Exploring and Conceptualising Software-Based Motivation Within Enterprise

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Abstract. Staff motivation leads to more efficiency, quality and enjoyment while performing tasks and fulfilling business requirements. Software-based motivation is the use of technology, such as gamification, persuasive technology and entertainment computing to facilitate and boost such behaviour and attitude. Despite its importance and unique peculiarities, motivation is not yet seen as a first class concept in enterprise modelling and requirements engineering literature. An ad-hoc design and deployment of software-based motivation might be detrimental and menace significantly other functional and non-functional requirements of the business, e.g., giving certain requirements more priority, increasing pressure to complete tasks, increasing competition to win the reward, etc. In this research, we follow a mixed method approach to conceptualise software-based motivation within enterprises taking the perspective of managers and employees and, also, experts from a wide range of domains including psychology, HCI, human factors in computing and software engineering. Our findings suggest the need for a personalised and human-centred engineering method of software-based motivation within enterprises which treats their profiles and preferences as equally important to their business roles. A blueprint of such method is introduced.

Keywords: Requirements engineering · Human centred design · Human factors in computing · Conceptual modelling · Gamificaiton

1 Introduction

Motivation as a research topic has been in the interest of various disciplines, e.g., psychology [1], business management [2], education [3], and healthcare [4]. Several definitions of motivation are available in the literature [5]. However, a widely accepted definition is the "psychological processes that cause the arousal, direction, and persistence of behaviour" [6]. It aims to encourage and increase people's act in a certain manner. The substance that enables motivation to achieve this goal is known as "motive" [7].

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With the popularity of new advances in computing, motivation has become subject to automation and software support. Examples include gamification and persuasive technology. These techniques, also known as software-based motivation (SbM) [8,9], aim to change users' behaviour towards a desired one through persuasion, social influence, and rewarding, but not *coercion* [10].

Enterprises endeavour to help employees achieve their goals and facilitate tasks. Motivation aims to encourage social actors such as employees to do their tasks and interact efficiently to achieve business goals and quality requirements of the enterprise such as productivity. It is also meant to achieve social requirements such as sense of membership, loyalty and mental well-being within workplace [11]. Hence, motivation is not a standalone requirement but a supplementary one which is meant to improve the fulfilment of other requirements.

Although there are several instances of successful implementations of SbMs available in the literature [12], we argue that ad-hoc introduction of such technique to an enterprise may be detrimental and lead to adverse and undesirable impacts [11,13]. There are various situations where the use of SbM may leave negative effect on the enterprise, e.g., if SbM is not designed carefully, it may put employees in situations that can persuade them to sabotage the performance of others where possible, in order to gain more points for their faction. This can happen especially when two or more groups are competing on gaining points, and one member of a group is delegated a task which ultimately is in benefit of a group, other than the group of the person the task is delegated to.

Therefore, we advocate the need for a systematic introduction of SbM to an enterprise. This requires consideration of various characteristics of the motives and their compatibility with goals and tasks they are meant to support. Furthermore, there is a need for considering the social actors who are subject to the desired behaviour change and their roles and inter-relations. Considering the preferences of all enterprise staff on SbM is challenging and to some extent impossible if the staff are high in number. As a solution to tackle this problem, the use of personas is proposed in [9] which advocates the clustering and grouping of employees with similar preferences and requirements with regards to SbM and furthermore, provides the constituents necessary to create personas with references to SbM. Clustering employees into a set of personas helps designers to focus on a limited number of preferences and requirements about SbM. In case the personas are created carefully and a representative sample of employees were involved in the requirements elicitation phase, every employee in the enterprise should be able to feel related to at least on of the personas in the set.

In this paper, we build on top of our initial statement in [8,9] and conduct a three-phase empirical study to explore the facets that need to be catered for when introducing SbM to an enterprise. We provide a thematic mapping to support a systematic integration of the concept within its organisational ecosystem at the early stages of software engineering, i.e., requirements engineering. Our results are meant to aid software engineers in the analysis and design of SbM that is effective, sustainable and compatible with the rest of the enterprise.

We also propose a requirements-driven conceptual architecture for an integrated and holistic engineering framework.

2 Background and Research Motivation

In this section, we discuss persuasive technology as a representative technique for SbM. We will also highlight various concerns and design issues to be addressed when introducing the concept to an enterprise and, hence, motivate this research.

According to [10,14], persuasive technology is mostly referred to as a technology which aims at changing human behaviour through persuasion and social influence, not through force and threat. Fogg introduced a model for persuasive design, the Fogg Behaviour Model (FBM) [10]. This model considers three main drivers necessary for human persuasion: *motivation*, *ability*, and *triggers*. FBM sets the target behaviour and suggests that the three mentioned drivers define how the behaviour can change towards achieving a desired target.

Both ability and motivation have direct impacts on the likeliness of achieving target behaviours, for instance, if the ability to perform a task is high, but the motivation is low, e.g., visiting a website regularly, then it is unlikely for the person to perform the desired behaviour. Moreover, if the motivation is high, but the ability is low, e.g., buying an expensive phone, it is still unlikely for the person to perform the desired behaviour. However, when both the ability and the motivation are high, e.g., a reasonable offer on the phone, the likelihood of achieving the desired behaviour increases accordingly. The third factor in the model is trigger and timing. In addition to motivation and ability, the presence of a trigger at the right time is essential for the desired behaviour to occur.

It is assumed that within an enterprise, employees are already assessed to have the ability to perform the tasks assigned to them. This means that ability, as a driver for persuasion, already exists in employees. Besides, employees are always informed of the tasks they need to perform and the time-line needed for the task to be accomplished. Therefore, trigger and timing is also already present for employees in the enterprise. However, according to Fogg's model, the lack of motivation as the third driver in employees can be the main cause that they are not persuaded to perform a desired behaviour. Therefore, there is a need for thoroughly investigating methods that can increase motivation in employees, its potential complications, and possible solutions to these complications.

According to [10], persuasive technology tools aim at easing behavioural change by means of interactive products. FBM consists of seven types of persuasive tools: tunnelling, tailoring, reduction, suggestion, surveillance, self-monitoring, and conditioning.

Tunnelling refers to leading the users through pre-defined structures of events that has to be performed step-by-step. Tailoring tries to provide users with personally relevant information regarding their work performance. It tries to attract employees attention by customising information related to themselves, as it is believed that people pay more attention to the information if they believe it is customised for them [15]. Reduction aims at changing the behaviour of its users

by simplifying a complex task to smaller task. This can be achieved by removing some of the steps necessary to perform the task, usually via technology, e.g., automating repetitive tasks. Suggestion tries to persuade users to perform certain behaviours by providing reminders on certain times. In case the suggestion seems rational to the user and is on the right time, it can motivate users to perform desired behaviours, e.g., a break reminder after a certain amount of continuous use of the computer. Self-monitoring tries to persuade users by creating the possibility of monitoring self-progress for self-motivated users. Surveillance aims at using social and peer pressure by capturing performance information from users and making decisions based on the collected information.

Surveillance in enterprise seems to be more acceptable when employees involved in it have work-related interactions with each other [16,17]. However, their usage within enterprise is argued to cause conflict amongst peers [18], or reduce quality of work despite increasing productivity [19]. It can also create ethical issues related to privacy of the users [10,11], or put pressure on employees and menacing their social and mental well-being within the workplace [11]. Finally, conditioning uses the information collected via surveillance to provide tangible or intangible rewards for users. However, in addition to a positive reinforcement, such as rewarding, a negative reinforcement could be introduced, conveying there could be a punishment for not achieving certain behaviours.

There is a trend in enterprises towards using SbM to increase motivation in employees. Authors in [20] developed an SbM to help novice users learn *AutoCad* through motives, such as gaining rewards, time pressure, and levelling up. This was perceived positively by users and increased their engagement, enjoyment, and performance. Despite several successful examples of SbM in the literature [12,21], there is still lack of systematic approaches for designing and implementing SbM in enterprises. The literature also has scarcely addressed potential adverse side effects of ad-hoc implementation of SbM in an enterprise [11,13].

3 Methodology

This research has followed a mixed method approach in order to explore and understand SbM in depth. A three-stage empirical study was conducted: firstly, a qualitative interview with six experts in the field of SbM as the exploration stage, secondly, a quantitative questionnaire with comment boxes to allow for further explanations with 40 expert participating as the confirmation and enhancement, and lastly for confirmation purposes, a qualitative interview with 22 participants from users' and managers' point of view.

3.1 Exploration

This research used interviews to elaborate on initial observations about the diversity of views on SbM, its design principles, its advantages and disadvantages, ethical concerns, evaluation metrics, and also to obtain insights and clarifications

from experts in this field. The results of this stage were used to design the questionnaire for the next stage. The interviews followed a semi-structured approach in order to communicate thoughts with experts and allow them to add additional insights that were not thought of prior to the interview. The interviews were recorded and further questions were asked when elaboration was needed.

Six experts participated in the interview. Four of the interviewees were academics, and two came from industry. Three of them were involved in developing theoretical frameworks and three others have developed and applied SbM in practice. All the interviews were recorded and transcribed. The text was then content-analysed to extract important issues related to SbM. These issues were then grouped together to form a number of themes. Two researchers worked on the analysis, and in case of a disagreement, a third researcher was consulted to make a final decision. The questionnaire items, discussed in the next section, were formed based on the agreed themes.

3.2 Confirmation and Enhancement

In this stage, an expert survey with open ended questions was performed to confirm and enhance the views, perspectives, and opinions obtained via the literature review and interviews with experts in the first qualitative stage. The survey comprised a total of 13 sections. Five questions were about the expert profile and general choices, e.g. whether they wish to be sent the results. The other eight questions focused on diverse aspects of SbM in general and Gamification in particular. A total of 71 sub-questions were embedded in these eight questions. These questions were designed as multiple choice questions, provided with an open text box at the end of each general question for participants to put any additional comments. The questionnaire was pilot tested on two participants and refined to ensure ambiguity is removed. No data were collected from these tests. The qualitative responds were statistically analysed and expert comments at the end of questions were content analysed by two researchers and a third researcher was involved when a disagreement occurred.

To ensure that all participants had solid expertise in the field, the survey was completed by invitation only. Authors of peer-reviewed and published papers were invited via email to take part in the survey. Our selection criteria of experts in this stage were similar to those that were followed in the qualitative stage. Experts from different affiliations, e.g., industry and academia, and various backgrounds, e.g., psychology, game design and social sciences, were invited to ensure a diversity of opinions.

3.3 Clarification

The clarification stage was designed to clarify the findings of the first two phases from the perspective of users. Diversity in users' roles in the enterprise was the focus and 22 people were interviewed. The selected participants were familiar with SbM and used computers as a main medium for their jobs. Diversity in age,

gender and work domain was also ensured, including 16 males and six females, and their age ranged from 25 to 58 years old.

4 Results

In this section, we report and reflect on the results of our literature review and empirical studies. We provide the constituents that shape SbM and its users' requirements and preferences.

4.1 Software-Based Motivation: Elements and Properties

Various elements, properties, and aspects of enterprises can influence the development of SbM to increase productivity and keep the social and mental well-being of the actors at a desired level. A thematic analysis of our findings following the six stages as recommended in [22], helps us to form three thematic areas that could help identify constituents that influence the perception of SbM amongst its actors. There are three aspects in enterprises with SbM implemented in them that can influence the perception of employees about SbM. Identifying attributes related to these aspects can help achieving a more preferred design of SbM by employees. These attributes relate to the tasks that SbM is being applied to, the rewards that are being introduced, and the information it is capturing. An initial thematic analysis of these findings is depicted in Table 1.

Table 1. Initial thematic map for conceptualising software-based motivation

Motivation	Reward	Policy		
		Nature		
		Strategy		
	Tasks	Uniformity		
		Measurability		
		Subjectivity		
		Standard		
		Nature		
		Values		
	Captured information	Visibility	Everyone	
			Relevant colleagues	
			Managers	
			Self-only	
		What is stored	Personal information	
			Work related information	Detailed information
				General information
		Element	Competition	
			Collaboration	

This study enhances the thematic mapping illustrated in Table 1, forming two distinct thematic areas that can have influence on the preferences and perception of SbM amongst employees in an enterprise. The two main themes derived from the findings are the *environment* and *motives*.

Environment: This refers to the intended enterprise in which SbM is introduced. This theme area consists of five sub-themes that can affect the success of SbM. These sub-themes are *roles*, *values personas*, *tasks*, and *relations*. The full thematic map related to the environment is provided in Table 2.

Roles: One of the very important aspects of any enterprise that can influence the success of a design for any SbM is the roles that are available in that environment. It is important know what roles exist in the environment, and who are the employees responsible for these roles. Roles and employees responsible for them carry information that can lead to detection of potential design problems in SbM. These information will be discussed further in this sub-section.

Table 2. Thematic mapping for conceptualising the environment

Environment	Roles		
	Values		
	Tasks	Uniformity	
		Measurability	
		Quality-oriented	
	Relations	Role role task	
		Task task	
		Task role	
		Role role	
	Persona	Incentives	Quality based
			Availability
			Value
			Chance of winning
		Performance and feedback	Frequency
			Generation type
		Privacy	Self-only
			Acquiaintance
			Managers
			Everyone
		Goal setting	Control over setting
			Opt-out possibility
		Collaboration nature	Collaborative
			Competitive

Value: This is a very important aspect of the enterprise that should be known to the designers of an SbM at early stages of the design. This defines the values of an enterprise that SbM should comply with. The values should be clearly defined before starting the design of any SbM as failure in eliciting correct values of the enterprise may hinder the ultimate goal of introducing SbM.

Tasks: Each task has three attributes that define which motives are suitable to be assigned to them through SbM. *Uniformity, measurability* and *subjectivity* are these attributes. Uniformity seeks to identify whether all employees go through a similar process for performing the task, or intellectual effort and creativity of employees are required. This concerned many employees as they were worried about the SbM being able to identify their additional intellectual effort and creativity. Next attribute is the possibility of measuring the outcome of the tasks. A number of employees stated not only their tasks are not uniform, but the outcome of their job is not measurable and trying to measure their efforts through numbers is either not possible or will diminish their actual effort. The last attribute for the tasks is whether the task is quality oriented or quantity oriented. Many employees stated that if they are performing quality-oriented tasks, they will not like being compared with other employees that perform quantity-oriented tasks, as "it is much easier to gain points if quantity is needed."

Relations: Relations defines possible interactions of elements in the enterprise that can influence the outcome of SbM when introduced to an enterprise. Relations could be between *Roles*, between *tasks*, between *roles* and *tasks*, and between various *roles* and *tasks*. In the following we describe these relations.

Our analysis showed two relations between roles could exist. One is a *supervision* relation. This relation gives privilege to the supervisor to monitor the performance and work-flow of the *supervisee*. Identifying this relation can aid the design of SbM to decide who should be given access to whose work information. In case a visibility to work information of a role is given to another when there is a lack of supervision relation between these two roles, some participants stated that this may lead to such stress that not only will this affect their productivity, but also they may decide to stop working within that enterprise under. The other relation between two roles could be a *promotion* relation. This means one role has the potential of being promoted to some other roles in the enterprise. This relation makes it possible to identify a possible conflict of interest in the enterprise and propose an SbM design that prevents it. To delve more into this, a situation can be assumed where a role is responsible for training new recruits that are supposed to join the same team that this trainer is a member of. Promoting competition in this particular team may persuade the trainer to put less required effort in training new recruits to avoid emergence of potential competitors in the team.

Moreover, our analysis suggests there exists one relation between two or more tasks that may influence the design of SbM and that relation is a *dependency* relation. This relation means the commencement of a task may rely on the outcome of another. This relation becomes important in various situations, e.g., it can create stress and tension if an employee in the enterprise is not able to

start the task and gain the designated points merely as a result of relying on another task which has not been delivered on-time.

Beside the clear relation of *performing* a task between a task and a role, it is important to know if there is a *genuine interest* in performing the tasks by responsible roles. There are ways of detecting if roles are interested in performing tasks, e.g., the use of group dynamics, which are out of the scope of this investigation. However, having the information regarding the interest of the role towards specific tasks can help designers to introduce motives that can make tasks more interesting to perform through a rewarding mechanism, or avoid a rewarding mechanism when there is already a genuine interest towards the task available, in order to prevent interference with the present intrinsic motivation.

Personas: Eliciting the preferences, needs, and requirements of SbM users is a necessity. By virtue of various circumstances, it may not be always feasible to elicit all users' requirements, or have a coherent collective decision available due to the diversity of opinions. Therefore, personas can be used in order to create clusters of users with similar SbM preferences [9]. This can help software designers to focus on the requirements, needs, and preferences of a set of personas. Although this solution may not lead to an SbM that satisfies all needs and preferences of all individuals, however, it will enable software designers to develop an SbM which can satisfy a considerable portion of requirements and preferences of a substantial number of users. For the sake of evolution, individuals may provide feedback to enhance or customise personas to become more representative of the actual employees.

Motives. Another new main theme is the motives introduced to the workplace. Various aspects of motives should be known in the development of SbM, also available in Table 3.

Reward: This is one of the main drivers that increases motivation in employees. If the reward is appealing for the employees, they may be persuaded to perform as desired. However, it is necessary for an SbM design to align the rewards with the environment it is being introduced to. Our results show that the policy of rewarding has three attributes, *competition, collaboration*, and *performance*. A reward can try to increase employees' motivation through competition and/or collaboration, based on their performance. However, there is a set of combinations of these policies that can influence how employees may react to the rewarding policy. As an instance, when the reward is promoting group competition based on the performance of each group, it may persuade some employees to rely on others and not perform at their best, whereas adding an individual performance monitoring could possibly prevent this problem.

The element of persuasion that a rewarding mechanism adopts is another important aspect. There are several scenarios that this could impact the success of SbMs, e.g., using social recognition may seem an effective element to increase motivation in employees. However, some employees stated they do not like the idea of being socially recognised as the best employees and if they are working in such environment, they will keep their performance at a lower level that they do

Table 3. Thematic mapping for conceptualising the motives

Motive	Reward	Policy	Competition	Individual
				Group
				None
			Collaboration	Individual
				Group
				None
			Performance	Individual
				Group
				None
		Element	Collaboration	
			Social recognition	
			Communication	
			Accomplishment	
		Nature	Intangible	
			Tangible	
			Combined	
		Strategy	Transparency	True
				False
			Value	High
				Low
				Balanced
			Chance of winning	High
				Low
			Points	Pre-defined
				Calculated
			Reinforcement	Positive
				Negative
				Combined
	Captured information	Visibility	Everyone	
			Acquaintance	
			Managers	
			Self-only	
		What is stored	Personal information	
			Work information	Detailed
				General
			Frequency	Low
				Medium
				High
				Real-time
	Techniques	Conditioning		
		Self-monitoring		
		Surveillance		
		Tunnelling		
		Reduction		
		Tailoring		
		Suggestion		

not gain this provided social recognition through SbM. In addition, the nature of the reward is crucial as some of the employees not only did not find intangible rewards persuasive, but also very useless and a waste of resources.

In addition to all mentioned rewarding aspects, there is the rewarding strategy that the motive is employing. There are several attributes that employees may find appealing or demotivating, depending on each individual. One attribute is the *transparency* of rewarding, as many employees stated, it is necessary to be informed about the exact processes of receiving the rewards to avoid bias. *Value* and the *chance of winning* the reward seem to be effective attributes, some employees eager to have high value rewards even if it means lower chance of winning, and on the contrast, some others preferred lower value prizes with a higher chance of winning. Another important attribute is the way *points* are given. A proportion of the employees believed that a pre-defined set of points will remove bias, on the contrary, some believed that a "human touch" in the calculation of points can understand their work better and provide them with fairer points and detect if they did "exceptionally good". Finally, it is important to know if the enterprise wants to use positive reinforcement, negative reinforcement, or a combination of both. This is a very important attribute as the presence of a negative reinforcement may persuade employees to behave in a manner that they would not do otherwise, e.g., cheating in order to gain more points.

Captured Information: In addition to rewarding, it is important to decide what attributes the *captured information* by means of SbM will have. Employees may care about the captured information by means of SbM from two perspective. *Visibility* of the captured information to others in the enterprise, and *what is stored* as the information. Depending on the preferences of employees, they may agree for *everyone* in the environment to have access to their information, especially if they are seeking social recognition. However, this is not true for all employees, as some may even totally disagree with their *managers* having access to their information for personal reasons, despite their tremendous positive performance. It is also important for employees to know *what is stored* about them by means of SbM. Employees were concerned about the ability of SbM in collecting personal information about them, e.g., detecting their mood throughout the working hours by the use of cameras and face detection technologies. However, mainly they found it acceptable for their general working information to be collected, yet a detailed collection of information was not deemed acceptable. The main concern was about managers being able to detect employees work patterns by looking at the collected information.

Another attribute of the captured information is the *frequency* of collecting the information. Employees showed various preferences, from lower frequencies as they wanted to "enjoy the feeling of accomplishment" without knowing how well they did the task in numbers and have an element of "surprise at the end of the week", to real-time collection of the information to know exactly how they are performing and decide to put more efforts where necessary.

Techniques: Motives can employ *conditioning*, *self-monitoring*, *surveillance*, *tunnelling*, *reduction, tailoring* and *suggestion*, described in Sect. 2, as tools to

increase motivation via SbM. It is important to know how motives use these techniques as these persuasive techniques rely heavily on the perception and preferences of its users, which may be in some cases conflicting.

Conditioning: This technique may be well perceived by some users and increase their motivation, and in some others, it may create problems. As an example, when the introduced motive is using the conditioning tool, some actors may find virtual badges motivating, some others may find it useless or even stressing when it is difficult to achieve.

Self-monitoring and Surveillance: These two persuasive techniques can be perceived differently by individuals. For example, some participants stated that they really like to have their information available to their managers. They argued that this will enable them to enhance their image in their managers' mind as hard-working employees. However, other participants raised the issue that SbM can capture and store information that is not possible to capture otherwise, e.g., the exact time an employee was either working or idle. This was the concern of some employees, mentioning this would create a very high level of pressure on them as they would think the "big brother is watching them".

Tunnelling: Tunnelling can also be perceived differently. A number of participants mentioned that they would really appreciate having their tasks broken down to smaller chunks and finding it helpful in increasing their productivity. Some others stated that this will limit them and take away their freedom on how to perform their job. Hence, they found it not motivating.

Tailoring: As mentioned in Sect. 2, tailoring tries to provide employees with customised information, such as periodic feedback. Employees may find it very helpful in order to track their performance and identify areas that need more focus to be enhanced. However, the way the feedback is generated and the frequency of updating it is where employees may differ in their preferences. Failure in aligning this with the employees preferences may lead to an increase in their level of stress and mental pressure in the enterprise.

Reduction: This technique tries to make complex tasks simpler, such as automating several tasks by just one click. However, some users may argue that the use of reduction minimises the control over how they can perform the tasks, stating this will make them to "work like a robot".

Suggestion: This tries to alert the employees about performing certain behaviours on specific times. The challenge here is to detect the current activity of employees and react accordingly, as some of the tasks that employees are performing may not be measurable or even detectable by the use of software.

5 Requirements-Driven Architecture for Motivation

Motivation is highly reliant on personal preferences of the staff it is being applied to. Therefore, it is beneficial to employ a user-centred design process for SbM

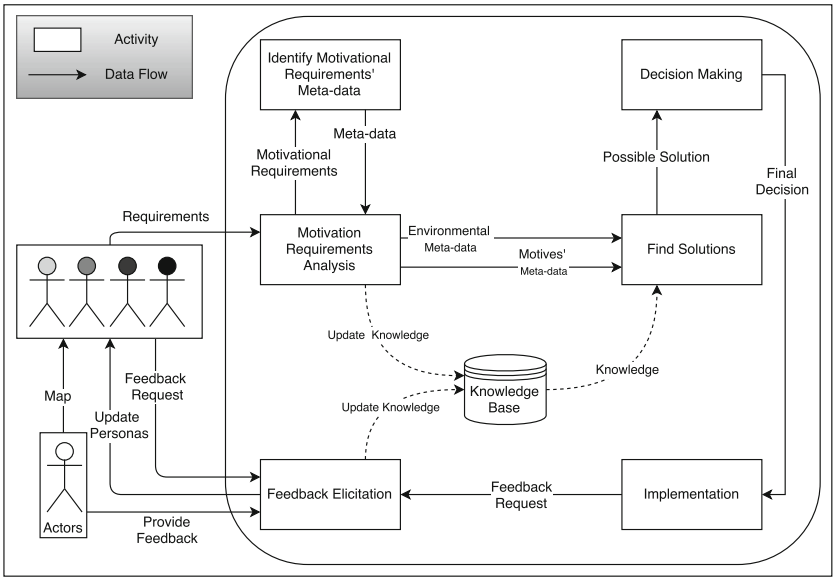

Fig. 1. Conceptual architecture for developing Software-based Motivation

in order to elicit users' requirements and preferences on SbM to ensure a more acceptable design from the perspective of users. Various aspects, e.g., contextual changes or a motive becoming boring over the course of time, may lead to a change in what employees find motivating. The dynamic nature of motivation demands an evolvable approach in order to empower detecting the need for evolution and alter the system according to the new needs and preferences. In the light of our findings, we sketch a blueprint for a conceptual architecture that facilitates a systematic evolvable user-centred design of SbM, depicted in Fig. 1.

Initially, we advocate the creation of personas, based on necessary persona constituents [9]. The identified personas can inform the design with the requirements and preferences of each persona. The provided requirements need to be further analysed by requirements engineers during the motivation requirements analysis. The thematic mapping provided in Tables 2, and 3 can be utilised to identify the motivational requirements' meta-data related to the environment, and the motives. Furthermore, the knowledge-base may be updated at this stage.

Knowledge-base stores information related to personas' preferences and requirements, motivational properties, and possible outcomes of their combinations. Its content originates from new requirements and preferences, plus feedback elicited from actors or employees during later stages of software evolution.

The meta-data, in conjunction with the knowledge taken from the knowledge-base, will be used to find solutions for achieving motivational goals of the enterprise. A recommender system can be utilised at this stage to assess the given meta-data and the content of the knowledge-base to find possible solutions.

Possible solutions, each with their possible effects on the productivity of employees and also their social and mental well-being within the workplace, will be used in the decision making process of the enterprise. Decision makers can choose a final decision based on their policies, business goals, and values.

In the implementation phase, the final decision is used to deploy the SbM in the enterprise. Besides, in order to sustain motivation and ensure the compatibility of the personas with the actual users and also to detect any changes over time, feedback elicitation will be initiated. Feedback elicitation phase tries to elicit any changes that can have an impact on the effectiveness of the design of SbM. The feedback stems from technological advances and changes in employees' preferences or the emergence of new employees in the enterprise, which yields the need for software evolution.

Software engineering can use control theory [23] to evolve and adapt the software system with the required changes through feedback loops. It sets a goal, monitors the output via sensors and measures the output with the reference point value. If the delta results in a need for a change in the software, the controller will introduce relevant changes to achieve desired outputs. However, SbM is highly reliant on users' perception. It is not a viable decision to rely on technological sensors to capture users' feelings and perceptions. The concept of social sensing [24] harnesses the cognitive power of users as monitors. This includes the value of the relevant contextual attributes and quality attributes which have not been thought of by requirements engineers or simply have emerged over time.

We advocate the use of control theory and social sensing, in developing SbM. This will enable a socially adaptive SbM solution. The concept of social adaptation [25], in the context of this study, could be seen as the ability of the system to gather people's perception on the quality of motives and their related concerns, and form a collective judgement and then decide and enact, or recommend, the best alternative to reach a motivational requirement or the best way to reach a business requirement with higher possibility of an increase in motivation.

6 Conclusion

In this paper, we argued the need for a systematic development of SbM in an enterprise. The lack of rigorous engineering principles for the development of SbM may inflict harm on the enterprise, such as creating tension and menacing social and mental well-being of employees within the workplace. Adding SbM introduces new concerns to the enterprise which need to be analysed. Various concerns are to be considered, which current methods and models do not take into account as a first-class problem. We provided a thematic mapping which paves the way for the modelling of SbM in enterprises and proposed a conceptual architecture that can utilise the thematic map for developing SbM. A further investigation is needed to study the use of this conceptual architecture in other enterprise modelling languages, e.g., goal models or process models, or the need for a new domain specific modelling language that can facilitate this conceptual architecture and comply the design of the SbM with the enterprise.

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