Indicator Based Software Product Line

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Abstract: - *Software Product Line is one of modern approaches in software engineering which use common assets and tools of software to develop a set of similar software systems. Components and concepts in product line are analyzed easily and decision could be made separately. In other hand, due to the nature of assets in the product line of software, they could have high level indicators. Also, decision model in product line could be defined and determined in parametric form using indicators. Product line in software production accepts indicators easily due to regular structure in order to arrange product and product process of software.*

In this study, a framework namely indicator based development framework is presented to develop effective interacting and cooperating between organizational employee and group who are producing software. Organizational and technical indicators are used in this framework as coordinator factors to develop cooperation between organizational and technical software approaches. Product line of software is used as a basic approach in this framework.

Keywords: *indicator based framework, software product line, organizational indicator, technical indicator.*

I. INTRODUCTION

Efficiency is considered as a key feature in desirable software. Main aspect of efficiency is defined as software replication capacity for actual needs of users. Standish research group have studied a project namely CHAOS, this group have analyzed factors which lead to failed projects and found that the main cause of failure is incomplete determination of requirements and user's disaffiliation, so they determined ten reasons to success projects. Most important reason is user's cooperation and determining business concepts clearly [15].

Attendance of internal organization users and experts and interacting to external development team is one of serious challenges of software engineering. In order to conduct and efficiency of this interaction, a characteristic list is used at software system which is presented to users as a document for agreement [12]. Therefore, a coordinator, evaluable and determinable factor is needed to develop constructive, effective and accurate interaction between different layers of technical and organizational layers in the project. This factor is known as indicator [1].

A. Indicator

Indicator is defined as a significant identifier which accepts specific values to present information about situation of a concept. Main application of indicators is quantitative expression of complex and qualitative aspects which are expressed by indicators in a simple and perceptible form. This indicator has two advantages, first provide possibility to evaluate past and second, provide possibility to plan and target accurately for the future [10]

In software industry, indicators along with metrics are used extensively to evaluate and improve process, product and software project. These indicators are obtained through statistical and engineering methods which usually are applied by project manager on extracted metrics of product, process and project. Project manager compares current values of indicators and planned and desirable values and explore problems and inconsistencies and then enterprises to solve them [2].

Similarly, organization indicators concept and business are used to evaluate and follow-up organizational processes in business intelligence. Since both of these experiences were succeed, they could play crucial role to develop cooperation between organization and development team if there is inconsistency between organization indicators and technical indictor in product line. Therefore, information technology experts who understand organizational and technical concepts completely could play indicators mapping and coordinator role between organization and development team.

Organization indicator: numerical, statistical and analytical markers were caused by analytical processing on organizational processes data and shows organization situation and its processes [3].

Technical Indicators: computational and numerical markers which are extracted from project data and shows aspects of product, process and software project [10].

B. Software product line approach

software product line approach have decreased cost and time of production as well as improve quality of product and scaling due to wide capacity in reuse of software components.

Each one of assets have defined role in common architecture of each product in product line. in order to embed different components in product, some of assets should be selective or have internal variation

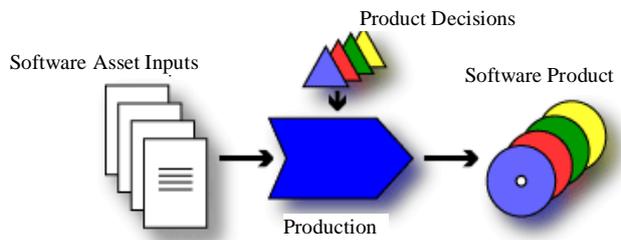point to configure in different methods to present suitable behavior in various application [7].

Fig 1 concepts of software product line

As expressed earlier, components and concepts in **product** line are analyzed easily and could be made decision separately. In other hand, they could have high level of indicators due to nature of assets in software product line. Also, decision model in product line could be determined and defined in parametric form using indicators.

Due to regular structure, product process in software product line could accept indicators to cooperate product and product process of software.

Applying indicator is possible in all cases of decision components of decision model, qualitative indicators of assets and product and assets arrangement. Some aspects of assets which are organized and expressed by parametric form will be explained as following:

Common point and variation: some aspects of assets which are common in all application and in fact main component of assets which are reused, alterable part or variation point provide possibility to reuse of assets [8]. Variation point like common point could be expressed well in parametric form in characteristic modeling [6]

Manageability: asses are easily managed, organized and categorized due to coherent and structured nature. In other hand, their flexibly facilitate their manageability in different application due to variation points [13]

Traceable: archive engineering of assets have potential to be reused and seek in libraries. Therefore, in a software product such components could be seek and reused due to some requirements [5]

this study emphasize on requirements extraction and related characteristics to project from organizational goal to evaluation of project process to assure complete cooperation with organizational planning and goals. In this study, a method in software product line is produced namely index based software product line. In this method, activities are extended to internal organization and internal organizational experts are used instead focusing on experts of development team and sideway viewpoint (external organization). This sideway viewpoint (external and internal organization) is done by middle layer of project which is placed in the organization. In order to cooperate and assure the project, expression and

evaluation metrics of project aspects and organizational requirements namely organization and technical indicators are used.

II. INDICATOR BASED DEVELOPMENT APPROACH

Using IT management layer in the organization, applying indictors as evaluation metric and consistency and enterprising and managing of development process of target organization are emphasized in index based development approach. Correlation between organizational components and development team and way of their participation in phases and disciplines of product line are shown in index based development framework.

A. Conduction Phase

This phase is started from beginning of development plan and is continued till beginning of initial phase of IT development project. Since, initial phase throughout the project is related to understanding target organization and its situation, so it is possible activities of this phase to be continued until end of initial phase. Certainly, first repetition of this phase has resulted before external activities of project to define and start product process of software according to output of this phase.

Purpose of Conduction Phase

End of this phase should be led to a complete, accurate and certified viewpoint of organizational purpose about IT system development and way to realization evaluation.

Small goals which should be realized in this phase include:

- accurate definition of viewpoint
- All involved processes in development and development goals and way to evaluate target realization should be defined clearly.
- All organizational indicators should be established and valued initially according to processes and their targets, also desirable values should be predicted according to program stages in viewpoint.
- All internal organizational roles of development project and mediator of external organization should be defined clearly; also their tasks should be specified.
- Way to interact development team and activities of indicator discipline should be documented and established clearly.
- Development plan, programs, administrative aspects and its resources should be specified completely.
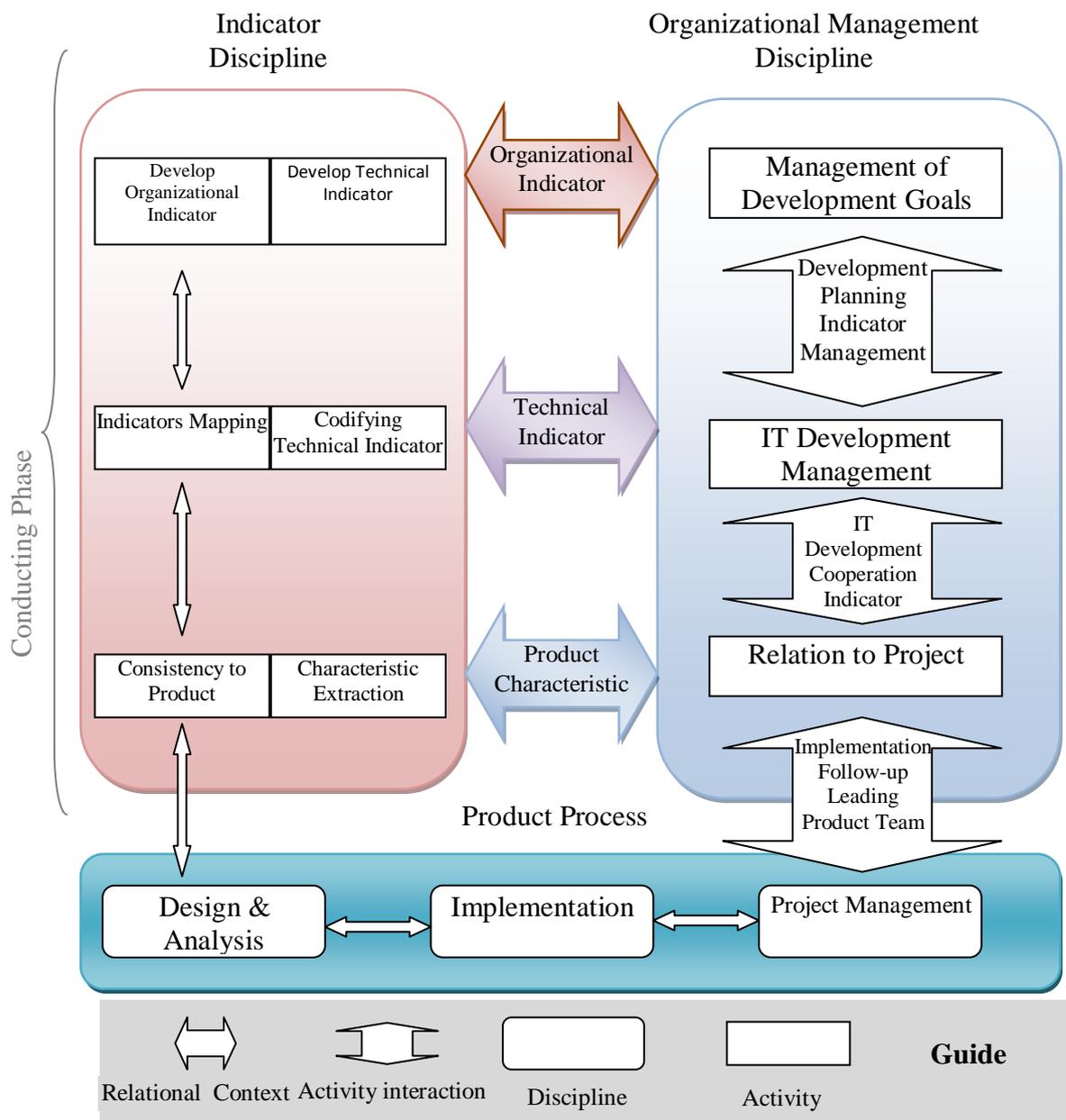
Fig 2 Indicator based development framework

Disciplines in Conduction Phase

Since, conduction phase is done in the organization by self-organizational experts completely; organizational management discipline and indicator are considered in this phase.

Organizational management discipline Activities:

Targeting: this activity in this phase specifies organizational development plan, development planning and development target aspects. In targeting activity, high level goals are divided to low level goal and administrative and relate to specific activities in specific form.

Designing: in this activity, timing programs, resources, individuals and development activities should be specified completely. This program maybe be modified or completed by development promotion.

Indicator development management: indicator development management is one of sensitive activities in index based framework. Indicators are used to express all concepts in development, so ambiguity, deficiency and inaccuracy leads to deviance in development process. But if indicators are managed and established accurately, best basic for development is created.

Process Information analysis: in this phase, required data is collected through organizational processes and current and desirable values for indicators to conduct statistical and informational analysis on organizational processes. In organizational management discipline this activity is planned and managed.

Indicator discipline activities:

Defining organizational and technical indicators: as mentioned in purpose of phase, indicators should be defined in conduction phase completely. Defining indicators in this phase is based on project conduction in other phases and stages.

Indicator mapping: organizational indicators first are defined in conduction phase and a technical image of organizational indicators is created base on them. Creating this image is consistent exactly but shows two different aspects and this defined as indicator mapping. Technical indicator caused by activity mapping should be consistent in the project [1].

Indicator valuing: organizational indicators should be valued according to development planning and targeting in first filtration of indicators to develop a specific basic to start projects.

Output issues and product of conduction phase

- development plan viewpoint
- schedule program, resources, activities and individuals
- identifier of organizational indictors
- identifier of IT technical indicators

- management plan and evaluating development process
- defining roles and responsibilities in the organization to implement development pla

B. **Activity Presence value in development process**

The following diagram shows presence value and its importance in development phases clearly. More red color shows importance of most of activities in development process success [2].

III. INDICATOR BASED SOFTWARE PRODUCT LINE METHODOLOGY

As mentioned earlier, PuLSE-I [9] is a developed model which is adopted PuLSE engineering methodology. This method could be used as a product process engineering method at index based develop framework. Improved method is defined as Indicator based Software Product Line Engineering Instantiation (I-PuLSE-I). In process model later, way to interact product line activities and indicator discipline and organizational management are shown.

As specified in the figure, this methodology has five disciplines as follows:
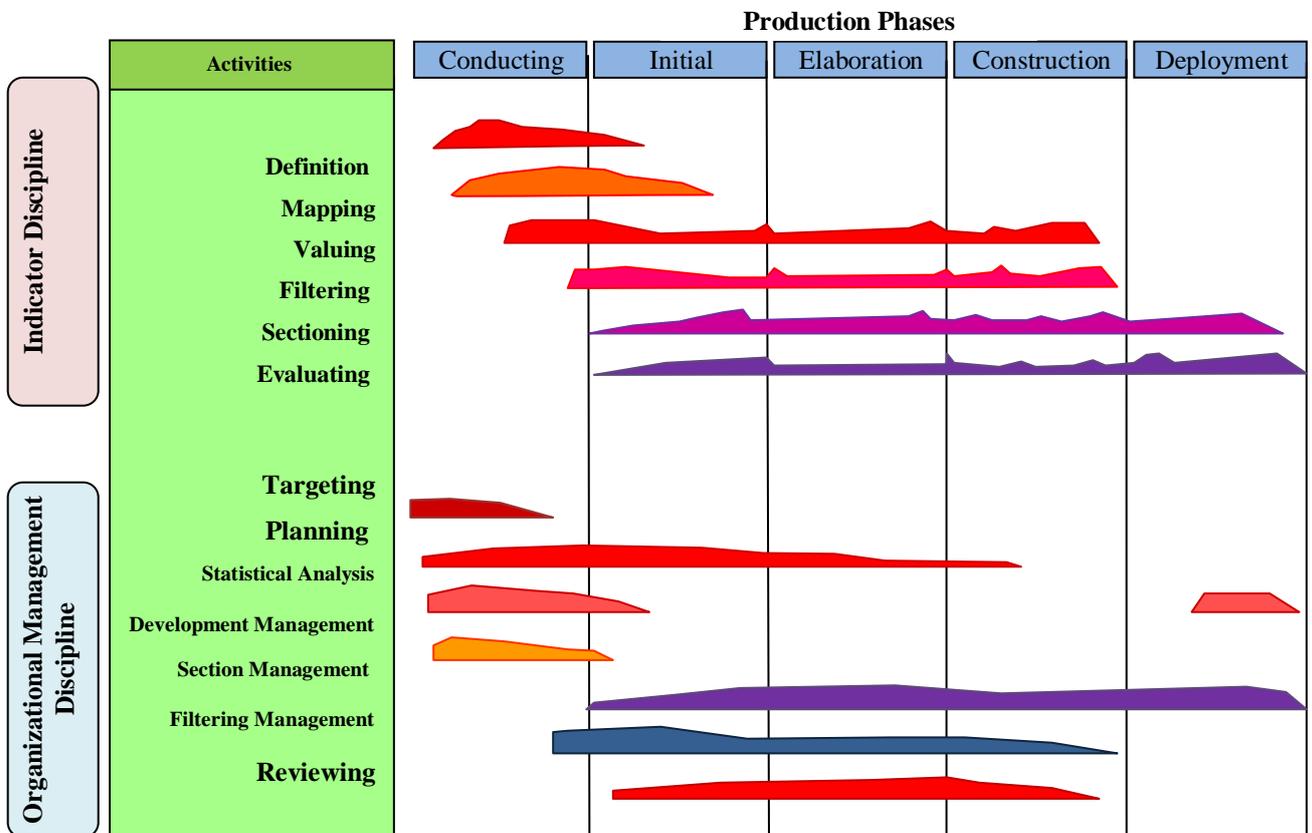

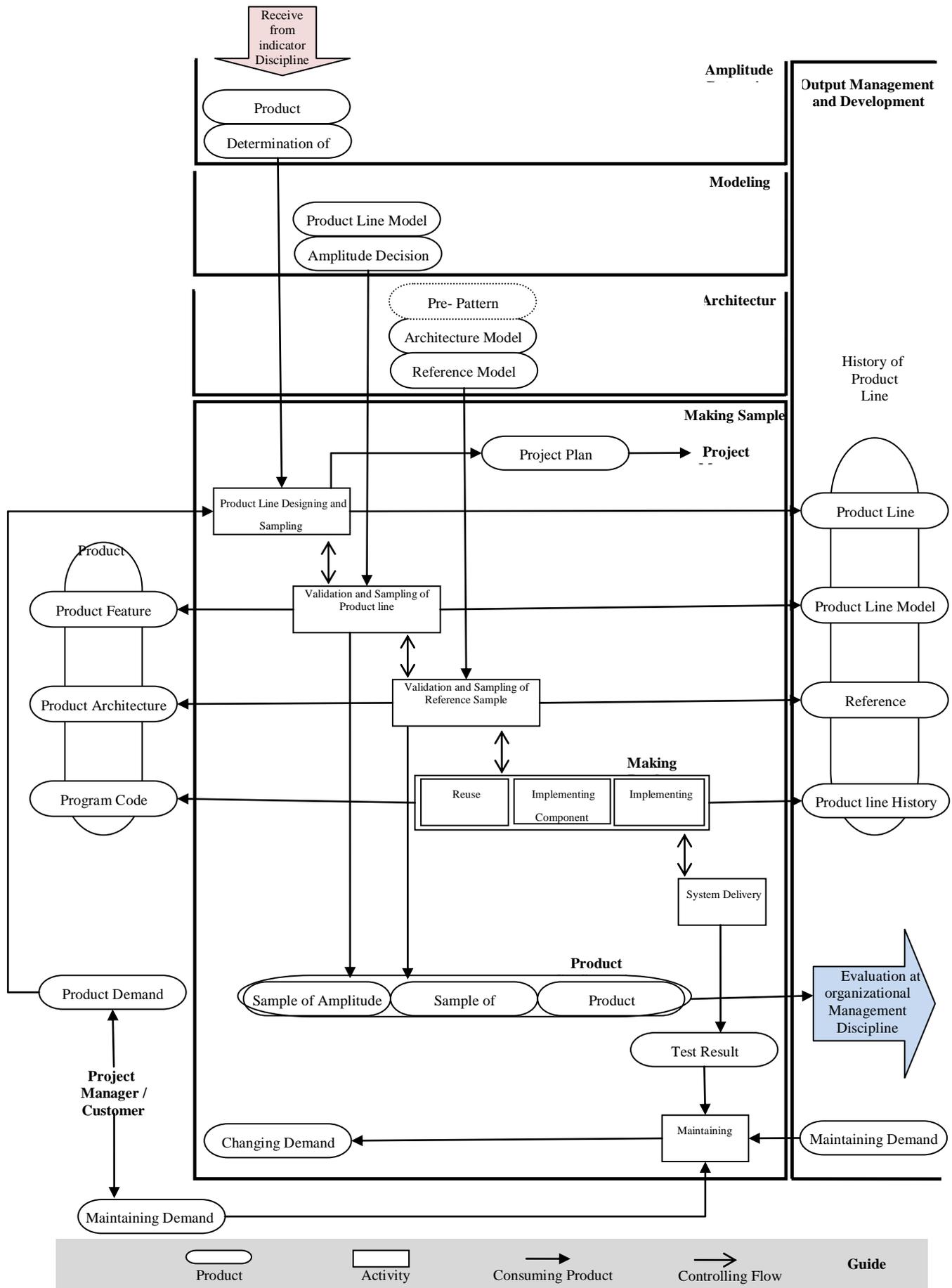Fig 3 Activity Presence Diagram in development Process

Fig 4 Indicator based software product line methodology

A. designing and analysis activities set

Determining amplitude: in fact, this stage is main component of initial phase and in this phase target product characteristic is determined. So obtained data and information in indicator discipline could be uses as best guide in this stage. Also, limitation of software product should be consistent to organization and development team and should be determined using technical indicators and product characteristic accurately in this stage.

Modeling: in this stage, data which are obtained from amplitude determination stage are filtered to use in designing phase and are formatted to formal models like characteristic model and decision model.

Architecture: since aggregate product approach should be inproduct line engineering, so it is necessary to design architecture to be able respond product variation. For this reason, fist reference model of product line should be designed for architecture and then is adjusted based on each product.

B. implementation activity set

Making sample: this activity is main part of product process and tries to make and present a specific product sample from product line. So, in this phase,

most supervision is done by organization to adjust product and needs and organizational goal. This is done by indicator secession activities, evaluation and review.

If product process needs to be changed in product process, this action is done by indicator filtration process and applying new value in the project for indictors to project.

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C. project management activity set

Output management and development: this part is responsible to maintain and organizing output staple to be applied and reused. In fact, this part is asset store and seek needed asset and recommend candidate assets to be applied.

In this section, obtained data from product characteristic is presented to organization by management to be evaluated. Also, before assets entrance to store, technical indicators is arranged and valued in order to adjust index based approach and effective seeking and searching for candidate assets.

TABLE 1: COMPARISON OF INDEX BASED METHOD AND OTHER SOFTWARE ENGINEERING METHODS

Methodology	organizational layer	Method to extract requirements	Applying criteria	Development approach
I-PuLSE-I	Three layer of organizational management, IT management and project mediator in the organization along with three secession level and a layer for development team external the organization	In addition to standard methods, by self-organization and experts, adjusting to management viewpoint, complete and curtained	Extensively from development design definition in the organization to implementing and system survive in all organizational layer and software development team	Index based product line
PuLSE-I	Total organization under a layer without detail	By software engineering and amplitude engineering, external organization	Quality metric and internal control of product line project	Product line
ERP Deployment	Total organization under two separated management and IT in unrelated form	Based on best experiences and limited analysis of organization	Software system metric and development team	Module based
Methodology	Total organization under a layer without detail	By business modelling and by software experts, external organization	Technical metrics which are applied and determined by development team	Object-oriented

IV. NECESSARY SITUATION TO APPLY INDICATOR BASED SOFTWARE PRODUCT LINE METHODOLOGY

In developed organization, for sensitive and influencing IT projects on organization success, this action is delivered to external team of organization. if information technology bed is defined accurately in the organization, so index based framework, better cooperation of IT development product are created in the organization. All concepts based on index should be defined clearly, but part of concepts could be defined in descriptive form along with indicators.

Basic of index based framework is done in the target organization by organizational forces, so this ability and capacity should be available in the organization and experts.

V. RESULTS

According to analysis about approach and recommended method form this study and implementing in a project, developing a big electronic store as a case study and available experiences form common methods, below results are certified.

A. application benefits of indicator based approach for target organization

✓ Goal-orientation of organization and creating process and knowledge- oriented approach in the organization
✓ Accurate relationship of organizational management and IT project
✓ Simultaneous creating of technical and organizational approach
✓ Effective use of internal IT experts in organizational goal related to IT project
✓ Adjusting organization and external organization development team
✓ Adjusting situation and organizational requirements based of goals

B. application benefits of indicator based approach for development team

✓ Decreasing related risks to requirements in the project
✓ Decreasing related price to extraction, understanding and modifying requirements
✓ Low needs to change in organizational goal
✓ Better acceptance of development process in the organization

C. risks of indicator based approach

✘ Lack of suitable situation and bed

✘ Lack of sufficient time and resource

✘ Lack of consistency and harmony in any part of the project

✘ High variability and instability of decisions and situations

✘ Not pursuing indexes and projects throughout project

✘ Ambiguity in definitions and criteria

VI. CONCLUSION

Although expressing requirements in form of indicators and measurable needs to more effort and precision, but leads to success and stability of project due to originality and sustainability which provide to requirements. This is important not only to establish IT system but then also is crucial, because most of IT systems are decaying due to not specified application and influence in the organization. This problem is solved and leads to continuous improvement using measurable indicators and improvement in the organization.

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