

“SOFTWARE ENGINEERING EMPLOYEE MOTIVATIONAL CAPITAL MODEL: SE-EMCM”

Serdar Türkeli

**University of Duisburg-Essen
International Studies in Engineering
M.Sc. Computer Engineering
Duisburg, Germany**

Email: serdar_tuerkeli@stud.uni-duisburg-essen.de

ABSTRACT

The business world has been reinventing the human. Employee participative transition projects for management strategies are becoming more important in IT organizations day by day. Humans are no more being considered as one or two dimensional human resource textual or graphical entries in human resource management systems, but have begun to be considered as assets and capitals. The paradigm shift of the century points out human spirit and redesign of human life.

The model SE-EMCM provides valuable information for top management, IT application development team members, and the IT industry in general. It could help decrease the number of failed IT projects that are caused in part by the human factor by knowing what problems have occurred in the past is now more controllable with the model. The risk of future failed projects could be minimized by knowing what to avoid at individual employee level. Knowledge begets wisdom; in this case, wisdom may generate huge cost savings. This benefits the company, as well as other stakeholders, in a very positive way. As stated by McConnell [1] "No individual is a success who hurts the team, and no individual who helps it, is a failure."

1. INTRODUCTION

SE-EMCM; Software Engineering Employee Motivational Capital Model is a transitional employment model developed for the initial step of the Master Thesis: Developing Cost Estimation –and Enterprise Models for Distributed Software Engineering Teams. As the building brick of a team and a base productivity indicator, an individual, and her/his work

motivation is thought to be an adequate core to begin with. The developed model; SE-EMCM, is a transitional employment model because of its property that employs both human motivation theories those belong to the approaches of industrial society and the human capital approach that belongs to information society of 21st century [2]. Therefore, through the developing processes of SE-EMCM; various world wide known and recognized advanced human motivation theories, human resource and capital management approaches were researched in depth and the outcomes were taken into account in order to achieve a powerful mapping between these human motivation, human capital theory studies and the IT world which must be aware of the paradigm shifts, new certifications and standardizations like People Capability Maturity Model[®][3], ISO 9001:2000 Quality Management Systems [4] and new technologies needed to be adapted and integrated to support the productivity of employees. The model is also enriched and analyzed from Socio-Technical Systems Theory point of view [5, 6, 7].

Through the lenses of human motivation theories [8], human capital management [9] and socio-technical systems theory [10], the former aim of the model SE-EMCM is defining a well-equipped model which is applicable on individuals in the IT industry or in the knowledge society to get the very best out of them and prepare them to the global processes of integrated productivity in the forms of technologically supported processes of distributed SE teams [11]. - Therefore, SE-EMCM is forming a base for the global parameters of the 21st century as its being the core component to SE-GEMCM; Software Engineering Global Employee Motivational Capital Model, which is developed for and

within the scope of this Master Thesis. – and the latter aim is supplying analysis and decision support information about human factor in terms of cost factors to the mathematical cost estimation models -and to the controlling, monitoring, integrated business processing opportunities which became available with modeled enterprises, in terms of human resource information systems or mainly human capital management [12].

2. THEORETICAL COMPONENTS OF SE-EMCM

SE-EMCM is designed as a motivational capital model of employment for software engineering employees who will further form a team / workgroup and participate to team work. Although software engineering is no longer the preserve of individuals but is essentially a team-based activity, it is increasingly becoming a collaborative activity as it draws on the knowledge, expertise and experience of a wide and often disparate group of „individuals“[11]. Therefore, SE-EMCM is stated to achieve enhancement at the level of individual software engineering employee and a best quality work system which has environmentally: social, physical and technical aspects and their respective base sufficiency levels which must be assured [13].

The theoretical components of SE-EMCM are:

- Human Motivation Theories
- Human Capital Theory
- Socio-Technical Systems Theory

3. SE-EMCM

SE-EMCM is a unique model designed to satisfy the requirements of the IT world of the 21st century at the level of individual employees as its being able to state requirements through the top three lenses of human factor theories in terms of human motivation, human capital and socio-technical systems while pointing out to the standardizations and technologies strongly required. The Model is designed to be interacted with the enterprise model and the cost model to achieve more effective enterprise knowledge and analysis for the development feedback in order to improve not only the business processes but also the cost estimations continuously.

SE-EMCM focuses on Human System Performance (HSP) among the selected performance indicators: Operational

Environment, Equipment system performance to achieve Optimum System Performance:

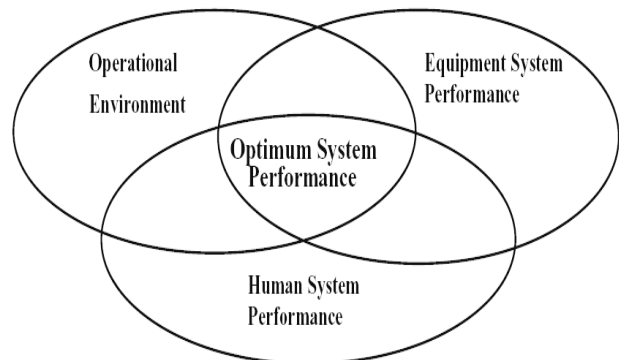


Figure 1 - SE-EMCM (HSP) among Optimum System Performance Indicators

By focusing on the interaction of Human System Performance (HSP) with the other sets of performance indicators, obtained is Figure 2.

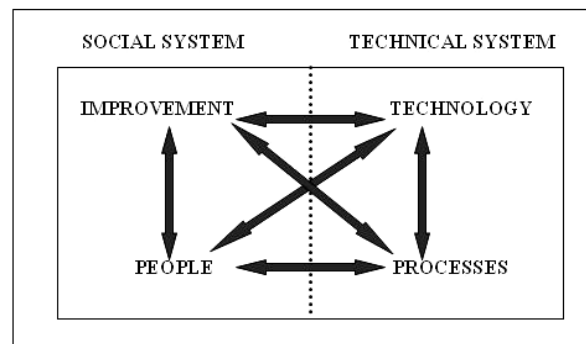


Figure 2 – SE-EMCM (PEOPLE) Interaction Lines of Optimum Performance

SE-EMCM tracks and focuses on the output parameters of four sets of job and employment quality study [14].



Figure 3 - SE-EMCM (EMPLOYEE) Parameters of Job and Employment Quality

Types of employment status, production system, working hours and pay, work organization are important parameters to be managed and also included in SE-EMCM.

	QUANTITATIVE	QUALITATIVE
EXTERNAL	<p>Employment status</p> <ul style="list-style-type: none"> • permanent contract • fixed-term contract • temporary agency contract • seasonal work • ad hoc working <p><i>numerical and/or contractual flexibility</i></p>	<p>Production system</p> <ul style="list-style-type: none"> • subcontracting • outsourcing • self-employed work <p><i>productive and/or geographical flexibility</i></p>
INTERNAL	<p>Working hours and pay</p> <ul style="list-style-type: none"> • reduction/adjustment of working hours • part-time work • overtime/additional hours • shift work • night/weekend working • irregular/unpredictable hours • changes in pay (individualisation, variable fraction, etc.) <p><i>time and/or financial flexibility</i></p>	<p>Work organisation</p> <ul style="list-style-type: none"> • 'job enrichment' • teamwork/semi-autonomous teams • multitasking/multiskilled • delegation of responsibilities • project groups <p><i>functional and/or organisational flexibility</i></p>

Figure 4 - SE-EMCM (EMPLOYMENT) External / Internal - Quantitative / Qualitative Parameters

4. STATEMENTS & SE-EMCM MODEL

In the 1950s, Peter Drucker was the first to assert that workers should be treated as assets, not as liabilities to be eliminated and originated the view of the corporation as a human community built on trust and respect for the worker and not just a profit making machine a perspective that won Drucker an almost godlike reverence among the Japanese [15]. Today, in this technological explosion, large amounts of funds are directed towards information technology (IT) software development. Despite the enormous advances in the IT industry, there are still many failed IT projects. Several factors contribute to the failure of IT software development projects; one of these is the human factor. SE-EMCM is focusing on that factor. It is obvious that unless a well defined work system base is provided at individual employee level, variances and issues cannot be controlled at source and they will be exported across processes and projects of organization. This may cause disastrous and costly consequences. McConnell [1] states that

"Peopleware [16] drives home the message that programming is first and foremost something done by people and only secondarily happens to involve computers." Examining the human factor will provide valuable information to IT teams and other IT personnel, as well as corporate management. This information could improve the company's chances of succeeding in the future with IT software development and IT teams. The cost savings alone should make management interested in this ongoing expensive problem. It also may increase the chances of aligning IT with the business needs of the company, which in turn may provide the company with a possible competitive advantage.

"Success in software development depends most upon the quality of the people involved.... [It] shows individual and team productivity to be the leading predictor in estimating software costs..."[17]

Employee satisfaction is an important key to retaining the employee. Personal and professional development should be part of the employee's development plan. Matching the employee with the job and career they are seeking helps to retain him/her. If the employee have potential to grow within the company, he/she is more likely to remain loyal to the company. The company should provide and present incentives such as career advancement, skill expansion, and of course money, either in the form of bonuses and/or raises. Such incentives will insure the staff will be focused and more willing to stay. Each employee should be considered on an individual basis. Some may be happy by receiving verbal recognition, monetary awards, stock options, bonuses, health insurance, retirement plans, days off..

With the tremendous shortage of IT professionals, the company must consider training the employee once they are hired. This is crucial. Throughout this article, unskilled team members are a major contributing factor to failed IT projects. The effective training of new employees should be a high priority of management if they expect to decrease team failure on software development projects. A team member who knows what to do and how to do is a constituent that must not be left out of the guidelines for team success. Providing whatever it takes to make that employee satisfied enough to stay might be a challenge.

SE-EMCM CODE	SE-EMCM STATEMENT	DERIVED FROM THEORY
SC.1	“Physical aspects of a work system such as needed infrastructure, buildings, and workspaces, must be identified, provided, maintained and managed.”	Motivation Theory Content Section Maslow, Herzberg, Mumford, Alderfer, McGregor
SC.2	“Technical aspects of a work system such as needed hardware, software, utilities, equipments and support services must be identified, provided, maintained and managed.”	Motivation Theory Content Section Maslow, Herzberg, Mumford, Alderfer, McGregor
SC.3	“The terms of employment with the consequences on the quality of work and employment must be defined, adjusted. Workers’ rights, particularly with regard to information / consultation / participation and equal opportunities must be stated in terms of earned income.”	Motivation Theory Content Section Maslow, Herzberg, Mumford, Alderfer, McGregor
SC.4	“Social aspects of a work system such as needed communication, collaboration and coordination and its related tools must be identified, provided, maintained and managed.”	Motivation Theory Content Section Maslow, Herzberg, Mumford, Alderfer, McGregor
SC.5	“Personnel aspects of a work system such as needed experience, education, training, skills, and competence, commitment, participation, supervision and awareness methodologies must be ensured, defined, delivered, recorded, maintained, evaluated and managed.”	Motivation Theory Content Section Maslow, Herzberg, Mumford, Alderfer, McGregor
SC.6	“Ensuring Career: Social protection, and in particular the mechanisms for covering workers that facilitate better career paths throughout working life.”	Motivation Theory Content Section Maslow, Herzberg, Mumford, Alderfer, McGregor
SC.7	“Personnel Improvement aspects of a work system such as needed additional training, competence, commitment, participation, mentoring methodologies must be identified, provided, maintained and managed.”	Motivation Theory Content Section Maslow, Herzberg, Mumford, Alderfer, McGregor
SC.8	“Personnel aspects of a work system must be re-designable in terms of managerial and / or employee variances according to the required process and project structures of work.”	Motivation Theory Process Section Adams, Vroom
SC.9	“Assignment Intensity and Job distribution information can be accessible within the individuals who work in the same hierarchy and phase of production.”	Motivation Theory Process Section Adams, Vroom
SC.10	“Expectancy, Instrumentality and Valence values of a project must be tracked by questionnaires, recorded and evaluated.”	Motivation Theory Process Section Adams, Vroom
SC.11	“Personnel aspects of a work system must have a feedback process module in order to supply participative, employee affective process improvement.”	Human Capital Theory - Human Capital Management
SC.12	“The investments to physical, technical, social and personnel aspects of a work system must be staged and / or leveled in order to support small and medium size enterprises and the continuous process improvement must be introduced either at the highest common level and / or at each level defined as custom target level according to organization’s strategy.”	Human Capital Theory - Human Capital Management

SC.13	“Human capital metrics must be defined, recorded, tracked and analyzed for personnel aspects of a work system to be employed in the related business process areas.”	Human Capital Theory- Human Capital Management
SC.14	“Change and Change Management phenomena must be initialized from top to down but it must be provided a platform of participative and determinative feedback by defined communication channels and policies in vertical hierarchy from bottom to up.”	Human Capital Theory- Human Capital Management
SC.15	“Employment model must assure a better alignment human resource strategy with organization’s strategy.”	Human Capital Theory- Human Capital Management
SC.16	“Employment model must provide managers information to make better decisions regarding workforce management and can be used for controlling human resource costs.”	Human Capital Theory- Human Capital Management
SC.17	“Employment model must provide information about the prioritization of human resource investment and actions.”	Human Capital Theory- Human Capital Management
SC.18	“Human Resource management / Human Capital Management technology can be converted into web-based Human Resource Management Systems and components of the Enterprise Resource Planning systems and permit to reduce transaction costs, leading to greater HR and organizational efficiency.”	Human Capital Theory- Human Capital Management
SC.19	“Employment Model with minimum critical specification must support multi-functional role assignments, power and authority mechanism to access and control processes, well established information flows between well defined boundaries.”	Socio-Technical Systems Theory
SC.20	“Employment Model with minimum critical specification must have well defined boundaries to control variances and must be in interaction with other supporting systems of the Enterprise Model to achieve more effective enterprise knowledge and analysis for the development feedback in order to improve business processes continuously.”	Socio-Technical Systems Theory
SC.21	“Employment Model with minimum critical specification must be in interaction with the Cost Models employed to achieve more effective project and process knowledge and analysis for the development feedback in order to improve (calibrate) cost estimations continuously.”	Socio-Technical Systems Theory

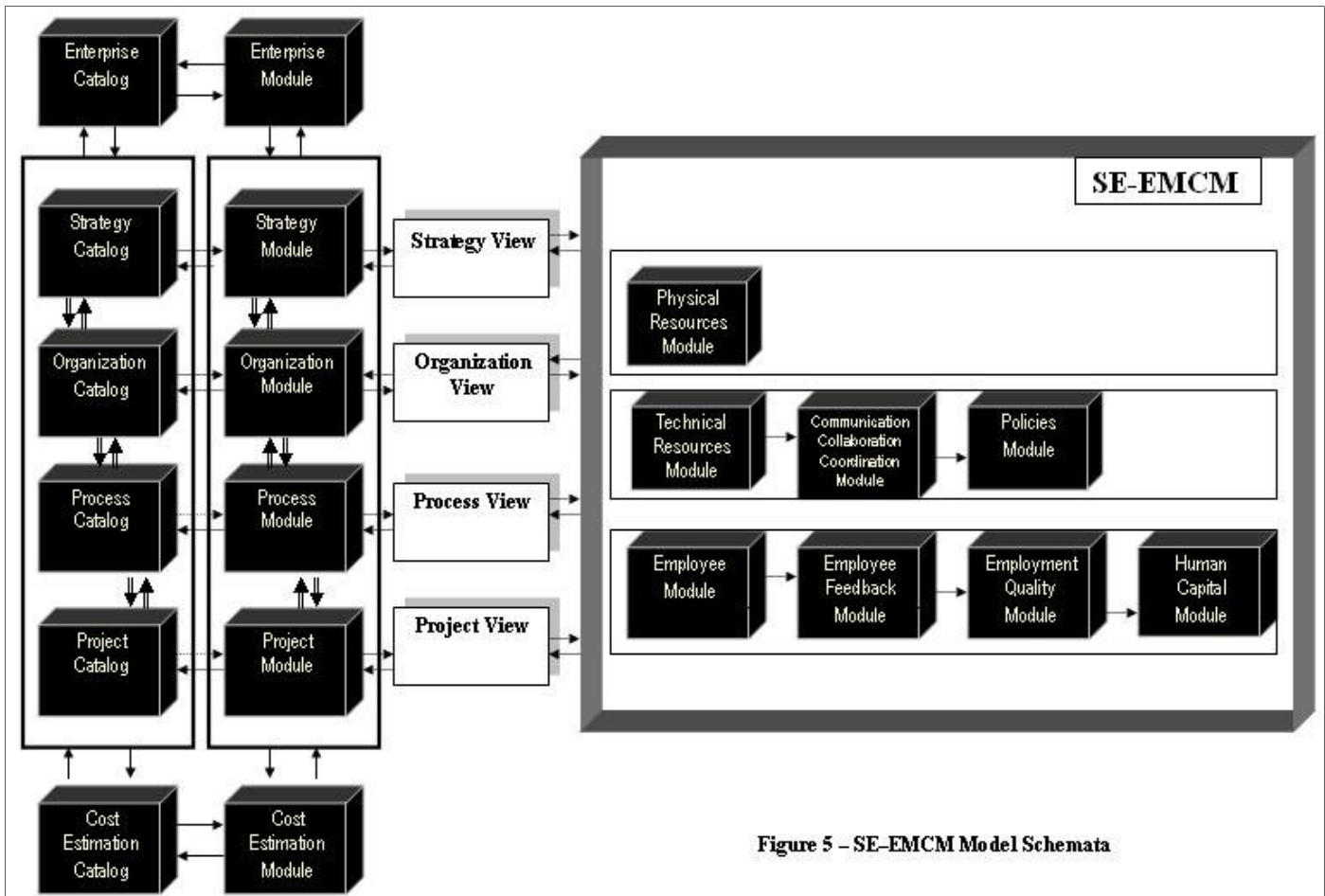


Figure 5 – SE-EMCM Model Schemata

1. PHYSICAL RESOURCES MODULE

Buildings:

Set_Building (BCODE Code, BNAME Name, BZONE Time_Zone, BWSL Workspaces_List);

Workspaces:

Set_Workspace (WSCODE Code, WSNAME Name, WSCPC Capacity, WSIS Network_Infrastructure_List);

Network Infrastructures:

Set_Infrastructure (ISCODE Code, ISNAME Name);

2. TECHNICAL RESOURCES MODULE

Hardware:

Set_Hardware (HRDWR Type, HRDWR System_Information, HRDWR Software_List);

Software:

Set_Software (SFTWR Type);

2.1 COMMUNICATION, COLLABORATION, COORDINATION MODULE

Digital Text Communication Data:

//Assigned Email Check

Audio Communication Equipments Data:

// Assigned Telephone Check

Video Communication Data:

// Assigned Camera, Video Conferencing Equipments Check

3C Tools – Groupware Type Data:

// Assigned Groupware Tools Check

2.1.1 POLICIES MODULE

Communication Types Data:

// Written, Oral, Email, Audio, Video, 3C Tools

Correspondences Data:

// Correspondent Event –Trigger Mechanisms defined in Vertical Organization Paths

3. EMPLOYMENT MODULE

Employee Data

3.1 EMPLOYMENT FEEDBACK MODULE

- Strategy Feedback Digital Questionnaire
- Organization Feedback Digital Questionnaire
- Process Feedback Digital Questionnaire
- Project Feedback Digital Questionnaire

3.1.1 EMPLOYMENT QUALITY MODULE

- Employment Status Data
- Work Organization Data
- Production System Data
- Working Hours and Pay Data
- Salary Adjustments Data

3.1.1.1 HUMAN CAPITAL MODULE

- Strategy Participation Data
- Organization Participation Data
- Process Participation Data
- Project Participation Data
- Career Development Data
- Training Data

5. DISCUSSIONS & CONCLUSIONS

The primary problems in software development are sociological and not technological. The Standish study [18, 19] shows that as a project fails, the human factor contributes a larger role in the failure. Because there are so many failures over successes, the human factor cannot be ignored if the problem is to be resolved. Successfully dealing with the human factor of IT software development is a great challenge for the entire IT industry [20].

In addition, in the perception of human resource management, there is a serious need for a paradigm shift. Creating loyal employees and organizing projects for improving motivation and performance by human resource management departments have been considered as insufficient if these studies are not accompanied with the aspects of change management.

Moreover, loyal employees cannot trigger the change and bring out any valuable or new ideas. It is a result of the perception that this may be considered as being against to loyalty. But adaptation to change is more important than loyalty. It is obvious that there can be no development without change and that is why

change management is a high ranking expertise area. The most important instrument that the change uses is communication. Change however is initialized from top to down in organizations, without from bottom to up participation and determination, no success seems to be achievable; therefore there must be improvement in established communication channels and policies across these vertical hierarchies. So, change is also employable for human resources. There was a transition, an evolution from Personnel Management to Human Resource Management; this was a paradigm change, paradigm shift. And the paradigm of today points the way of shift from Human Resource Management to Human Capital and human capital management strategies which based on participation-based representative systems, participative transition models employing institutional process reconsideration [21]. As employee affective and participative management, in human capital management or in people capability management, human is not a resource but a capital. Coal, wood, petrol is resource, even money is not a resource; it becomes a capital when it enrolls to the production processes. There is an urgent need for such kind of transition. This paradigm shift can be consulted by consultancy firms, but this is the old way used by human resource management. It began the era of the importance given to how manage the future expectation more than the consideration of past performances. That is why the first dimension of intellectual capital is profit and institutionalized performance. Customer value, human capital, management value, communication value; all reflect into the organization value. It is impossible to manage human capital by human resource management methodologies. The difference between is the break point of the transition from industrial society to information society. In human capital management, aim is not improving motivation, loyalty or motivational performance, but improving affection, intellectual added value, participation and determination. Because in information society, performance and motivation are the properties those must be brought by employees themselves as self motivation and self management; as also partially focused in personal software processes. For small and medium size enterprises, SE-EMCM must be staged into levels; a road map must be defined however the paradigm behind the SMEs as personal enterprises is stuck between feudalism and middle age.

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