships with others); *Psycho-pleasure* (which pertains to people's cognitive and emotional reactions, for example, when things are completed in a satisfying way); *Ideo-pleasure* (derived from people's values, such as artistic quality in a design, or ecologically sound products.). These are of more general types of pleasure. Yet, they may well be used as a support in designing tests and analyzing data.

Hassenzahl (Hassenzahl, 2003) identified three needs people are desire to fulfill. First, stimulation: Mankind has the inherent need to develop and move forward. Novel, interesting, and stimulation functions, contents, and interaction- and presentation-styles can attract interest or reduce motivation problems. Second, identification: People tend to use object to express themselves. Products can help users to communicate their desired identity. Third, evocation: Products may able to provoke memories. Products can represent past situations or impressions, which are important for the user.

Based on this model Hassenzahl (Hassenzahl, 2003) introduced an instrument in order to proof these qualities. The AttrakDiff-Questionnaire helps test users to indicate their perception of the product by using pairs of opposite adjectives. The Questionnaire is built on the following four constructs: Pragmatic Quality (PG): The perceived ability to fulfill a desired task; Hedonic Quality – Stimulation (HQS): To what extent the product can support my personal development? Hedonic Quality – Identity (HGI): To what extent the product allows me to identify with it? Attractiveness (ATT): What is the general quality perception?

In addition, Norman (Norman, 2004) distinguishes between visceral, behavioral and reflective levels of processing that are stimulated by appearance, effectiveness in use, and self-image respectively. Norman shows that design of most objects are perceived on all three levels (dimensions). Therefore, a good design should address all three levels.

Shneiderman (Shneiderman, 2004) argues that designers must address three almost equally important goals that contribute to fun: (1) provide the right functions so that users can accomplish their goals, (2) offer usability plus reliability to prevent frustration from undermining the fun and (3) engage users with fun-features. For the third goal, designers are now beginning to develop theories of user engagement through fun-features: alluring metaphors, compelling content, attractive graphics, appealing animations, and satisfying sounds. Getting this right is difficult; too many designers go too far in using excessively bold colors, distracting animations, and annoying sounds.

Designing for enjoyment is particularly relevant for games. How to create enjoyment in games? The psychologist M. Csikszentmihalyi (Csikszentmihalyi, 1996) talks about the flow experience where a persons' ability and the challenge they are undertaking are perfectly balanced. When people are in the flow state they suspend their fears, put aside their anxieties, and engage fully in the experience of the moment. The implications of *flow* are that challenges must be constantly moderated in order to match the individuals increasing ability. According to Chris Crawford, stalwart game theorist, the point of play is the challenge -

not just the goal<sup>1</sup>. Some categories of challenges to be considered are: *Cerebellar challenge*; *Sensorimotor challenges*; *Pattern Recognition*; *Sequential Reasoning*; *Resource Management*; *Social Reasoning*.

### 2.1.5 Designing for Incentives

There has been a growing design efforts for incenting users. They address users' desire to receive something in exchange for contribution. There are different approaches (Farzan et al., 2008) such as those including incenting with rewards, incenting by explaining community benefits, incenting by goal setting, incenting by providing self benefits. Incentives mechanisms have been designed and embedded in several systems.

Rashid et al. (Rashid et al., 2006) investigate a design augmentation for an existing community Web site. The augmented interface includes individualized opportunities for contribution and an estimate of the value of each contribution to the community.

According to Cheng and Vassileva (Cheng, Vassileva, 2006) it is important to control the quality and the quantity of users' contributions and avoid information overload or degrade its level. Therefore, an incentive mechanism with adaptive rewards was designed that includes a **collaborative rating mechanism** which ensures a decentralized way of measuring the quality of contributions by encouraging the users to rate each other's contributions and an **adaptive rewards mechanism** encourages users' contributions differently, taking into account the users' individual reputation and the current needs of the community.

Vassileva and Sun (Vassileva, Sun, 2007) show that an appropriately designed visualization of the community will stimulate social comparison among the users and will result in increased user participation. Farzan et al. (Farzan et al., 2008) have implemented a feature that rewards contribution with points in order to encourage contribution to an opt-in social networking site designed for employees.

Zhang, P. (Zhang, 2008) proposes a set of design principles (high-level and context-free design goals) to guide ICT design with high motivational affordances. The design principles are based on four sources of motivation (psychological, social, cognitive and emotional sources of motivation). Design principles include: (1) support autonomy, (2) promote creation and representation of self-identity, (3) design for optimal challenge, (4) provide timely and positive feedback, (5) facilitate human-human interaction, (6) represent human social bonds, (7) facilitate one's desire to influence others, (8) facilitate one's desire to be influenced by others, (9) induce intended emotions via information and communication technology surface features, and (10) induce intended emotions via information and communication technology interaction features.

## 2.2 Relevant Variables for Incentives Models

For the purposes of the analysis of the situation of content annotation terms we need to carefully analyze the relevant task-related variables that might affect the performance of the users of semantic annotation tools. Broadly speaking, these are based on individual characteristics of users (e.g., ability, motivation) and social, technological, and environmental/contextual constraints. A rich, multidisciplinary literature has contributed to the definition of an extremely lengthy list of these factors (find quotes in literature reviews), however, trying to use such a list with a practical implementation goal in mind might be unwieldy, so we propose to use a simplified set of the most prominent features that can be relevant for the kind of tasks involved in semantic annotation. We constructed this set around three basic principles:

- In most cases, when working with large, distributed communities of people such as the ones that can help build extensive semantic annotation repositories it is safe not to make too many assumptions on the personal character of each individual, or on the group composition, so we exclude from the set of the variables used for the analysis any reference to individual or group qualities and focus on the task;
- Many of the variables emerging from the literature are of limited scope (for instance, they apply to specific domains) and applicability; others present a high level of correlation and thus do not identify clear, independent dimensions. For these reasons we only concentrate on variables that, on average, are widely applicable across domains and tend to be independent.

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<sup>1</sup> [http://www.amber-light.co.uk/resources/primer\\_emotion.shtml](http://www.amber-light.co.uk/resources/primer_emotion.shtml)

- In order to be of practical use – that is, in order to serve as a reference point to identify the situation at hand in a real application – each of the identified variables needs to include a limited number of values.

Using these principles we identified the following as the main analytical dimensions along which we can partition the space of possible cases:

- Goal of the annotation or ontology population exercise
- Task, or more typically, an ordered collection of tasks into which the annotation exercise can be divided
- Social structure, a stylized and simplified set of social relationships among the subjects participating in the exercise
- Nature of good, a stylized description, in game-theoretical terms, of the relationship between what good is produced and who consumes it
- Required skills of the agents to complete the annotation task.

These variables influence the users' performances in terms of direction (the choice of activities people make in expending effort), intensity (the level of effort people exert), and duration (the persistence of effort people overtime keep).

### 2.2.1 Goal

People handle their activity toward specific goals which are terminated by aspiration, satisfying, impatience, and discouragement mechanisms.

If the goal itself is enough interesting individuals' motivation will be high. In many cases, a challenging goal might address the interest of individuals and catalyze interests and motivation. Also specificity and reasonable levels of difficulty are considered important elements related to the amount of effort and persistence that individuals will put to achieve their goals (see Locke and Latham, 1990).

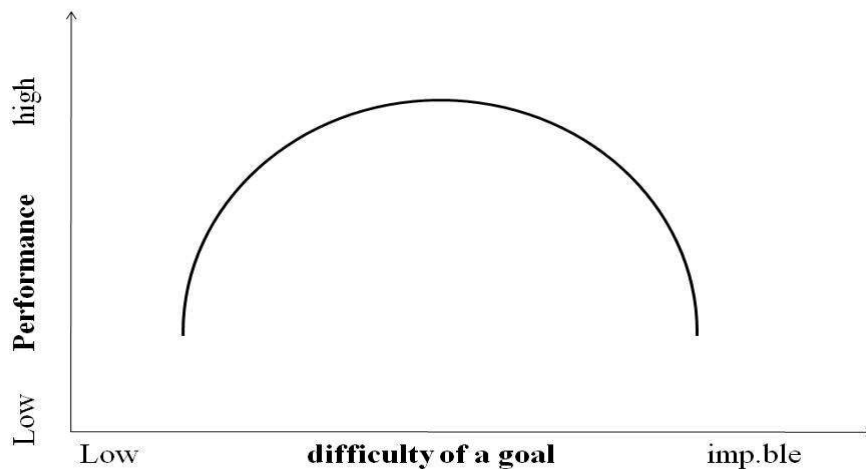
In the organizational setting, individuals must accept the goal being set by supervisors or top managers. This acceptance is related to the alignment of personal and organizational values, and the so called goal congruence (Barnard, 1938).

In organizational settings three situations might occur:

1. Goals are communicated successfully from the top level of the organization down to the bottom, and commitment to goals is achieved at each level. In this case, employee-organization goal congruence is achieved because employees either agree with the goals or decide to put the goals in front of their own personal preferences (Locke, Latham, 1990). In other words the goal congruence is affected by the successfulness of communication from the managers or the top levels of the organization down to the bottom, and the commitment to goals which is achieved at each level.
2. Goals are communicated successfully from the top down, but employees for some reason do not agree with them and they do not want to put the goals in front of their own self-interests. In this case there is no ambiguity in identifying the source of resistance in the organization which might be overcome by employee participation, additional training, selection procedures, and monetary incentives and rewards (monetary incentives and recognitions).
3. Goals are not communicated successfully, but employees for some reasons misunderstand the message and the values. In this case, that is the common one, the rewarding and incentive systems might be fine tuned according to individual reactions and behaviors.

There are also some positive relationships that should be described in order to better understand the goal and its influence on performance:

- There is a positive relationship between the difficulty of a goal and the expected performance. Only when the goal is considered too much difficult or impossible the frustration take over and the goal is abandoned by individuals. See Figure 1.



**Figure 1: The relationship between performance and difficulty of a goal**  
[Source: Locke and Latham, 2002]

- There is a positive relationship between the clearness of goals and an expected performance. Clear and specific goals tend to produce better results than general and undefined ones. In an uncertain environment in which goals cannot be clearly specified at the beginning, feedback and collaboration help individuals to clarify and agree on the meaning of the goal.
- There is a positive relationship between the level of participation and the level of goal acceptance and congruence. Participation in goal-setting is a strong key to make people accept the goals (and make them clearer).

### 2.2.2 Tasks/ Job

The nature of task and in particular variety and complexity, identity, significance, autonomy and discretion affect the internal motivation of individuals, namely their work performances (in terms of quality, speed), their satisfaction (in term of significance), and the duration of the task.

Some of the following elements refer to the core job dimensions as well as to the relation between the job and the individuals:

- The skill variety is the degree to which a job requires a variety of activities in carrying out the work and involves the use of several individual skills. Competencies are positively related to the ability to perform the a variety of activities
- The task identity is one factor of the job that influences the experienced meaningfulness of work. According to Griffin (Griffin, 1982), task identity is the degree to which the job requires completion of a whole and identifiable piece of work that is done from the beginning to the end with a visible outcome (Hackman, Oldham, 1980).
- The job autonomy and discretion are positively related to the desires to self-organize experience and behavior according to the individual's integrated sense of self, the experience of integration and freedom, and the essential aspect of healthy human functioning (Deci, Ryan, 2000).
- The level of tasks specificity / clearness is positively related to performance, when a task is not well defined participation might help individuals to understand it.

- The degree of amusing individuals feels carrying on the task.

In some cases jobs require reciprocal interdependencies and social aspects might affect the personal satisfaction, the inner motivation of individuals and their performance. Below some examples:

- Task significance extent to which an identifiable job / task affects, or is important to, others within or outside the organization. Namely, is the judgment that an individual's job has a positive impact on other people (Hackman, Oldham, 1976; Morgeson, Humphrey, 2006). Task significance is positively related to performance and it is thought to be particularly critical in today's economy, as employees are increasingly concerned with doing work that benefits other people and contributes to society (e.g., Colby, Sippola, Phelps, 2001; Turban, Greening, 1997).
- Task interdependence is likely to foster social norms of cooperation and helping, make the need for collective social responsibility, and enhance group cohesiveness. In this case the task might become a mean of power because due to a specific task individuals can control some critical resources, manage the uncertainty, and promote the rigid exclusivity of tasks. Systems increasing user's sense of control (either at the task level or job level) would motivate and therefore tend to be adopted by users. Systems reducing control, in contrast, would be demotivating and would therefore be subject to resistance from users.
- Individual discretionarily either at the task or job levels. If the task is mandatory and the level of goal congruence is low, a set of incentives should be implemented in order to reduce opportunistic behaviors of individuals and guarantee a good quality level of performances.

### 2.2.3 Social Structure

The social structure is the enduring and relatively stable pattern of relationships among various agents or group of agents. It can be considered also as a set of institutionalized norms, cognitive frameworks, cultural patterns that define and address actions of agents in a social system (Lopez, Scott, 2000). This pattern of relationships is wrought according to the set of norms, communication channels, coordination mechanisms, beliefs and views, feelings, etc., of people of varying social positions within a group, a firm, or any other social system. In traditional and positive studies, social structure is usually considered as a set of situational constraints or barriers, which can be beyond the control of the individual or a group. For instance, they might be tools, equipment, procedures, internal climate, relationships, information, values and knowledge commonly shared by the individuals, which influence the choices, opportunities, challenges that individuals possess and foresee. In practice, firms successfully use the set of incentive mechanisms that take account of the social structure they are embedded in (Fukuyama 1995, Granovetter 1985).

The social structure of business companies are characterized by a variety of hierarchical levels in which the system of relations strongly depends on the reputation system. This latter is usually based on the supervisors' feedback. In this case the role of supervisor is quite strategic. She/he might clearly communicate expectations, provide the necessary training or clarify the goals assigned by the management, can remove or minimize constraints, or recognize positive behaviors, and reward people for their performance. In such context, relationships among principal and agents are not neutral and two main problems should be taken into account: the principal-agents and the stewardship.

The principal-agent problem occurs when cooperating parties have different goals and vision of labor (Jensen, Meckling, 1976; Ross, 1973). Specifically, agency theory is directed at the ubiquitous agency relationship, in which one party (the principal) delegates work to another (the agent) who performs that work. This is the typical case of employer/employee relationship in which a principal hires an agent to pursue a specific interest. The two agents may not share the same interests and a situation of information asymmetry, uncertainty and risk may occur. Considering the contract between parties as the unit of analysis, the focus of the theory of agency is on determining the most efficient contract given assumptions about people (e.g., self-interest, bounded rationality, risk aversion), organizations (e.g., goal conflict among members) and information (e.g., information is a commodity which can be purchased). The solution to this problem, closely related to the moral hazard problem, is to ensure the provision of appropriate incentives, so agents act in the way principal wish. Various mechanisms can be used to compensate (or supervise) an agent

performing certain acts. These are useful to the principal and costly to the agent. Examples of incentive mechanisms may be “piece rates, (share) options, discretionary bonuses, promotions, profit sharing, efficiency wages, deferred compensation, and so on” (Prendergast, 1999). In the case of tagging and ontology population, in a hierarchical context, the systems of incentives can be based on performance-related payments (which might depend by the quantity and the quality of content annotation/population provided), or profit sharing (Jones and Kato 1995, Knez and Simester 2001). Some studies (Drago and Garvey, 1998) show that when agents are placed on individual pay-for performance schemes or performance evaluations, they are less likely to help their co-workers and free-riding effects increase. These negative effects are particularly important in those jobs (such as the ontology creation) that require team production (Alchian and Demsetz, 1972). Another issue that should be taken into account is the incentive-intensity which depends on four factors: the marginal profit created by additional effort, the precision with which the desired activities are assessed, the agent’s risk tolerance, and her/his responsiveness to incentives.

In an organization context, stewardship refers to management's responsibility to properly utilize and develop its resources, including its people, its property and its financial assets. It also refers to thanking and recognizing donors. This includes organizing thank you phone calls, recognition events and conveying the impact that the donor's gift has had.

In community of peers, hierarchy is considered as neutral, and relations among agents don’t heavily depend on the role individuals have in the firm. To regulate the quality and the quantity of user contributions and ensure a sustainable level of user participation in the community, it is important to adapt the individuals and groups’ rewards on the community’s social structure such as the needs of community members, their style of contributions, their past performance and practices, their system of values, etc. In particular in communities, “situations involving interactions with other human beings are characteristically more heavily laden with emotions than any other situations” (Simon, 1967, p. 37). Also, “the majority of human emotions are social in nature, specifically developed so as to make the active group cooperation feasible” (Toda, 1985, p. 261). Focusing on how behaviors change through motivations the following elements should be analyzed: social identity, feedback processes, justice and equity, trust, altruism, and reciprocity.

- Social identity. The notion of social identity (Tajfel and Turner 1979) is defined as an umbrella term used throughout the social sciences to describe the way individuals label themselves as members of particular groups (social groups, communities, nations, classes, etc.). Categorizing in groups provides individuals with a sense of belonging that contributes to a positive self concept. Also the process of interaction among peers, develop a consistent set of behaviors that reinforce the identity of the person. Theoretical analysis as well as review of empirical studies of the relationship of social identity with motivations and performance leads to the conclusion that identification is positively related to work motivation and task performance.
- Positive and negative feedback focus on how behaviors change according to positive and negative reinforcement or punishment, and it concentrates on the relation between past and future behaviors. Individuals answer to an impulse choosing among several responses. Usually, the responses they choose are the ones that in the past obtained positive results. For instance an individual will repeat the action that in the past did right and obtaining a prize. In those cases, awards and punishments by peers can be used to reinforce a favorable behavior or stop a disliked behavior.
- Justice and equity refer on the fair treatment with respect to the effort-reward balance. The perception of equity is determined by the comparison between the:
  - balance between individuals’ own outcomes (payment and rewards: such as salary, benefits, intangibles, recognition, etc), and individual inputs (work and efforts: such as hard work, skill level, tolerance, enthusiasm), and
  - balance between partner’s outcomes and inputs (Adams, 1965; Carrel, Dittrich, 1978).

It could also be based on the so called procedural justice: a fair treatment in terms of how decisions are made about things that affect them in the workplace.

- Trust, altruism and reciprocity are essential to human interaction, especially in dealing with too complex tasks. In many experiments it emerges that people often are altruistic, trust others, and reciprocate the benevolence of others far more than economic models of "rational" human selfishness predict. This is the case of Wikipedia contribution in which altruism, reciprocity,

community, reputation and autonomy are considered antecedents of user motivations (Kuznetsov, 2006). Trust grows when each side's contribution is reciprocated by the other's, but not if reciprocity is withheld, and trust shrinks rapidly if one party abuses the other's trust by acting opportunistically (this is the case of free riders' opportunism). The free riding behaviors are dramatically reduced in small groups in which individuals count on the others' contributions.

#### 2.2.4 Nature of Good

In economics a good is any object that increases the utility of the consumer/ product directly or indirectly. For the INSEMTIVES project, good is the outcome of the annotation process.

What is the best incentive system to provide a good? The answer depends on the nature of a good. In thinking about the nature of a good it is necessary to respond to two questions:

- Are goods excludable? Can people be prevented from using this good?
- Is the good rival? Does one person's use of a good diminish others' enjoyment from it?

Using these characteristics it is possible to distinguish among 4 types of goods: private goods, public goods, common resources and club goods.

*Private goods* are both excludable and rival. Consider a piece of bread, for example. A piece of bread is excludable because you can prevent someone from eating it – you just don't give it to the person in question. A piece of bread is rival because if one person eats it, the other one cannot eat the same piece of bread. Most goods in economy are private as a piece of bread. Their provision depends on the market forces and established laws of supply and demand.

*Public goods* are neither rival nor excludable. That is, people cannot be prevented from using a public good, and one person's enjoyment of the good cannot reduce another person's enjoyment of it. National defense is a good example of public good. Once a country is defended from aggressors, it is impossible to exclude any person from enjoyment of this protection. The common feature in public goods settings is the existence of externalities. In public goods problems, individuals can use private resources to provide goods that have positive externalities for others. Moreover, when one person enjoys the benefits of being protected it does not interfere with the enjoyment of any other person of being protected.

*Common resources* are rival but not excludable. For example, fish in the ocean are rival goods. If someone catches fish there are fewer fish for others to catch. However, the fish is not excludable as it is difficult to charge fishermen for the fish they catch.

*Club goods* or *natural monopoly* are goods that are non rival but excludable. Cable television is an example of such good. To have cable television you need to pay a fee, those that do not pay the fee cannot have access to this television. But, enjoyment of the program transmitted by cable television by one person does not preclude other individuals that paid the fee from enjoying it at the same time.

The nature of good influences in a dramatic way the structure of the appropriate incentive model. In the case of private good it is possible to impose a price to be paid by the final user to take advantage of the good. Exclusivity of private good permits to control that each final user pays this price. The producer of the good in this case receives material reward that becomes the main motivational factor of production.

In the case of public good it is impossible to respect the price if it was imposed on the good given that it is impossible to exclude individual that is not paying the price due to non-excludability of the good itself. Therefore, individuals tend to consume the good without contributing to its production. This problem is referred to as a problem of free riding – enjoying the benefit of a good without paying for it.

Annotation of semantic content in many cases can be seen as an example of public good. Typically the final beneficiaries of annotation are the same individuals that perform the annotation task. It is impossible, and meaningless, to exclude any user of the portal from benefits deriving from the semantic content annotation once it is done. At the same time annotation task requires attention and time from the user, it is a costly activity. There is a strong individual inducement to avoid undertaking the activity of annotation, therefore avoiding individual cost of annotation, but to take advantage of the benefits provided by annotation activity

of other users. Therefore, the main concern of the designer in the case of public good is dealing with free rider problem and inducing all users to contribute.

Annotation of semantic content becomes club good in case when only users that perform annotation can benefit from it. Here, the designer would concentrate attention on involving users to the club. Increasing the level of contribution among the club members would be a secondary concern.

Annotation of semantic content can be seen as a sort of private good<sup>2</sup> in the case in which users that perform annotation task are different from the users that benefit from this task. Namely, when a third party performs annotation by commission. In this example, rivalry of the good refers to the fact that given annotation can be interesting for several third parties, although within a given third party the benefits of annotation remain non-rival. In this case, incentive mechanism should be concerned with motivating the third party to perform the task in a required way (i.e., principal-agent problem). Public good has been extensively studied in experimental economics. Ledyard (1995) provides an excellent survey, although out of date, of experimental literature on the point. One of the most popular scenarios studied by experimentalists is the one of the voluntary contribution mechanism. This scenario is relevant for the discussion above as the decision space of individuals here involves giving. Individuals are provided with an endowment that can be privately consumed or allocated to public good. Individual allocations versus public good produce positive value for all participants in the experiment (positive externalities) in increasing fashion: the more is allocated toward the public good, the greater are the social benefits. However, allocation to public good is costly to the individual. The net benefit of individual contribution to the public good, benefit from public good minus the cost of contribution, is lower than the value derived from private consumption of the endowment. Theoretical analysis suggests that the optimal strategy is to consume the whole endowment privately; therefore no one expects to be contributing. Nonetheless, subjects in experiments do contribute to public good (Croson, 2008). Results from a wide variety of experiments are quite robust. General pattern of contributions can be described as follows. Subjects start by contributing about half of the tokens on average, although individual contributions are very different. The average amount of contributions tends to decrease in consecutive rounds of experiment to reach 10-20% of endowed tokens in the final round. Tendency to contribute less with time is a general pattern encountered in real life behavior also for new annotation communities. Driven by enthusiasm people tend to contribute a lot in the beginning but these contributions vanish as time passes if they do not receive additional incentives along the way (Kollock, 1998).

Many experiments have been conducted to test strategies to increase contributions in experimental public good games. Here we provide a short review of these results<sup>3</sup>.

#### *Payoff structure*

The greater the personal return from contribution and the lower the return from not contributing, the higher the levels of contribution. Increase in the benefit from public good relative to non-contributing results in the increase of contribution to public goods in experiments (Isaac and Walker, 1988, Isaac et al., 1984).

People also tend to increase the level of contribution when the benefit to other's from their contribution increases (Bonacich et al., 1976, Kelley and Grzelak, 1972). In this case, other-regarding preferences are in place.

Allocation of a lump sum to be spent on the group activity instead of each person getting individual payoff has significant effect on contributions to public good (Alfano and Marwell, 1980).

While in experiments payoffs are clear and carefully explained to experimental subjects benefits from the semantic content may not be as clear to the users of the platform. The main action that the designer can take is to make clear what benefits users can derive from the platform and how these benefits may improve their life/work/use of the platform. This kind of awareness can be created through the implementation of participatory design.

<sup>2</sup> Common resources are not of interest here given that annotation is never a rivalry good and benefits deriving from it cannot be exhausted no matter how many users are enjoying them

<sup>3</sup> For a good introduction into experimental research in the area of public goods we recommend Croson (2008). Ledyard (1995), Kollock (1998) and Dawes (1980) provide review of experimental results in public goods coming from experiments in economics, sociology and psychology.

It is possible to introduce a system of points for every action that a person performs in terms of annotation. These points can be translated in some personal benefit ranging from monetary reward or an additional day-off in a corporate setting to construction of status in the community in a Web-based open community.

#### *Group size*

Results on the effect of the group size on contribution to public goods are not uniform. Numerous studies demonstrate that cooperation declines as group size increases (Komorita and Lapworth 1982, Fox and Guyer, 1977, Bonachich et al, 1976). In a large group it is more difficult to monitor everybody's contributions. People may expect others to contribute and think that the lack of their small contribution will not be noticed. In addition, in larger groups it is more difficult to encourage others to contribute by personal example while defecting anonymously is a very attractive strategy.

This evidence encourages the designer to create a network of smaller groups of users. This solution is feasible for corporate environments where this division is naturally accepted. However, even if it is not possible to divide users in smaller groups it is possible to obtain efficient levels of contributions.

Several studies find that decline in contributions with increase in group size vanishes quickly (Fox and Guyer, 1977, Liebrand, 1984). Yamagishi and Cook (1993) and Isaac et al (1990) demonstrate that contributions increase as the size of the group increases. In particular, Isaac et al (1990) study interplay between group size and payoff structure. Experimental subjects make their choices over Internet at their own locations. They show that groups of 40 and 100 provide the public good at higher levels than groups of 4 and 10 for lower levels of benefit from public good while the difference is non significant for high level of benefit. In the experiment with very low individual benefit from public good they find the same levels of contribution in large groups compared to small groups.

Marwell and Oliver (1993) suggest that large groups are more likely to contain a critical mass of individuals whose interests are served by providing highly non rival good. Heterogeneity of the group member's interests and resources encourages formation of the critical mass (Glance and Huberman, 1994).

#### *Thresholds and provision points*

In the case of threshold or provision point, if enough resources are collected then the public good is provided and all receive its benefits. If too few resources are collected, then the public good is not provided and no positive externalities are enjoyed. Theoretically there exist multiple equilibriums in which the public good is exactly provided with each individual contributing a share of costs. These equilibriums differ by the share of the cost covered by each single individual. Therefore, from theoretical point of view this situation can be seen as coordination game where subjects need to coordinate on the preferred equilibrium.

Experimental data seem to suggest that increase in the threshold increases contributions but also increases the probability that the target will not be reached (Isaac et al, 1988). An implication of this finding can be that designer defines the target to be reached by each single user for the project to have success, an average number of actions that each user needs to perform. This target should be feasible for members of the community. It is important that all users know and understand the importance of their single action.

#### *Efficacy*

The main reason of low levels of contribution to public good is the perception that a single person does not have a significant effect on the situation. If the problem is structured in a way that a person can have a noticeable effect on the outcome the levels of contribution can be increased.

One way of inducing perception of importance of individual contribution is introduction of thresholds. If an individual believes that the group is close to the threshold, then adding one's own contribution can be enough to help the group to reach it.

The perception of efficacy is enough to induce cooperation (Kerr, 1989, Rapoport et al, 1989).

#### *Group identity*

Social identity theory (Tajfel, 1981) argues that simply categorizing individuals into a common group will increase their altruism towards the group. Therefore, higher level of contributions is expected. However, Karp et al (1993) argues that for creation of group identity needed a belief in interdependencies of group members and expectation of reciprocity among the members.

Introduction of competition between groups in public good games with threshold changes the structure of the problem. In this new game, free riding is no longer a dominant strategy for players (Rapoport et al 1989, Rapoport and Bornstein, 1989). However, competition should be used with caution as it may harm the cooperative environment, especially in corporate setting.

#### *Communication*

Communication among group members significantly increases levels of contribution (Orbell et al, 1990, Liebrand, 1984). Ledyard (1995) assesses that the effect of communication is limited to small groups with size N smaller than 15 individuals.

Dawes, McTavish and Shaklee (1977) investigate on what kind of communication matters for contribution to public goods. People that participated in discussions on irrelevant topic made the same level of contributions as those that did not communicate at all. Discussion of the topic of contribution with or without public commitment of personal contribution doubled the level of contribution compared to no communication treatment. Dawes (1991) argues that the key effect of communication comes from eliciting group identity.

#### *Moralizing*

Dawes et al, (1976) show that contributions of people exposed to a moralistic speech about group benefit, exploitation, ethics and so on, are higher compared to contributions of people that were not told anything. These contributions result at the level of condition with communication and commitment. Although this speech confounded social pressure, experimental demand, emotional appeal, etc., apparently it works at motivating people to contribute.

This strategy can be easily implemented in corporate portals where the chief of the company, department, or group can give a motivational speech on how implementation of semantic ontology is important for the company, department, or group and on the need of everyone to contribute. Every Web-based community can have a moralizing address to users that to appears to newly registered users or flashes on the screen to every return user at the login to the system.

#### *Public disclosure of choice versus anonymity*

Making public the choice of each member of the group increases individual contributions to public goods (Fox and Guyer, 1978).

People tend to imitate those around them. In a university fundraising campaign, Frey and Meier (2004) find that information about the average contribution in the past has a significant impact on contribution. In a field experiment on MovieLens providing information on performance of median user significantly increased monthly movie ratings of below median users while above median users do not necessarily decreased their contributions (Chen et al., 2008).

Report on average contribution to the community is an easy and effective instrument. Each member of the group should be able to see what other members did and how the group stands relative to other groups. This information should be easily retrievable (preferably always in the user's sight) and understandable.

To conclude, the designer has a wide range of tools to influence behavior of users of the platform. The variables discussed above can hardly be implemented alone. The designer should study carefully the situation and choose the main variables. For example, if the project concerns a corporate portal the designer can choose to have smaller groups and measurable individual payoffs like money or additional day-off or lump prize to the group. Small groups and measurable payoffs define the measures of efficacy, moralizing, possibility of communication and efficiency of choice disclosure.

Main variables of a web-based portal open to general public will be very different. In this case, the designer has to deal with a very large group of heterogeneous persons. In this case, it is hard to ensure monetary payoffs to users, therefore non-monetary rewards, like status, competition, enjoyment of the process, etc., should be implemented. Communication as well is hard to install and maintain in such communities. The designer should concentrate on the measures of efficacy, moralizing, thresholds, public disclosure of choice and so on.

The interplay of the variables creates a unique system of incentives suitable for the concrete project.

### 2.2.5 Required Skills / Abilities / Competences

The ultimate goal of any activity involving human work is that of reaching an acceptable, or satisfying, performance. This very broad statement can be typically characterized along two dimensions. The first dimension – which generally speaking is at the center stage of INSEMTIVES – involves the willingness of the person involved in the performance of the task to a) undertake it; b) actively commit to the task itself. The second dimension regards the set of skills and capabilities required in principle to carry out with proficiency the task at hand that is the ability of a person to perform.

Therefore, it does not make sense to claim that a task can be characterized just in terms of technical features and emotional attachment; in order to present a comprehensive framework we also need to keep requirements in terms of ability into consideration.

In this paragraph we are going to introduce just a short synopsis of a theme that has occupied a central place at the crossroads of multiple disciplines in the last forty years. Specifically, what is really at stake when designing an annotation tool is the set of requirements regarding the skills necessary to effectively operate the tool itself?

Generally speaking, we can distinguish at least two modes in which proficiency might be exhibited by subjects. These two modes take the alternate names of **skills** and **competences** in the economic and managerial literature, and of **routine** and **adaptive expertise** in the cognitive psychology literature (see, Holyoak, Spellman, 1993 for a useful review). The origins and the specifics of the nature of the differences between skills and competences are highly controversial topics in the literature (see Squire, 1987 and Roediger, 1990, for the two dominating alternative views).

Aside from these theoretical difficulties, we can however essentially identify two groups of features that make the difference between skills and competences relevant in our case.

We can define **skills** as a form of knowledge entailing a largely implicit process of learning about the task at hand. This process involves the acquisition of implicit knowledge about the task itself which can be characterized by four main features (Holyoak, Spellman, 1993):

1. It is about co-variations happening in the environment, that is the process regards the awareness about the simultaneous presence of two phenomena happening in the environment, with the first one, which is proximate to the subject cannot be expressed in a explicit form, the other one, farther away (*distal*), can be expressed in an explicit form.
2. These co-variations can be learned by means of an exposure to stimuli exhibiting these co-variations.
3. They can be learned with no intention or awareness. However this does not exclude a more deliberate effort to comprehend them.
4. The acquisition of knowledge about these co-variations is demonstrated by an improvement in task-related performance (for instance as an improved ability in generalization or prediction). However, this improvement does not translate to an explicit representation of the problem because:
  - a. The representation is not fully codified (for instance verbally);
  - b. This representation cannot be manipulated symbolically so that it can be fed into other thought processes.

**Competences**, on the other hand typically emerge as the result of the learning process whenever two conditions are met:

1. The problems to solve present a relevant amount of variance in terms of structure: in this case the subjects exhibit a tendency to search, and generally speaking find, more general rules for generating reliable solutions;
2. The level of pressure on finding an immediate solution is weaker, so that subject can take some time before completing the task (Rashid, et.al. 2006), but see (March, 1991) for an example in an organizational context.

Explicit (that is codified) knowledge, thus generated, can play two functions: on the one hand they can be used to generate performance, similarly to what happens with implicit knowledge embodied in skills and, moreover, they can be manipulated or reorganized in higher level procedures (Karmiloff-Smith, 1990). Moreover, they allow for the representation of alternative solutions to new problems, and this seems to be the most relevant difference with skills (Salomon and Perkins, 1989).

It appears obvious that the tasks are typically *difficult* as far as automated annotation is concerned, whenever the ability demonstrated by humans is of *skill* (or routinized) type.

## 2.2.6 The annotation task matrix: a multidimensional tool for semantic annotation task analysis.

The many characteristics of tasks that we introduced in the last few paragraphs characterize individual<sup>4</sup> tasks in both their technical and social features. We now need to implement a tool that allows for a description of an annotation task along all of these dimensions simultaneously, thus allowing the identification of subset of possible solutions which are fit for the case at hand in the design phase combining technical features for the annotation tool and social features for the task that will motivate users to actively contribute. These dimensions define a multi-dimensional space of possible states of the world that can be then used to understand the basic situation at hand in most practical applications. We call this hyperspace the *annotation task matrix*, which can be roughly described by looking at table 1<sup>5</sup>.

Goal	Tasks	Social Structure	Nature of good being produced	Skill variety/level
Communication level	Variety of	Hierarchy neutral	Private good	Skilled ability
Participation level	Specificity of	Hierarchical	Public good	Competence
Clearness level	Identification with		Common resource	
			Club good	

**Table1: The annotation task matrix reference table.**

Essentially this matrix can be used to both make sense, in analytical terms, of the situation at hand before any design or redesign effort occurs, and to instantiate an assessment procedure once design has occurred and the tool has been introduced. The use of this table is pretty simple: for each envisioned situation in which we have the need to implement or design a set of appropriate incentives to go along with annotation tasks requiring human effort we can select the appropriate value for each feature. In this fashion we will be able to describe any annotation task situation by means of five different major keys, whose combination can then be associated to one or more possible design solutions stemming from the empirical literature that has analyzed similar solutions in the past.

In principle, one can expect to find any combination of factors in real cases; however we can anticipate some combinations to be pretty rare or unviable in the long run. For instance, tasks that can be characterized as very simple and with low variety can seldom be associated with the need to develop a highly refined competence for their execution in real cases. A similar caveat applies to the link between a given

<sup>4</sup> It is important to understand that this, in and by itself, is just a preliminary step in order to carry out the analysis in a given organizational context. Tasks are seldom, if ever, undertaken in isolation from each other. Rather they tend to be grouped in jobs and assigned to clearly identified individuals. If this is the case, then a few other dimensions – which we are not going to discuss here – need to be taken into account (for instance, alongside these other dimensions, one needs to pay special attention to the way tasks are grouped within jobs in terms of variety in time and space, the social dimension attached to each job, that is organizational roles, and so on and so forth).

<sup>5</sup> One should be aware, however, that the space thus defined is not completely specified, that is, there might be other dimensions that are still relevant, but that are, at the moment, outside the scope of the annotation task matrix.

combination of values taken on by the variables and a suggested combination of implicit and explicit incentives: this link has to be assumed as a possible starting point for the experimentation phase that will help steer the design process towards the desired goals. What the table should be helpful for, in practical terms, is to circumscribe very complex situation by means of a manageable set of constraints. In this regard, the next section 3 shows how this template can be used to make sense of a very complex example of annotation drawn from one of the partner use cases.

One should note, however, that using the matrix to identify situations is only the first step required to implement the integration of an appropriate incentive model into a given annotation task effort, as this is no guide to the design process itself that is more comprehensively described in D1.2.1.

### 3 Application to Use Cases

The project considers three main case studies where knowledge acquisition tasks have to be done and incentive models can be applied in order to foster user participation. These can be summarized as the follows:

1. **Corporate knowledge management** is about creating and maintaining knowledge within a controlled setting (enterprise), sharing information among colleagues and providing metadata on all content.
2. The **Web service annotation** case study involves a portal that allows different user roles to enrich Web service descriptions with semantics and receive benefits in return.
3. The third case study is about a **virtual world**, a game where rewards for adding annotations to graphical elements are given in the course of the game within the virtual world.

These case studies will be deeply described and discussed in D5.1.2 “Requirements Specification (final version)”, D6.1.2 “Requirements Specification (final version)”, D7.1.2 “Requirements Specification (final version)” planned for month 20.

In this paragraph we outline the concrete case study of Telefónica I+D (TID) in order to show how the internal portal of Telefónica, called OKenterprise, might be improved with incentive mechanisms and solutions based on participatory design. The OKenterprise solution would enable the knowledge creation and maintenance within the enterprise setting, the information sharing among colleagues and the provision of metadata on all enterprise content. On the concrete case study, we investigate, what incentives mechanisms could bring the users to do semantic annotations of the texts in order to improve the efficiency of retrieval / navigation tools, integrate heterogeneous sources of information (linked data), personalize content, and develop effective recommendation systems (e.g. semantic based RSS, contextual links). In other words we aim at showing how the design of an ontology creation/population tool and a set of correlated incentive mechanisms needs be shaped according to the real social environment in which the tool will be implemented. With this example we also show how complex a real case study can be, allowing us to showcase how the task annotation matrix can be practically employed to analyze a concrete case that would otherwise appear overwhelming.

*The analysis:* We can sketch a description of TI+D problem s follows. Telefonica has structured a corporate portal that groups all the relevant information that its employees might need for work purposes. From an outsiders perspective the available information is fairly complete and displayed logically. The part where real things become problematic is the usual problem shared by many knowledge management systems: there is a huge incentive to keep strategic knowledge private so one can leverage on it when dealing/negotiating with others. A representative agent working for TID is faced with two nested decisions. Decision (1): do I want to share information or keep it private? Decision (2): do I want to spend my time providing content information on my own stuff or do I want to spend time doing annotation other user’s stuff? These two questions are compounded with the problem that the company already requires employees to provide an extensive documentation associated with any project they are involved with.

To investigate these problems, we made two days interviews with 11 representative employees of TID (heads of division, senior project managers, project managers, developers, computer engineers, and consultants). Each semi-structured interviews was conducted by two interviewers, took 60 to 90 minutes and was recorded on audio tape. These recordings have been transcribed and analyzed descriptively according to ex-post categories. Additionally, a focus group discussion with 6 TID employees was conducted, focusing on usage problems of the existing system and on possible design solutions to overcome these problems. The interviewees tried to explain whether and to what extent semantic annotation can actually improve the information retrieval practices of TID workers. TID interviewees’ feedbacks were decisive for the direction of the design, depending both on their impressions and their usage along the way.

Most of the interviewees find semantic annotation useful and interesting for their personal use, such as:

- email classification system
- personal bookmarks and documents management (for fast discovering the content of different documents)

- people finding (who work with needed skills).

Some others express the idea that tagging is a waste of time for the most. It would be nice only if it does not take too much time. As far as incentives are concerned, employees reported that the company tried to build a reputation mechanism with monetary prizes (although of small amount), but it did not work as expected. Maybe the prizes were too small, or the benefits derived by knowledge were too low.

*Applying the matrix:* this scenario can be interpreted according to the main variables (of incentives and participatory design) described above. A first observation regards the link between the tool as conceived and the **goals** it aims at reaching. In terms of clarity and participation of the users in defining them, the purported goals of the portal are unclear. As a natural consequence, we can interpret as obvious the current (low) level of commitment in contributing the right kind of information at the right places.

If we consider the annotation **tasks** at hand, coupled with the **skill** level and variety required to complete them, they are, for the vast majority of TI+D employees, rather trivial in nature. The only problems that might arise regard the variance in the familiarity levels that different employees have shown with regards to the concept of semantic tagging.

As far as the **social structure** is concerned, this is clearly a large corporate context with a very strong presence of hierarchical mechanisms of coordination and control. In this kind of situation we expect to encounter few problems in defining the general incentive mechanism, but severe problems in fine-tuning the combination of the single parts of the mechanism, especially when it comes to defining the effect of the hierarchical relationships on individual performances within the company's structure.

In terms of defining the **nature of good** we are dealing with, we can think of TI+D portal and any information support system or solution linked with it as a case of public good provision. In fact, providers and consumers are the same people and the population of the portal by means of annotations can be considered a public good. An important issue is to deal with a big number of users with an obvious problem of low impact of a single contribution. As previously underlined in the survey section of the paper, group size plays an important role in modifying behavior of individual contributors. If, in principle, employees could perceive that their contribution is vital for the success of the group we could expect a higher probability of contribution from each employee. To solve these problems there is a need to create awareness in employees that sharing their own information and annotations is something they can benefit from.

*The design solution:* for the annotation purposes, a little floating banner has been designed. It will allow users to change among the following options: annotate, visualize, search, configure, help, and close. Each user upon her/his wish can provide annotations to all the kinds of information (texts, photos, videos, etc.) on the enterprise portal. For example, in corporate directory the employees can semantically annotate and thus make any kind of information better accessible. For instance, a team leader who is searching for a team for the new project will be provided then with the new semantic search capabilities in this menu. She/he can search for the employees who have all the skills appropriate for the project obtaining a ranked list of people who match the search criteria.

In this way, semantic annotations will enhance searching of assets, navigation, information integration, personalization, and recommendations. For example, the semantic annotation tool provides them with suggestions about annotations to add to the selected context. Also, providing the annotations for daily news, blogs and forums will help the employees to orientate themselves better in the information flood as well as simplify the work of portal administrators. So the providers of annotations get the double profit:

1. by annotating resources they make the information about themselves and the news they like more available and better ranked
2. by consuming annotations they improve navigation, searching and syndicating capabilities of the enterprise portal.

In order to overcome the feeling of detachment that many of the employees felt towards the portal, we incorporated their input from the early stages of the design, so that goals of the tools can be clearly shared, at least among the small community of pilot users.

Moving to the incentive mechanism, we conceived it as strictly linked (incorporated, in fact) to the floating banner, so that each employee can immediately check her/his situation in terms of benefits as a consequence of her/his contributions to the portal in terms of annotation tasks completed. In large groups, as we have seen

above, it is often a problem to convince people that their contribution is necessary or, at least, very important to complete a complex task. For these reasons, we come to the conclusion that the reputation mechanism in-built in the floating banner, should be developed and shared at group or project level. To succeed in this same kind of endeavor at the company level, TI+D needs to effectively communicate the great value of the tool to employees, or of the importance of their particular contributions to the achievement of relevant goals of the system.

As a last point, in order to comply to the variety of situations that might emerge in such a large company environment we have suggested, this far, a composite incentive scheme including scores building on three different dimension (monetary, career, status).

## 4 Conclusion

In this deliverable we have outlined some general design requirements and a simplified set of the most prominent incentive features that can be relevant for the kind of tasks involved in semantic annotation and content creation. In particular, we need to carefully analyze the relevant task-related variables that might affect the performance of the users of semantic annotation tools. Broadly speaking, these are based on individual characteristics of users (e.g., ability, motivation) and social, technological, and environmental/contextual constraints.

Both participatory design and incentive dimensions constitute a general framework that can be used by designers to analyze a real case study, define a set of requirements and develop a very effective solution.

In the first part of the deliverable we provided a list of user-centered design requirements such as usability, sociability, design for human values, emotions and enjoyment, etc. We assumed that a solution aimed at satisfying emotional, cognitive, social and ethical needs will influence the internal motivation of users to engage in annotation projects. Using the principles of game theories, motivation and economic incentives, we identified the following as the main analytical dimensions along which we can partition the space of possible cases: goal of the annotation or ontology population exercise, task, or more typically, an ordered collection of tasks into which the annotation exercise can be divided, social structure, a stylized and simplified set of social relationships among the subjects participating in the exercise, nature of good, a stylized description, in game-theoretical terms, of the relationship between what good is produced and who consumes it, and finally required skills of the agents to complete the annotation task.

All these listed design goals, requirements, factors and incentives antecedents are not necessarily independent from each other, nor are they systematically distinct and complete. They have been selected from a rich multidisciplinary literature having in mind how they can be practically implemented for the tasks of semantic content creation and annotation. Since there are not any better and more sophisticated requirements available, the annotation and participation tools that will be developed in the INSEMTIVES project shall take these requirements into account when designing the applications. Furthermore, the evaluation of INSEMTIVES tools will follow these requirements lists as well and will include tests with users.

The framework provided a set of dimensions that help to carefully analyze the relevant task-related variables that might affect the performance of the users of semantic annotation tools. Broadly speaking, these are based on individual characteristics of users (e.g., ability, motivation) and social, technological, and environmental/contextual constraints, so we proposed to use a simplified set of the most prominent features that can be relevant for the kind of tasks involved in semantic annotation.

Finally, in paragraph 3, we outline a concrete case study in order to show how an annotation and content creation system might be analyzed and then improved with incentive mechanisms and solutions based on participatory design. We investigate both the main features of the tool, and the social structure of the organization in which the tool should be adopted. We identify the main design features, and incentives mechanisms that could bring the users to do semantic annotations of the texts in order to improve the efficiency of retrieval / navigation tools, integrate heterogeneous sources of information (linked data), personalize content, and develop effective recommendation systems (e.g. semantic based RSS, contextual links).

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